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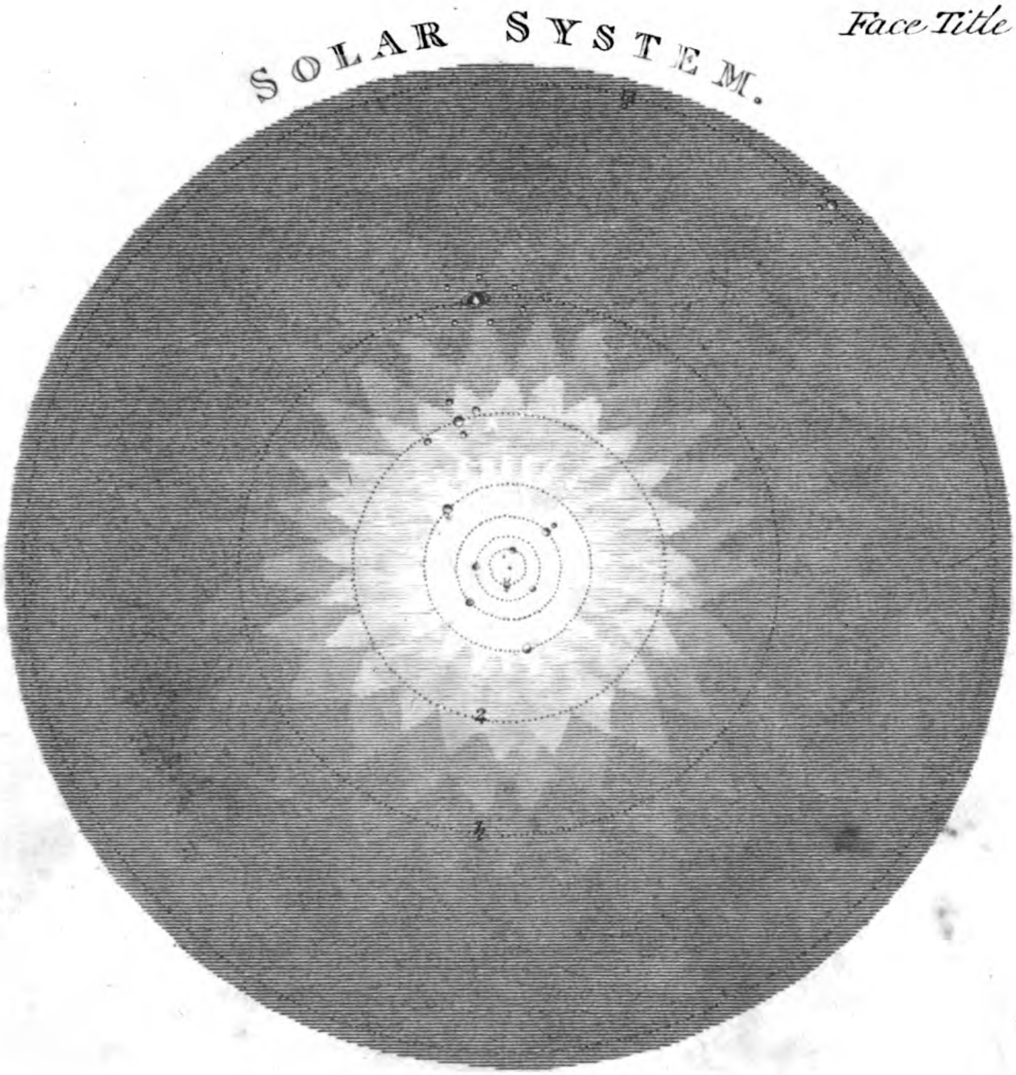
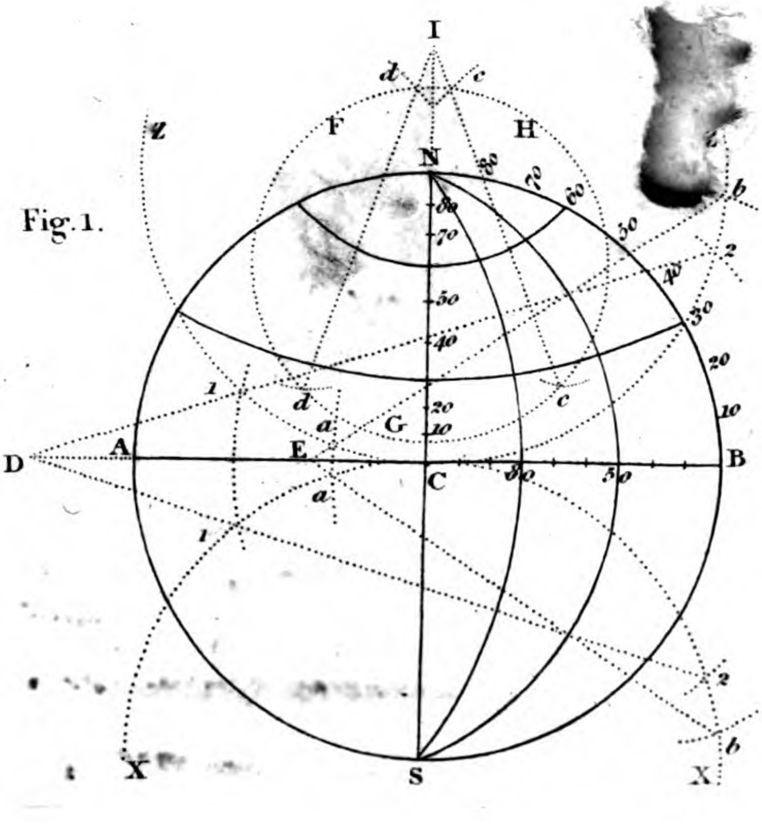


Fig. 1.



AN

INTRODUCTION

TO

GEOGRAPHY AND ASTRONOMY,

BY THE USE OF

THE GLOBES AND MAPS.

TO WHICH ARE ADDED,

THE CONSTRUCTION OF MAPS,

AND

A TABLE OF LATITUDES AND LONGITUDES.

SIXTH EDITION,

WITH CONSIDERABLE ADDITIONS AND IMPROVEMENTS.

BY E. AND J. BRUCE,

TEACHERS OF GEOGRAPHY AND THE MATHEMATICS.

"Seized in thought,
"On Fancy's wild and roving wing I sail,
"From the green borders of the peopled EARTH,
"And the pale MOON, her duteous fair attendant,
"From solitary MARS, from the vast orb
"Of JUPITER, whose huge gigantic bulk
"Dances in ether like the lightest leaf,
"To the dim verge, the suburbs of the system,
"Where cheerless SATURN, midst his watery moons,
"Girt with a livid zone, majestic sits,
"In gloomy grandeur, like an exil'd queen
"Amongst her weeping handmaids." BARBAULD.

LONDON:

PRINTED FOR BALDWIN, CRADOCK, AND JOY,

PATERNOSTER ROW.

1821.

C. Baldwin, Printer,
New Bridge Street, London.

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PREFACE

TO THE SECOND EDITION.

GEOGRAPHY is now considered as a necessary branch of education; and one of the best methods of becoming acquainted with its principles, and also of obtaining an exact knowledge of the situation of places upon the earth, is by the use of the globes: and whoever can furnish a treatise in which the method of performing the problems is expressed in a short and familiar manner, with a variety of examples to each, will lessen the labour of the teacher, and greatly facilitate the progress of the learner.

The writers of this little treatise, having had considerable experience in teaching geography, first published it for the use of their pupils; the favourable reception, which it met with, now induces them to submit it to the public in a second edition.

This edition they have considerably enlarged, by prefixing a compendium of geography. In drawing up this, it has been their chief object to make the pupil acquainted with *natural geography*. The political situation of Europe is frequently varying, so that a person who was thoroughly acquainted with it a few years ago, might now be a total stranger to some parts of it. Little, therefore, has been said on this head: only it was necessary to enumerate the principal states. The boundaries are not described, that being given as an exercise to the pupil, who, being furnished with good maps, will find it a very easy task. A more particular account is given of the rivers than is generally to be met with in books of this kind; and as full an account of the *inland navigation*, as is consistent with the brevity of the plan.

A short account is given of the *trade winds*, and also a few observations on the *seasons* and *climates* of the different regions of the earth.

To all who possess *Arrowsmith's Maps*, it is hoped this part will be useful in assisting them to survey the different quarters of the globe, as delineated by that accurate geographer.

As a recapitulatory exercise, geographical questions are added: these may be answered by the pupil, either verbally or in writing, and will assist the teacher in examining the progress of his pupils.

Part II. treats of the terrestrial globe: it is divided into six sections, and contains thirty-six problems. At the beginning of each section, only so many definitions are given as are necessary for understanding the problems in that section. This is not the common mode of arrangement, but it is presumed, it will be found the most convenient in teaching. Each definition is expressed in as short a way as possible; and, when it is thought necessary, a definition of the same word, in more scientific terms, is added, printed in a smaller character.

At the beginning of each section is given an abstract of the problems contained in that section, together with the principles upon which they are founded. This will serve as a sort of connecting chain, and enable the learner easily to review the whole of the problems contained in the work. Problem I. is given only as an example of the advantageous manner in which young persons may be exercised in drawing up for themselves an account of the names and situations of the principal countries, islands, &c. The method of performing most of the problems, by maps and calculation, is added. This, it is hoped, will be a great advantage: for performing the same problems, by two or three different methods, will make them more fully understood.

In those problems that require numerical calculations, it is adviseable to accustom the pupils to mental arithmetic; and it will be found that even children can add, subtract, and multiply without the aid of a pencil. A little accuracy may be sacrificed to facility; as in multiplying by 70 instead of 69½, to bring degrees to English miles.

Brevity being aimed at in giving the general rules, explanatory notes have sometimes been added, printed in a smaller type. It will also be seen that, in some of the sections, the examples have been so arranged as to illustrate the general observations placed at the beginning of the section. The method of performing the problems by Adams's globes is given, when that is different from the common method.

Part III. treats of the celestial globe: it is divided into four sections, and contains thirty problems.—The first section contains problems relating to the stars; the second to the sun; the third to the planets; and the fourth to the moon. The above arrangement was adopted on account of the stars being laid down upon the celestial globes, whilst the other heavenly bodies are not. Each section is preceded by a short account of those bodies, not indeed enough to satisfy curiosity, but it is hoped sufficient to excite it.

In performing the problems of the first section, the pupils will be familiarised with the names and characters of the principal fixed stars: but it is not enough to know them on the globe, they ought to be able to distinguish them in the heavens. Problem XII. will be of the greatest assistance to the pupils in doing this, as the authors have found from experience.

The planets which, from their size and colour, may easily be distinguished, should also be pointed out to them; and from noticing near which of the fixed stars they are at any time situated, their apparent motion in the heavens may easily be discovered. They may be taught to find the amplitude of the sun at rising or setting, and its meridian altitude at different times of the year. By directing them to view Nature herself, instead of referring them to imperfect delineations of her works, they will form more correct and sublime ideas of the universe.

The method of constructing maps is given at the end: this will be of great use in assisting young persons to draw maps for themselves, which is one of the most effectual ways of learning geography.—There is also a list of the latitudes and longitudes of all the places mentioned in the examples, to enable the learner to find them more readily upon the globe or maps.

As the work was not originally intended for the use of mathématical students, none of the examples have been calculated by spherical trigonometry.* In some of the problems, such as to find the places that have the same latitude, &c. several places are inserted that have only nearly the same latitude. This observation must also be extended to the problems for finding the antoeci, perioeci, &c.

In compiling this little treatise, unlimited use has been made of the works of former writers on the subject; and as the greater part of it was drawn up at a time when there was no intention of publishing it, care has not always been taken to make the proper acknowledgements. This defect can now no otherwise be remedied than by stating, that to Varenius's Geography, Martin and Brandsby on the Globes, Dr. Hutton's Mathematical Dictionary and Translations of Montucla's Mathematical Recreations, the Companion to Arrowsmith's Map of the World, Pinkerton's Geography, and the Scientific Dialogues, this work is much indebted.

Conscious that this little treatise must possess many imperfections, it is not without great diffidence now delivered into the hands of the public: but those who are the most capable of distinguishing its faults, will be the most ready to pardon them.

Newcastle, May 15, 1805.

* The mathematical student is referred to Kelly's Spherics, or to Dr. Olinthus Gregory's Trigonometry, lately published for the use of schools.

ADVERTISEMENT

TO THE

FIFTH EDITION.

IN preparing this edition, it has been the chief object of the editor to render this work still more worthy of the public approbation, by inserting every thing in it, which he thinks necessary for the pupil to attend to, on beginning to study Geography; and it is hoped those teachers who have already done it the honour to introduce it into their academies, or those who may in future adopt it as a Class Book, in teaching Geography, will find it sufficient to answer all the purposes of an introductory work on that subject. The additions occupy nearly a hundred pages, and are,..a catalogue of the chief towns in England and Wales, the rivers on which they stand, their population, and remarks on the trade of each:—the towns in Scotland and Ireland:—a minute account of the different states in Europe, so arranged as to correspond to a series of questions applicable to each state:—a very full catalogue of the sea-ports in Europe, their situation, and (as far as could be obtained) their imports and exports, with their latitude and longitude.

The population of the British towns is taken from the Abstracts of Returns made in 1811, and laid before parliament. In drawing up the list of the sea-ports of Europe, Oddy's European Commerce was chiefly consulted; where that failed, the new edition of Crutwell's Gazetteer was applied to.

The editor, without attempting to dictate to others, as to the method of teaching Geography, suggests the following plan, as one which he has found useful. To commit to memory the definitions, page 1,—situation of Europe, p. 4,—states in Europe—oceans and seas—bays, gulfs, and straits—lakes and mountains—volcanoes—(the rivers to be omitted)—proceed to islands, page

10th,—isthmuses—capes—British Islands—England—counties with chief towns and rivers on which they stand—(general description of English rivers and canals, to be omitted, and also the towns in Enland and Wales.) To proceed in the same manner with Scotland and Ireland, viz.:—to learn the general situation and counties, (omitting the rivers and towns,)then proceed to the general survey of Europe, page 72, and either direct the whole to be committed to memory, or a selection of the questions as may be most suitable to the abilities of the learner. Having finished Europe, (omitting the sea-ports) it may then be proper to go over the whole again, and to learn those parts which were before omitted, viz,: the rivers, towns, sea-ports, &c. Then to proceed in a similar manner with the other quarters of the globe.

Care must be taken, however, to furnish the pupil with good maps, on which to point out every thing which they commit to memory; and, also, blank maps of Europe, England, Scotland, Ireland, &c. on which to trace out the various divisions and boundaries. These blank maps the pupils may easily draw for themselves.

The catalogues of towns will form some useful and amusing exercises for young people. Let them first find out all the English towns on the map; then let it be an exercise to write out an arrangement of the towns according to their population, noticing at the same time the rivers on which they stand, and the remarks on each. The exercise may also be varied, by making them arrange the towns in the order of the counties; and, by referring constantly to the map, they will, without much labour, gain a general knowledge of all the chief towns in England, and of the importance of each. A similar use may be made of the Scotch and Irish towns.

In the sea-ports of Europe, let them be required to write out a list of those that are situated on a particular sea, as on the Baltic, the Mediterranean, &c. or of those belonging to particular countries, as Russian sea-ports, French sea-ports, &c. remarking the particular trade of each port.—They may also point out those from which particular goods are exported, as timber, hemp, &c.

Whilst the pupils are committing Part I. to memory, they may begin to perform the problems in Part II. But as the problems are not all equally interesting, it will sometimes be found advantageous, on the first time of going over the book, to omit problems XX. XXI. XXII. XXVII. XXVIII. XXIX. XXX. XXXV. and XXXVI.

The following problems in Part III. may then be performed, viz.—I. II. III. IV. V. VI. XI. XII. XIII. XIV. XXI. XXII. XXIII.

On going a second time over the work, all the problems may be performed in their regular order; and from the knowledge the pupils will have already obtained, they will be better able to attend to those problems that are more difficult. It will also be of use to accustom them to learn the situation of the places mentioned in the list of latitudes and longitudes, and to point them out upon maps: by learning half a column for every lesson, they will soon acquire a knowledge of the whole.

The progress of the pupils should be constantly examined, by making them answer the questions for examination, and perform the examples at the end of the sections.

As a School Atlas, the author begs leave to recommend Ostell's as the best that he has seen.

A greater number of examples to the problems on the globes is given in this edition; and, except to the two first examples in each problem, no answers are inserted. A Key, containing all the answers, is published for the use of teachers.

Academy, Percy-street, Newcastle upon Tyne,
April 4, 1817.

The present edition has been carefully corrected and revised, and such improvements made in it as appeared necessary.

August 2, 1821.

INTRODUCTION,

&c. &c. &c.

PART I.

DEFINITIONS.

GEOGRAPHY is a description of the earth.—The surface of the earth contains *land* and *water*. The great collection of water is called the *sea* or *ocean*, and this is divided into three principal parts; the *Atlantic Ocean*, which divides *Europe* and *Africa* from *America;* the *Pacific Ocean*, or *Great South Sea*, which divides *Asia* from *America;* and the *Indian Ocean*, which lies east of *Africa* and south of *Asia*. Besides these, there are many small seas, some of which take their names from the countries against which they are situated; as, the *Irish* Sea, the *German* Sea, &c.

A *bay*, or *gulf*, is a part of the sea running into the land; as, the *Bay* of *Biscay*, the *Bay* of *Bengal*, the *Gulf* of *Venice*, &c. If a gulf be very large, it is called an *inland Sea;* thus, the *Gulf* of *Venice* is sometimes called the *Adriatic Sea*. A small bay is called a *creek* or *haven*.

A *strait* is a narrow part of the sea running between two countries, and connecting two seas; as the *Strait of Dover*, the *Strait of Gibraltar*, &c.

A *lake* is a considerable body of inland fresh water: as, the *Lake of Geneva*, *Lake Ontario*, &c.

A considerable stream of inland water, which runs into the sea, is called a *river*.

A very great extent of land is called a *continent*, of which there are two: One contains *Europe*, *Asia*, and *Africa*; and the other is *America*;—and these are called the *four quarters* of the world. The former is also called the *eastern*, and the latter the *western*, continent.

An *island* is an extent of land surrounded by the sea; as, *Great Britain*, *Jamaica*, &c.

A *peninsula* is a tract of land every where surrounded by water, except at one narrow neck, by which it is joined to some other land. The narrow neck is called an *isthmus*.

A *promontory* is a point of land stretching far into the sea, the end of which is called a *cape*; as, the *Cape* of *Good Hope*.

OF THE EARTH IN GENERAL.

The diameter of the earth is 7,958 miles, and its surface contains 198,956,786 square miles, more than two-thirds of which are covered with water.

The seas and unknown parts contain 159,966,217 square miles, tne inhabited parts 38,990,569, of which

Europe contains	4,456,065 sqr. miles.
Asia	10,768,823
Africa	9,654,807
America	14,110,874
Total	38,990,569*

The following may be taken as an estimate of the population of the Globe :—

Asia contains	500,000,000 inhab.
Europe	150,000,000
Africa....................	30,000,000
America	20,000,000
Austral Asia, Polynesia, and Isles in the Pacific	500,000
Total	700,500,000

Admitting the above calculations to be accurate, the population to every square mile will be—to Europe 34 nearly, to Asia 46, to Africa 3, and in America there are only 3 inhabitants to every 2 square miles.

* Instead of the above numbers, it may be more easy to commit to memory the following, which are nearly correct:—

Surface of the Earth........	199	million square miles.
Seas and unknown parts	160	———
Inhabited parts	39	———
Europe	4½	———
Asia	10¾	———
Africa	9⅔	———
America	14	———

EUROPE.

Europe is situated between the 10th degree west and the 60th degree east longitude from London; and between the 36th and 72d degree of north latitude. It is bounded on the north by the Frozen Ocean,—on the east by Asia,—on the south by the Mediterranean Sea, which divides it from Africa,—and on the west by the Atlantic Ocean. Its length from east to west, is about 3,300 British miles; and its breadth from north to south, 2,350.

STATES OF EUROPE.

The chief countries of Europe are, four in the north, six in the middle, and four in the south.

The four in the north are,

British isles,	London, on the river Thames
Danish Dominions,	Copenhagen on the Sound
Sweden and Norway,	Stockholm, on lake Mæler
Russia,	Petersburg, on the r. Neva.

Six in the Middle.

France,	Paris on the river Seine
Holland and the Netherlands	Amsterdam, on the r. Amstel.
Swisserland,	Basle, on the r. Rhine.
Germany Austrian Dominions,	Vienna and Presburg, on the r. Danube
Prussia.	Berlin, on the r. Sprey

Four in the south.

Spain,	Madrid, on the r. Manzanares
Portugal,	Lisbon, on the r. Tagus
Italy,	Rome on the r. Tiber
Turkey,	Constantinople, on the strait of Constantinople.

OCEANS AND SEAS.

1st, The Atlantic Ocean on the west, which divides Europe from North America; 2d, the Frozen Ocean on the north; 3d, the Mediterranean Sea, which divides Europe from Africa: the eastern part of the Mediterranean is frequently called the Levant.

The smaller seas are,—1st, the White Sea, in Russia; 2d, the Baltic, between Denmark, Sweden, Russia, Prussia, and Germany; 3d, the German, or North Sea, between Britain and Germany; 4th, the Irish Sea, the south part of which is called St. George's Channel, between England and Ireland; 5th, the English Channel, between England and France; 6th, the Adriatic Sea, or Gulf of Venice, between Italy and Turkey; 7th, the Archipelago, south of Turkey; 8th, the Sea of Marmora; 9th, the Black Sea; 10th, the Sea of Azof, between Europe and Asia.

BAYS, GULFS, AND STRAITS.

There are four large Gulfs, and six small.

The large Gulfs are,—the Gulf of Bothnia, between Sweden and Russia; the Gulf of Finland,* in Russia; the Bay of Biscay, between France and Spain; and the Gulf of Venice, between Italy and Turkey.

The smaller gulfs are,—the Gulfs of Riga and Dantzic, in the Baltic; and the Gulfs of Lyons, Genoa, Tarento, and Salonica, in the Mediterranean.

The straits are,—the Sound, between Denmark and Sweden: the Strait of Dover, between England and France; the Strait of Gibraltar, between Spain and Africa; the Strait of Bonifacio, between Corsica and Sardinia; the Strait of Messina, between Sicily and Italy; the Strait

* Finland, which lies to the east of the Gulf of Bothnia, was ceded to Russia in 1809.

of Gallipoli, forming the entrance into the Sea of Marmora; the Strait of Constantinople, forming the entrance into the Black Sea; and the Strait of Kaffa or Jenicale, forming the entrance into the Sea of Azof.

LAKES AND MOUNTAINS.

The principal lakes are,—Onega, Ladoga, and Peypus, in Russia; Wener and Weter, in Sweden; Neufchatel and Geneva, on the borders of France; and Lucerne, Zurich, and Constance, in Swisserland.

The principal mountains are,—the Alps, in Swisserland, which extend in a semicircular form for above 500 miles; the highest part, Mount Blanc, is 15,662 feet above the level of the sea: the Pyrenees, between France and Spain, the greatest height of which is 11,000 feet; the Appenines, in Italy; the Carpathian Mountains, which run for nearly 500 miles to the north and east of Hungary; and the Langfiall, or Long Mountains, and Dofrefial Mountains, which separate Norway from Sweden.

VOLCANOES.

The valcanoes in Europe are,—Mount Etna, in Sicily, whose base covers a space of 180 miles, and its height above the sea is 11,000 feet; the crater of Etna is often 3 miles in circumference: Mount Vesuvius, east of Naples, is about 3,600 feet high; and Mount Heckla, in Iceland, 5,000 feet above the sea.

RIVERS IN RUSSIA AND PRUSSIA.

The Dwina ~~runs by Oustug, and~~ falls into the White Sea at Archangel, after a course of 450 miles.

The Duna ~~runs by Polotsk and Dunaburg,~~ and falls into the Baltic at Riga; its course is 500 miles.

The Niemen, or Memel river, forms a boundary between Russia and Prussia, ~~passes by Grodno and Kowno~~, and falls into the Bàltic near Memel.

The Vistula rises in the Carpathian Mountains, passes ~~Cracow~~, Warsaw, ~~Thorn, Marienburg~~, and joins the sea near Dantzick, after a course of 450 miles.

The Oder rises in the mountains of Moravia, ~~and passing by Breslaw, Glogau, and Francfurth on the Oder~~, falls into the Baltic below Stettin.

RIVERS IN GERMANY AND THE NETHERLANDS.

The Elbe rises in the Sudetic Mountains of Silesia, ~~and runs by Prague, Dresden, Wittenberg,~~ Magdeburg, ~~and~~ Hamburg, and enters the sea near Cuxhaven, after a course of more than 500 miles.

The Weser is formed by the Wurra and Fulda, which join near Munden: it runs into the sea at Bremen, 270 miles from its source.

The River Ems runs by Munster and Embden.

The Rhine rises in Swisserland, passes through the Lake of Constance, runs by Basle, whence it forms the boundary between France and Germany; ~~it then runs by Strasburg, Spire, Manheim, Maynz or Mentz, Coblentz, Cologne, and Nimeguen~~; on entering Holland, it divides itself into four different branches: the only one which retains the name of Rhine falls into the sea at Leyden: its course may be computed at 600 miles. The principal rivers which run into the Rhine are the Neckar and Mayne from the east, and the Mozelle from the west.

The Schelde, or Escaut, runs by ~~Tournay, Ghent~~, Antwerp, ~~and Fort Lillo~~; it ~~then~~ divides itself into two branches, called the East and West Schelde: the East Schelde runs by Bergen op Zoom, and the West Schelde falls into the sea at Flushing.

The Maese rises near Verdun, in France, passes by ~~Meziere~~, Namur (where it receives the Sambre), ~~Leige, Maestricht, Venloo, and Gorcum~~, and falls into the sea below Rotterdam.

RIVERS IN FRANCE.

The Seine rises near St. Seine, in the department of Côte d'Or, passes by ~~Troyes, Melun~~, Paris, ~~and Rouen~~, and falls into the English Channel at Havre de Grace; its comparative course being 250 miles.

The Loire rises in the mountains of ancient Languedoc, passes by ~~Le Puy, Foeurs, Nevers, Orleans, Blois, Tours, and Nantes~~, and falls into the ocean at Painbœuf, after a course of 500 miles.

The Garonne rises in the Pyrenees, runs by ~~Tolouse, Agen, and~~ Bourdeaux, and below that place falls into the sea. After being joined by the Dordogne, it assumes the name of Gironde. Its course is 250 miles.

The Rhone rises in Swisserland, crosses the Lake of Geneva, ~~waters Lyons, Vienne, Valence, Avignon, and Arles~~, and enters the Mediterranean; its course being 400 miles.

RIVERS IN SPAIN AND PORTUGAL.

The Minho rises in Galicia, and forms the northern boundary of Portugal.

The Douro passes ~~Valladolid, Toro~~, Zamora, in Spain, crosses Portugal from east to west, and falls into the sea at Oporto, after a course of 380 miles.

The Tagus rises on the borders of Arragon, ~~passes by Toledo, Alcantara, and Santaren~~, and, after a course of about 500 miles, falls into the ocean below Lisbon, forming a capacious haven.

The Guadiana passes by Merida, Badajos, in Spain, whence it separates Spain from Portugal, and falls into the Atlantic, after a course of about 400 miles.

The Guadalquaver passes by Cordova and Seville, and falls into the Atlantic at St. Lucar.

The Ebro rises in the mountains of Asturias, passes by Saragossa and Tortosa, and falls into the Mediterranean, after a course of about 400 miles.

RIVERS IN ITALY.

The Arno rises among the Appenines, passes by Florence, and Pisa, and falls into the Gulf of Genoa.

The Tiber rises near the source of the Arno, runs by Peruggia and Rome, and falls into the Mediterranean; its course is 150 miles.

The Po runs a course of 300 miles; rising on the borders of France, it passes by Turin, Casal, Placentia, and Cremona, and falls into the Gulf of Venice.

The Adige passes by Trent and Verona, and falls into the Gulf of Venice.

RIVERS IN GERMANY, TURKEY, AND RUSSIA.

The Danube rises in Swabia, passes by ~~Ulm,~~ Ingolstadt, ~~Ratisbon, Passau~~, Vienna, Presburg, ~~Buda~~, in the Austrian dominions; and Petervaradin, Belgrade, and Widin, in Turkey; and, after a passage of 1,300 miles, falls into the Black Sea near Ismael. The Danube, in some places, is a mile in breadth.

The Inn rises in Swisserland, passes by Inspruck, and joins the Danube at Passau.

The Niester rises in the Carpathian Mountains, forms the present boundary between Turkey and Russia, and, passing by Bender, falls into the Black Sea at Akerman; its course is 600 miles.

The Dnieper, the ancient Boristhenes, rises at Viesma in Russia, passes Smolensk, Rogatchov, Kiow, Catharinoslav, Alexandrowskaia, and falls into the Black Sea, at Cherson, after a course of 1,000 miles.

The Don rises to the south of Moscow, and falls into the Sea of Azof, after a course of 800 miles.

The Wolga may be reckoned the sovereign river of Europe: it derives its source from several lakes between Moscow and Petersburg; is navigable from Twer; passes by Mologa, Kostroma, Nisney Novogorod, Kasan, Simbirsk, Samara: whence, to Tzaritzin, it is the boundary between Europe and Asia; it then runs south-east, and falls into the Caspian Sea at Astracan; its comparative course may be estimated at 1,700 miles.

ISLANDS IN EUROPE.

The islands in the Baltic are Rugen, Oeland, Gothland, and Aland, which belong to Sweden; Zealand, Funen, Alsen, Langland, Laland, Falster, Mona, Femeren, and Bornholm, which belong to Denmark; and Dago and Osel, which belong to Russia.

In the Frozen Ocean are Nova Zembla, belonging to Russia: and Iceland, belonging to Denmark.

In the Atlantic Ocean are the large islands of Great Britain and Ireland. The Orkney and Shetland Islands are to the north of Scotland; the Hebrides are to the west of Scotland. The Ferro Isles are to the north of the Shetland islands, and belong to Denmark.

The Azore Islands in this ocean properly belong to Europe: the principal are, St. Michael, Tercera, Pico, Fayal, Florez, and Corvo. They belong to Portugal.

In the Irish Sea are the Isles of Man and Anglesea. The Isles of Wight, Jersey, Guernsey, Sark and Alderney, are in the British Channel.

In the Mediterranean are the Islands of Minorca, Majorca, and Iviza, off the coast of Spain, to which they belong. Corsica belongs to France; Sardinia is a separate kingdom; and Sicily belongs to Naples.—South of Sicily lies the small Island of Malta, now in possession of the English; a place of great strength. Corfu, Cephalonia, Zanté, with some other smaller ones at the entrance of the Gulf of Venice, form the Republic of the Ionian Islands. Candia, with the Islands of the Archipelago, are to the south and east of Turkey.

ISTHMUSES.

The Isthmus of Corinth, between the Morea, and Turkey: and the Isthmus of Precops, in the Crimea.

CAPES.

The principal capes in Europe are,—the North Cape, in Lapland; the Naze, in Norway; Land's End, in England; Cape Clear, in Ireland; Cape La Hogue, in France; Cape Ortogal and Cape Finisterre, in Spain; Cape St. Vincent, in Portugal; Cape Spartivento, in Italy; and Cape Matapan, in Turkey,

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BRITISH ISLANDS.

GREAT BRITAIN,

Great Britain extends from 50 to 58½ degrees north latitude, and from 2 degrees east to 6 degrees west longitude. Its length may be computed at 580, and its breadth at 370, British miles.

I contains 87,502 square miles, and the number of inhabitants amounts to 12,353,000, being about 180 to each square mile.

ENGLAND.

England is bounded on the east by the German Ocean, or North Sea; on the south by the English Channel; on the west by the Irish Sea; and on the north by Scotland.

It is separated from Scotland by the rivers Esk and Tweed, the Cheviot Hills, and an ideal line falling down south-west to Solway Frith.

The extent of England and Wales, in square miles, is computed at 58,335; and, the population being estimated at 10,488,000, the number of inhabitants to a square mile will be 180.

England is divided into 40 counties, and the Principality of Wales into 12,—thus making the whole number 52; of which the following is a list, together with their respective chief towns, and the rivers on which they are situated.

Six Northern.

COUNTY.	CHIEF TOWN.	RIVER.
Northumberland	Newcastle	Tyne
Cumberland	Carlisle	Eden
Durham	Durham	Wear
Yorkshire	York	Ouse
Westmoreland	Appleby	Eden
Lancashire	Lancaster	Lon

Four bordering on Wales.

Cheshire	Chester	Dee
Shropshire *or* Salop	Shrewsbury	Severn
Herefordshire	Hereford	Wye
Monmouthshire	Monmouth	Wye

Twelve Midland.

COUNTY.	CHIEF TOWN.	RIVER.
Nottinghamshire	Nottingham	Trent
Derbyshire	Derby	Derwent
Staffordshire	Stafford	Sow
Leicestershire	Leicester	Soar
Rutlandshire	Okeham	
Northamptonshire	Northampton	Nen
Warwickshire	Warwick	Avon
Worcestershire	Worcester	Severn
Gloucestershire	Gloucester	Severn
Oxfordshire	Oxford	Thames
Buckinghamshire	Aylesbury	Tame
Bedfordshire	Bedford.	South Ouse

Eight Eastern.

Lincolnshire	Lincoln	Witham
Huntingdonshire	Huntingdon	South Ouse
Cambridgeshire	Cambridge	Cam
Norfolk	Norwich	Yare
Suffolk	Ipswich	Orwell
Essex	Chelmsford	Chelmer
Hertfordshire	Hertford	Lea
Middlesex	London	Thames

Three South-eastern.

Surry	Guildford	Wey
Kent	Canterbury	Stour
Sussex	Chichester *or* Lewes	

Four Southern.

Berkshire	Reading	Thames
Wiltshire	Salisbury	Avon
Hampshire	Winchester	Itchyn
Dorsetshire	Dorchester	Frome

Three South-western.

COUNTY.	CHIEF TOWN.	RIVER.
Somersetshire	Wells *or* Taunton	
Devonshire	Exeter	Exe
Cornwall	Launceston	Tamar
	Six North Wales.	
Flintshire	Flint	Dee
Denbighshire	Denbigh	Clwyd
Caernarvonshire	Caernarvon	
Anglesey	Beaumaris	
Merionethshire	Harlech *or* Bala	
Montgomeryshire	Montgomery	Severn
	Six South Wales.	
Radnorshire	Radnor *or* Presteign	
Cardiganshire	Cardigan	Tivy
Pembrokeshire	Pembroke	Milford Haven
Caermarthenshire	Caermarthen	Towy
Brecknockshire	Brecon	Usk
Glamorganshire	Caerdiff	Taafe

England is also divided into six circuits, each containing a certain number of counties. These circuits are as follow :—

Home Circuit.—Essex, Hertford, Kent, Surry, and Sussex.

Norfolk Circuit.—Bucks, Bedford, Huntingdon, Cambridge, Suffolk, and Norfolk.

Oxford Circuit.—Oxford, Berks, Gloucester, Worcester, Monmouth, Hereford, Salop, and Stafford.

Midland Circuit.—Warwick, Leicester, Derby, Nottingham, Lincoln, Rutland, and Northampton.

Western Circuit.—Hants, Wilts, Dorset, Somerset, Devon, and Cornwall.

Northern Circuit.—York, Durham, Northumberland, Lancaster, Westmoreland, and Cumberland.

☞ Middlesex and Chester are not comprised in these circuits, the former being the seat of the supreme courts of judicature, and the latter a county palatine, having a separate judge.

RIVERS THAT FALL INTO THE NORTH SEA.

The Tweed divides Northumberland from Scotland for a considerable space, and then falls into the sea at Berwick.

The Tyne is formed of a southern branch, which rises near Alston in Cumberland; and of a northern one, from the borders of Scotland. Those branches unite above Hexham, and become a large river, which, flowing on to Newcastle, and forming a fine harbour between North and South Shields, empties itself into the sea at Tynemouth.

The principal trade of Shields consists in supplying the London market with coals. It has a considerable share in the Baltic trade, and also partakes in the Greenland fishery.

The Wear rises on the edge of Cumberland, and, running by Wolsingham, Bishop-Auckland, Durham, and Chester-le-Street, enters the sea at Sunderland.

This port partakes with Shields in the coal trade.

The Tees rises very near the source of the Wear, and, running by Barnardcastle, Yarm, and Stockton, forms the boundary between Durham and Yorkshire, from its source to the sea.

This river has no port at its mouth, but goods are imported at Stockton for the surrounding country, and lead and corn are exported.

The Esk is a small river, which joins the sea at Whitby.

The Humber is a large estuary, and receives a great number of rivers. The principal are the following:—

The Hull, which joins the Humber at Kingston upon Hull.

This port is reckoned the fourth for business in the kingdom. The coasting trade for coals, corn, wool, manufactured goods, &c. is very great. The foreign trade extends to every country in Europe, and to America, and the West Indies.

The Swale, from Richmond, and the Ure, navigable from Ripon, unite near Boroughbridge, and form the Northern Ouse, which flows by York and Selby.

The Derwent rises near Scarborough, is navigable to Malton, and joins the Ouse below Selby.

The Wharfe runs by Otley, Harewood, Wetherby, and Tadcaster, whence it is navigable, and joins the Ouse at Cawood.

The Aire, from Leeds, and the Calder, from Wakefield and Halifax, unite at Castleford, run by Ferrybridge, and join the Ouse at Howden.

The Don, from Sheffield and Rotheram, runs by Doncaster, and joins the Ouse in an artificial channel called the Dutch River.

The other branch of the Humber is the Trent. It rises near Newcastle in Staffordshire; and, receiving the Sow from Stafford, the Tame from Tamworth, the Dove from Ashbourn, the Derwent from Derby, the Soar from Leicester, and the Witham from Lincoln, joins the Ouse at Adlingfleet, where both are lost in the Humber. The direct course of this river is 100 miles. It is navigable from Burton, and runs by Nottingham, Newark, and Gainsborough.

Gainsborough is a river port of some consequence, being accessible to vessels of sufficient size to navigate the sea.

Another Witham runs by Boston, the only sea-port town in Lincolnshire.

Boston has some trade to the Baltic, and a great exportation of oats to London.

The Welland forms the north-west boundary of Northamptonshire, and runs by Stamford (whence it is navigable), Market-Deeping, and Spalding. Barges can get up to Spalding only at spring-tides.

The Nen is navigable from Northampton, whence it runs by Peterborough and Wisbeach into the Wash.

Wisbeach possesses considerable trade in the export of corn, and of oil pressed from seeds. Only barges can come up its river, larger vessels stopping six miles below it.

The Southern Ouse rises in Northamptonshire, runs by Towcester, Buckingham, Bedford, Huntingdon, St. Ives, Ely, and at Lynn-Regis falls into the Wash. The Cam from Cambridge, the Lark from Bury, and the Little Ouse from Thetford, fall into this river.

Though Lynn has a bad harbour, it carries on a trade by means of its inland communications. It supplies most of the inland counties with coal, timber, and wine, and exports corn and malt in great quantities.

The Yare, in Norfolk, becomes navigable at Norwich, and, being joined by the Waveney, falls into the sea at Yarmouth.

Yarmouth is a considerable sea-port, and, besides the coasting trade, it sends ships to the Baltic, Holland, Portugal, and the Mediterranean. The fishing on the coast is also considerable; that for mackarel in May and June, and that for herring in October and November.

The Deben, in Suffolk, is navigable to Woodbridge, the Orwell to Ipswich and Stow, and the Stour to Sudbury.

The Stour is the boundary between Suffolk and Essex. At the mouth of this river is Harwich, the station of the packets to Holland.

The Coln runs by Colchester; the Blackwater, in the north-western corner of Essex, near Maldon, is joined by the Chelmer, and then forms a large estuary called Blackwater Bay, famous for its oysters.

The Thames rises near Cirencester in Gloucestershire, and, receiving the Cherwell at Oxford, the Tame at Dorchester, the Kennet at Reading, the Coln and the Brent in Middlesex, the Wey and the Mole in Surry, and the Lea from Hertford and Ware, joins the sea near Gravesend. It passes by Oxford, Abingdon, Dorchester, Wallingford, Reading, Windsor, London, Woolwich, and Gravesend.

The course of the Thames is computed at 140 miles, and it is navigable to Cricklade. It serves as a boundary line during the greater part of its course, and separates the counties of Oxford, Buckingham, Middlesex, and Essex, on the north; from Berkshire, Surry, and Kent, on the south. The breadth of this river at London is about 440 yards, crowded with ships, which convey into that capital the wealth of the globe. This city enjoys the advantages of a sea-port, with the security of an inland town.

The Medway rises in Sussex, is navigable from Tunbridge, and, running by Maidstone, Rochester, and Chatham, falls into the mouth of the Thames at Sheerness.

Chatham is famous for its great naval arsenal and docks, defended by strong fortifications.

The Stour runs by Canterbury and Sandwich, and falls into the sea at Ramsgate, remarkable as a bathing place.

RIVERS THAT FALL INTO THE ENGLISH CHANNEL.

The Rother runs by Rye, the Ouse by Lewes, and the Arun by Arundel.

A bay, running up between the island of Portsea and the opposite peninsula, forms the capacious harbour of Portsmouth, the grand naval arsenal of England. The harbour is narrow at its entrance, but spreads out into an inland bay, five or six miles in length, and from two to four in breadth. The fortifications are the strongest in Great Britain.

The Itchyn runs by Winchester, and falls into the bay of Southampton.

This town possesses some trade in French and Port wines, and a considerable trade with Guernsey and Jersey.

The Avon is navigable from Salisbury, and, meeting the Stour from Stourminster, falls into the sea at Christchurch, an inconsiderable port.

The Exe runs by Exeter, and falls into the sea below Topsham, a considerable town, serving as the port of Exeter, whence the woollen goods manufactured in the counties of Cornwall, Devon, and part of Somerset, are exported.

The Tamar separates Cornwall from Devonshire, and runs into Plymouth Sound.

Plymouth, at the mouth of the river Plym, is, next to Portsmouth, the most considerable harbour in England for men of war. It carries on great trade, domestic and foreign.

RIVERS THAT FALL INTO THE BRISTOL CHANNEL.

The Towbridge by Biddeford, and the Taw by Barnstaple, run into Barnstaple Bay.

These places possess some trade to Bristol, Wales, and Ireland.

The Avon, navigable from Bath, falls, below Bristol, into the Bristol Channel.

Bristol was formerly reckoned the second city in the kingdom for commerce; but it now yields to Liverpool. The trade is chiefly with Ireland, the West Indies, North America, Hamburgh, and the Baltic.

The Severn rises from the mountain Plinlimmon, pursues an easterly course to Shrewsbury, turns south to Gloucester, and, after a progress of 150 miles, forms that large arm of the sea called the Bristol Channel. It runs by Welch Pool (whence it is navigable), Shrewsbury, Bridgenorth, Bewdley, Worcester, Tewksbury, and Gloucester.

The Avon, from Warwick and Stratford, joins the Severn at Tewksbury.

The Wye has its source near that of the Severn, runs by Hereford, Ross, and Monmouth, and falls into the Bristol Channel at Chepstow.

Chepstow has a tolerable port, and carries on a considerable trade. The tide rises here to an extraordinary height.

RIVERS THAT FALL INTO THE IRISH SEA.

The Towey runs by Caermarthen, and the Tivy by Cardigan. Milford Haven, in Pembrokeshire, is a remarkable inlet.

The Dee rises in Wales, and runs, by Chester, into the Irish Sea.

The Mersey rises in Yorkshire, divides Lancashire from Cheshire, is navigable to Stockport, and runs, by Warrington and Liverpool, into the Irish Sea. It receives the Irwell, a navigable river, from Manchester.

Liverpool, with respect to extent of commerce, is the second port of the kingdom. The trade is principally to the West Indies and to America: The Baltic and Portugal branches are also considerable; and the trade to Ireland is very extensive. The slave-trade, so long a disgrace to this country, principally centered here; but it is now happily abolished.

The Ribble runs through the middle of Lancashire, by Preston, into the Irish Sea.

The Lune, or Lon, rises in Westmoreland, and falls, below Lancaster, into the Irish Sea.

The Eden rises also in Wesmoreland, and runs, by Appleby and Carlisle, into the Solway Frith.

Milton has personified some of the principal rivers of England in the following lines:—

Rivers arise! whether thou be the son
Of utmost *Tweed* or *Ouse*, or gulfy *Don*,
Or *Trent*, who, like some earth-born giant, spreads
His thirty arms along th' indented meads;
Or sullen *Mole*, that runneth underneath,
Or *Severn* swift, guilty of maiden's death;
Or rocky *Avon*, or of sedgy *Lea*,
Or coaly *Tyne*, or ancient hallow'd *Dee*:
Or *Humber* loud, that keeps the Scythian's name,
Or *Medway* smooth, or royal tower'd *Thame*.

CANALS.

The earliest inland navigation that can be authenticated is the Sankey canal, leading from the coal-pits at St. Helen's, in Lancashire, to the river Mersey, in order to convey coals to Liverpool; the length of the canal is 12 miles.

The Duke of Bridgewater is regarded as the grand founder of inland navigation. His first canal extends from Worsley Mill to Manchester, by a course of 9 miles. There are subterraneous passages to the coal, in the mountains, of nearly a mile in length, sometimes cut through the solid rock. This beautiful canal is brought over the river Irwell, by an arch of 30 feet in height, and under which barges pass without lowering their masts.

We shall review the other canals in a geographical order, proceeding from north to south.

The Lancaster canal extends from Kendal in Westmoreland, by Lancaster, to West-Houghton in Lancashire, a space of 74 miles.

The canal from Leeds to Liverpool, by Skipton, winds through an extent of 117 miles; and from this canal a branch extends to Manchester.

From Halifax to Manchester is another canal, commonly called that of Rochdale; length 31½ miles.

Another canal extends from Manchester towards Wakefield; and another, called the Peak Forest canal, stretches from the former south-east, about 15 miles.

Another joins the river Don, several miles above Doncaster, to the river Calder, near Wakefield.

The Chesterfield canal extends from Chesterfield to the river Trent at Stockwith, a course of 55 miles.

In Lincolnshire, one canal extends from Lincoln to the Trent, and another from Hornecastle to Sleaford.—Grantham canal reaches from that town to the Trent, a course of 30 miles.

Liverpool is connected with Hull by a canal from that long navigable river the Trent. This canal is styled the Grand Trunk: its length is 99 miles.

It was attended with great difficulties, particularly in passing the river Dove in Derbyshire, where there is an aqueduct of 23 arches: the tunnel through the hill of Hare Castle in Staffordshire is in length 2880 yards, more than 70 yards below the surface of the ground, and was executed with great labour and expense.

Several branches extend in various directions from the Grand Trunk; one reaches to the river Severn, near Bewdley, and connects the port of Bristol with those of Liverpool and Hull: the length is 46 miles.

A canal, proceeding by Shrewsbury, unites the Mersey and the Severn.

From Coventry, in the centre of the kingdom, canals extend to the Grand Trunk, to Ashby-de-la-Zouch, and to the Braunston, or Grand Junction, canal.

Several inland navigations pass by Birmingham. The Union canal completes a course of 44 miles from Leicester to Northampton, whence the Nen is navigable to the sea. Another canal extends from Gloucester to Hereford.

The Severn is united with the Thames by a canal from Stroud to Lechlade, a course of 40 miles.

The Oxford canal extends to the Grand Trunk, or rather joins the Coventry canal, after a course of 92 miles.

The Grand Junction canal reaches from Brentford on the Thames, and joins the Oxford canal at Braunston in Northamptonshire, after a course of 90 miles.

On the south of the Thames, a canal extends from Reading to Bath.

Besides these, there are several smaller canals.

TOWNS IN ENGLAND AND WALES, WITH THE POPULATION IN 1811.

[☞ Those places marked with an (*) send members to Parliament. Those printed in Italic are Bishoprics.]

No.	Town.	County.	River.	Population.	Remarks.
1	Abergavenny	Monmouth	Usk & Gavenny	2,815	
2	*Abingdon	Berks	Thames	4,801	Trades in malt.
3	*Agmondesham or Amersham	Bucks	Coln	2,259	
4	*Aldborough	York	Near the Ure	464	
5	*Aldeburgh	Suffolk	Alde	1,066	
6	*Andover	Hants	Near the Test	3,295	Shalloons, malt, &c.
7	Alfreton	Derby		3,396	Brown earthen ware.
8	Alnwick	Northumberld.	Alne	5,426	A noble castle, the seat of the Duke of Northumberland.
9	Alston	Cumberland	Tyne	5,079	The environs abound with lead mines.
10	Alton	Hampshire	Wye	2,316	A variety of worsted articles.
11	Altrincham	Cheshire	Canal	2,032	Manufactories of cotton, &c.
12	Ambleside	Westmoreland	Windermere Lake	624	Woollen cloth.
13	*Appleby	Westmoreland	Eden	1,100	Good market for corn—including Bondgate parish, the population is 2,160.
14	*Arundel	Sussex	Arun	2,188	Great quantities of timber shipped.
15	Ashburn	Derby	Dove	2,112	Cheese.

No.	Town.	County.	River.	Population.	Remarks.
16	*Ashburton	Devon	Near the Dart	3,053	
17	Ashby de la Zouch	Leicester		3,141	Malt.
18	Atherstone	Warw.		2,921	
19	Austle St.	Cornwall		3,616	In the environs are tin mines and quarries of porcelain clay.
20	Axminster	Devon	Axe	2,387	Carpets, tapes, druggets, gloves, &c.
21	*Aylesbury	Bucks	Tame	3,447	Vale of Aylesbury is reckoned the richest land in England.
22	Bala	Merion.	Dee	1,463	
23	*Banbury	Oxford	Cherwell	2,841	Cakes and ale.
24	*Bangor*	Caernarvon	Strait of Menai	2,383	
25	Barking	Essex	Rhoding	2,421	
26	Barnardcastle	Durham	Tees	2,986	
27	Barnsley	Yorkshire	Canal	5,014	Hardware, linen, bottles, &c.
28	*Barnstaple	Devon	Taw	4,019	
29	Basingstoke	Hants	Canal	2,656	Shalloons, &c.
30	**Bath*	Somerset	Avon	31,496	Famous for its medicinal springs.
31	Battle	Sussex		2,531	The best gunpowder.
32	*Beaumaris	Anglesea	Strait of Menai	1,810	Good harbour.
33	*Bedford	Bedfordshire	South Ouse	4,605	

34	*Bedwin	Wilts	Canal	851	Market discontinued.
35	Beccles	Suffolk	Waveney	2,979	
36	*Beeralston	Devon	Near the Tamar		The population is so inconsiderable, that it is returned in the parish of Beerferris. The court for choosing the members of parliament is held under a large tree.
37	Belper	Derby		5,778	Cotton manufactories.
38	*Berwick	Northumberl.	Tweed	7,746	Exports corn, eggs, salmon, &c.
39	*Beverly	Yorkshire	Near the Hull	6,731	Malt, leather, and oatmeal.
40	*Bewdley	Worcestershire	Severn	3,454	Iron goods, salt, malt, and leather.
41	Biddeford	Devon	Towbridge	3,244	Good harbour and trade.
42	Bilston	Staffordshire		9,646	Iron forges, slitting mills, japanned and enamelled goods.
43	Birmingham	Warwickshire	Canals	85,753	The most noted manufactories of hardware in the world.
44	Bishop-Auckland	Durham	Wear	1,807	
45	*Bishop's Castle	Shropshire	Clun	1,367	
46	Blackburn	Lancashire	Ribble and Canal	15,083	Cotton, calicoes, and muslin.
47	Blandford	Dorsetshire	Stour	2,425	Shirt buttons.
48	*Blechingly	Surry		1,116	
49	*Bodmin	Cornwall	Camel	2,050	Serge.
50	Bolton	Lancashire		24,149	Calicoes, muslins, dimities, &c.

No.	Town.	County.	River.	Population.	Remarks.
51	*Boroughbridge	Yorkshire	Swale and Ure	747	
52	*Boston	Lincolnshire	Witham	8,180	Considerable trade.
53	*Bossiney	Cornwall	Bristol channel		The population is so inconsiderable, that it is included in another parish.
54	*Brackley	Northampton	Ouse	1,580	One of the oldest boroughs in England.
55	Bradford	Wilts	Lower Avon	2,989	Finest broad-cloths.
56	Bradford	Yorkshire	Canal	7,767	Shalloons, stuffs, &c.
57	*Bramber	Sussex		95	
58	Brampton	Cumberland	Irthing	2,043	
59	*Brecon	Breck.	Usk	3,196	One member to parliament.
60	*Bridgenorth	Shropshire	Severn	4,386	Cloth, stockings, iron tools, &c.
61	*Bridgewater	Somerset	Parret	4,911	Tide rises 36 feet.
62	*Bridport	Dorset	On a creek	3,567	Sail-cloth and hats.
63	Bridlington	York	German Ocean	3,741	A safe and commodious harbour.
64	Brighthelmstone	Sussex	English Channel	12,012	Fashionable resort for bathing.
65	**Bristol*	Somerset	Avon	76,433	Hot wells, and third sea-port in the kingdom.
66	*Buckingham	Bucks	South Ouse	2,987	Principal manufactory, lace making.
67	Burnley	Lancashire	Canal	4,368	Country abounds with pit coal.
68	Burslem	Stafford	Canal	8,615	Extensive potteries in this neighbourhood.
69	Burton	Stafford	Trent	3,979	Noted for ale.

70	Burton	Westmoreland	Near Canal	574	
71	*Bury St. Edmund	Suffolk	Larke	7,986	
72	Bury	Lancashire	Irwell	8,762	Cottons.
73	*Caerdiff	Glamorgan	Taeff	2,457	Cast and wrought iron exported—Sends one member to parliament.
74	*Caermarthen	Caermarthen	Towey	7,275	Sends one member to parliament.
75	*Caernarvon	Caernarvon	Strait of Menai	4,595	Sends one member to parliament—good harbour and quay—the population here given includes the parish of Llanbelig.
76	*Callington	Cornwall		938	
77	*Cambridge	Cambridge	Cam	11,108	University.
78	*Camelford	Cornwall	Camel	1,100	
79	**Canterbury*	Kent	Stour	10,200	An archbishoprick, and the metropolitan See of all England.
80	*Cardigan	Cardigan	Tivy	2,129	Sends one member to parliament.
81	**Carlisle*	Cumberland	Eden	12,531	Cottons, hats, fish-hooks, &c.
82	Cartmel	Lancashire		3,939	
83	Castleford	Yorkshire	Aire and Calder	890	
84	*Castle Rising	Norfolk		297	No market—harbour choaked up.
85	Cawood	Yorkshire	Wharfe and Ouse	1,053	
86	Chorley	Lancashire	Chor	5,182	Cottons.
87	Chatham	Kent	Medway	12,652	Famous for dock-yard and naval arsenal.

No.	Town.	County.	River.	Population.	Remarks.
88	*Calne	Wilts	Marlow and Canal	3,547	Cloth.
89	Chelmsford	Essex	Chelmer	4,694	
90	Chard	Somerset		2,932	A decayed town.
91	Cheltenham	Gloucester	Chelt	8,325	Mineral waters.
92	Chepstow	Monmouth	Wye	2,581	This is the port of all the towns which stand on the rivers Wye and Lug.
93	Chertsey	Surry	Thames	3,629	
94	**Chester*	Cheshire	Dee	16,140	Has a convenient harbour.
95	Chesterfield	Derby	Canal	4,476	Silk and cotton mills—carpets, &c.
96	Chester-le-street	Durham	Wear	1,726	
97	**Chichester*	Sussex		6,425	Large market for sheep and black cattle.
98	*Chippenham	Wilts	Avon	3,410	Superfine cloths.
99	*Christchurch	Hants	Avon and Stour	1,553	Knit silk stockings and watch chains.
100	*Cirencester	Gloucester	Canal	5,540	
101	*Clitheroe	Lancashire	Ribble	1,767	Cotton manufactories.
102	*Cockermouth	Cumberland	Cocker and Derwent	2,964	Leather, hats, coarse woollens, and linens.
103	Coggleshall	Essex	Blackwater	2,471	Manufacture of baize and toys.
104	*Colchester	Essex	Colne	12,544	Baize, and famous for oysters.
105	Collumpton	Devon	Culm	2,917	Woollen cloth and corduroys.
106	Colne	Lancashire		5,336	Cotton and worsted.

107	Congleton	Cheshire	Dean	4,616	Leather and cotton.
108	*Corfe Castle	Dorset		744	Sends Purbeck stone to London, and clay to Staffordshire.
109	**Coventry*	Warwick	Avon	17,923	Ribbons—the steeple of St. Michael's church is perhaps the most beautiful in Europe, and is 303 feet high.
110	Cranbrook	Kent		2,994	The first woollen manufactory in England was established here in the reign of Edward III.
111	Crediton	Devon	Exe	1,846	Serges.
112	Crewkerne	Somerset	Parrot and Axe	3,021	Sail-cloth, stockings, &c.
113	*Cricklade	Wilts	Thames	1,556	
114	Croydon	Surry		7,801	Paper, printing cottons, &c.
115	Dalton	Lancashire	Irish Sea	643	A large and commodious port.
116	Darlington	Durham	Skern	5,059	Linen and woollen manufactories.
117	Dartford	Kent	Darent	3,177	Gunpowder.
118	*Dartmouth	Devon	Dart	3,595	Torbay is on the north of this town, the principal rendezvous of the British navy.
119	Daventry	Northampton		2,758	Whips.
120	Deal	Kent	Strait of Dover	7,351	
121	*Denbigh	Denb.	Clwyd	2,714	Shoes, gloves, &c.—1 member to parliament.
122	Deptford	Kent	Thames	19,833	A royal dock-yard, with all sorts of stores for the navy.

No.	*Town.*	*County.*	*River.*	*Population.*	*Remarks.*
123	*Derby	Derbyshire	Derwent	13,043	Silk, porcelain, chimney ornaments, &c.
124	Dereham East	Norfolk		2,888	Cowper, the poet, was buried here.
125	*Devizes	Wilts		3,750	Druggets, serges, kerseymeres, &c.
126	Diss	Norfolk		2,590	Hempen cloth, hose, and stays.
127	Doncaster	Yorkshire	Don	6,935	The situation of this town is remarkably pleasant.
128	*Dorchester	Dorset	Frome	2,546	Broad cloth—excellent ale.
129	Dorking	Surry		3,259	
130	Dolgelly	Merioneth	Avon	3,064	
131	*Dover	Kent	Strait of Dover	9,074	Thoroughfare to and from France in time of peace.
132	*Downton	Wilts	Avon	2,624	Lace-making.
133	*Droitwich	Worcester	Canal	2,079	Fine white salt, the best in Europe.
134	Dudley	Worcester	Canal	13,025	Nails and hardware.
135	Dunstable	Bedford		1,616	Straw hats.
136	*Dunwich	Suffolk		208	A decayed borough.
137	**Durham*	Durham	Wear	6,763	The cathedral is a grand gothic building.
138	Dursley	Gloucester		2,580	Cloth, and cards for wool-combers.
139	*East Grinstead	Sussex		2,804	
140	*East Looe	Cornwall	Looe	608	Herring fishery.

141	Eccleshall	Stafford	Sow	3,618	
142	Ellesmere	Shropshire		5,639	Malt.
143	*Ely*	Cambridge	South Ouse	4,249	
144	Enfield	Middlesex		6,636	Celebrated for its chase.
145	*Evesham	Worcester	Avon	3,068	The vale of Evesham is remarkable for its fertility.
146	**Exeter*	Devon	Exe	18,896	Has a woollen market, the greatest in England except Leeds.
147	*Eye	Suffolk		1,893	Bone lace.
148	Falmouth	Cornwall	Fale	3,933	Station of the packets to Spain, Portugal, and the West Indies.
149	Fareham	Hampshire	Portsmouth harb.	3,325	Ropes and sacking.
150	Farnham	Surry	Wey	2,911	A great wheat market.
151	Faversham	Kent		3,655	Extensive manufactory of gunpowder—oyster fishery.
152	Ferrybridge	Yorkshire	Aire and Calder		
153	*Flint	Flintshire	Dee	1,433	Sends one member to parliament.
154	Folkstone	Kent	English channel	3,697	Fishery.
155	Fording Bridge	Hampshire	Avon	2,259	Calico printing.
156	*Fowey	Cornwall	Fowey	1,319	Large harbour—Pilchard fishery.
157	Frodsham	Cheshire	Wever	2,105	Salt refining, and cotton manufactories.
158	Frome	Somerset	Avon and Frome	9,493	Cloths, woolcomber's cards, &c.

No.	*Town.*	*County.*	*River.*	*Population.*	*Remarks.*
159	Gainsborough	Lincoln	Trent	5,172	River port of some consequence—the rise of the tide is very rapid.
160	*Gatton	Surry		99	A mean village, though once a large town.
161	Glastonbury	Somerset		2,337	Formerly celebrated for its abbey, the richest in England.
162	**Gloucester*	Gloucester	Severn	8,280	Pin-making, rope-making, wool-stapling and malting.
163	Godalmin	Surry	Wye	3,543	Hosiery.
164	Gosport and Alverstoke	Hampshire	Portsmouth harb.	12,212	King's docks, &c.
165	*Grampound	Cornwall	Fale	601	
166	*Grantham	Lincolnshire	Witham	3,646	Here Sir Isaac Newton first received the rudiments of literature.
167	Gravesend	Kent	Thames	3,119	All ships leaving the Thames for foreign ports must clear here.
168	*Great Grimsby	Lincolnshire	Humber	2,747	Coals and salt.
169	Greenwich	Kent	Thames	16,947	Famous for its hospital and royal observatory.
170	Guernsey (an island) in the British Channel			15,000	nearly.
171	*Guildford	Surry	Wey	2,974	Sends corn, malt, and beer to London.
172	Guilsbrough or Gisborough	York	Near the Tees	1,834	Long noted for alum works.

173	Hadleigh	Suffolk	Breton	2,592	Spinning yarn.
174	Halifax	Yorkshire	Calder	9,159	Extensive woollen manufactures.
175	Halstead	Essex	Colne	3,279	Baize.
176	Harewood	Yorkshire	Wharfe	802	
177	Harlech	Merionethshire	Irish Sea		The population of this town was not returned in 1811.
178	Hartlepool	Durham	German Ocean	1,047	An inconsiderable sea-port.
179	*Harwich	Essex	Stour and Orwell	3,732	Large and safe harbour, and station of the packets to Holland.
180	*Haslemere	Surry		756	
181	Haslinden	Lancashire	Canal	5,127	Linen, Cotton, and woollen manufactures.
182	*Hastings	Sussex	English Channel	3,848	One of the Cinque ports—William the Conqueror landed here.
183	Hawkeshead	Lancashire	Near Esthwaite Lake	676	Copper ore obtained in the neighbourhood.
184	*Haverford West	Pembroke	Cledken	3,093	Principal trading town in the county.
185	*Heyden	Yorkshire	Near the Humber	780	
186	*Helstone	Cornwall	Looe	2,297	Tin.
187	Hemel Hempstead	Hereford	Gade	3,240	Great corn market.
188	Henley	Oxfordshire	Thames	3,117	Flour, malt, beech-wood.
189	**Hereford*	Herefordshire	Wye	7,306	Cyder.
190	*Hertford	Hertfordshire	Lea	3,900	

No.	Town.	County.	River.	Population.	Remarks.
191	Hexham	Northumberld.	Tyne	3,518	Tanned leather and gloves.
192	*Heytesbury	Wilts	Willy	1,023	Woollen manufactory.
193	*Higham Ferrers	Northampton.		823	One member to parliament.
194	*Hindon	Wilts		781	
195	Hinckley	Leicestershire	Canal	6,058	Wove and knit stockings.
196	Hitchen	Hertfordshire		3,608	
197	Holbeach	Lincolnshire		2,962	
198	Holywell	Flintshire	Dee	6,394	Lead, calamine,—copper mines near.
199	Holyhead	Anglesea		3,005	Station of packet boats to Ireland.
200	*Honiton	Devonshire		2,735	Broad lace.
201	*Horsham	Sussex	Arun	3,839	Horsa, the brother of Hengist, is said to have built this town,—hence its name
202	Howden	Yorkshire	Ouse	1,812	The Bishop of Durham is Lord of the manor. He is obliged to find ropes for every bull baited here.
203	Huddersfield	Yorkshire	Canal	9,671	Woollen manufactures.
204	*Hull	Yorkshire	Hull	26,792	Extensive commerce.
205	*Huntingdon	Huntingdonsh.	South Ouse	2,397	It takes its name from its ancient convenient neighbourhood for hunting.
206	*Hythe	Kent	Strait of Dover	2,318	One of the Cinque ports.
207	*Ilchester	Somersetshire	Ivel	610	Roger Bacon was born here.

208	Ilfracombe	Devon	Bristol Channel	1,934	Convenient harbour.
209	Ilminster	Somersetshire	Ille	2,160	Narrow cloths.
210	*Ipswich	Suffolk	Orwell	13,670	Malting and corn. Ship timber is sent from hence to the king's docks, especially to Chatham. Cardinal Wolsey was a native of this town.
211	Keighly	York	Canal	6,864	Woollen cloths, cottons & Manchester goods
212	Kendal (Kirkby)	Westmoreland	Ken	7,505	Cottons, woollens, worsted stockings. By canals it communicates with the rivers Mersey, Dee, Ribble, Ouse, Trent, Severn, Thames, &c.
213	Keswick	Cumberland	Lake	1,683	Coarse woollens. The situation of the country adjoining the lake very romantic.
214	Kettering	Northamptonsh.		3,242	Lace working, wool combing, &c.
215	Kidderminster	Worcestershire	Stour	8,038	The manufacture of carpets here gives employment to more than 3,000 people. By canals it has communication with Hull, Liverpool, Bristol, Manchester, &c.
216	Kirkby Lonsdale	Westmoreland	Loyne	1,368	
217	Kirkby Stephen	Westmoreland	Eden	1,235	Great numbers of cattle are sent from this neighbourhood to Liverpool.
218	*Knaresborough	Yorkshire	Nid	4,234	Linen cloths. Noted for its petrifying wells and medicinal springs.

No.	Town.	County.	River.	Population.	Remarks.
219	Knutsford	Cheshire	Birken	2,114	Velvet and sewing thread. It is supposed to take its name from Canute's ford, that king having forded the river after obtaining a victory in the neighbourhood.
220	*Lancaster	Lancaster	Lon	9,247	Trades to the West Indies, America, and the Baltic. It communicates by canals with most of the inland counties.
221	*Landaff*	Glamorgansh.	Taafe	960	A tolerable harbour.
222	*Launceston	Cornwall	Tamar	1,758	
223	Leeds	Yorkshire	Aire	62,534	The trade in woollen cloths is perhaps the greatest in the world.
224	Ledbury	Herefordshire	Leden	3,136	Cloth.
225	Leek	Staffordshire	Churnet	3,703	Ribbons, silk, twist, and buttons.
226	*Leicester	Leicestershire	Soar	23,146	Stocking manufactory.
227	Leighton Buzzard	Bedfordshire	Ouse	2,114	
228	*Leominster	Herefordshire	Wye	3,238	Gloves and hats.
229	*Leskeard	Cornwall		2,884	Tin mines.
230	*Lestwithiel	Cornwall	Fowey	825	
231	*Lewes	Sussex	Ouse	6,221	The river navigable for barges.
232	**Lincoln*	Lincolnshire	Witham	8,861	Cathedral largest in England except York.
233	**Litchfield*	Staffordshire	Canal	5,022	Dr. Johnson was born here.

234	*Liverpool	Lancaster	Mersey	94,376	This town is said to enjoy 1-12th of the navigation of Great Britain, 1-6th of its general trade, and ½ as much commerce as London.
235	*London	Middlesex	Thames	1,009,546	The greatest trading city in the world.
236	Loughborough	Leicester	Soar	5,400	
237	Louth	Lincolnshire	Lud	4,728	Some coasting trade.
238	Lowestoff	Suffolk	German Ocean	3,189	Herring fishery.
239	*Ludlow	Shropshire	Teme and Corve	4,150	
240	*Luggershall	Wilts		487	
241	Luton	Bedfordshire	Lea	3,716	Straw hats.
242	*Lyme-Regis	Dorset	Artificial harbour	1,925	
243	*Lymington	Hants	British channel	2,641	Imports coals, exports salt.
244	Lynn-Regis	Norfolk	Ouse	10,259	A considerable sea-port.
245	Macclesfield	Cheshire	Bollin	12,299	Buttons, silk twist, cotton goods, hats, hat-bands, &c.
246	*Maidstone	Kent	Medway	9,443	Hop plantations.
247	*Malden	Essex	Blackwater	2,679	Salt, brandy, wine, deals, and iron.
248	*Malmesbury	Wilts	Avon	1,152	Woollen cloth.
249	*Malton	Yorkshire	Derwent	3,713	
250	Manchester	Lancashire	Irwell	98,573	This town is the centre of the cotton trade.
251	Mansfield	Nottingham	Idle	6,816	Corn and malt.

No.	Town.	County.	River.	Population.	Remarks.
252	March	Cambridge	Nen	3,098	
253	Margate	Kent	Sea coast	6,126	A fashionable resort for sea-bathing.
254	*Marlborough	Wilts	Kennet	2,579	
255	*Marlow	Bucks	Thames	2,799	Black silk, lace, and paper—military academy.
256	Melford	Suffolk	Stour	2,068	
257	*Midhurst	Sussex	Arun	1,256	
258	*Milburneport	Somerset	Parret	1,000	Dowlas, ticking, stockings, &c.
259	Mildenhall	Suffolk	Larke	2,493	
260	Minchin-hampton	Gloucester		3,246	Extensive manufactures of cloth.
261	*Minehead	Somerset	British Channel	1,037	Coal trade.
262	*Melcombe-Regis	Dorset	Wey	2,985	
263	*Monmouth	Monmouth	Wye	3,503	An iron manufactory.
264	*Montgomery	Montgomery	Near the Severn	932	
265	*Morpeth	Northumberld.	Wentsbeck	3,244	Largest market for live cattle in the north of England.
266	Nantwich	Cheshire	Weaver	3,999	Salt, cheese.
267	Neath	Glamor.	Neath	2,740	Copper works, iron forges, &c.
268	*Newark	Nottingham	Trent	7,236	
269	Newbury	Berkshire	Kennet	4,898	Woollen manufactories.
270	Newcastle	Caerm.	Towy		A small decayed town.

271	*Newcastle	Northumberld.	Tyne	27,587	Coal trade—including Gateshead, the population is 36,369.
272	*Newcastle	Stafford	Trent	6,175	Pottery ware.
273	Newent	Gloucester		2,538	Coal mines in the neighbourhood.
274	Newmarket	Cam. & Suffolk		1,917	Horse-racing.
275	Newport	Shropshire		2,114	
276	*Newport	Cornwall			An inconsiderable village, the property of the Duke of Northumberland.
277	*Newport	Hants	Cowes	3,855	Situated in the Isle of Wight.
278	*Newton	Lancashire		1,589	Manchester goods.
279	Newport-Pagnel	Bucks	Ouse	2,515	Paper and lace manufactories.
280	*Northallerton	Yorkshire	North of Swale	2,234	
281	*Northampton	Northampton	Nen	8,427	Shoes, stockings, and lace.
282	Northwich	Cheshire	Weaver	1,382	Cotton manufacture, and salt works.
283	**Norwich*	Norfolk	Yare	37,256	Woollen stuffs, camlets, and crape.
284	*Nottingham	Nottingham	Trent	34,253	Stocking manufactories.
285	*Oakhampton	Devon	Oak	1,440	Serges.
286	Oakham	Rutland		1,719	
287	Oakingham	Berks		2,365	
288	Olney	Bucks	Ouse	2,268	Bone lace.
289	*Orford	Suffolk	Ore & Alde	737	

No.	*Town.*	*County.*	*River.*	*Population.*	*Remarks.*
290	Ormskirk	Lancashire	Canal	3,064	
291	Oswestry	Shropshire	Canal	3,479	
292	Otley	Yorkshire	Wharfe	2,602	
293	Ottery St. Mary	Devon	Otter	2,880	
294	**Oxford*	Oxford	Thames	12,931	University—the beauty of this city in magnificent buildings is unequalled.
295	*Pembroke	Pembrokeshire	Milford Haven	2,415	
296	Penrith	Cumberland	Eamont	4,328	Check and fancy waistcoat pieces.
297	*Penryn	Cornwall	a Creek	2,713	Pilchard and Newfoundland fisheries.
298	Penzance	Cornwall		4,022	Tin mines.
299	**Peterborough*	Northampt.	Nen	3,674	Corn, timber, &c.
300	*Petersfield	Hants		1,280	
301	Pickering	Yorkshire		2,332	
302	*Plymouth	Devon	Plym	56,060	Plymouth sound is capable of holding 1,000 sail of ships.
303	*Plympton	Devon		715	
304	*Poole	Dorset	Creek	4,816	Newfoundland fishery.
305	*Pontefract	Yorkshire	Near the Ayre	3,605	
306	*Portsmouth, including Portsea	Hants		40,567	Principal sea-port for the British navy.
307	Prescot	Lancashire		3,678	Celebrated for watches.

308	Presteign	Radnor	Lug	1,114	
309	*Preston	Lancashire	Ribble	17,065	Cotton manufactories.
310	*Queensborough	Kent	Medway	805	Situated on the Isle of Sheppy—oyster fishery.
311	Ramsgate	Kent	Strait of Dover	4,221	Fashionable bathing place.
312	*New Radnor	Radnor		380	
313	*Reading	Berks	Thames	10,788	Corn, flour, and timber to London—manufactures pins, ribbons, and blankets.
314	*East Retford	Nottingham	Idle	2,030	
315	*Richmond	Yorkshire	Swale	3,056	Yarn stockings and woollen caps.
316	Rickmansworth	Herts	Calne	3,230	
317	Ringwood	Hants	Avon	3,269	Leather, stockings, narrow cloths, &c.
318	*Ripon	Yorkshire	Ure	3,633	Its market place is reckoned one of the finest in England.
319	Rochdale, parish	Lancashire	Roche	37,229	Woollen, cotton, and hat manufactories.
320	**Rochester*	Kent	Medway	9,070	
221	*New Romney	Kent		841	One of the cinque ports.
322	Ross	Hereford	Wye	2,261	Cyder.
323	Rotheram	Yorkshire	Don	2,950	Iron and steel manufactories.
324	Royston	Hertf. & Cam.		1,309	Noted for its species of crow, which visits the neighbourhood only in winter.
325	*Rye	Sussex	Rother	2,681	One of the cinque ports.

No.	*Town.*	*County.*	*River.*	*Population.*	*Remarks.*
326	*Ryegate	Surry	Near the Mole	1,128	The neighbourhood abounds with fuller's earth.
327	*St. Alban's	Herts	Coln	3,653	
328	*St. Asaph*	Flint.	Clwyde	1,520	
329	*St. David's*	Pemb.		1,816	
330	*St. Germain's	Cornwall	Tidi or Lyner	2,139	
331	*St. Ives	Cornwall	Bay	3,281	Bad harbour.
332	St. Ives	Hunts.	South Ouse	2,426	
333	*St. Maws	Cornwall	Falmouth Harbour		No market: the population included in another parish.
334	*St. Michael	Cornwall		178	
335	Saffron Walden	Essex		3,403	Great quantities of saffron were formerly cultivated here.
336	**Salisbury*	Wilts	Avon	8,243	Flannels, bone lace, and cutlery.
337	*Saltash	Cornwall	Tamar	1,478	Malt.
338	*Sandwich	Kent	Stour	2,735	Cinque port—harbour choaked up with sand.
339	New Sarum	[See Salisbury]			
340	*Old Sarum	Wilts			Of this ancient borough there is not a single house remaining.
341	*Scarborough	Yorkshire	German Ocean	7,067	Resorted to for its mineral waters.
342	Scilly Isles	Off the Land's-end		700	Inhabited by fishermen, pilots, &c.

343	*Seaford	Sussex	Sea Coast	1,001	Cinque port—fishing town and bathing place.
344	Seven Oaks	Kent	Darent	1,922	Here are an alms-house and a grammar-school, founded by Sir W. Rumsted, who had been a deserted child, and having been found in Seven Oaks, afterwards became Lord Mayor of London.
345	Selby	Yorkshire	Ouse	3,363	Considerable trade.
346	*Shaftesbury	Dorset.		2,635	Shirt buttons—water scarce.
347	Sheffield	Yorkshire	Don	35,840	Noted for its cutlery—above 600 master cutlers employed.
348	Shepton Mallet	Somerset		4,638	Woollen manufactories.
349	Sherborne	Dorset	Ivel	3,370	Woollen cloth and silk.
350	Shields, North	Northumberld.	Tyne	7,699	Centre of the coal trade.
351	Shields, South	Durham	Tyne	9,001	Life-boat invented here.
352	Sheerness	Kent	Medway	1,685	Strongly fortified.
353	*Shoreham	Sussex		770	Ship-building—oysters.
354	*Shrewsbury	Shropshire	Severn	16,606	Flannels, cakes.
355	Skipton	Yorkshire	Canal	2,868	
356	*Southampton	Hants	Itchen	9,617	Trade to Portugal, Guernsey, Jersey.
357	Southwell	Nottingham	Trent	2,674	
358	*Southwark	Surry	Thames	72,119	
359	Spalding	Lincoln	Welland	4,330	Coals and corn.

No.	Town.	County.	River.	Population.	Remarks.
360	*Stafford	Stafford	Sow	4,868	Cloth and shoes.
361	*Stamford	Lincoln	Welland	4,582	Malt and coals.
362	*Steyning	Sussex		1,210	
363	Stockport	Cheshire	Mersey	17,545	Cotton manufactories.
364	Stockton	Durham	Tees	4,229	Huckabacks, checks, &c.
365	Stone	Stafford	Trent	2,314	
366	Stourbridge	Worcester	Stour	4,072	Iron manufactories and earthen-ware.
367	Sturminster	Dorset	Stour	1,461	White baize.
368	*Stockbridge	Hants		663	
369	Stratford upon Avon	Warwick	Avon	2,842	Birth-place of Shakspeare.
370	Stroud	Gloucester	Canal	5,321	Cloths—famous for its scarlet dye.
371	*Sudbury	Suffolk	Stour	3,471	
372	Sunderland, including Bishop & Monkwearmouth	Durham	Wear	25,180	Coal trade—iron bridge one arch 100 feet high, 236 feet long.
373	Swansea	Glamor.	Bristol Channel	8,196	Exports stone, coal, iron ore, &c.
374	Sutton Coldfield	Warwick.		2,959	
375	Swaffham	Norfolk		2,350	
376	Tadcaster	Yorkshire	Wharfe	1,483	
377	*Tamworth	Staffordshire	Tame	2,991	Narrow cloths.

378	*Tavistock	Devon	Tamar	4,723	
379	*Taunton	Somerset	Thone	6,997	Manufactory of silks.
380	Tenby	Pembroke	Severn	1,176	A fashionable bathing place.
381	Tenderden	Kent		2,786	
382	Teignmouth East	Devon	Teign	813	Exports pipe clay.
383	Teignmouth West	Devon	Teign	2,080	Exports pipe clay.
384	Tetbury	Gloucester		2,533	Woollen cloth.
385	*Tewksbury	Gloucester	Severn	4,820	Stocking knitting, frame work, mustard and malt.
386	Thame	Oxford	Thames	2,328	
387	*Thetford	Norfolk	Ouse	2,450	Woollen cloth and paper.
388	*Thirsk	Yorkshire		2,155	Coarse linens.
389	Tideswell	Derby		1,219	Its name is derived from its ebbing and flowing well, reckoned one of the wonders of Derbyshire.
390	Thorne	Yorkshire	Air, Don, & Ouse	2,713	
391	*Tiverton	Devon	Exe	6,732	Serges, kerseys, diapers, &c.
392	*Totness	Devon	Dart	2,725	Fishing town.
393	Topsham	Devon	Exe	2,871	Port of Exeter.
394	Towcester	Northampton.	South Ouse	2,245	Lace and silk.
395	Trowbridge	Wilts	Were	6,075	Broad-cloth.

No.	*Town.*	*County.*	*River.*	*Population.*	*Remarks.*
396	*Tregony	Cornwall	Fale	923	
397	*Truro	Cornwall	Sea Coast	2,482	Exports copper and tin.
398	Tonbridge	Kent	Medway	5,932	Famous for its wells.
399	Tynemouth	Northumb.	Tyne	5,834	Bathing place.
400	Ulverstone	Lancashire	Near the Leven	3,378	Exports iron ore, limestone, and corn.
401	Uttoxeter	Staffordshire	Dove	3,155	Ironmongery.
402	Uxbridge	Middlesex	Colne	2,411	The principal trade is in supplying London with flour.
403	*Wallingford	Berkshire	Thames	1,901	Malt and corn.
404	Walsall	Staffordshire		11,189	Hardware, as buckles, bridle bits, &c.
405	Wakefield	Yorkshire	Calder	8,593	Woollen cloths and stuffs.
406	Wantage	Berkshire	Ock	2,386	This town is celebrated as the birth-place of Alfred the Great.
407	Ware	Hertfordshire	Lea	3,369	Corn and malt.
408	*Wareham	Dorset	Frome	1,709	Pipe clay.
409	Warminster	Wiltshire	Willy	4,866	
410	Warrington	Lancashire	Mersey	11,738	Sail cloth, canvass, pins, and glass.
411	*Warwick	Warwickshire	Avon	6,497	
412	Watford	Hertfordshire	Colne	3,976	Silk manufactory.
413	Wednesbury	Staffordshire	Canal	5,372	Iron manufactories and enamel painting.

414	Welchpool	*Montgom.*	*Severn*	3,440	Flannels.
415	**Wells*	Somersetshire	Brue	5,156	The cathedral is a spacious Gothic structure.
416	Wem	Shropshire	Roden	1,395	
417	*Wendover	Bucks		1,481	
418	*Wenlock, Much	Shropshire		2,079	
419	*Weobly	Hereford.		626	
420	*Westbury	Wilts		1,799	Broad-cloth.
421	*West Looe	Cornwall	Looe	433	
422	**Westminster*	Middlesex	Thames	162,085	
423	Wetherby	Yorkshire	Wharfe	1,140	
424	*Weymouth	Dorset	Wey	1,747	A fashionable resort for bathing.
425	Whitby	Yorkshire	Esk	6,969	A considerable coasting trade.
426	Whitehaven	Cumberland	Irish Sea	10,106	Coal trade.
427	*Whitechurch	Hants		818	Shalloons—the whole parish contains 1,407 inhabitants.
428	Whitchurch	Shropshire		2,589	
429	*Wigan	Lancashire	Douglass	14,060	
430	Wigton	Cumberland		3,051	
431	**Winchester*	Hants	Itchen	6,705	
432	*Winchelsea	Sussex		652	A cinque port.
433	Wight Isle	On Coast of Hants		24,120	

No.	Town.	County.	River.	Population.	Remarks.
434	*Wilton	Wilts	Willy & Nadder	1,963	Carpets.
435	Winbourne-Minster	Dorset	Stour	3,158	
436	*Windsor	Berkshire	Thames	6,155	Famous for its castle and forest.
437	Wirksworth	Derby		3,474	Lead mines.
438	Wisbeach	Cambridge	Nen	6,300	
439	Witham	Essex	Blackwater	2,352	
440	Witney	Oxford	Windrush	2,722	Blankets.
441	Wakingham	[See Oakingham]			
442	*Woodstock	Oxford		1,419	Near this town are the house and park of Blenheim.
443	Wolsingham	Durham	Wear	1,983	
444	Wolverhampton	Staffordshire	Canal	14,836	Hardware—noted for its locksmiths.
445	Woodbridge	Suffolk	Deben	4,332	It trades to London, Hull, Newcastle, &c.
446	Wooler	Northumb	Till	1,704	
447	Woolwich	Kent	Thames	17,054	Noted for its military and naval arsenal, and royal military academy.
448	**Worcester*	Worcester	Severn	13,814	During the season the largest hop market in the kingdom.
449	Workington	Cumberland	Derwent	5,807	Salt works, salmon fishery, coal trade.
450	Worksop	Nottingham	Canal	3,702	

451	*Wootton-Basset	Wiltshire		1,390	Only 10 voters.
452	Wivelscomb	Somerset.	Tone	2,550	Blankets, kerseys, shrouds, &c.
453	Wrexham	Denbigh.		3,006	Flannels.
454	Wrington	Somerset.		1,109	Birth-place of John Locke—chief trade is in thistles sold to the woollen-cloth manufacturers.
455	*Wycombe-Chipping, or High Wycombe	Bucks		4,756	
456	Yarm	Yorkshire	Tees	1,431	Corn, cheese, and lead.
457	*Yarmouth	Norfolk	Yare	17,977	Considerable commerce, and very extensive fishery.
458	*Yarmouth	Hants	On the Isle of Wight	427	
459	Yeovil	Somersetshire	Yeo or Ivil	3,118	Gloves
460	**York*	Yorkshire	Ouse	18,217	Famous for its minster, the largest in England.

SCOTLAND.

That part of Great Britain, called Scotland, is 260 miles in length, by about 160 at its greatest breadth; it extends from the 55th degree of north latitude, to more than 58½.

The superficial contents have been computed at 29,167 square miles. The population being estimated at 1,865,000, there will, of course, be only 64 inhabitants for every square mile.

Scotland is divided into 33 counties, which, according to their situations, we shall arrange in three divisions.

Six Northern.

COUNTIES.	CHIEF TOWNS.
Orkney (Isles)	Skalloway and Kirkwall
Caithness	Wick
Sutherland	Dornoch
Ross	Dingwall and Taine
Cromarty	Cromarty
Inverness	Inverness

Fourteen Midland.

Argyle	Inverary
Bute	Rothsay
Nairn	Nairn
Murray *or* Elgin	Elgin
Banff	Banff
Aberdeen	Aberdeen
Mearns *or* Kincardine	Bervie
Angus *or* Forfar	Montrose
Perth	Perth
Fife	St. Andrews
Kinross	Kinross
Clackmannan	Clackmannan

COUNTIES.	CHIEF TOWNS.
Stirling	Stirling
Dunbarton	Dunbarton
Thirteen Southern.	
West-Lothian *or* Linlithgow	Linlithgow
Mid-Lothian *or* Edinburgh	Edinburgh
East-Lothian *or* Haddington	Haddington and Dunbar
Berwick *or* Merse	Dunse and Lauder
Renfrew	Renfrew
Ayr	Ayr
Wigton *or* W. Galloway	Wigton
Lanark *or* Clydesdale	Glasgow and Lanark
Peebles *or* Tweedale	Peebles
Selkirk	Selkirk
Roxburg	Jedburg
Dumfries	Dumfries
Kircudbright *or* E. Galloway	Kircudbright

LAKES AND FRITHS.

The principal lakes in Scotland are Loch Ness, Loch Lochy, Loch Lomond, Loch Tay, and Loch Awe.

The principal friths, or arms of the sea, in Scotland, are the Frith of Dornock, Murray Frith, the Frith of Tay, and the Frith of Forth, on the east; the Solway Frith, on the south; the Frith of Clyde, and Loch Fyn, with several more inlets, on the west.

RIVERS.

The Spey, in Inverness-shire, forms, for a considerable way, the boundary between Murray and Banff, and falls into the sea at Speymouth.

The Deveron, dividing the county of Banff from that of Aberdeen, falls into the sea at Banff.

The Dee and the Don, crossing Aberdeenshire from west to east, fall into the sea at Aberdeen.

The South Esk passes by Brechin and Montrose.

The Tay rises out of Loch Tay, in Perthshire, runs by Dunkeld and Perth, and, spreading into a wide estuary, falls into the sea below Dundee: for a considerable space it forms the boundary between Angus and Fife.

The Forth rises in Perthshire, runs by Stirling, and then forms that large arm of the sea called the Frith of Forth.

The Tweed rises in Peebles, runs by Peebles, Melrose, Kelso, and Coldstream, and falls into the sea at Berwick.

The Annan, a small river, runs into the Solway Frith at the town of Annan.

The Nith runs by Dumfries into the Solway Frith.

Another Dee runs by Kircudbright into the Irish Sea.

The Clyde rises in Lanarkshire, runs by Lanark, Glasgow, and Renfrew, and falls into the Frith of Clyde at Greenock.

CANALS.

The principal canal in Scotland is that connecting the Friths of Forth and Clyde. Its length is 35 miles, beginning at the mouth of the Carron, and ending at Dalmair Burnfoot on the Clyde, 6 miles below Glasgow. It admits vessels drawing 8 feet water.

This canal was begun in 1768, under Mr. Smeaton. It was attended with great difficulties. There are several aqueduct bridges in its course; that over the great road, to the west of Falkirk, is a very fine one; and that over the Helvin is considered as one of the finest pieces of workmanship in the world. It consists of 4 arches, and carries the canal over a valley 65 feet deep, and 420 feet long.

Another canal is now constructing at the expense of government, called the Caledonian Canal, to open a communication between the Murray Frith and the western sea. It proceeds along a line of lakes from Inverness, by Fort Augustus and Fort William: length about 80 miles.

MOUNTAINS.

These are the Cheviot Hills, between England and Scotland, and the Grampian Hills, south of Inverness, which extend from Loch Lomond to Stonehaven, and form the southern boundary of the Highlands. Ben Nevis, in Inverness-shire, is the highest mountain in Great Britain, being 4,350 feet above the sea.

SCOTTISH ISLES.

Bute and Arran are two beautiful islands, which adorn the Frith of Clyde.

West of the peninsula of Cantyre begin the Hebrides, the principal of which are Ilay, Jura, Mull, Tirey, Col, Sky, and Lewis.

The Orkney Isles are separated from the continent by a strait called Pentland Frith. The inhabited isles are about 26 in number: the chief is Mainland, frequently called Pomona. Kirkwall and Stromness are the principal towns.

The Shetland Isles are to the north of the Orkneys: they are 46 in number, 26 of which are said to be inhabited. Mainland is the largest. The principal town is Lerwick.

TOWNS IN SCOTLAND, WITH THE POPULATION IN 1811.

No.	Town.	County.	River.	Population.	Remarks.
1	Aberdeen	Aberdeen	Dee and Don	21,639	An university—the new town a place of considerable trade.
2	Aberdour	Fife		1,302	
3	Alloa	Clackman.	Forth	5,096	A sea-port on the Frith of Forth, 20 miles above Leith.
4	Andrew's St.	Fife	North Sea	4,311	An university—the harbour small.
5	Annan	Dumfries	Annan	3,341	A small sea-port, with some manufactures.
6	Anstruther	Fife	North Sea	1,401	
7	Aberbrothwick, or Arbroath	Angus	Brothwick	5,280	A good coasting trade in coals and lime—some linen manufactories.
8	Augustus Fort	Inverness	Lochness		
9	Ayr	Ayr	Doon and Ayr	6,291	
10	Banff	Banff	Deveron	3,603	Quantities of salmon are exported hence.
11	Berwick North	Haddington	Frith of Forth	1,727	
12	Bervie	Kincardine	North Sea	927	
13	Blair Athol	Perth	Tilt and Garry	2,515	
14	Boileau or Beauly	Inverness	Beauly		

15	Brechin	Angus	South Esk	5,559	Manufactures of brown linen and sail cloth—salmon fishery.
16	Burnt Island	Fife	Frith of Forth	1,934	A good harbour with considerable trade.
17	Burroughstoness	Linlithgow	Frith of Forth	2,704	
18	Cambletown	Argyle		7,807	This harbour is much frequented during the herring fishery.
19	Clackmannan	Clackman.	Devon and Forth	3,605	The Devon iron company is established near this town.
20	Coldstream	Berwick	Tweed	2,384	
21	Craill	Fife	Forth	1,600	
22	Cromartie	Cromartie	Frith of Cromartie	2,413	The Frith of Cromartie is one of the finest bays in Great Britain, capable of containing the whole British navy.
23	Cullen	Banff	Murray Frith	1,070	Linen and damask.
24	Cullross	Perth	Frith of Forth	1,611	The neighbourhood abounds in coal, iron, &c.
25	Cupar	Fife	Eden	4,758	Coarse linens.
26	Cupar	Angus & Perth		2,590	Linen manufactory.
27	Dalkeith	Edinburgh	North & South Esk	4,709	One of the greatest weekly corn markets in Scotland.
28	Dingwall	Ross	Frith of Cromartie	1,500	The Frith of Cromartie is navigable for small vessels up to the town.
29	Dornock	Sutherland	Frith of Dornock	2,681	The Frith of Dornock is about 2 miles wide here.

No.	Town.	County.	River.	Population.	Remarks.
30	Dumbarton	Dumbarton	Leven and Clyde	3,121	An ancient but decayed town.
31	Dunblaine	Perth	Allan	2,733	
32	Dumfries	Dumfries	Nith	9,262	On the banks of the Nith are several fisheries.
33	Dunbar	Haddington	North Sea	3,965	A considerable trade in the export of corn.
34	Dunfermline	Fife	Frith of Forth	11,649	Diaper table linen manufactured here.
35	Dundee	Angus	Frith of Tay	29,616	The Tay here is 2½ miles wide—principal manufacture linen.
36	Dunkeld	Perth	Tay	1,360	An ancient town, once the capital of a Caledonian monarchy.
37	Dunse	Berwick	Whittadder	3,082	The celebrated Duns Scotus was born in this place.
38	Dysart	Fife	Frith of Forth	5,506	About 700 looms are here employed in the manufactory of checks—a good harbour, and considerable trade.
39	Edinburgh	Edinburgh	Near the Forth	82,624	University—this city ranks high as a seat of literature—as a school of medicine, it is first in Europe.
40	Elgin	Elgin	Lossie	4,602	
41	Elie	Fife	Frith of Forth	886	An excellent harbour, the deepest in the Frith of Forth except Burnt Island.
42	Falkirk	Stirling	Catton	9,929	Noted for its fairs, at which it is said above 60,000 head of black cattle are sold in one

					year, besides sheep and horses. [The iron works at Carron, near Falkirk, are said to be the largest in Europe, and employ above 1,000 men.]
43	Falkland	Fife near the Forth & Clyde Canal		2,317	Coarse linens and Osnaburgs.
44	Forfar	Angus	Loch of Forfar	5,652	Canvass, sail cloth, Osnaburgs, &c.
45	Forress	Elgin	Findhorn	2,925	
46	Fortrose	Ross	Murray Frith	1,312	Including the parish of Rosemarkie.—There is a regular ferry between this place and Fort George.
47	Fraserburgh	Aberdeen	North Sea	2,271	Linen yarn—a good harbour—some trade to the Baltic.
48	Galloway New	Kircudbright	Ken	941	Including Kell's parish—situated in a delightful vale.
49	Glasgow	Lanark	Clyde	100,749	This city, with respect to commerce and manufactures, may be considered the chief city of Scotland—an university.
50	Greenock	Renfrew	Frith of Clyde	19,042	Considerable trade to America and the West Indies—great sugar refineries.
51	Haddington	Haddington	Tyne	4,370	The famous John Knox, who brought about the reformation in Scotland, was born here.
52	Hamilton	Lanark	Avon and Clyde	6,453	Linen yarn, thread lace, shoes, and cabinet goods.
53	Inverkeithing	Fifeshire	Frith of Forth	2,400	A large and safe bay.

No.	Town.	County.	River.	Population.	Remarks.
54	Inverary	Argyle	Loch Fyne	1,113	Herring fishery, about 20,000 barrels are annually caught in the loch.
55	Inverness	Inverness	Ness	10,757	Salmon fishery—manufactories of linen, cotton, and woollen.
56	Irvine	Ayr	Irvine	5,750	Exports coals to Ireland, and carpets, muslins, lawns, &c.
57	Jedburgh	Roxburgh	Jed	4,454	The neighbourhood is famous for orchards.
58	Kelso	Roxburgh	Teviot	4,408	Manufactures of flannel and woollen cloth.
59	Kilmarnock	Ayre	Irvine	10,148	Scotch carpets, woollen cloths, &c.
60	Kilrenny	Fife	Frith of Forth	1,233	
61	Kincardine	Perthshire	Forth	2,419	Thornhill parish included—some trade to the Baltic.
62	Kinghorne	Fife	Frith of Forth	2,204	Thread stockings, spinning of cotton and flax
63	Kinross	Kinross	Loch Leven	2,214	Coarse cottons, Silesias.
64	Kintoré	Aberdeen	Don	863	
65	Kircudbright	Kircudbright	Dee	2,763	Cotton manufactory.
66	Kirkaldy	Fife	Frith of Forth	3,747	Checks, tickings, and cottons—Dr. Adam Smith was born here.
67	Kirkwall	Orkneys		1,715	Exports beef, salt fish, coarse cloth, and kelp.
68	Lanark	Lanark	Clyde	5,667	Cotton manufactories.
69	Lauder	Berwick	Lauder	1,742	

70	Leith	Edinburgh	Frith of Forth	20,363	Extensive commerce and manufactories.
71	Lerwick	Orkneys	Shetland Island	1,949	Gulberwick parish inclusive—the rendezvous of the fishing vessels of Great Britain, Denmark, and Holland.
72	Linlithgow	Linlithgow	Near the Avon	4,022	Leather, woollen cloth.
73	Lochmaben	Dumfries	Annan	2,392	Coarse linen cloth.
74	Maybole	Ayr	Doon and Gervan	3,946	
75	Meldrum parish	Aberdeen		1,655	
76	Melrose	Roxburgh	Tweed	3,132	Linen and woollen cloths.
77	Montrose	Angus	South Esk	8,955	Linen yarn, sail cloth, &c.
78	Musselburgh	Edinburgh	Esk & Frith of Forth	6,339	Including Inveresk parish.
79	Nairne	Nairne	Nairne	2,504	Small harbour.
80	Paisley	Renfrew	Whitecar	19,937	One of the principal manufacturing towns in Scotland.
81	Peebles	Peebles	Tweed	2,485	Woollen manufactories.
82	Perth	Perth	Tay	16,948	The staple manufacture is linen, but the cotton has lately been introduced.
83	Peterhead	Aberdeen	North Sea	4,707	The most eastern part of Scotland.
84	Pittenweem	Fife	Frith of Forth	1,096	Salt, coal trade.
85	Port Glasgow	Renfrew	Clyde	5,116	Thread, woollen, and cotton cloth manufactories.

No.	Town.	County.	River.	Population.	Remarks.
86	Preston Pans	Haddington	Frith of Forth	1,995	Near this place a battle was fought with the rebel army in 1745, in which Col. Gardener was killed.
87	Queen'sferry	Linlithgow	Frith of Forth	553	Here is a ferry across the Forth.
88	Renfrew	Renfrew	Cart	2,305	Trade inconsiderable—the chief manufacture is thread.
89	Rothsay	Bute Island		3,544	A large herring fishery.
90	Rutherglen	Lanark	Clyde	3,529	The fairs of this town are famous for the show of Lanark horses, esteemed the best draught horses in Scotland.
91	Saltcoats	Ayr	Frith of Clyde		It has an excellent harbour, though it has only lately become a place of trade—population returned in two different parishes.
92	Sanquhar	Dumfries	Nith	2,709	Woollen trade.
93	Scalloway	Shetland			
94	Scone	Perth	Tay	1,953	Once the residence of the kings of Scotland.
95	Selkirk	Selkirk	Etterick	2,466	This town is much decayed.
96	Stewarton	Ayr	Annock	3,049	Its chief trade is in the manufacture of bonnets.
97	Stirling	Stirling	Frith of Forth	5,820	Carpets and shalloons.
98	Stonehive	Kincardine	North Sea	1,886	This population includes the parish of Dunottar, in which Stonehive is situated.

99	Stranrawer	Wigton	Loch Ryan	1,923	Some cotton and linen manufactories.
100	Taine	Ross	Frith of Dornoch	2,384	This town has much increased of late years.
101	Thurso	Caithness	Pentland Frith	3,462	
102	Whithorn	Wigtown	Bay of Wigtown	1,935	
103	Wick	Caithness	Wick	5,080	Fisheries.
104	Wigtown	Wigtown	Wigtown Bay	1,711	

The royal Boroughs which choose Representatives are, Edinburgh, 1—Kirkwall, Wick, Dornoch, Dingwall, and Tayne, 1—Fortrose, Inverness, Nairn, and Forres, 1—Elgin, Cullen, Banff, Inverary, and Kintore, 1—Aberdeen, Bervie, Montrose, Aberbrothe, and Brechin, 1—Forfar, Perth, Dundee, Cupar, and St. Andrew's, 1—Crail, Kilrenny, Anstruther East and West, and Pittenween, 1—Dysart, Kirkaldy, Kinghorne, and Burnt-Island, 1—Inverkeithing, Dunfermline, Queen'sferry, Culross, and Sterling, 1—Glasgow, Renfrew, Rutherglen, and Dumbarton, 1—Haddington, Dunbar, N. Berwick, Lauder, and Jedburg, 1—Selkirk, Peebles, Linlithgow, and Lanark, 1—Dumfries, Sanquehar, Annan, Lochmaban, and Kircudbright, 1—Wigtown, New Galloway, Stranrawer, and Whithorn, 1—Ayr, Irvine, Rothsay, Cambletown, and Inverary, 1.

IRELAND.

Ireland lies to the west of Great Britain, and is abou 300 miles in length, and about 182 at its greatest breadth.

The contents in square miles may be computed at 28,000, and, the population being estimated at 5,000,000, there will be about 164 inhabitants to each square mile.

Ireland is divided into 4 provinces :—

1. Leinster, in the east, containing 12 counties.
2. Ulster, in the north, containing 9 counties.
3. Connaught, in the west, containing 5 counties.
4. Munster, in the south, containing 6 counties.

The counties of Leinster, are

COUNTY.	CHIEF TOWN.	RIVER.
Dublin	Dublin	Liffey
Louth	Drogheda	Boyne
Wicklow	Wicklow	Irish Sea
Wexford	Wexford	Slayney
Longford	Longford	Near the Shannon.
East Meath	Trim	Boyne
West Meath	Mullingar	
King's County	Philipstown	
Queen's County	Maryborough	
Kilkenny	Kilkenny	Nore
Kildare	Kildare	
Carlow	Carlow	Barrow

The counties of Ulster, are

Down	Down Patrick	Strangford Bay
Armagh	Armagh & Charlemont	
Monaghan	Monaghan	
Cavan	Cavan	

COUNTY.	CHIEF TOWN.	RIVER.
Antrim	Carrickfergus	Bay of Carrickferg.
Londonderry	Londonderry	Foyle
Tyrone	Omagh	
Fermanagh	Enniskillen	Lough Erne
Donegal	Lifford	Foyle
	The counties of Connaught, are	
Leitrim	Carrick on Shannon	
Roscommon	Roscommon	
Mayo	Castlebar & Ballenrobe	
Sligo	Sligo	
Galway	Galway	
	The counties of Munster, are	
Clare	Ennis	
Cork	Cork	
Kerry	Tralee	
Limerick	Limerick	Shannon
Tipperary	Tipperary & Clonmel	
Waterford	Waterford	Suir

RIVERS.

The Shannon rises among the mountains near Swadlingar; it then expands into Lough Allen ; next forms Lough Lee and Lough Derg ; passes Killaloe ; flows on to Limerick, whence it is navigable ; and, about 60 miles below that port, falls into the Atlantic Ocean. It divides the province of Cannaught from Leinster and Munster. Its course is about 170 miles.

The Suir rises in Tipperary, and, receiving the Neor and Barrow, is navigable from Clonmel, and falls into the sea at Waterford.—The Barrow is navigable to Athy.

The Blackwater springs from a mountain in the county of Kerry, and falls into the bay of Youghall.

Here the potatoe was first planted in Europe, having been brought from America by Sir Walter Raleigh.

The Bann rises in the county of Down, falls into Lough Neagh, and, dividing the counties of Antrim aud Londonderry, after a course of 70 miles, falls into the sea below Coleraine.

The Bann is famous for its salmon leap near Coleraine, and for its salmon fishery, which is the greatest in the kingdom.

The Liffy runs by Dublin.

The Boyne rises in King's County, and falls into the sea at Drogheda, having a course of about 50 miles.

LAKES.

The principal lakes in Ireland, in the order of their magnitude, are, Lough Erne, Lough Neagh, Lough Corrib, Lough Ree, and Lough Derg.

MANUFACTURES AND COMMERCE OF THE BRITISH ISLES.

The earliest staple commodity of England was tin, first introduced into commerce by the Phoenicians, 500 years before the birth of Christ. This metal principally abounds in the county of Cornwall, and is very rare in other countries.

The woollen manufactories are of great importance, and extend themselves over the whole west-riding of Yorkshire. In Wiltshire superfine broad-cloths are manufactured.

The manufactories of iron and copper have become great sources of national wealth. Sheffield has long been remarkable for its cutlery ware. Birmingham, from the variety and beauty of the articles which are manufactured there, has been styled *the toy-shop of Europe.*

Elegant earthenware forms an extensive article of exportation. Staffordshire is the principal seat of this manufacture.

The cotton manufacture is diffused far and wide, forming a grand source of industry and prosperity. Manchester, next in point of opulence to Bristol, owes its importance to it. Nottingham is chiefly supported by the weaving of cotton stockings.

The manufactures of glass and fine steel, clocks, watches, &c. are deservedly eminent and extensive.

The English manufactures have been recently estimated at the annual value of 63,600,000l. and supposed to employ 1,585,000 persons.

TOWNS IN IRELAND.

*Those marked * send members to the Imperial Parliament, each one, except Dublin, which sends three, and Cork two.*

No.	*Town.*	*County.*	*River.*	*Remarks.*
1	Antrim	Antrim	Lough Neagh	It communicates with the sea by the river Bann and by the Newry Canal.
2	Ardagh	Longford		
3	Ardee	Louth		
4	Arklow	Wicklow	Irish Sea	Sea-port.
5	*Armagh	Armagh		Great linen market.
6	Askeaton	Limerick	Near the Shannon	
7	Athenry	Galway		
8	*Athlone	West Meath	Shannon	
9	Athy	Kildare	Barrow and Canal	
10	Ballycastle	Antrim	North Channel	Sea-port—collieries.
11	Ballynakill	Queen's County.		
12	Baltimore	Cork		Good harbour.

13	Ballyshannon	Donegal	Donegal Bay	Linen manufactory and salmon fishery.
14	Baltinglass	Wicklow	Slaney	
15	*Bandonbridge	Cork	Bandon	12,000 inhabitants—strong garrison.
16	Bangor	Down	Belfast Lough	
17	*Belfast	Antrim	Carrickfergus Bay	Exports butter and salt provisions—18,320 inbitants—this is the centre of the linen manufactories.
18	Blessington	Wicklow	Liffy	
19	Boyle	Roscommon	Boyle	Linen manufactories.
20	Callen	Kilkenny		
21	Carlingford	Louth		A large and excellent harbour.
22	*Carlow	Carlow	Barrow	
23	Carrick	Leitrim	Shannon	
24	Carrick	Tipperary	Suir	Woollen manufactories.
25	*Carrickfergus	Antrim	Carrickfergus Bay	Good harbour.
26	*Cashell	Tipperary	Suir	
27	Castlebar	Mayo		
28	Castlemartyr	Cork		
29	Cavan	Cavan		Linen manufactories.
30	Charleville	Cork		
31	Charlemont	Armagh	Blackwater	

No.	Town.	County.	River.	Remarks.
32	Cloghar	Tyrone		
33	*Clonmell	Tipperary	Suir	Lawrence Sterne born here.
34	*Coleraine	Londonderry	Bann	Salmon fishery.
35	*Cork	Cork	Lee	It is the grand market of Irish provisions, and for trade and commerce exceeds any town in Ireland—80,000 inhabitants.
36	Dingle	Kerry	Dingle Bay	
37	Donegal	Donegal	Donegal Bay	
38	*Down Patrick	Down	Strangford Bay	
39	Drogheda	Louth	Boyne	Imports coals and goods from England—exports grain.
40	*Dublin	Dublin	Liffy	Considerable trade—190,000 inhabitants.
41	Duleek	Meath	Naney	
42	*Dundalk	Louth	Dundalk Bay	Muslins.
43	Dundrum	Down	Irish Sea	
44	*Dungannon	Tyrone		Coal mines.
45	*Dungarvon	Waterford	Dungarvon Bay	This town supplies Dublin with fish and great quantities of potatoes.
46	Elphing	Roscommon		
47	*Enniskillen	Fermanagh	Lough Earn	
48	*Ennis	Clare	Fergus	

49	Fethard	Tipperary		
50	*Galway	Galway	Galway Bay	Linen manufactories—herring and salmon fisheries—12,000 inhabitants.
51	Granard	Longford		
52	Hillsborough	Down		
53	Jamestown	Leitrim	Shannon	
54	Kells	East Meath	Blackwater	
55	Kildare	Kildare		Horse-races, called the Newmarket of Ireland.
56	Killala	Mayo	Bay	
57	Killaloe	Clare	Shannon	Salmon fishery.
58	Killarney	Kerry	Lake Killarney	The country round the Lake is very beautiful.
59	Killbeggen	West Meath	Brosna	
60	*Kilkenney	Kilkenney	Nore	17,000 inhabitants—coarse woollens.
61	Killough	Down	Irish Sea	Salt.
62	Killybeg	Donegal	Donegal Bay	Good harbour.
63	Killyleagh	Down	Strangford Lake	Linen and thread manufactories.
64	Kilrea	Derry	Bann	
65	*Kinsale	Cork	Bandon	This place contains a maritime arsenal, and may be called the Plymouth of Ireland.
66	Knocktopher	Kilkenny		
67	Lanesborough	Longford	Shannon	

No.	Town.	County.	River.	Remarks.
68	Leighton Old	Carlow	Barrow	
69	*Limerick	Limerick	Shannon	This is reckoned the third city in the island—exports provisions.
70	Lifford	Donegal	Foyle	
71	*Lisburn	Antrim	Loggan	Damask table linen.
72	Lismore	Waterford	Blackwater	Salmon fishery.
73	*Londonderry	Londonderry	Foyle	
74	Longford	Longford	Cammin	Linen manufactory.
75	Loughrea	Galway	Loughrea	
76	*Mallow	Cork	Blackwater	A fine spring of tepid water, resembling the hot wells at Bristol.
77	Maryborough	Queen's C.	Barrow	
78	Middleton	Cork		
79	Mullingar	Westmeath		
80	Naas	Kildare	Barrow and Canal	
81	Navan	East Meath	Boyne and Blackwater	
82	Newcastle	Limerick		
83	*Newry	Down	Canal	A large and increasing town—large exports in linens and butter.
84	Philip's Town	King's County	Canal	

85	*Portarlington	King's County	Barrow	
86	Ratoath	Meath		
87	Roscommon	Roscommon		
88	*Ross New	Wexford	Barrow	Good harbour—exports provisions.
89	St. John's Town	Donegal	Foyle	
90	St. John's Town	Longford		
91	*Sligo	Sligo	Bay of Sligo	Considerable trade—8,000 inhabitants.
92	Strabane	Tyrone	Morne	
93	Thomas Town	Kilkenny	Nore	
94	Thurles	Tipperary	Suir	
95	Tipperary	Tipperary		
96	*Tralee	Kerry	Bay of Tralee	Fisheries.
97	Trim	East Meath	Boyne	
98	Tuam	Galway		
99	*Waterford	Waterford	Suir	Population 35,000—butter, salt provisions, linen, &c. are exported—packet boat to Milford Haven.
100	*Wexford	Wexford		Woollen manufactories.
101	Wicklow	Wicklow	Leitrim	Considerable trade to Dublin.
102	*Youghall	Cork	Blackwater	Commodious harbour and considerable trade.

☞ *The Surveys of the different States in Europe are arranged to correspond to the following*

QUESTIONS.

1. What are the boundaries?
2. Between what parallels of latitude and meridians of longitude is it situated?
3. What is the length and breadth, and the number of square miles it contains?
4. What is the natural geography; as rivers, lakes, mountains, and the face of the country?
5. What is the nature of the climate?
6. What are the produce, manufactures, and commerce?
7. What are the provinces and chief towns?
8. What are the foreign possessions?
9. What is the population?
10. What are the manners and customs?
11. What are the government and religion?
12. What peculiar plants, animals, and curiosities are in this country?
13. What is the ancient name?

DENMARK.

I. W. North Sea—N. Skager Rack—E. Kategate and Baltic. It consists of the peninsula of Jutland and the large islands of Zealand and Funen, together with several small isles.

2. Between 54° and 57½° N. L. and 8° and 13° E. L.

3. Length 260 miles, medial breadth from 90 to 100; and contains nearly 21,000 square miles. [redacted]

4. There are several small streams in Denmark, but no large rivers; the country is much intersected by the surrounding sea. A canal is made from the river Eider, connecting the North Sea and the Baltic—The country is flat.

6. The climate is moist and temperate, but the frost in winter is sometimes very severe: The change from winter to summer is so sudden that spring is almost unknown.

6. Fine rich pastures on which large herds of cattle are fed. It has few considerable manufactures, but carries on great trade with the other European nations, especially with the English. It exports black cattle, horses, butter, fish, tallow, hides, &c., and imports salt, wine, brandy, broad cloths, &c.

7. The whole territory subject to Denmark is divided into the following provinces:—

PROVINCES.	CHIEF TOWNS.
Jutland	Aalborg, Wiborg, Aarhuus, and Ripen
Isle of Funen	Odenseè
Isle of Zealand	Copenhagen

PROVINCES.	CHIEF TOWNS.
Sleswick	Sleswick
Holstein	Altona, Gluckstadt, and Kiel

Lunenburg, or Lauenburg, was ceded to Denmark in 1815.

8. Greenland; The Ferro Islands and Iceland; Tranquebar in the East Indies; and the islands of St. John, St. Thomas, and St. Croix in the West Indies. Norway, formerly a part of the Danish dominions, is now attached to Sweden.

9. One million four hundred thousand.

10. The manners of the superior ranks of the Danes differ little from those of similar ranks in other parts of Europe; but the lower orders are held in a state of vassalage. Dancing is a very favourite amusement, and Germany supplies them with itinerant musicians.

11. An absolute monarchy, though in some degree restricted by legal forms. The present king is Frederick VI. The religion is Lutheran.

12. Chersonesus Cimbrica.

SWEDEN AND NORWAY.

1. N. by the Arctic Ocean—E. by Russia—S. by the Baltic—W. by the Northern Ocean.

2. Between 55° and 71° N. L. and between 5° and 30° E. L.

3. 1150 miles in length, and about 600 in breadth; and contains 340,000 square miles.

4. There are few navigable rivers, but many impetuous

torrents, which falling from the rocks and mountains, discharge themselves into the Baltic. There are numerous lakes; the principal are, Wener, and Weter, and lake Maeler an inlet of the Baltic, on which Stockholm stands. This is a mountainous country; the Langfiall and Dofrefiall mountains separate Sweden from Norway.

5. This may be denominated a cold country, but the air is very salubrious, and is not subject to sudden changes: spring and autumn are both unknown.

6. It has been estimated that two thirds of Sweden, are occupied by lakes, mountains, and forests, and that not more than one fourth has been brought into a state of cultivation. The chief wealth arises from its mines. Those of copper and iron are very extensive. Sweden also exports timber, pitch, tar, &c. Deals form the most considerable export from Norway.

7.

PROVINCES.	CHIEF TOWNS.
Sweden Proper	Stockholm, Upsal
Gothland	Gottenburg, Linkioping, &c.
West Norland	Gefle, Umea
Swedish Lapland	Torneo
East Bothnia.	Ulea, Christianstadt
Provinces in Norway.	
Christiansand	Christiansand
Aggerhuus	Christiania
Bergen	Bergen
Drontheim	Drontheim
Norland	(no towns)
Finmark	(no towns)

8. St. Bartholomew in the West Indies. Rugen, Aland, and Gothland, three islands in the Baltic, belong to Sweden.

9. Three millions six hundred thousand, being 10 inhatants to each square mile.

10. The superior classes of the Swedes very much resemble the French. The lower classes are simple, honest, industrious, and hospitable.

11. An absolute monarchy. The present king is Charles XIV. The religion is Lutheran.

12. Amongst the wild animals are the lynx, the bear, the wolf, the beaver, the otter, and the glutton. The rein deer is the most useful animal in Norway.

13. The peninsula of Norway and Sweden was anciently called Scandinavia.

RUSSIA.

This empire, including Siberia, extends from the Baltic and Sweden on the west, to Kamschatka and the Eastern ocean: and from the Arctic Sea on the north, to the boundaries of Turkey, the Euxine and Caspian Seas, Eastern and Western Tartary, and other unknown regions of Asia on the south.

1. N. by the Arctic Ocean—E. by Russia in Asia—S. by the Black Sea and Turkey—and W. by Austria, Prussia, and Sweden.

2. Between 44° and 69° N. L. and from 22° to 66° E. L.

3. Length 1600 miles and breadth 1000 miles. It contains 1,600,000 square miles. Including Russia in Asia, the length is 9200 miles, and breadth 2400 miles.

4. The Wolga, the Don, the Nieper, the Niester, the Petshora, and the Dwina, are the principal rivers. The Uralian mountains run from N. to S. and separate Europe from Asia. The lakes are Ladoga, Onega, and Peypus. European Russia contains plains of prodigious extent.

5. Russia presents all the various climates in Europe, from that of the frozen regions of Lapland to the mild temperature of Italy.

6. The principal exports are hemp, flax, leather, tallow, furs, and coarse cloths: with isinglass, salt-petre, timber, pot-ash, bees-wax, and honey. The imports are, wines, brandy, rum, sugar, tea, together with various manufactured goods from England.

The commerce and manufactures of Russia have been increasing ever since the time of Peter the Great. The commerce is carried on from ports greatly distant from each other: the Baltic, the White Sea, the Caspian and the Black Sea, all contribute to its extension.

7. Russia in Europe contains the following governments, named after those towns in which courts of judicature are established.

Northern Governments:

Petersburgh	Riga	Vologda.
Archangel	Pscov	Yaroslav
Olonetz	Tver	Kostroma
Vybourg	Novogorod	Viatka
Revel		

Middle Governments:

Moscow	Kharkov	Nizney Novogorod
Smolensk	Koursk	Kazan
Polotsk	Orel	Simbirsk
Moghilev	Kalouga	Penza
Tchernigov	Toola	Tambov
Novogorod Sieverskov	Raizan	Voronez
	Vladimir	Saratov

Southern Governments:

Kiov	Catharinoslav, including Taurida	Country of the Don Cossacks
Caucasus		

Finland, formerly a part of Sweden, is now united to Russia: the chief town is Abo.

Asiatic Russia contains the Governments of Perm, Oufa, Kholyvan, Tobolsk, and Irkutsk.

8. The isles of Osel and Dago in the Baltic, and Spitzbergen in the Arctic Ocean, belong to Russia; but no colonies of importance belong to this empire.

9. European Russia 34 millions, having 21 inhabitants to each square mile.

19. The Russians are hardy, vigorous, and patient of labour, remarkably cheerful in their disposition, and in no country are the lower classes more contented with their situation than the Russians. Singing is a favourite amusement.

11. An absolute monarchy. The present emperor is Alexander. The established religion in Russia is that of the Greek Church.

12. The sea bear of Nova Zembla, the wolf, the lynx, the elk, &c.

13. Sarmatia, but this country was almost wholly unknown to the ancients.

FRANCE.

1. N. by the British Channel—E. by Germany—S. by the Mediterranean and Spain—W. by the Bay of Biscay.

2. Between 42° and 51° N. L. and 5° W. and 8° E. L.

3. 600 miles in length and 560 in breadth, and contains 204,000 square miles.

4. The four largest rivers in France, are, the Seine, the Loire, the Garronne, and the Rhone. France may be called a level country, though in the eastern part there are two ranges of mountains; the Vosges, running parallel with the Rhine, and the Cevennes further to the S. running

parallel with the Rhone. The Pyrenees form a natural boundary between France and Spain.

5. The climate of this country may be divided into the northern, which yields no wine—the middle, which produces no maize—the southern, which produces wine, maize, and olives.

6. The chief exports of France are wine, brandy, and silk manufactures. The manufactures and commerce decreased very much during the late revolution. Formerly the silk manufactures of Lyons were estimated to employ 60,000 people. There are several canals in this country.

7. France was formerly divided into provinces: but, since the revolution, it has been divided into departments. The following table contains both divisions.

Ancient Prov.	*Department.*	*Chief Town.*	*River.*
French Flanders	North	Lille	Deule
Artois	Straits of Calais	Arras	Scarpe
Picardy	Somme	Amiens	Somme
Normandy	Lower Seine	Rouen	Seine
	Calvados	Caen	Orne
	Channel	Coutances	
	Orne	Alençon	Sarte
	Eure	Evreux	Iton
Isle of France	Seine	Paris	Seine
	Seine & Oise	Versailles	Seine
	Oise	Beauvais	Therain
	Aisne	Laon	
	Seine & Marne	Melun	Seine
Champagne	Marne	Châlons-sur-Marne	Marne
	Ardennes	Mézières	Meuse
	Aube	Troyes	Seine
	Upper Marne	Chaumont	Marne
Loraine	Meuse	Bar-le-Duc	Ornain
	Moselle	Metz	Moselle
	Meurthe	Nancy	Meurthe
	Vosges	Epinal	Moselle
Alsace	Upper-Rhine	Colmar	Fecht & Lauch
	Lower-Rhine	Strasburgh	Rhine

Ancient Prov.	*Department.*	*Chief Town.*	*River.*
Bretagne	Ille & Vilaine	Rennes	Vilaine
	North Coast	St. Brieuz	Near the Sea
	Finisterre	Quimper	Oder
	Morbihan	Vannes	Sea-port
	Lower Loire	Nantes	Loire
Maine and Perche	Sarthe	Le Mans	Sarte
	Mayenne	Laval	Mayenne
Anjou	Mayenne & Loire	Angers	Mayenne
Touraine	Indre & Loire	Tours	Loire
Orleanois	Loiret	Orleans	Loire
	Eure & Loire	Chartres	Eure
	Loire & Cher	Blois	Loire
Berri	Indre	Châtearoux	Indre
	Cher	Bourges	Eure
Nivernois	Nièvre	Nevers	Loire
Bourgogne	Yonne	Auxerre	Yonne
	Côte d'Or	Dijon	Ouche
	Saône & Loire	Mâçon	Saône
	Ain	Bourg	Ressouze
Franche Compte	Upper Saône	Vesoul	
	Doubs	Bensançon	Doubs
	Jura	Lons-le-Saunier	Valliere
Poitou	Vendée	Fontenay-le-peu-ple	Vendée
	Two Sèvres	Niort	Sèvres
	Vienne	Poitiers	Clain
Marche	Upper Vienne, comprising part of Limosin	Limoges	Vienne
	Creuze	Guèret	Creuze
Limosin	Corrèze, comprising part of Upper Vienne	Tulle	Corrèze
Bourbonnois	Allier	Moulins	Allier
Saintoigne, comprising Aunis	Lower Charante	Saintes	Charente
Angoumois, comprising part of Santoigne	Charante	Angoulême	Charente
Auvergne	Puy de Dôme	Clermont	
	Cantal	St. Flour	

Ancient Prov.	*Department.*	*Chief Town.*	*River.*
Lyonnois, Forêt, & Beaujolois	Rhône	Lyons	Rhône
	Loire	Montbrison	
	Isére	Grenoble	Isére
Dauphiné	Upper Alps	Gap	
	Drôme	Valence	Rhône
Guyenne, comprehending Gascogne	Dordogne	Perigueux	Ille
	Gironde	Bourdeaux	Gironde
	Lot & Garonne	Agen	Garonne
	Lot	Cahors	Lot
	Aveyron	Rhodez	Aveyron
	Gers	Auch	Gers
	Landes	Mont-de-Marsan	Douze
	Upper Pyrénées	Tarbe	Adour
Bearne	Lower Pyrénées	Pau	Le Gave de Pau
Comté de Foix	Arriege	Tarascon	Arriege
Roussillon	Eastern Pyrénées	Perpignan	Tot
Languedoc	Upper Garonne	Toulouse	Garonne
	Aude	Carcassonne	Aude
	Tarne	Castres	Agout
	Garde	Nismes	Vistre
	Lozere	Mende	Lot
	Ardéche	Privas	Near the Rhône
	Upper Loire	Le Puy	Borne
	Héraut	Montpellier	
Provence	Mouths of the Rhone	Aix	Arc
	Lower Alps	Digne	
	Var	Toulon	Mediter. Sea
Corsica	Golo	Bastia	
	Liamone	Ajaccio	

8. France possesses Pondicherry, in the East Indies, and the isles of Guadaloupe and Martinique, in the West Indies.

9. Twenty-nine millions, or 143 inhabitants to a square mile.

10. The French character is remarkable for vivacity, impetuosity, and fickleness; politeness and good manners may be traced through every rank of society.

11. A monarchy. The present king is Louis XVIII. brother to Louis XVI.

12. The bear, the wolf, the ibex, and the chamois.
13. Gallia.

MORE PARTICULAR ENUMERATION OF THE RIVERS IN FRANCE.

The Somme runs by St. Quintin, Peronne, Amiens, (whence it is navigable for boats), Abbeville, and St. Vallery, into the English Channel.

The Orne is navigable to Caen, and runs into the English Channel.

The Vilaine runs by Rennes, Redons, and la Rochebernard, into the Atlantic.

The Sevre is navigable from Niort, and runs into the Bay of Biscay, opposite the isle of Ré.

The Charente runs by Angoulême, Cognac, Saintes, and Rochefort, and, 8 miles below that place, falls into the sea, opposite the isle of Oleron.

The Adour runs into the Bay of Biscay, at Bayonne.

The Herault rises in the Cevennes mountains, and runs into the Mediterranean a little below Agde.

The Marne, from Chaumont, Joinville, Chalons, Epernay, and Chateau Thiery, falls into the Seine above Paris.

The Oise receives the Aisne at Compeigne, and runs by Pontoise into the Seine.

The Yonne runs by Auxerre, Joigny, Sens, and Villeneve, and joins the Seine.

The Eure runs by Chartres, Dreux, and Louviers, into the Seine.

The Loire receives, from the north, the Sarthe: and, from the south, the Allier, the Cher, the Indre, the Vienne, and the Sevres.

The Arriege, the Tarne, the Lot, the Dordogne, and the Gers, fall into the Garonne.

The Saone, the Iser, the Ardeche, and the Durance, fall into the Rhone.

HOLLAND, OR KINGDOM OF THE NETHERLANDS.

1. N. and W. by the North Sea—E. by Germany—and S. by France.

2. Between 50° and 54° N. L. and between 3° and 7° E. L.

3. 250 miles in length, and 150 in breadth, and the surface may be estimated at 24,800 square miles.

4. Holland is a flat country scarcely rising above the ocean, and in some places actually below the level, being protected from it by immense embankments, which sometimes prove too weak to avert its fury. There is no appearance of a hill in all this country. Several rivers terminate here, as the Rhine, the Maese, and the Scheldt. The Zuyder Zee is an inland shallow sea, with which the lake of Haerlem is connected.

5. Holland is reckoned one of the most unhealthy countries in Europe. It is subject to frequent fogs and marshy exhalations, so that cold and moisture are the prevailing characteristics of the climate. In winter the frost is sometimes so severe as not only to freeze the lakes and rivers, but also the Zuyder Zee.

6. Holland was long reckoned one of the greatest trading nations in Europe. It had valuable colonies in the East Indies, whence it supplied the rest of Europe with spices. Linen is the greatest manufacture in Holland. Butter, cheese, and salted fish, are exported in great quantities, and also flower-roots.

7. *Provinces.*	*Chief Towns and Rivers.*
Holland	Amsterdam and the Hague
Overyssel	Deventer on the r. Yssel, and Zwol on the r. Aa

Provinces.	*Chief Towns and Rivers.*
Zealand	Middleberg on the isle of Walcheren
Friesland	Leewarden Canal
Utrecht	Utrecht on the r. Rhine
Groningen	Groningen Canal
Guelderland	Arnheim on the r. Rhine
Zutphen	Zutphen on the r. Yssel

This kingdom gained considerable accession of territory by the annexation of Flanders at the last general peace.

8. The island of Java and the Molucca or Spice Islands in the East Indies.

9. Five millions two hundred and sixty-six thousand, being 212 to a square mile.

10. The Dutch are proverbially characterized for their industry and œconomy, and they were formerly distinguished for their love of liberty.

11. This was formerly a republic, but the Prince of Orange has now assumed the title of King of the Netherlands.

12. The stork is very common in Holland, and generally builds its nest on the tops of the houses.

13. Batavia.

SWITZERLAND.

1. N. by Germany—S. and E. by Italy—W. by France.

2. Between 45° and 48° N. L. and between 5° and 11° E. L.

3. Length 200 miles from E. to W. and breadth 130 from N. to S. It contains about 19,000 square miles.

4. This is the most mountainous country in Europe, the Alps stretching over a considerable part of it. It also contains several lakes as Constance, Geneva, Neufchatel, Zu-

rich and Lucerne; and it gives rise to two of the grandest rivers in Europe, the Rhine and the Rhone.

5. The various parts of this country, according to their elevation, exhibit all the changes of climate, from the Frigid Zone to the southern parts of the Temperate; thus the native plants of Greenland and Lapland are found growing not far distant ~~from those of~~ Italy and Spain.

6. The valleys and lower parts of the mountains in Switzerland are remarkably fertile; vineyards are common, and fruits of the choicest kinds come to perfection. Various kinds of wood adorn the mountains; first the oak, the elm, the birch, and the lime; then above these are found the larch, the pine, the fir, and the mountain ash.

The situation of this country is unfavourable for manufactures and commerce: the chief exports are cattle, butter, cheese, &c. and imports flax, raw silk, cotton, salt, and manufactured goods.

7.

Cantons.	*Towns, Lakes, and Rivers.*
Zurich	Zurich, on the lake Zurich
Berne	Berne on the river Aar
Basil	Basil on the river Rhine
Underwalden	Stanz and Sarnen
Schweitz	Schweitz
Zug	Zug on the Lake Zug
Glaris	Glaris
Soleure	Soleure on the river Aar
Uri	Altorf* on the river Reuss

* It was in this town that the tyrant Gesler, the Austrian governor, placed his hat upon a pole, with orders that the inhabitants should pay the same deference to it as to himself. This so enraged the people, that, under the celebrated William Tell, they threw off the Austrian yoke, and laid the foundation of the liberties of Switzerland.

Cantons.	*Towns, Lakes, and Rivers.*
Appenzell	Appenzell
Lucerne	Lucerne, lake of Lucerne
Fribourg	Fribourg, river Sanen
Schaffhausen	Schaffhausen, river Rhine

8. None.

9. Two millions nearly, about 91 inhabitants to a square mile.

10. The Swiss have long been distinguished for their honesty, steadiness, and bravery; and, above all, for their attachment to the liberties of their country.

11. Republic.

12. The ibex, the chamois, and the marmot are common in the Swiss Alps; the bear and the wolf are also found in some unfrequented districts.

13. Helvetia.

GERMANY.

1. N. by Denmark and the Baltic—E. by the dominions of Prussia and Austria—S. by Italy and Switzerland—and W. by France and Holland.

2. Between 46° and 54° N. L. and from 6° to 16° E. L.

3. Exclusive of the Austrian and Prussian territories, Germany contains about 100,000 square miles.

4. Germany is watered by numerous rivers, as the Danube, Rhine, Elbe, Weser, Ems, and Oder, which empty themselves into the sea: and also the Mayne, the Neckar, the Lech, the Iser, and the Inn.

5. In the north the climate is cold, towards the south it is similar to that of Austria.

6. The chief of the German manufactures are velvets,

silks, cotton, linen and woollen cloth; tapestry, embroidery, porcelain, and paper.

They are also expert in dressing leather, dyeing and printing; with the fabricating of various works in metals, glass, wood, and ivory. The situation of this country is favourable to commerce. Its numerous navigable rivers open a communication with the interior country; and from Hamburg, which is the first commercial city on the continent, the various products are exported: the imports are chiefly from the East and West Indies, China, and America.

7. It is divided into 9 great parts, called circles.

Three Northern.

Westphalia	Lower Saxony	Upper Saxony

Three in the Middle.

Lower Rhine	Upper Rhine	Franconia

Three Southern.

Suabia	Bavaria	Austria

Germany contains four kingdoms, Bavaria, Wirtemburg, Hanover, and Saxony; and also a great number of principalities, duchies, &c.

The chief towns are,

Dresden,	Stutgard,
Munich,	Frankfort on the Maine,
Cassel,	Hamburg
Hanover,	Bremen,
Brunswick,	Manheim, &c.

8. None.

9. Twenty-four millions, but excluding the territories belonging to Austria, and Prussia, it contains little more than twelve millions.

10. The Germans are regarded as a frank and hospitable people: the higher orders are extremely fond of titles and shew. But the strongest trait in their national character is

persevering industry, which has been carried to a great extent in the mechanical arts.

11. Germany is divided into about 200 principalities; each prince is arbitrary in his own dominions. The religion is partly Lutheran and partly Roman Catholic; but all sects are tolerated.

12. The bison is numerous in the Carpathian forests: the bear, the wolf, the lynx, the chamois, and marmot, are also common, nor is the beaver entirely unknown.

13. Germania.

AUSTRIA.

1. N. by Saxony and Prussia—E. by Russia—S. by Turkey and Italy—W. by Bavaria.

2. Between 45° and 52° N. L. and between 12° and 26° E. L.

3. Length from E to W. 600 miles; breadth from N. to S. 400; containing about 258,000 square miles.

4. The surface of Austria is greatly diversified with hills and valleys, elevated mountains and extensive plains. Bohemia is nearly surrounded with mountains, and the Carpathian chain bounds Hungary on the N. and E. The Danube runs from W. to E. through the whole of Austria, and receives several considerable rivers, as the Inn, the Drave, and the Tiess. The Elbe and the Vistula both rise in the Austrian territories.

5. The climate is in general mild and salubrious, except among the mountains, where it is sometimes very severe.

6. The soil in this country is generally fertile, and produces all the necessaries and most of the luxuries of life. Hungary produces the richest wines. The mineral riches of the Austrian territories are greater than in any other

country in Europe. Almost all the metals are found here —gold, silver, copper, iron (from which the finest steel is made), lead, tin, and quicksilver. This country also abounds with antimony, coal, salt, and alum. The opal is a gem peculiar to Hungary, and the garnets of Bohemia are the most beautiful of the kind. The manufactures are not extensive, and the commerce is chiefly internal.

7. The Austrian territory comprehends,

		Chief Town.	*River.*
1 The Circle of Austria, including	Archduchy of Austria	Vienna	Danube
	Duchy of Stiria	Gratz	Muehr
	———— Carniola	Laybach	Laybach
	———— Carinthia	Clagenfurt	Glan
2 The kingdom of Bohemia		Prague	Danube
3 Moravia		Olmutz & Brunn	
4 Part of Silesia		Troppou	Oppa
5 Part of Bavaria, East of the Inn			
6 Hungary, including	Upper Hungary	Presburg	Danube
	Lower Hungary	Buda or Offen	Danube
	Slavonia	Eszeg	Drave & Danube
	Croatia	Carlstadt	Culp
7 Transylvania		Hermanstadt	
8 Part of Poland bordered by the Bug	Galitzia	Lemburg or Leopold	Bug
	Londomiria	Cracow	Vistula*

8. Austria is an inland country, and has no colonies or foreign possessions.

9. About twenty-eight millions, having 109 inhabitants to each square mile.

10. See Germany.

11. The government of Austria is imperial, and may be styled an absolute monarchy: the present Emperor is Francis II.

* The Venetian territories are now also annexed to Austria.

PRUSSIA.

1. N. by the Baltic—E. by Russia—S. by Austria—and W. by Germany.

2. It extends from 50° to 55° N. L. and from 11° to 24° E. L.

3. Length 600, breadth 300 miles; about 107,000 square miles.

4. The surface of Prussia is diversified with hills and plains, but no part can be called mountainous, except Silesia, in which is an extension of the Carpathian chain, called the Sudetic mountains. Several of the rivers enumerated in Germany run through Prussia; but the Oder and the Pregel are the only ones which may be regarded as Prussian rivers.

5. The climate is moist and cold, and the forests and marshes in many places render it unhealthy.

6. The staple manufacture of Prussia is linen: it also possesses manufactures of woollen, cotton, silk, iron, and porcelain. The exports are timber, corn, flax, &c. Amber is almost peculiar to Prussia, and is found in great abundance on the shores of the Baltic.

7.

Division.	*Town.*	*River.*
Kingdom of Prussia	Koningsberg	Pregel
Polish or Western Prussia	Dantzic	Vistula
Southern Prussia	Warsaw	Vistula
Part of Silesia	Breslaw	Oder
Electorate of Brandenburg	Berlin	Spree
Part of Pomerania	Stettin	Oder
Part of Lower Saxony	Magdeburg	Elbe
Part of Westphalia	Embden	Ems

Swedish Pomerania has lately been added to Prussia; its chief town is Stralsund.

8. Prussia has no foreign possessions.

9. Ten millions and a half, about 98 inhabitants to a square mile.

10. The manners and customs of the Prussians are similar to those of the Germans; they are allowed to be a brave and upright people; unaffected and industrious.

11. An absolute monarchy. The established religion is the Protestant, under the two denominations of Lutheran and Calvinistic; the present king is Frederic William III.

SPAIN.

1. N. By the Bay of Biscay and the Pyrenees—E. by the Mediterranean—S. by the Mediterranean, the Strait of Gibraltar, and the Bay of Cadiz—and W. by Portugal and the Atlantic Ocean.

2. Between 36° and 44° N. L. and between 9° W. and $3\frac{1}{2}$° E. L.

3. Length 600 miles, breadth 500; number of square miles about 190,000.

4. The surface of this kingdom is agreeably diversified. Numerous rivers adorn the lower parts of the country, and the long chain of lofty mountains gives a grandeur to the landscape. The chief rivers are the Tagus, the Douro, Gaudiana, Gaudalquiver, Ebro, Xucar, and Segura.

5. From the situation of Spain, it would be one of the hottest countries in Europe, were it not for the extensive ridges of mountains, and the great extent of sea coast; these causes tend very much to lessen the heat. The air is gene-

rally dry and healthy, except at the time of the equinoctial rains.

6. The finest fruits grow almost spontaneously in Spain, as oranges, lemons, prunes, citrons, almonds, grapes, figs, &c. The Spanish sheep are superior to those of any other country for the fineness of their wool. The manufactures and commerce of Spain have been long in a declining state. —The Spaniards exchange their gold and silver brought from America, for the merchandize of other European countries.

7. The most recent divisions of Spain are the following:

Situation.	*Province.*	*Town, River, &c.*
On the Bay of Biscay	Gallicia	Compostello or St. Jago
	Asturias	Oviedo
	Biscay	Bilboa, r. Ybaiçabal
On the French frontier	Navarre	Pampelona
	Arragon	Saragossa, r. Ebro
	Catalonia	Barcelona, Med. Sea
On the Mediterranen coast	Valencia	Valeneia, r. Gaudalaviar
	Murcia	Murcia, r. Segura
	Granada	Granada
Near the Strait of Gibraltar	Andalusia	Seville, r. Gaudalquiver
On the frontier of Portugal	Estremadura	Badajos, r. Guadiana
	Leon	Leon
Midland	Old Castile	Burgos, r. Alarcon
	New Castile	Madrid, r. Manzanares

8. The Spanish colonies are very extensive: they include New Mexico and Florida, in N. America; Chili, Peru, and La Plata, in S. America; the isles of Cuba and Porto Rico, in the W. Indies; the Canary Isles, in the Atlantic Ocean; the Philippine Isles, belonging to Asia; and the Ladrone Isles, in Polynesia.

9. About ten millions five hundred thousand, being fifty-five inhabitants to a square mile.

10. The Spaniards are remarkable for gravity of deportment and taciturnity. Their character is highly respectable for integrity and generosity. Their chief defect is an aversion from agriculture and commerce, and a bigotted devotion to the clergy.

11. An absolute monarchy. The Roman Catholic in its most intolerant state. The present king is Ferdinand VII.

12. The Merino sheep have already been mentioned: the Spanish horses are esteemed for their spirit, and the elegance of their forms. The asses and mules are superior to those of other European countries. Wolves are the only beasts of prey in Spain.

13. Hispania or Hesperia.

PORTUGAL.

1. N. and E. by Spain—S. and W. by the Atlantic Ocean.

2. Between 37° and 42° N. L. and between 6° and 10° W. L.

3. Length 360, breadth 120; and its superficial contents have been estimated at 41,000 square miles.

4. The surface of this country is similar to that of Spain, and the rivers which run through it all rise in Spain, as the Tagus and the Douro.

5. The climate of Portugal is one of the most delightful and salubrious in Europe; the solar heat is moderated by cooling breezes, and vegetation refreshed by showers from the Atlantic. The mean temperature of Lisbon is 60° of Fahrenheit's thermometer.

6. Both manufactures and agriculture are much neglected in Portugal. The principal exports are wine, oil, fruit, wools, silk, and cork; with sugar, tobacco, spices, Brazil wood, ivory, gold, precious stones, and other products of the tropical climate. Most of the Portuguese wine is exported to Great Britain, under the name of Port.

7. It is divided into six provinces.

	Provinces.	*Towns.*
North	Entre Douro e Minho	Oporto, Viana, Braga
	Tras os Montes	Miranda, Braganza
Middle	Beira	Coimbra, Guarda
	Estremadura	Lisbon, Leira, St. Ubes
South	Alentejo	Evora, Elvas, Beja
	Algarva	Faro, Lagos, Tavora

8. Portugal still retains considerable colonial possessions, viz. the Azore Islands; Brazil, in South America; the Madeira and Cape Verd Islands; the settlement of Goa, on the Malabar coast of India; and Macao, in China.

9. Two and a half millions.

10. The Portuguese very much resemble the Spaniards. The pride and prejudices of the great are equally prevalent in both countries. The lower classes are honest and sober, affectionate to their parents, and respectful to their superiors. The peasants are still in a state of vassalage to the Fidalgoes, or gentlemen.

11. A monarchy. Their religion is the Roman Catholic, with all the horrors of the Inquisition. The present king is John Maria Lewis Joseph.

12. The plants and animals are similar to those in Spain. The cork tree is very common in this country.

13. Lusitania.

ITALY.

1. N. by Switzerland—E. by the Gulph of Venice—S. and W. by the Mediterranean.

2. Between 36° and 47° N. L. and 7° and 19° E. L.

3. Length 670 miles, breadth 100; its superficial contents amount to 103,480 square miles.

4. The surface of Italy is extremely diversified with hills and valleys, rivers, lakes, and mountains: towards the North are the Alps—and the Appenines run nearly the whole extent from N. W. to S. E. The largest rivers are the Po, the Adige, and the Tiber.

5. The climate of Italy is considerably diversified. Towards the N. the summits of the Alps are covered with perpetual snow. During the whole length of this peninsula, the Appenines in the middle, and the sea coast on each side, considerably lessen the violence of the heat. The atmosphere usually possesses great serenity. But there are many marshy tracts from which noxious vapours are exhaled, and in the south the Sirocco wind prevails.

6. Italy is rich in mineral treasures: it contains gold, silver, copper, cobalt, antimony, arsenic, zinc, and plumbago; but one of its most important minerals is quicksilver. Its chief exports are silks, a variety of choice wines, and the finest oils in Europe. The imports are Indian products, broad cloths, and other manufactured goods.

7. Italy is divided into Lombardy, Piedmont, Genoa, Parma, Tuscany, the Papal Dominions, and the kingdom of Naples. The chief towns are Turin, Milan, Florence, Leghorn, Rome, and Naples.

8. The chief Italian islands are Sicily and Malta.

9. The whole population of Italy may be estimated at thirteen millions.

10. The manners of the modern Italians are those of a degenerate and humiliated people; complimentary, artificial, wary, and distrustful, and little bound by moral principle, yet amiable and gentle in the common intercourse of society. The Italians are famous for their skill in music.

11. The government varies in different states. Naples and Sicily are governed by a king. The middle part is under the dominion of the Pope; and the northern part is divided into a number of petty states.

12. The vegetable products of all the southern regions of the temperate zone attain perfection in Italy.

13. This country still retains its ancient name.

TURKEY.

1. N. by Russia and Austria—E. by the Black Sea, the Bosphorus, the sea of Marmora, and the Archipelago—S. by the Mediterranean—and W. by the Adriatic.

2. Between 36° and 46° N. L. and between 15° and 30° E. L.

3. Length 630, breadth 570 miles; the square miles may be estimated at 197,000.

4. Turkey contains a number of mountains: the most noted are Pindus and Olympus, celebrated in the Grecian fables; Parnassus consecrated to the muses; Hacmus and Athos.

5. The general climate of this country is warm, but in some of the elevated regions it is subject to severe cold,

This was formerly the finest country in the world, but owing to the ignorance of the Turks, and the despotism of the government, it is now the most miserable.

6. Carpets and leather are the chief manufactures; the other exports are rhubarb, opium, figs, currants, saffron, &c. with cotton, raw silk, and fine marble from the island of Paros. The chief imports are coffee from Arabia, sugar, spices, cloths, muslins, wrought silks, glass, hardware, and corn.

7.	*Provinces.*	*Towns.*
	Moldavia	Jassy
	Bessarabia	Bender
	Wallachia	Bucharest
	Bulgaria	Silistria
	Romelia	Constantinople
	The Morea	
	Albania	Durazzo
	Dalmatia	
	Servia	Belgrade
	Bosnia	Banjaluka
	Croatia	

8. The islands surrounding Turkey are very numerous; the largest are Candia and Negropont.

9. Six millions seven hundred thousand, being about 34 inhabitants to a square mile.

10. The deportment of the Turks is solemn and slow, and they appear sedate, passive, and humble; but they are easily provoked, are so very vindictive that they will abandon their avarice to gratify their revenge. They sit cross-legged upon carpets.

11. The Emperor of Turkey is despotic; the religion is the Mahometan. The present Emperor is Mahmoud II.

12. The horses are noted for their spirit, and the sheep for the beauty of their spiral horns.

13. Greece, Thrace, and Macedon.

SEA-PORTS IN EUROPE.

Town.	*Country.*	*Sea or River.*	*Long.*	*Lat.*	*Exports and Imports.*
Aalborg	Denmark	Gulf of Lymfort	9° 46′ E	57° 3′ N	Grain, herrings, fire-arms.
Aarhuus	Denmark	Canal	10 13 E	56 10 N	Possesses a considerable trade.
Archangel	Russia	Dwina, White Sea	38 56 E	64 40 N	Exports iron, tallow, lintseed, tar, pitch, and sends beef and mutton to Petersburg during the winter.
Abo	Sweden	Gulf of Bothnia	22 7 E	60 28 N	Exports fir deals, pitch, and tar; about 8,500 inhabitants.
Agde	France	Near the Gulf of Lyons	3 27 E	43 19 N	The inhabitants are principally merchants and sailors. Exports barilla, antimony, aniseed, cummin-seed, fruit, wool, and wine.
Akerman	Turkey	R. Dniester	30 0 E	46 8 N	Taken by the Russians in 1790.
Altona	Germany	R. Elbe			Considerable trade—it is the port for the Danish East India Company—it is 2 miles W. of Hamburgh.
Alicata	Sicily	Mediterranean	13 50 E	37 11 N	
Almissa	Turkey	R. Cettina	16 58 E	43 18 N	Excellent wines are made here.
Almeira	Spain	R. Almeira	2 41 W	36 50 N	Salt-petre is manufactured here.
Alicante	Spain	Gulf of Alicante	0 24 W	38 35 N	Salt-petre is manufactured here—wine and fruits.
Amsterdam	Holland	R. Amstel, Zuyder Zee	4 51 E	52 22 N	This is the largest and safest port in the United Provinces—the trade formerly extended to every part of the world—inhabitants 212,000.
Anclam	Prussia	R. Peene			

Town.	*Country.*	*Sea or River.*	*Long.*	*Lat.*	*Exports and Imports.*
Ancona	Italy	Adriatic Sea	13°30′E	43°36′N	Exports grain, wool, and silk.
Antwerp	France	Scheldt	4 22 E	51 14 N	This was the greatest trading city in Europe, little more than two centuries ago—its harbour was blocked up by the Dutch, but it has been again opened and declared free.
Arendal	Norway	The Sleeve	9 0 E	58 20 N	Exports fish and wood.
Arcadia	Turkey	Gulf of Arcadia	21 55 E	37 22 N	
Arensburg	Russia	On the Island of Oesel			
Argos	Turkey	Gulf of Napoli	22 37 E	37 48 N	
Athens	Turkey	Gulf of Egina	23 53 E	38 2 N	Exports silk, wax, wool, and oil.
Barcelona	Spain	Mediterranean	2 10 E	41 25 N	Silk, cotton, and wool—excellent fire-arms and cutlery—100,000 inhabitants.
Bastia	Corsica		9 36 E	42 35 N	Trade inconsiderable.
Bayonne	France	R. Adour and Nive	1 24 W	43 29 N	Masts from the Pyrenees are brought to this port, and shipped for Brest, &c.
Bergoy	Lapland		28 15 E	70 14 N	
Bergen	Norway		5 40 E	60 10 N	This town forms a semicircle round a small gulf of the sea—it has a good harbour—imports necessaries and a few luxuries—exports fish, skins, tallow, and timber—population about 19,000.
Bilboa	Spain	R. Ybaiçabal	2 45 W	43 15 N	It trades in wool and iron.
Boulogne	France	English Channel	1 40 E	50 42 N	The harbour is shallow and difficult to enter.
Bourdeaux	France	R. Garonne	0 29 W	44 51 N	Imports woollen stuffs, tin, copper, coals, herrings, leather, salted beef, tallow, drugs, deals, ship masts, hemp, pitch, and tar—and exports wine, brandy, vinegar, fruit, rosin, paper, honey, cork-wood—the

					harbour is large, and the quays grand and extensive —four or five hundred ships are often found there at one time—the canal of Languedoc unites this port with the Mediterranean—80,000 inhabitants—this town must have suffered greatly from the suspension of trade.
Bremen	Germany	R. Weser	9 15 E	53 6 N	Trade similar to Hamburgh, which see.
Brest	France		4 31 W	48 24 N	This is one of the best harbours in France, and the grand depot of the French navy—it is capable of containing 500 men of war in 8, 10, and 15 fathoms at low water—the entrance is narrow and difficult —about 30,000 inhabitants.
Brindisi, anciently Brundusium	Italy	Adriatic Sea	18 20 E	40 48 N	This harbour was formerly large and safe, but is now choaked up.
Bukari or Buccari	Aust. Dominions	Adriatic Sea	15 4 E	45 16 N	
Cadiz	Spain	Bay of Cadiz	6 13 W	36 32 N	This port is the centre of the commerce to the West Indies and to America—the ships carry out the various manufactures of Europe, and bring back gold, silver, precious stones, cochineal, indigo, coffee, tobacco, chocolate, &c.—there are various linen manufactories, and great quantities of salt are made here—about 70,000 inhabitants.
Cagliari	Sardinia	Mediterranean	9 16 E	39 25 N	This is a large and secure harbour.
Calais	France	Strait of Calais or Dover	1 57 E	50 57 N	The regular station of packets to England in time of peace—it has communication by means of canals with St. Omers, Gravelines, Bourbourgs, Dunkirk, &c.—the harbour is much obstructed with sand, and will admit only small vessels.
Candalax	Russ. Lapland	White Sea	32 18 E	67 3 N	

Town.	*Country.*	*Sea or River.*	*Long.*	*Lat.*	*Exports and Imports.*
Candia	Turkey	Isle of Candia	25° 4′ E	35° 16′ N	The city was taken from the Venetians by the Turks in 1669, after a siege of 23 years, 70,000 Turks and 30,000 Venetians having been lost in the siege.
Canea	Turkey	Isle of Candia	23 56 E	35 30 N	Exports oil of olives, wax, silk, honey, and wine.
Carlsham	Sweden	Baltic	14 39 E	56 12 N	Here is a woollen manufacture and a forge for copper.
Carlscrona	Sweden	Baltic	15 24 E	56 12 N	This harbour is large and spacious, with depth of water sufficient for first rate ships of war—the ships for the Swedish navy are principally built here—oak timber is brought from Germany, and hemp from Riga—all other naval stores are supplied by Sweden—11,000 inhabitants.
Carthagena	Spain	Mediterranean	1 6 W	37 34 N	This harbour is the best in Spain: it is very spacious, and so deep, that ships may moor close to the land—silk, wool, pot-ash, and barilla, are the chief exports.
Cefala	Sicily	Mediterranean	14 5 E	38 4 N	It has a productive fishery, and a place of some trade.
Cherson	Russia	R. Dnieper	32 32 E	46 40 N	This is a free port, and intended to be the principal mart for export and import in southern Russia—here the humane Howard died, January 20, 1790.
Christiana	Norway	On a Gulf 25 miles from the Sea	10 54 E	59 56 N	It has an excellent harbour—the principal exports are tar, soap, iron, copper, planks, and deals—saw mills are used for cutting the planks—twenty millions of deals are allowed to be annually sawn here—about 10,000 inhabitants.
Christiansand	Norway		8 11 E	58 11 N	Exports timber and fish.
Christiansound	Norway	Northern Ocean in the Island of Fessen	8 15 E	63 7 N	The harbour is commodious—the exports are timber and fish—36 miles N. W. of Drontheim.
Christinestadt	Sweden	Gulf of Bothnia	21 9 E	62 16 N	

CittaNova	Austr. Dom.	At mouth of the Quieto	13 20 E	45 35 N	The inhabitants are principally fishermen.
Cimbresham	Sweden	Baltic	14 20 E	55 34 N	Small port.
Constantinople	Turkey	Str. of Constantinople	28 56 E	41 0 N	One of the largest cities of Europe—the harbour is spacious and convenient—about 400,000 inhabitants.
Colberg	Germany	Persante, near the Baltic	15 27 E	54 8 N	Manufactures of linen and woollen—some salt springs.
Contessa	Turkey	Strinon	24 4 E	40 40 N	
Copenhagen	Denmark	Sound	12 35 E	55 41 N	A capacious harbour, in time of peace crowded with ships; the streets are intersected with canals—this is reckoned the best built city of the north—about 90,000 inhabitants.
Coron	Turkey	Gulf of Coron, anciently Gulf of Messina	21 56 E	36 59 N	A large harbour.
Corinth	Turkey	Morea	23 6 E	38 6 N	Contains about 1,400 inhabitants.
Corunna	Spain	Atlantic Ocean	8 7 W	43 23 N	A large and safe harbour.
Cuxhaven	Germany	Elbe	8 50 E	53 54 N	Ships bound to Hamburgh take in pilots here.
Dantzic	Prussia	Vistula	18 36 E	54 22 N	Exports corn, tallow, leather, wool, wax, butter, skins, &c.—imports wine, spices, cloths, silk and woollen stuffs, herrings, salt, iron, lead, drugs, &c.—about 46,000 inhabitants.
Derkus	Turkey	Black Sea			About 30 miles north of Constantinople.
Dieppe	France	R. Bethune	1 9 E	49 56 N	Good harbour, but small—about 21,000 inhabitants.
Dolcigna	Turkey	R. Drino	18 56 E	42 23 N	Retreat for Corsairs.
Dunkirk	France	English Channel	2 24 E	51 2 N	The most important French harbour on this coast—by means of a sluice, the bason within the town will hold 40 ships of the line always afloat.

Town.	Country.	Sea or River.	Long.	Lat.	Exports and Imports.
Durazzow	Turkey	Adriatic Sea	19°3 6′E	41°26′ N	
Drontheim	Norway	Northern Ocean	10 3[illegible] E	63 26 N	Exports masts, fir-timber, copper, iron, pitch, tar, stock-fish, skins, and pot-ash—imports wine, spices, salt, brandy, corn, tobacco, cloth, &c.—about 8,000 inhabitants.
Ekenas	Sweden	Gulf of Finland	23 18 E	59 58 N	
Elsinore	Denmark	Sound	12 37 E	55 58 N	No harbour, but a good and safe road—All ships passing through the Sound, pay a duty here.
Embden	Germany	R. Ems	7 1[illegible] E	53 20 N	Trade same as Hamburgh.
Engelholm	Sweden	Sound	12 39 E	56 15 N	
Eupatoria	Russia	Crimea	33 26 E	45 12 N	
Faro	Portugal	Gulf of Cadiz	8 0 W	37 2 N	Exports figs—it has a considerable trade.
Frejus	France	Mediterranean	6 48 E	43 25 N	The sea has left the harbour.
Fiume or St. Veit	Austrian Dominions	R. Finmara	14 42 E	45 46 N	Goods chiefly from Hungary are exported from this place.
Farsund	Norway				Fish and timber.
Ferrol	Spain	Bay of Corunna	8 11 W	43 28 N	The first marine arsenal in Spain—a good harbour strongly fortified—about 30,000 inhabitants.
Flensburg	Denmark	Gulf of the Baltic	9 27 E	54 47 N	Good harbour, with depth of water for large vessels.
Frederick-sham	Russia	R. Kymene	28 18 E	60 36 N	Deals and timber.
Frederick-stadt	Norway	R. Glomme	11 1 E	59 2 N	Timber.
Gothenburg	Sweden	R. Moldal and Gotha	11 44 E	57 40 N	Next to Stockholm, the most commercial town in Sweden—considerable herring fishery—population about 20,000.

Gallipoli	Turkey	Sea of Marmora	26 44 E	40 24 N	
Genoa	Italy	Gulf of Genoa	8 56 E	44 25 N	Formerly a place of great trade—wine, fruit, salt, marble, silk, gold and silver stuffs, lace, gloves, oil, parmesan cheese, anchovies, &c.—population about 80,000.
Gibraltar	Spain	Strait of Gibraltar	5 22 W	36 6 N	A strongly fortified town in possession of the English.
Glukstadt	Germany	Elbe	9 25 E	53 51 N	
Halmstadt	Sweden	R. Nissa	12 37 E	56 40 N	Woollen manufactures—a salmon fishery.
Hapsal	Russia	Gulf in the Baltic			A place of little trade—opposite the island of Dago.
Hamburgh	Germany	Elbe	9 56 E	53 36 N	This city is supposed to be the third commercial city in Europe—the inland commerce from Hamburgh by the Elbe is more extensive than on any other river in Europe—in 1799, 2,430 vessels entered this harbour—before this port was seized upon by the French, it engrossed the whole of the trade to the north of Germany—about 100,000 inhabitants.
Harlingen	Holland	Zuyder Zee	5 22 E	53 11 N	The harbour is shallow, but well frequented.
Havre-de-Grace	France	R. Seine	0 7 E	49 29 N	
Helsinfors	Sweden	Gulf of Finland	24 56 E	60 11 N	One of the best towns in the province.
Holmstrand	Norway		10 30 E	59 30 N	Exports timber.
Hoolum	Iceland		15 0 W	65 42 N	
Husum	Denmark		9 6 E	54 32 N	It has some trade in beer, cattle, and horses.
Hyers	France	Mediterranean	6 12 E	43 7 N	This town is seated in a most delightful country, surrounded by the most beautiful gardens, in which is found the best fruit in France.
Ismael	Turkey	Danube	29 45 E	45 23 N	Taken by the Russians, under Suwarrow, in 1790—The Russians massacred 30,000 Turks in cold blood.

Town.	*Country.*	*Sea or River.*	*Long.*	*Lat.*	*Imports and Exports.*
Iviza	Iviza	Mediterranean	1°22′E	38°58′N	Island in the Mediterranean—fertile in corn, grapes, figs, &c.—the chief employment of the inhabitants is making salt, highly esteemed for its whiteness.
Jenicul	Russia	ChannelbetweenBlack Sea and Sea of Azof	36 30 E	45 19 N	
Jenitschen	Russia	Sea of Azof	34 38 E	46 5 N	
Kaffa	Crimea		35 25 E	45 2 N	
Kambilax	Russia	White Sea	31 0 E	61 54 N	
Kemi	Russia	White Sea	33 25 E	65 2 N	
Kavarna	Turkey	Gulf of Varna, in the Black Sea	28 17 E	43 21 N	
Killia	Turkey	Mouth of Dunube	29 3 E	45 28 N	Situated 20 miles from Ismael.
Kola	Russia	Kola in Arctic Ocean	32 26 E	68 50 N	A fishery for whales, seals, &c.
Konigsberg	Prussia	Pregel	20 20 E	54 43 N	It has a flourishing trade—about 52,000 inhabitants.
Krageroe	Norway	Northern Ocean			Wood.
Kronstadt	Russia	Gulf of Finland	29 22 E	59 58 N	The Russian ships of war lie here.
Laurigen	Norway	Northern Ocean			
Lepanto	Turkey	Gulf of Lepanto	22 0 E	38 37 N	It underwent several long sieges between the Turks and the Russians.
Leyden	Holland	Rhine	4 20 E	52 9 N	Here the Rhine joins the sea in several small channels—the fair is much frequented—inhabitants 50,000.
Liebau	Russia	Baltic	21 57 E	55 58 N	Hemp, linseed, &c.
Lisbon	Portugal	Tagus	9 3 W	38 43 N	The harbour is large, and will contain 1000 vessels—it is the grand magazine of all goods brought from Brazil and other Portuguese colonies—population estimated at 270,000.

Livorno, or Leghorn	Italy	Mediterranean	10 16 E	43 32 N	This is the chief port in the Mediterranean—the trade is very considerable—the light-house is on a rock in the sea, where every night 30 burning lamps are contained in one lanthorn—about 45,000 inhabitants.
Lubec	Germany	Trave	10 40 E	53 52 N	Its situation is commodious for trade, which is considerable.
Lulea	Sweden	Lulea	22 4 E	65 38 N	A good harbour in the Gulph of Bothnia.
Mahon Port	Minorca	Mediterranean	4 5 E	39 52 N	One of the best harbours in the Mediterranean.
Malaga	Spain	Mediterranean	4 26 W	36 48 N	This is reckoned the second port in Spain—exports wines, fruits, sumach, anchovies, oil, &c.—imports woollens, spice, cutlery, laces, ribbons, thread, &c. about 40,000 inhabitants.
Malvasia	Turkey	Morea.	23 4 E	36 52 N	A small harbour—the wine produced here was formerly much esteemed, under the name of Malmsey.
Mandal	Norway	Mandal	7 42 E	58 2 N	Wood and fish.
Marseilles	France	Mediterranean	5 21 E	43 10 N	Gold and silver stuffs are made here—before the revolution upwards of 4500 vessels entered the port in the course of the year—about 80,000 inhabitants.
Marstrand	Sweden	Kattegat	11 35 E	57 54 N	A good harbour—but the town is inconsiderable.
Memel	Prussia	Curisch Haff	21 13 E	55 50 N	Timber, flax, linseed, hemp, &c.
Mezene	Russia	Mezene	43 34 E	66 30 N	
Messina	Sicily	Strait of Messina	15 40 E	38 10 N	The trade is on the decline, but still considerable—an annual fair is held in August for foreign goods.
Middleburg	Holland	Isle of Walcheren	3 29 E	51 33 N	The fortifications are strong.
Modon	Turkey	Morea	21 35 E	36 58 N	A large and safe harbour.
Monaco	France	Mediterranean	7 22 E	43 43 N	A small port, 6 miles from Nice.

Town.	Country.	Sea or River.	Long.	Lat.	Imports and Exports.
Moss	Norway	Christiania	10°50′E	59°25′N	Wood.
Nantes	France	R. Loire	1 26 E	47 13 N	Great trade to the French colonies, America, Spain, &c.—ships of burthen can come up only to Painbouef, where the cargoes are put up into smaller vessels.
Naples	Italy	Mediterranean	14 17 E	40 54 N	Exports silk, oil, sulphur, manna, rosemary, aniseed, rosin, tartar, figs, soap, essences, &c.—water is conveyed to the city from the foot of Vesuvius—ice is the greatest luxury here—about 380,000 inhabitants.
Napoli de Romania,	Turkey	Morea	22 48 E	37 39 N	A good harbour, but narrow entrance.
Narbonne	France	Canal	3 5 E	43 11 N	
Narva	Russia	Narva	28 2 E	59 16 N	Exports hemp, flax, timber, and corn; imports salt, tobacco, wine, salted herrings, spices, tea, sugar, &c.—the harbour will not admit large vessels, which are obliged to lie in the road.
Negropante	Turkey	In the Archipelago	24 15 E	38 30 N	The admiral of Turkey generally resides here—the harbour is seldom without a fleet of galleys.
Nice	France	R. Paglion Med.	7 14 E	43 2 N	
Nikioping	Sweden	Baltic	16 35 E	58 45 N	Considerable trade in cloth, morocco leather, brass, &c.
Nikoloff	Russia	Bug	31 50 E	46 57 N	
Odensee	Denmark	Isle Funen	10 24 E	55 4 N	Cloth, gloves, soap, leather accoutrements for cavalry.
Odessa	Russia	Black Sea	30 38 E	46 35 N	Its trade is increasing;—it is intended by Russia to make this port the centre of her commerce in the Black sea.
Onega	Russia	R. Onega, White Sea	36 0 E	64 15 N	
Oporto	Portugal	R. Douro	8 36 W	41 15 N	Its chief trade is in wine; 80,000 pipes are exported annually—about 40,000 inhabitants.

Oristagni	Sardinia	G. Oristagni	8 50 E	39 40 N	It is fortified, but thinly inhabited.
Oster Rusoer	Norway	N. Ocean	9 15 E	58 45 N	Wood.
Ostend	France		2 58 E	51 13 N	A strongly fortified town—about 14,000 inhabitants.
Otchakov	Russia	Dnieper	31 34 E	46 44 N	Since the establishment of Odessa the trade has declined.
Otranto	Naples	Gulf of Venice	19 0 E	40 8 N	The harbour is good, and trade considerable.
Padua	Italy	R. Brenta	10 52 E	45 24 N	Livy, the historian, was born here.
Painboeuf	France	R. Loire	1 57 W	47 17 N	Port of Nantes.
Palermo	Sicily	G. Palermo	13 25 E	38 10 N	Silk manufactures—130,000 inhabitants.
Panormo	Turkey	Adriatic Sea	20 25 E	40 0 N	Near the Island of Corfu.
Patrass	Morea	G. Lepanto	21 43 E	38 33 N	Oil, silk, honey, wheat, manna.
Pernov	Russia	R. Pernov, Baltic	24 25 E	58 26 N	
Perpignan	France	R. Tet	2 59 E	42 41 N	
Petersburg	Russia	Neva	30 19 E	59 56 N	The greatest trading town in Russia—about 170,000 inhabitants.
Pillau	Prussia	Frische Haff	19 55 E	54 37 N	Port of Konigsburg.
Piombino	Etruria	G. Piombino, Mediter.	10 34 E	42 57 N	
Pirano	Aust. Dominions	G. Venice	13 36 E	45 37 N	
Piza or Pisa	Etruria	R. Arno	10 15 E	43 42 N	Trade formerly very considerable.
Pola	Aust. Dominions	G. Venice	14 3 E	45 5 N	Fishery for tunney fish.
Ponoi	Russia	Frozen Ocean	40 44 E	67 10 N	
Port Baltic	Russia	Baltic	24 3 E	59 26 N	
Prevessa	Turkey	G. of Arta	21 5 E	39 22 N	
Ragusa	Dalmatia	G. Venice	18 18 E	42 33 N	Annexed to the kingdom of Italy.

Town.	Country.	Sea or River.	Long.	Lat.	Exports and Imports.
Raumo	Sweden	G. Bothnia	21°33′E	61°25′N	It is situated to the north of Abo.
Revel	Russia	G. Bothnia	59 20 E	24 34 N	Flourishing trade.
Riga	Russia	R. Duna	23 54 E	56 55 N	Exports corn, hemp, flax, iron, timber, masts, leather, tallow, &c.—imports salt, cloth, silk, wine, groceries, and salted herrings.
Rochelle	France	Charente	1 3 W	46 9 N	Considerable trade.
Rochefort	France	Charente	0 52 W	45 56 N	Excellent docks and magazines, with naval stores.
Rosas	Spain	Gulf of Rosas	3 0 E	42 17 N	
Rodosto	Turkey	Sea of Marmora	27 28 E	41 0 N	The environs are fertile in corn and wine.
Rotterdam	Holland	Rotter	4 24 E	51 55 N	Next to Amsterdam in regard to commerce—the quay is extensive and commodious—inhabitants 48,000.
Rouen	France	Seine	1 10 E	49 26 N	It has several manufactures, and a considerable trade—72,000 inhabitants.
Rostoc	Germany	Baltic	12 12 E	54 0 N	Exports grain, wool, hides, timber, and staves—imports East and West India goods, British salt, coals, manufactured goods—wine from France.
St. Brieux	France	Atlantic Ocean	2 40 W	48 22 N	
St. Lucar	Spain	Guadalquivar	6 27 W	36 45 N	The chief trade is in salt.
St. Tropez	France	B. of St. Tropez, Medit.	6 41 E	43 11 N	It lies to the north-east of Toulon.
Salonika	Turkey	Gulf of Salonika	23 8 E	40 40 N	A good situation for trade, being seated on a noble gulf in the Archipelago—about 60,000 inhabitants.
Sebastipol	Russia	Black Sea	33 24 E	44 45 N	A royal port and dock.
Setuval, or St. Ubes	Portugal	Sandao	8 38 W	38 29 N	A good harbour, capable of receiving ships of considerable burthen—about 12,000 inhabitants.

Skeen	Norway	Northern Ocean	9 48 E	59 15 N	Timber.
Sizeboli	Turkey	Black Sea	27 44 E	42 30 N	A good road-stead, where men of war may moor.
Sluys	Holland	N. Sea	3 25 E	51 20 N	The haven is capable of containing 500 ships—opposite Flushing.
Soderham	Sweden	Baltic	17 9 E	61 22 N	Considerable trade in arms, linen, butter, timber, flax.
Solvitsborg	Sweden	Baltic	14 40 E	56 0 N	Almost environed by the Baltic Sea.
Sonderborg	Denmark	Little Belt	9 58 E	54 58 N	On the island of Alsen.
Spalatro	Dalmatia	G. Venice	16 45 E	43 22 N	A large well frequented harbour—exports iron, copper, hides, wool, bees wax, cotton, silk, &c.
Spinalonga	Is. Candia	Mediterranean	25 55 E	35 15 N	
Stadtland	Norway	Northern Ocean	5 40 E	62 12 N	On a small island.
Stettin	Prussia	River Oder	14 44 E	53 29 N	Carries on great trade with Norway, Denmark, Sweden, Spain, France, Holland, England, &c.
Stockholm	Sweden	L. Maeler	18 4 E	59 20 N	Manufactures of glass, china, woollen, silk, linen, &c.—it occupies 7 small rocky islands—about 80,000 inhabitants.
Stavenger	Norway	Northern Ocean	5 56 E	58 56 N	Wood, fish, and iron.
Stromstad	Sweden	Northern Ocean	11 15 E	58 56 N	Celebrated for its shell fish.
Syracuse	Sicily	Mediterranean	15 14 E	35 5 N	War, tyranny, and earthquakes have nearly destroyed this once superb and populous city.
Talanta	Negroponte	Mediterranean	23 26 E	38 49 N	
Tarento	Naples	Bay of Tarento	17 31 E	40 30 N	This harbour, once excellent, is now so shallow as to admit only fishing boats.
Tarragona	Spain	Francoli	1 33 E	41 8 N	The harbour is dangerous, and of little importance.
Theodosia, or Kaffa	Crimea	Black Sea	33 4 E	45 6 N	This town is the largest in the Crimea, and a free port.

Town.	*Country.*	*Sea or River.*	*Long.*	*Lat.*	*Exports and Imports.*
Tonsberg	Norway		10° 30′ E	59° 23′ N	Wood, furs, and butter.
Tonningen	Denmark	Eider	9 18 E	54 23 N	
Tortosa	Spain	Ebro	0 26 E	40 47 N	
Tornea	Sweden	Tornea	24 15 E	65 48 N	A considerable trade is carried on here by the Swedes, Laplanders, Russians, and Norwegians.
Toulon	France	Mediterranean	5 52 E	43 7 N	A spacious harbour, strongly fortified—the station of the French fleet in the Mediterranean.
Trau	Dalmatia	Gulf of Venice	16 30 E	43 30 N	Wine, oil, figs, almonds, corn, cheese, wool, and plenty of fish, particularly fine sardines—it is an excellent harbour, and well sheltered.
Trieste	Austrian dominions	Gulf of Trieste	13 55 E	45 53 N	This is almost the only sea-port belonging to Austria—it exports iron, steel, copper, quicksilver, salt, gunpowder, mirrors, &c.—excellent wines are produced in the neighbourhood—about 18,000 inhabitants.
Uddevalla	Sweden	Cattegate	11 45 E	58 21 N	Convenient harbour—it exports iron, planks, and herrings.
Ulea	Sweden	R. Ulea, G. Bothnia	25 23 E	65 5 N	A commodious harbour, and fine salmon fishery.
Umea	Sweden	R. Umea, G. Bothnia	20 4 E	63 52 N	
Ushant	France	Island	5 10 W	48 27 N	
Valentia	Spain	R. Guadalaviar	0 25 W	39 27 N	Manufactured silks, cotton, fruit, hemp, &c.
Varna	Turkey	Black Sea	27 10 E	43 14 N	
Venice	Italy	G. Venioe	12 18 E	45 28 N	This city, from its being built on a number of islands, appears to float on the sea; formerly it was the most commercial city in the world—trade in silk

					goods, looking-glasses, gold and silver stuffs, is still considerable.
Westerwick	Sweden	Baltic	16 24 E	57 45 N	Exports ship timber, and all sorts of naval stores.
Windau	Prussia	R. Wera, Baltic	21 32 E	57 10 N	Timber, pitch, tar, wax, &c.
Wisby	Sweden	Is. Gothland, Baltic	18 18 E	57 38 N	Formerly a flourishing town—harbour safe, but not large.
Wyberg	Russia	G. Finland	28 50 E	60 50 N	Exports plank, tallow, pitch, and tar—imports wine, spices, and salt.

ASIA.

Asia is bounded on the north by the Arctic Ocean, on the east by the Pacific Ocean, on the south by the Indian Ocean, and on the west by the Red Sea, the Mediterranean, the Black Sea, and Europe.

Its breadth, reckoned from west to east, may be estimated at 5,000 British miles; and its length, from the southern Cape of Malacca to the Cape of Cevero Vostochnoi, in the Arctic Ocean, at 5,250 miles.

ASIA CONTAINS THE FOLLOWING STATES.

In the North.

COUNTRIES.		CHIEF TOWNS.
Siberia *or* Russian Tartary		Astracan, on the r. Wolga Tobolsk, on the r. Irtish
	In the Middle.	
The Chinese Empire	China	Pekin
	Chinese Tartary	Cashgar
	Tibet	Lassa
Independent Tartary		Samarcand, r. Sogda
Turkey in Asia		Aleppo and Jerusalem
	In the South.	
Arabia		Mecca and Medina
Persia		Ispahan and Shirez
Hindostan		Delhi and Calcutta
The Birman Empire		Ummerapoora and Ava
Malaya *or* Malacca		Malacca

The inhabitants of SIBERIA cannot amount at present to more than three millions and a half. The trade is chiefly in furs and skins.

The population of CHINA has been estimated at 333,000,000. The chief export is tea, of which, it is said, 13,000,000lbs. weight are consumed by Great Britain and her dependencies, and 5,000,000 by the rest of Europe. China has rich mines of all the precious metals. It produces abundance of corn, rice, fruit, and cotton.

INDEPENDENT TARTARY consists of Great Bucharia, Little Bucharia, the country of the Kirgouses, and that of the Usbeck Tartars.

The climate of TURKEY IN ASIA is delightful; but this country suffers much from the plague. It produces cotton, silk, oil, fruits, wines, and rhubarb, and is famous for carpets.

ARABIA is divided into three parts; Arabia Stony, Arabia Desert, and Arabia Happy. Suez, Mocha, and Aden, on the Red Sea, are sea-ports in Arabia. Camels are the common beasts of burden.

PERSIA is a very mountainous country, and contains several deserts. From Persia are brought silks, carpets, leather, and gold and silver lace.

The population of the parts of HINDOSTAN, subject to Great Britain, amounts to 14,000,000. India produces rice, sugar, cotton, calicoes, silk, indigo, salt-petre, diamonds, &c.

The BIRMAN EMPIRE is in the eastern peninsula of India, and extends over Laos and Cambodia. There are numerous and large forests in this empire: the teek tree is superior to the English oak. Cambodia is celebrated for the camboge gum.

MALACCA occupies the southern part of the eastern peninsula of India. The Malay language is reckoned the finest in all the Indies, where it is as common as the French is in Europe.

SEAS, BAYS, AND GULFS.

Besides the three large oceans mentioned in the boundaries of Asia, viz. the Arctic, the Pacific, and Indian Oceans, the following seas belong to this quarter of the globe:—the Arabian Gulf, or Red Sea, between Africa and Arabia; its length, from Babelmandeb to Suez, is 1,470 miles: the Persian Gulf, between Arabia and Persia, about half the length of the former: the Bay of Bengal, separating the two peninsulas of India: the Gulf of Siam, to the south of Siam: the Gulf of Tungquin, to the south of China: the Yellow Sea, to the east of China: the Sea of Japan: and the Sea of Okhotsk.

Asia may claim to the Levant, the Archipelago, the Sea of Marmora, the Black Sea, and the Sea of Azof, already enumerated among the seas of Europe.

Asia contains one remarkable inland sea, the Caspian, whose length is 700 miles, and breadth from 100 to 200. To the east of this is the Sea of Aral, length 200 miles, breadth about 70. Another remarkable detached sea is that of Baikal, being about 350 miles in length, and 35 in breadth.

STRAITS.

The Strait of Babelmandeb, at the entrance of the Red Sea; the Strait of Malacca, between Malacca and Sumatra; the Strait of Sunda, between Sumatra and Java; the Strait of Corea, between Corea and the Japanese Islands, and Bherring's Strait, between Asia and America.

MOUNTAINS OF ASIA.

The principal Asiatic mountains are the following:

The Ouralian chain forms a boundary between Europe and Asia; its length is more than 1000 miles.

The Altaian chain extends across the centre of Asia, reaching from the 70th to the 140th degree of east longitude, or about 5,000 miles. Beyond the rise of the Enissei, this chain receives the appellation of the *Mountains of Sayansk;* and, from the south of the Sea of Baikal, the *Mountains of Yablonoi;* branches of which extend to the extreme boundaries of Asia.

The mountains of Tibet are situated in the country of that name; those of Belur Tag are to the west of the Chinese empire, running from north to south. Mount Taurus was, by the ancients, supposed to extend from Cape Chelidoni, in Asia Minor, through Armenia, even to India. The Caucasian mountains lie between the Black Sea and the Caspian.

Towards the east of Armenia is Mount Ararat, whose highest summit is covered with perpetual snow.

In Syria, the most celebrated mountain is that of Lebanon, running in the northerly and southerly direction of the Mediterranean: the highest parts are between Balbec and Damascus.

Mount Olympus, of great classic fame, is near the city of Bursa in Asia Minor, and is one of the highest in Asia.

The eastern and western Gauts are in Hindostan.

RIVERS.

The river Obe rises to the north of the Altay mountains, passes Kolyvan, Narym, Samarov, Beresov, and falls into the Gulf of Obe, after a comparative course of 1,900 miles. It receives the Tomm from Tomsk, and the Irtish from Tobolsk.

The river Enissei rises also in the Altay mountains, passes by Enisesk, receives the Toungouska, and falls into the Arctic Ocean, below Avamska.

The river Lena rises to the west of the Sea of Baikal, passes by Olekminsk, Yakutsk, Gighansk, and falls into the Arctic Ocean.

The river Amour passes by Yacsack, Hotun, and, running north, falls into the Pacific Ocean, after a course of 1,850 miles.

The river Hoanho, or Yellow River, in China, rises on the eastern boundary of Tibet, runs from west to east, and after a course of about 2,000 miles, falls into the Yellow Sea.

The Kian-ku rises very near the former river, but runs more towards the south; after passing by Nankin, it enters the sea 100 miles to the south of the Hoanho: its length is estimated at about 2,200 miles.

The Maykaung rises in the Tibetian Alps, runs through Laos and Cambodia, fertilizing the country by its annual inundations, and falls into the Indian Ocean: at its mouth it is called the Japanese River.

The river Maygue falls into the Gulf of Siam.

The Irrawady is the chief river of the Birman Empire; it passes by Bampoo, Ummerapoora, Ava, and Prome, and joins the Bay of Bengal by many mouths, after a course of near 1,200 miles.

The Burrampoot is supposed to rise near the mountains of Tibet, not far from the source of the Ganges, from which river it separates to the distance of more than 1,000 miles, and afterwards joins it near its termination: it passes through the country of Asam, hitherto little known, and for the last 400 miles runs through the British territory. For the last 60 miles, before its junction, it is from four to five miles wide.

The Ganges is considered as the sacred sovereign of the Hindoo rivers: its source has never been explored; but it is supposed to spring from a lake called Lanken, in Tibet: it receives such a number of other rivers, that its magnitude exceeds what might have been expected from the length of its course. At Hurdwar, the Ganges enters the plains of Hindostan, and pursues a south-east direction by Canoge, Allahabad, Benares, Patna, &c. till, dividing into several large mouths, it forms an extensive Delta at its egress into the Bay of Bengal. On the most western outlet of this river, called the Hoogley, stands Calcutta, the capital of British Hindostan.—The comparative course of the Burrampoot and the Ganges, is each estimated at 1,400 miles.

The Indus, or Sindeh, rises in Little Bucharia, and, after a course of about 1,000 miles, in which it receives several large rivers, it falls into the Indian Sea below Tatta.

The Godavery rises in the western Gauts, about 70 miles N. E. of Bombay, and then running S. E. and being joined by the Bain Gonga, a large river from the north, it falls into the Bay of Bengal.

The Kistna rises south of Poonah, and, after a course of 500 miles, falls into the Bay of Bengal, near Masulipatam. The richest diamond mines in the world are to the north of this river.

The Cavery runs by Seringapatam and Trichinopoly, and falls into the sea to the north of Tranquebar.

The Nerbuddah runs from east to west, and falls into the Gulf of Cambay, to the north of Surat.

The principal river of Asiatic Turkey is the Euphrates, which rises from the mountains of Armenia, a few miles to the N. E. of Erzerion; it is joined by the Morad from the east: at Sameset, it assumes a southerly direction, runs an extensive course to the S. E. and after receiving the Tigris, falls, by two or three mouths, below Bassora, into the Gulf of Persia: its course is estimated at 1,400 miles.

The Tigris runs by Diarbeker, Mosul (ancient Nineveh), Bagdad, near which was ancient Babylon, and joins the Euphrates 60 miles to the north of Bassora, after a comparative course of 800 miles.

The Kizel Irmak, the Halys of antiquity, rising in Mount Taurus, and pursuing a winding course to the north, through the whole of Asia Minor, joins the Euxine on the west of the Gulf of Sansoun.

The river Meander, falls into the Archipelago, opposite the Isle of Samos.

The river Jihon, which runs by Balk, and the Sir, or Sihon, fall into the Sea of Aral.

The Aras, by Erivan,—the Tedjen, by Herat and Nesa,—the Ural by Orenburg and Uralskoi, fall into the Caspian Sea.

The Wolga, which falls into this sea, has been enumerated among the rivers of Europe.

ASIATIC ISLES.

The Island of Ceylon, now in possession of the English, lies to the south of the western peninsula of India. The Nicobar and Andaman isles are in the Bay of Bengal, at some distance from the coast of Malacca. The small island of Bombay is on the Malabar coast; it is an English settlement, and a place of great strength.

To the north-east of Asia are the Japanese Isles, the largest of which is Niphon; length 750 miles, breadth 80. Jesso, or Chicha, lies to the north.

EASTERN ARCHIPELAGO.

The Eastern Archipelago is divided into,

1. The Sunda isles, to the south of Asia, including Sumatra (on which is the English settlement of Bencoolen), 950 miles in length, and 200 in breadth; Java, remarkable for the city of Batavia, the capital of the Dutch possessions in the East Indies, taken by the English in 1811: and the small isles of Balli, Sumbava, Florez, Timor, &c.

2. The Bornean isles, including Borneo, which, except New Holland, is the largest island in the world; its length

being 900, and breadth 600 miles; the Sooloos, Pulo Laut, Anamba, Natuna, &c. The Sooloos are rich in pearls.

3. The Manillas, or Philippine islands, the principal of which are Luzon, capital Manilla; Mindanao, Pulawain, Mindoro, Pani, Buglas, Zebu, Leyt, and Samar. On the east of Zebu is the small island of Mactan, where Magalhaens was slain.

4. The Celebezian isles include, besides Celebez, Sanguy, Shulas, Peling, Boutan, Sala, &c.

5. The Spice islands, including the Moluccas: these are Gilolo, Ceram, Bouro, Mortay, Ternat, Amboyna, Banda, Tidore, &c. They are famous for producing nutmegs, cloves, and other valuable spices.

AUSTRAL ASIA.

Austral Asia contains the following islands:

1. New Holland, or Notasia: length 2,730, breadth 1,960 miles: this island is only one-fourth less than Europe.
2. Papua, or New Guinea, and the Papuan isles.
3. New Britain and New Ireland, with the Solomon isles.
4. New Caledonia, and the New Hebrides.
5. New Zealand.
6. Van Diemen's Land, separated from New Holland by Bass's Strait, which is about 30 leagues wide.

POLYNESIA.

The groups of islands in the Pacific Ocean have been styled *Polynesia*, and consist of the following islands:

1. The Pelew islands.
2. The Ladrone, or Marian, islands, the principal of which are Guam and Tinian.

3. The Carolines, the largest of which are Hogoleu and Yap.

4. The Sandwich islands, discovered by Captain Cook. Owhyhee, the largest, is about 100 miles in length.

5. The Marquesas, which are very numerous.

6. The Society islands, which are about 60 in number; Otaheite is the largest.

7. The Friendly islands, and the Feeje islands.

8. The Navigator's islands, the principal of which are, Otutuelah, Tumaluah, &c.

AMERICA.

This continent, which is called the Western Hemisphere, or New World, is bounded on the north by the Arctic Ocean, on the east by the Atlantic Ocean, on the south by the Antarctic Ocean, and on the west by the Pacific Ocean. It is separated from Asia by Bherring's Strait.

The length of America, estimating it from 72 degrees of north latitude to Magalhaen's Strait, is about 8,800 miles; and its greatest breadth 4,400 miles.

This continent is divided into two parts, called North and South America: these are united by the Isthmus of Darien, narrower than that of Suez.

NORTH AMERICA.

North America includes British Possessions, United States, Spanish Dominions, and native Tribes.

I. British Possessions.

COUNTRIES.	CAPITALS.
Canada	Quebec, r. St. Lawrence
New Brunswick	Frederic Town
Nova Scotia	Halifax
Cape Breton	Louisburg
Newfoundland	St. John's

This part of North America is mountainous and barren, abounding, however, with lakes, rivers, and bays, that afford plenty of fish. The fur trade and fisheries render this colony very valuable.

2. United States.

Northern States.

New Hampshire	Portsmouth
Vermont	Bennington
Massachusetts	Boston
Rhode Island	Newport
Connecticut	Hartford New Haven

Middle States.

New York	New York, on Hudson's river
New Jersey	Trenton
Pensylvania	Philadelphia, river Delaware
Delaware	Dover
Ohio	St. Vincent's
Indiana	Corydon

Southern States.

Maryland	Baltimore, Bay of Chesapeak Annapolis Washington, r. Potomac
Virginia	Richmond
North Carolina	Newbern and Edenton

COUNTRIES.	CAPITALS.
South Carolina	Charlestown
Georgia	Louisville Augusta Savannah
Kentucky	Frankfort Lexington
Tennasee, a country south of Kentucky	Knoxville
Mississippi	Washington
Louisiana	New Orleans, r. Mississippi

These states are in an improving condition, and promise to become one of the most powerful empires of the world. They export to Europe, iron, copper ore, timber, pitch, skins, corn, tobacco, rice, cotton, &c. The population is estimated at nine millions, and is rapidly on the increase.

3. Spanish Dominions.

East Florida	St. Augustine
West Florida	Pensacola
New Mexico	Santa Fé
Old Mexico	Mexico

These countries are extremely fertile. Vera Cruz is the chief trading port on the Atlantic, and Acapulco on the Pacific Ocean: the trade carried on between the latter port and the Philippine Islands is very valuable. The chief trade of Campechy is in dying woods. The population is stated at seven millions,—four millions of whom are Indians.

4. Native Tribes and Unconquered Countries.

Greenland	
Labrador	Nain, a Moravian settlement
Country round Hudson's Bay	Albany Fort Churchill Fort
Central Parts	Unexplored
Western Coast	No towns.

These countries, lying in a high northern latitude, are covered with snow great part of the year. There is a company of merchants trading for fur to Hudson's Bay. The coasts of Greenland are yearly visited by ships employed in the whale fishery.

INLAND SEAS, GULFS, AND LAKES.

Among the inland seas of North America may be mentioned the Gulfs of Mexico, Californio, and St. Lawrence, Hudson's Bay, and Davis's Strait; the latter is probably a sea of communication between the Atlantic and Arctic Oceans.

Delaware Bay and the Bay of Chesapeak are in the United States.

Baffin's Bay lies to the north of Davis's Strait.

The lakes Superior, Michigan, and Huron, form one large inland sea, which may be called the sea of Canada: its length is about 560 miles, and breadth 180. Lake Erie and Lake Ontario are to the east, and Lake Winnipeg to the north of this sea. Slave Lake, explored by Mackenzie, is about 200 miles in length, and 100 in breadth.

STRAITS.

Hudson's Strait, at the entrance of Hudson's sea; Strait of Belle Isle, between Newfoundland and Labrador; Strait of Florida, between Florida and Cuba; and Bherring's Strait, between Asia and America.

MOUNTAINS.

A range of mountains proceeds from New Mexico, in a northerly direction, and joins the ridge called the Stony mountains: they are said to be 3,500 feet high.

The Apalachian mountains run through the United

States, from S. W. to N. E. Their length is about 900 miles, and height, above the level of the sea, 3,000 feet.

RIVERS.

The Unjiga, or Mackenzie's River, passes through Slave Lake, and falls into the Arctic Ocean.

Nelson's River falls into Hudson's Sea.

The river St. Lawrence is regarded as the second in North America; it rises from Lake Ontario, and, passing by Montreal and Quebec, falls into the gulf of the same name. Its comparative course may be estimated at 700 miles. It is navigable for ships as far as Quebec, 400 miles from the sea, where its breadth is 5 miles.

Hudson's River flows by New York, the Delaware by Philadelphia, and the Potomac runs by Washington into the Bay of Chesapeak, which also receives the Susquehanna.

The Mississippi is the largest river in North America. Its source has been traced to three small lakes, 1,400 miles from the sea; and the source of the Missouri, which falls into the Mississippi, is 600 miles more remote, so that its course may be estimated at 2,000 miles. It receives the Ohio, and falls into the Gulf of Mexico at New Orleans. It has been navigated by French traders for about 1,200 miles.

The Rio Bravo runs through New Mexico, and, after a course of about 1,000 miles, falls into the Gulf of Mexico.

AMERICAN, OR WEST-INDIA, ISLANDS.

These, in the order of their importance, are Cuba, which belongs to Spain, length 700, breadth 70 miles; St. Domingo, now in possession of the Blacks, length 400, breadth 100 miles; Jamaica, the most valuable of the English West-India Islands; and Porto Rico, which belongs to Spain.

The Caribee Islands extend from Tobago in the south, to the Virgin Isles in the north. Of these, Barbadoes, Antigua, St. Lucia, Tobago, St. Christopher's, St. Vincent, Dominica, Grenada, Trinidad, Montserat, Nevis, and some of the Virgin Isles, are British.

Martinique and Guadaloupe belong to France; St. Croix, St. Thomas, and St. John, to Denmark; St. Bartholomew belongs to Sweden; and St. Eustatius and Curaçao to Holland.

The Bahama, or Lucayos Islands, to the north of St. Domingo and Cuba, belong to the English: the principal is Providence Island.

The Bermudas, or Summer Islands, situated half way between Nova Scotia and the West Indies, belong to the English.

From the West-India islands are procured sugar, rum, cotton, indigo, cocoa, coffee, and mahogany.

SOUTH AMERICA.

The length of South America, from Cape Vela to Cape Horn, may be estimated at 4,700 miles; and its breadth, from Cape Blanco on the west, to Cape Roque on the east, at 3,200 miles.

DIVISION.

South America may be divided into

SPANISH POSSESSIONS,

Including the Vice-Royalties of

COUNTRIES.	CAPITALS.
Buenos Ayres	Buenos Ayres, r. La Plata
Peru, including Chili	Lima
New Grenada and the Caracas	Santa Fé de Bogota

Portuguese Dominions.

COUNTRIES.	CAPITALS.
Brazil	Rio de Janeiro

French Dominions.

Guiana, S. E. part	Cayenne

Dutch Territories.

Guiana, N. W. part, *or* Surinam	Paramariboo

Native Tribes.

Amazonia Patagonia	No cities

South America is best known for its gold and silver mines. The choicest gums and drugs are likewise found in various parts of this continent. The southern part, Patagonia, is extremely desolate and barren.

MOUNTAINS.

The highest mountains on the globe are in South America. The Andes extend from the most southern Cape of America to the Isthmus of Darien, a distance of 4,600 miles. They generally follow the windings of the coast at the distance of about 100 miles. The highest mountain of this range is Chimborazo, situated about 100 miles to the south of Quito: its height is estimated at 20,280 feet, or nearly 4 miles, about 5,000 feet higher than Mount Blanc. It is covered with perpetual snow about 2,400 feet from the summit.

RIVERS.

The river Amazons, or Maranon, is the largest river in the world. It takes its rise among the Andes, and consists of two principal branches, which, uniting and receiving, from the north, the Napo, the Parana, Yupuro, and the

Great Negro; and, from the south, the Cuchivara, or Araza, and the Madera,—runs from west to east nearly the whole breadth of South America; its course is estimated at 2,300 miles. The breadth, at the Portuguese boundary, is estimated at a league; but it is generally about two miles, and no bottom is found at 103 fathoms. The tide runs up 600 miles from the sea. It is navigable from the town of Jaen, a distance of nearly 2,000 miles.

The river next in consequence is the Rio de la Plata, or the River of Silver, formed of the Paraguay and the Parana. It runs by Assumption (whence it is navigable), Corrientes, Santa Fé, Buenos Ayres, below which latter place it falls into the ocean. Its estuary is so broad, that a ship in the middle of the stream cannot discover land on either side. Its course is reckoned about 1,600 miles, for 1,200 of which it is navigable.

The third river of South America is the Orinoco, formed by the junction of several small rivers; it falls into the Atlantic Ocean, south of the island of Trinidad.

ISLANDS BELONGING TO SOUTH AMERICA.

The islands of Juan Fernandes and Chiloe, in the Pacific Ocean; Terra del Fuego, separated from the continent by the Strait of Magalhaens; Falkland's Islands to the east of this strait, and Trinidad on the north, already named among the West-India Islands.

AFRICA.

Africa is bounded on the north by the Mediterranean Sea,—on the east by the Red Sea and the Indian Ocean,—on the south by the Southern Ocean,—and on the west by the Atlantic Ocean. Its length is 4,900 miles, and breadth 4,800. It is the third in size, and is joined to Asia by the Isthmus of Suez.

DIVISION.

COUNTRIES.	CAPITALS.
Abyssinia	Gondar
Egypt	Cairo, r. Nile

MAHOMETAN STATES IN THE NORTH.

Tripoli	Tripoli
Tunis	Tunis
Algiers	Algiers
Morocco	Morocco

The inhabitants of these states are chiefly remarkable for their piracies.

THE WESTERN COAST.

On this coast there are many different tribes: the Jalofs and Foolahs are on the rivers Senegal and Gambia. Sierra Leone is an English settlement. Guinea is divided into the Grain, Ivory, and Gold Coasts, and formerly supplied the West-Indies with slaves: this trade disgraced humanity from the year 1517 till the year 1807, when it was happily abolished; Hawkins, the great navigator, was the first

Englishman engaged in it. The settlements in Guinea are chiefly Portuguese, from which elephants' teeth are exported.

Proceeding southward, we meet with Benin, Loango, and Congo.

Caffraria, or the Land of Hottentots, extends to the Cape of Good Hope, the most southerly part of Africa.

The Eastern Coast.

On the eastern coast of Africa are Natal, Delagoa, Sabia, Sofala, Mocaranga, Mozambique, Zanguebar, Ajan, and Adel.

These countries produce ivory, gold, ostrich feathers, ebony, and drugs.

An extensive desart in North Africa, called the Desart of Zaara, extends from the Atlantic to the confines of Egypt, equal in size to the half of Europe. This ocean of sand is interspersed with several fertile islands, called Oases, of which Fezzan is the chief. It abounds in salt.

MOUNTAINS.

The mountains of Atlas extend along the north of Africa, from Morocco to Egypt. A range of mountains is supposed to extend across this continent, from east to west, at about 10 degrees of north latitude. The mountains of Abyssinia are a continuation of this chain. The mountains of the Moon are known only by name.

RIVERS.

The chief river hitherto discovered is the Nile, which, rising in Abyssinia, runs through Egypt, fertilizing the country by its annual inundations, and falls into the Mediterranean: it begins to rise about the middle of June, and is at its height in September or October: its comparative course is reckoned at 2,000 miles, and its breadth about one-third of a mile.

The Niger runs from west to east for above 1,000 miles, and either flows into some inland sea, or is lost in the sands.

The Senegal falls into the Atlantic to the north of Cape Verd, and the Gambia to the south of the same cape.

AFRICAN ISLANDS.

Madagascar, on the east, one of the largest islands in the world, being 980 miles in length, and 260 in breadth. The smaller islands are Mauritius, or Isle of France, in possession of the English; Bourbon, in possession of the French; and Kerguelen's Land, far to the south, called by Captain Cook the *Island of Desolation.*

The islands in the Atlantic Ocean are St. Helena, a very desirable port, containing an English garrison: Ascension Island; St. Thomas; St. Matthew; Cape Verd Isles, ten in number—the two largest are St. Jago and St. Anthony: Canary Isles, on one of which is the Peak of Teneriffe, said to be visible at the distance of 80 leagues, and which is more than 3 miles high; Madeira Island, remarkable for its wines.

AN ACCOUNT OF THE PRINCIPAL CANALS IN THE WORLD,

Supplemental to the account already given of those in England and Scotland.

CANALS IN EUROPE.

In Ireland a canal is formed from Dublin to the river Shannon, and another is completed from the town of Newry to the sea.

The inland navigation of Russia is very extensive. An intercourse is formed between the Caspian Sea and the Baltic, a distance of nearly 2,400 miles, by means of the canal of Vetni Volotchok, uniting the Twertza, which runs into the Wolga, and the Shlina, which communicates with the Baltic.

The canal of Ladoga passes along the lake of that name, and extends from the river Volk to the Neva, a space of 67 miles, and communicates with the former canal. Another canal leads from Moscow to the river Don, forming a communication with the Euxine.—Peter the Great intended to unite the Don and the Wolga, and thus to form an intercourse between the Caspian and Euxine Seas and the Baltic.

In Sweden an attempt has been made to unite Stockholm with Gottenburgh, by the canal styled that of Trolhattan, conducted along the river Gotha; but the attempt has hitherto failed.

The chief inland navigation of Denmark, is the canal of Kiel: it unites the Baltic and the river Eyder, which flows into the German Sea. Its length is about 21 miles; the breadth 100 feet at top, and 54 at bottom: the least depth about ten feet, so as to admit vessels of 120 tons.

A canal is made in the Prussian dominions to unite the Elbe with the Oder: its length is nearly 60 miles.

Holland is intersected with innumerable canals, which, for number and size, may be compared to our public highways. By them a great inland trade is carried on with France and Germany. In summer they are constantly crowded with boats of pleasure or of traffic; and in winter, when they are frozen over, the inhabitants travel on them with skates, and perform long journeys in a very short time.

In France the canal of Briare, otherwise styled the canal of Burgundy, unites the Loire and the Seine. From Briare, upon the Loire, it passes by Montargis, and falls into the Seine near Fontainbleau.

A canal from Orleans joins the last-mentioned canal at Montargis.

The canal of Picardy extends from the Somme to the Oise, beginning at St. Quintin.

But the chief canal of France is the celebrated one of Languedoc, which forms a junction between the Mediterranean and the Bay of Biscay. This noble canal begins at Cette, in the Bay of Languedoc, and joins the Garonne, below Toulouse. The breadth, including the towing paths, is 144 feet, the depth 6 feet, and the length 180 miles.

CANALS IN ASIA.

The canals of China have long excited the wonder of other nations. There is a large canal in every province, with branches to most of the towns and villages.

The imperial canal runs north and south, beginning at

Lin-sin-choo, where it joins the river Euho, and extends to Han-choo-foo, in an irregular line of about 500 miles.

The river Kan-Kian facilitates the navigation of the southern provinces; and all kinds of merchandize entering Canton, can be conveyed directly to Pekin, a distance of 825 miles.

In Hindostan, the river Ganges is uninterruptedly navigable for the distance of 500 miles from the sea; its medium breadth is three quarters of a mile, and the depth of its channel 30 feet.

The Indus admits of an uninterrupted navigation from the Gulf of Cutch to Lahore, for vessels of 200 tons, a distance of nearly 800 miles.

CANALS IN AMERICA.

No country can boast of superior means for inland navigation than the United States. An extensive sea coast, with many large bays, on the east; Lake Superior, Michigan, and Huron, forming one large sea, on the north; and the river Mississippi, into which the Ohio runs, on the west. The internal parts of the country are also intersected with the noblest rivers, many of which are navigable for some hundreds of miles; and very little assistance is wanting from canals to render this country the most convenient, for commerce and inland navigation, of any on the globe.

By means of the Lake Nicaragua, whose length is 170 miles, and which has a great outlet, the river of St. Juan, flowing into the Gulf of Mexico, an easy passage might be made from the Atlantic into the Pacific, and in the most direct course that could be desired.—Were any enterprising nation, instead of Spain, in possession of this part of America, this improvement would probably soon be made.

A canal in Africa, between the Mediterranean and the Red Sea, would open a shorter way to India.

WINDS.

Wind is a current of air produced by a partial rarefaction of the air by heat. Winds may be divided into *constant*, *periodical*, and *variable*.

Constant winds blow always in one direction; periodical winds blow half a year in one direction and half a year in a contrary direction, and are called *monsoons*; the constant and periodical winds have also obtained the name of *trade winds*. Variable winds are subject to no rules.

In the Atlantic and Pacific Oceans, under the equator, there is a constant east wind. To about 28 degrees on the north of the equator the wind blows constantly from the north-east; and to as many degrees south, it blows from the south-east. Hence, in these oceans, it is easy for ships to sail westward; but to sail eastward, it is necessary to go into higher latitudes to meet with variable winds.

In the Indian Ocean the wind blows one half of the year in one direction, and one half in an opposite direction. During the months of May, June, July, August, September, and October, the wind blows from the south-east; and during the rest of the year, a north-west wind prevails from 3 degrees to 10 degrees S. latitude.

From 3 degrees S. latitude, over the Arabian and Indian Seas, and Bay of Bengal, there is another monsoon, blowing from October to April, from the north-east; and during the other six months, it blows from the opposite or south-west points.—The shifting of these winds is attended with great hurricanes.

The constant and periodical winds blow only at sea, and never extend beyond 30 degrees of latitude; on land the wind is generally variable.

Besides the winds already mentioned, there are others called *land* and *sea breezes*: These are chiefly felt in islands situated between the tropics. The air over the land being hotter during the day than the air over the sea, a current of air will set in from the sea to the land by day; but the air over the sea being hotter than that over the land by night, the current at night will be from the land to the sea.

The sea breeze in the West-Indies begins about nine in the morning, increases till noon, and dies away at four or five in the afternoon: about six in the evening it changes to a land breeze, which blows from the land to the sea till eight in the morning. These breezes moderate very much the heat of the islands situated in the torrid zone.

The velocity of wind has been estimated as follows:—In a storm, at the rate of 63 miles in an hour; when it blows a fresh gale, at the rate of 21 miles in an hour; and in a small breeze, at the rate of 10 miles in an hour.

It is stated in the Edinburgh Review, vol. xiii. page 284, that, in the Pacific Ocean, beyond 40 degrees latitude, north and south, a constant west wind blows ten months in the year: and that the voyage across this ocean, from the west coast of America to the East-Indies, or from the East-Indies to America, may be made in so expeditious and steady a manner, that the arrival of ships may be calculated almost with the accuracy of a mail coach.—In the western passage, ships keep within the tropics, to avail themselves of the constant east wind, prevalent in all tropical regions; and in the eastern passage, they must sail north or south till they arrive in 40 degrees of latitude, where they will meet with a constant west wind.

OBSERVATIONS

On the Seasons and Climates of the different Regions of the Earth.

The seasons in the torrid zone being very different from what we observe in the temperate zone, a short account of them will be necessary.

As it is summer with us when the sun is nearest our zenith, it has by some been imagined that the inhabitants of the torrid zone have double seasons: namely, two summers, because the sun is twice vertical to them,—two autumns, when he is retiring, &c. But in many places a torrent of rain follows the course of the sun, and the worst season is when the sun is vertical; the only distinction of seasons within the tropics, therefore, is from hot and dry to hot and rainy; most countries in the torrid zone having six months inclining to a wet, and six months inclining to a dry air.

On the western coast of Africa, at Sierra Leone, the dry season is from September to June, and the wet from June to October. About the end of June the rains increase, accompanied with dreadful storms of thunder and lightning.

On the gold coast, the rainy seasons last from April to October; and in the kingdom of Congo, from the end of March to the middle of September. The greatest quantity of rain generally falls about mid-day.

The seasons on the eastern coast are opposite to those on the western: the winter, or rainy season, in Sofala, Mozambique, and Zanguebar, is from September to February. In Egypt rain is a very uncommon phenomenon.

In Abyssinia, the climate, though hot, is tempered by the mountainous nature of the country. From April to September there are heavy rains. These rains, added to the melting of the snows on the mountains, occasion the overflowing of the Nile.

In Bengal the hot or dry season begins with March, and continues to the end of May: the intense heat is sometimes interrupted by violent thunder storms. The rainy season continues from June to September; the three last months of the year are generally pleasant, but excessive fogs prevail in January and February. By the latter end of July, all the lower parts of Bengal are overflowed, and form an inundation of more than a hundred miles in width, nothing appearing but villages and trees, excepting, very rarely, the top of an elevated spot appearing like an island.

The chains of the Gauts, running from north to south along the western peninsula of India, intercept the great mass of clouds, and produce opposite seasons on the coasts of Malabar and Coromandel. The rainy season, on the coast of Coromandel, is with the N. E. monsoon, or from October to April: and on that of Malabar with the S. W. monsoon, or from May to September. In the month of September the navigation on the Malabar coast is open, and ships begin to sail from the Malabar shore to all parts of the world.—The rains are not continual during the wet season, but pour down in floods for several days together, or for several hours in a day.

Peru is divided into two different climates by the Andes, —for whilst it is summer in the mountainous parts, it is winter in the vales. Winter, on the mountains, begins in December—but this in the vales is the first summer month; and a journey of four hours conducts the traveller from one season to another.

In general the confined regions on the west of the Andes are dry, whilst the wide countries on the east of that chain are deluged with torrents of rain, from the trade winds blowing over the Atlantic.

Travellers, on the Andes, have sometimes enjoyed a delightful serenity in these elevated regions: at the same time that they have heard the horrid noise of tempests discharging themselves on the level country, they have seen lightnings issue from the clouds, and heard the thunders roll far beneath their feet.

At Lima, rain is seldom or never seen, but a strong dew falls and waters the vallys. The country is much subject to earthquakes; the most dreadful seems to have been that of 1747, when the port of Callao was submerged, and out of 4,000 inhabitants only 200 escaped.

In Brazil the wet season commonly begins in March or April, and is over in August: when the spring, or rather the summer, begins. The nights are very cold; and the nights in summer are colder than in winter.

In Jamaica the rain commonly begins in May. July is always very wet; and toward the end of that month, and the beginning of August, the weather is very close. In September and October hurricanes are frequent.

In Nicaragua it rains six months, from the first of May to the first of November; in the other six months it is hot and dry.

That part of the frigid zone which is inhabited, viz.: Greenland, Lapland, &c. has only two seasons, winter and summer. The night of winter, the sun never appearing above the horizon, is extremely severe. The most rapid rivers are sometimes frozen five or six feet deep or more the largest lakes and bays are frozen to bear any weight, and rocks often burst by the intensity of the frost. The brilliancy of the stars, the Aurora Borealis, and the full moon, which never sets, make some atonement for the absence of the sun. The long twilight also, which the inhabitants enjoy before the sun rises and after he sets, considerably diminishes the time of their total darkness.

The transition from winter's frost to summer's heat, is very rapid in the frigid zone. The short summer is very warm, but foggy. The continual sunshine now enables the inhabitants to lay up a store of provisions for winter.

The hottest part of the earth is the middle and western parts of Africa. The trade winds, in passing over the extensive sandy deserts of this continent, become heated to an extreme degree before they arrive at the western coast.

The climate, on the western continent, is much colder than it is in similar parallels on the eastern continent.

Canada, in North America, which is nearly in the same parallel with France, has the winters almost as severe as at Petersburgh: the river St. Laurence, notwithstanding its breadth, is frequently frozen the whole of the winter, strong enough to bear even carriages upon it. Philadelphia and New York, nearly in the same parallel with Madrid, have often severe winters, but the heat of the summer is excessive.

The cold in the southern hemisphere is much greater than in the northern. The climate of Terra del Fuego is an instance of this: situated as far south as Newcastle is north of the equator; and, therefore, were the degrees of heat and cold proportionable to the latitude, we might expect the summers of Terra del Fuego as warm as ours; yet Captain Cook, who was there at Midsummer, found the cold so excessive, that a party, botanizing on the hills, was in danger of perishing by cold.

The mountains and vast fields of ice, around the South Pole, extend to a much greater distance than those around the North Pole. Navigators have penetrated to within 9 degrees of the North Pole; yet Captain Cook could not get nearer the South Pole than within 18 degrees.

In great continents the weather is more settled than it is in islands: the summer's heat is greater, and the winter's cold is more intense.

In islands the heat is tempered by clouds and vapours from the surrounding sea; but the weather is inconstant. The cold of winter is also mitigated from the same cause, and the frost is generally of short duration.—This is particularly the case with respect to Great-Britain.

A COMPARATIVE VIEW OF THE LENGTHS OF RIVERS.

EUROPEAN RIVERS.

Thames, as the standard of unity..	1
Rhine, ...	4¼
Danube, ...	9¼
Volga, ...	12

ASIATIC RIVERS.

Indus, ...	7
Euphrates, ...	6
Ganges, ...	10
Irrawaddy, ...	8½
Burrampoot, ...	10
Enissei, ...	10

Obe, ...	13
Amour, ...	13
Hoan-ho, ...	14
Kian-ku,........................	15½

AFRICAN RIVER.

Nile, ...	14

AMERICAN RIVERS.

Mississippi, reckoning its length to the most remote branch of the Missouri,	14
Amazons,........................	16
Rio de la Plata,........................	11

QUESTIONS IN GEOGRAPHY,

ADAPTED TO PART I.

DEFINITIONS.

What is Geography? What does the surface of the earth contain? How is water divided? How many oceans are there, and how are they situated? What is a bay or gulf? What is a strait? What is a lake?

What is a continent? How many continents are there? What are the names of the four quarters of the world? How many of these are in the eastern hemisphere? What is an island? What is a peninsula? What is a promontory?

OF THE EARTH IN GENERAL.

What is the diameter of the earth? How many millions of square miles does its surface contain? What proportion of it is covered with water? Which of the four quarters of the globe is the most extensive, and which is the least? Whether is Asia or Africa the most extensive? Does the most extensive quarter of the globe contain the greatest number of inhabitants? How many inhabitants are there for every square mile in each quarter? How is this found?

QUESTIONS FOR THE MAP OF EUROPE.

In what part of the eastern hemisphere is Europe situated? What are its boundaries, and with which of the other general divisions is it connected? Which is the most southern point of Europe? Which is the most northern? Between what parallels of latitude is Europe situated? How many degrees of longitude does it contain? What is its length and breadth in English miles?

What are the countries in the north of Europe? What are the boundaries and capitals of each? What countries compose the Danish dominions? What are the boundaries and capitals of the six countries in the middle? What are the boundaries and capitals of the four in the south? How many of the countries in Europe are maritime, and how many inland? Which is the most mountainous country in Europe? What part of Europe is situated farthest from the sea?

What small sea branches out from the Frozen Ocean? What small seas communicate with the Atlantic? What small seas communicate with the Mediterranean?

What are the two gulfs that empty themselves into the Baltic? What bay lies between France and Spain? What gulf separates Italy from Turkey?

What small gulfs are in the Baltic? What gulfs communicate with the Mediterranean? What strait forms the communication between the Atlantic and the Baltic? What strait communicates between the German Ocean and the English Channel? Through what strait does the Atlantic constantly flow into the Mediterranean?

What strait lies between the Sea of Marmora and the Archipelago? What strait lies between the Sea of Marmora and the Black Sea?

What are the principal lakes in Europe? Which are the highest mountains in Europe, and where are they situated? What range forms the boundary between France and Spain? Through what country, and in what direction, do the Appenines run? What mountains bound Hungary on the north and east? What mountains lie to the west of Sweden?

How many volcanoes are there in Europe, and where are they situated?

What river falls into the White Sea, and what town is situated at its mouth?

What rivers run into the Baltic, and what principal towns are situated upon them? Which of the rivers that run into the Baltic has the longest course?

Where does the Elbe rise, by what town does it pass, and where does it fall into the sea?

What river runs by Bremen, and what town stands near the mouth of the Ems?

What river forms the eastern boundary of France, where does it rise, by what towns does it pass, and where does it fall into the sea? What other rivers fall into it? What is the name of that river which passes by Namur, Liege, Maestricht, and which falls into the sea below Rotterdam?

What are the four principal rivers in France, where do they rise, by what large towns do they pass, and into what seas do they empty themselves?

What river forms the northern boundary of Portugal? On what river is Oporto situated?

Which is the longest river that runs through Spain and Portugal? What river falls into the Gulf of Cadiz? What river falls into the Mediterranean Sea at Tortosa?

What rivers of Italy fall into the Mediterranean? What rivers fall into the Gulf of Venice, and by what places do they run?

Describe the rise and course of the Danube, by what towns it passes, and where it falls into the sea. What river forms the boundary between Turkey and Russia, and what town is situated near its mouth? What is the name of that river which falls into the Black Sea at Cherson? What river falls into the sea of Azof? Describe the course of the Wolga, by what towns it passes, and into what sea it empties itself.

What islands are in the Baltic? What small islands are situated near Great Britain or Ireland, and reckoned part of the British Islands? What islands off the coast of France belong to Great Britain? What islands in the Atlantic Ocean belong to Denmark? How far are the Azore Islands situated from the coast of Europe?

Is Iviza, Mallorca, or Minorca, nearest Spain? Which is the most southerly island, Sardinia or Corsica? Describe the situation of Sicily. What strait separates it from Italy? How far is Malta situated from Sicily?

What large island lies south of the Morea? In what part of the Mediterranean is Rhodes?

What is the name of the isthmus between the Morea and the continent?

What is the name of that cape to the north of Lapland? What is the cape to the south of Norway? What two capes are those, one of which lies to the south-west of England, and the other to the south-west of Ireland?

What are the principal capes in Spain and Portugal? What is the name of the southern promontory of Italy? Which is the most southern cape of Turkey?

Whether is Vienna or Berne the most northerly? Whether does Berlin or Warsaw lie farthest to the north? Of Stockholm and Petersburgh, which is the most northerly? Whether does Paris or Amsterdam lie farthest to the east? Does Constantinople or Madrid lie farthest to the north? Opposite to what part of England is Cape La Hogue? Where is the isle of Ushant? Is Bourdeaux or Nantes the most westerly?

QUESTIONS FOR A MAP OF THE BRITISH ISLES.

Between what parallels is Great Britain situated? What is its greatest length and breadth? Describe the boundaries of England. What river separates it from Scotland? Into how many counties is England divided? How many counties are there in Wales? What counties lie to the north, and what are their chief towns? How many border upon Wales? What are their names and chief towns? Name the midland counties and capital towns. What are the names of the eight eastern? Which are the south-eastern counties? Name the four southern, and the three south-western. What are the six counties in North Wales? What are the six counties in South Wales? Describe the boundaries of all the counties in England and Wales.

Which is the most northern county in England? Which is the nearest to France? What counties lie farthest to the south-west? Supposing a straight line drawn from Newcastle to London, through what counties would it pass?

What counties border upon the Bristol Channel? Name those bordering on the English Channel. How do Oxford and Cambridge lie from London?

In what county is Weymouth? In what county is Flamborough Head? In sailing from London to Berwick, what counties must I pass? Is Leeds or York the most northerly? Is Durham or Carlisle the most northerly? Is Bristol or Liverpool the most westerly?

What river falls into the sea at Tynemouth? What river runs through the middle of the county of Durham, and where does it fall into the sea? What river divides Durham from Yorkshire? On what river is Whitby situated? What are the rivers in Yorkshire that flow into the Humber? On what rivers are York, Leeds, Sheffield, and Ripon situated?

What river runs from the south into the Humber? Describe the rise, course, and tributary streams of this river. On what river is Boston situated? What river runs by Wisbeach? Describe the course of the Southern Ouse. What rivers are there in Norfolk, Suffolk, and Essex? To how many counties does the river Thames serve as a boundary? What are the principal towns it runs by? On what river is Canterbury?

What are the rivers that run into the English Channel? What large river empties itself into the Bristol Channel? On what river is Chester situated? What river runs by Liverpool? On what river are Appleby and Carlisle? On what river is Lancaster?

What are the length and breadth of Scotland? What are the counties in the northern division, with their chief towns? Name those in the midland division. What counties are in the southern division, and what are their chief towns? Which is the capital of Scotland, and what is its port? Which of the Scottish counties are washed by the British Ocean or North Sea? What county is the nearest to Ireland? Between which two counties does the Frith of Clyde lie? What is the name of that Frith, which lies between Fifeshire and Edinburgh and Haddington? On what river is Aberdeen situated? What is the principal river in Perthshire, and where does it fall into the sea? How does the Clyde run, and where does it fall into the sea? Where is the Pentland Frith? What are the principal mountains in Scotland?

How does Ireland lie from England? Into how many provinces is it divided? What are the counties and capitals of Leinster? Name those of Ulster. What are the counties of Connaught? How many counties are there in Munster, and what are their names?

Which is the largest river in Ireland? Where does it fall into the sea? On what river is Waterford? On what rivers are Dublin, Londonderry, and Drogheda? What are the principal lakes in Ireland? What county in Ireland is nearest Scotland? In what county is Antrim?

Where is the Isle of Man? Where are the Hebrides? Whether are the Shetland or Orkney Isles the nearest Scotland?

QUESTIONS FOR THE MAP OF ASIA.

What are the boundaries of Asia? What is its greatest length and breadth? What is the name of its most northerly cape? What part of it stretches farthest to the south? What part of Asia takes the name of Siberia, and to whom is it subject? What are its chief towns?

What are the countries that lie in the middle, and what are their capitals? Near what sea does Independent Tartary lie? What is its capital city? What are the names of those countries that belong to Turkey in Asia? Near what seas are they situated? What are the chief towns?

Where is Arabia situated? What are its chief towns? What large river runs through Arabia? How does Persia lie from Arabia? What sea bounds it on the north? What gulf lies between it and Arabia? What is the principal city? What country is that which lies between the Arabian Sea and Bay of Bengal? What is the name of the western coast, and what of the eastern? What are the names of the principal towns on the eastern coast that belong to the English? What large town is situated near the mouth of the Ganges? What small island on the western coast is a strong English settlement?

How is the Birman Empire situated with respect to the Bay of Bengal? What are the chief towns? What is the name of that peninsula which lies to the south of the Birman Empire?

What sea lies between Arabia and Persia? What strait unites it with the Arabian Sea? Where are the Gulfs of Siam and of Tungquin? What sea lies between the peninsula of Corea and China? What sea lies to the west of Kamtschatka? What strait separates Asia from America?

What chain of mountains forms the boundary between Europe and Asia? What chain extends across the centre of Asia, and what is its length? What mountains lie between the empire of China and Independent Tartary?

Where do the Caucasian mountains lie? What is the name of the mountains in Hindostan?

Describe the rise and course of the large rivers that fall into the Arctic Ocean. By what places does the river Amour run, and what is the length of its course? What are the two large rivers in China, and what is the direction of their course? What river runs through Cambodia into the Indian Ocean? What river runs into the Gulf of Siam? What is the chief river of the Birman Empire, by what places does it pass, and what is the extent of its course?

What two large rivers run into the Bay of Bengal? In what country does the Ganges rise, and by what towns does it pass? Where does the Indus rise, and into what sea does it fall? What river runs by Seringapatam? What rivers run into the Persian Gulf? Name the large rivers of Asia, in the order of the extent of their course.

Where is the island of Ceylon situated? What small islands lie in the Bay of Bengal? What island is separated from Malacca by the straits of that name? In what island is Batavia? What two islands do the straits of Sunda separate? How do the Japanese islands lie from China, and between what parallels of latitude are they situated? Does Borneo or Sumatra lie farthest to the east? Do the Phillippine or Celebezian Isles lie farthest to the south? How do the Molucca Isles lie from Java?

To what islands has the name of *Austral Asia* been given? What groups of islands have been styled *Polynesia?*

What part of Asia lies in the torrid zone? Which is the more northerly port, Mocha or Aden? Are the Pelew Isles or the Moluccas nearest the equator? How is the island of Formosa situated? Which is the most southern cape of Hindostan? On what river is Bagdad?

ON THE MAP OF AMERICA.

What ocean separates America from Europe and Africa? How is it bounded on the north? What is the name of the most southerly cape in America, and in what latitude is it situated? If you travel from east to west across America, what sea do you arrive at? What is the greatest length and breadth of America? Into how many parts is America divided, and how are these united?

In what part of North America are the British possessions? What are the names of the countries belonging to Great Britain, with the principal towns?

In what part of North America are the United States situated? Name the principal states, with their chief towns, as divided into Northern, Middle, and Southern, How is Florida situated? What is the latitude of Mexico? What is the capital of New Mexico? What strait lies between Greenland and America?

How are Hudson's Bay and the Gulf of Mexico situated? Where is the Gulf of St. Laurence? What are the names of the lakes which form one large inland sea to the south of Canada? Is the Slave Lake or the Lake Athapescow the most northerly?

What strait lies between Labrador and Newfoundland? Where are Hudson's Straits? What strait lies to the north of Cuba?

What range of mountains are to the west of the United States?

Which is the largest river in North America? Describe its rise and course, and where it falls into the sea. Describe the rise and course of the river St. Laurence. How far is it navigable? What two rivers in North America fall into the Arctic Ocean?

Which is the largest of the West-India islands? Which is the most valuable of the English West-India islands? What other islands belong to Great Britain? Whether do the Bahama islands lie to the north or south of Cuba? Which of the West-India islands lies the farthest south? Which is situated the farthest to the east? Name the French islands. To what nation does St. Eustatius belong?

What is the breadth of South America? What is its length? Between what parallels of latitude is it situated? In what longitude is the most eastern part of South America? What countries in South America lie to the north of the equator? What countries lie on the western coast, and what are the chief towns? What ridge of mountains runs the whole extent of South America? What island lies to the south of South America? What country in South America belongs to Portugal? What countries lie in the interior of South America?

Which is the largest river in the world? What is the length of its course, and how far is it navigable? On what river is Buenos Ayres situated? What river rises in New Grenada and runs north-west? What river falls into the Atlantic Ocean at the equator, in longitude 50 degrees west? Where are Falkland's Islands situated?

QUESTIONS FOR A MAP OF AFRICA.

On how many sides is Africa surrounded by the sea? How could it be made an island? What isthmus unites it with Asia? In what part of it is Egypt situated? What is the capital of Egypt? What river runs through it? Where does it rise?

What countries of Africa are seated on the Mediterranean? What countries lie on the western coast? What is the most southern cape? In what latitude is Cape Verd? Which is the most easterly cape? What is the latitude of Sierra Leone? What sea lies between Africa and Arabia? What is the course of the Niger? Into what sea does it run? Where is Abyssinia? What large island lies east of Africa? How are the Canary isles situated? Whether are the Cape Verd islands or the Canaries the most northerly? What is the name of the great desert in North Africa? What part of Africa remains unexplored?

EXERCISES FOR THE TOWNS IN THE BRITISH ISLES.

Point out the English sea-ports on the North Sea—the English Channel—the Bristol Channel—the Irish Sea—and name the river or bay on which each is situated. Name some of the principal manufacturing towns in England.

What towns have been greatly benefited by inland navigation? What towns in England have a population of above fifty thousand? Name those whose population is between thirty thousand and fifty thousand. Which towns have a population of above fifty thousand and below thirty thousand? Name the cities in England.

Write out a list of all the towns in each of the six northern counties.—Do the same with each of the counties bordering on Wales—the midland counties—the eastern counties—the south-eastern—the southern—and the south-western.

Which are the principal town in Wales?

Which sea-ports in Scotland are situated on the North Sea—the Atlantic Ocean—the Irish Sea? Name some of the most populous towns in Scotland.

Which is the most commercial town in Scotland? Name the Scotch universities. Which are the principal manufacturing towns in Scotland?

Which are the principal sea-ports in Ireland, and what are the exports and imports? Name the towns in Ireland that send members to the Imperial Parliament.

EXERCISES FOR THE SEA-PORTS IN EUROPE.

What are the principal sea-ports in the Danish dominions—in Sweden—in Russia—in Germany—in Holland—in France—in Spain—in Portugal—in Italy—in Turkey?

Point out the chief sea-ports in the Baltic, and name their principal imports and exports. What are the continental sea-ports situated on the North Sea—on the English Channel—on the Bay of Biscay—on the Atlantic Ocean? What are the chief articles of commerce at each of these sea-ports? Point out the principal sea-ports in the Mediterranean, and mention some particular relating to each.

Name the sea-ports on the Black Sea.

Which are the sea-ports in Europe, whence hemp and flax are chiefly imported? Name those whence timber is imported? To what sea-port would a merchant send a ship for a cargo of port-wine?—of brandy? Where would a ship go for a cargo of oranges, lemons, figs, raisins, &c.?

What sea-ports in Europe export the greatest quantity of corn? What country supplies the English manufacturers with the finest wool for making superfine broad cloths? From what country is the best iron imported? Which is the largest commercial town in the north of Germany? In what ports are the French navy chiefly stationed? Which are the principal harbours in Spain for ships of war? Which is the strongest fortress in Spain, and what nation is at present in possession of it?

Which city on the Adriatic Sea was formerly the most commercial city in Europe? Which is the greatest trading town in Russia?

PART II.

CONTAINING PROBLEMS ON THE TERRESTRIAL GLOBE.

GEOMETRICAL DEFINITIONS.

1. A *CIRCLE* is a figure formed by drawing a line every where equally distant from a point called the *centre.*

2. The boundary line is generally termed the *circumference.*

3. Any straight line passing through the centre, and terminated both ways by the circumference, is called the *diameter.*

4. The *radius* is half the diameter.

5. A *globe* is a perfectly round body; its middle point is called the *centre.*

A *globe,* or *sphere,* is a solid, formed by the revolution of a semicircle about its diameter, which remains fixed.

The *axis* of a sphere is the right line about which the semicircle revolves.

6. A *great circle* divides the globe into two equal parts or hemispheres.

A *great circle* of the sphere is a section of the sphere by a plane passing through the centre.

7. A *less circle* divides a globe into two unequal parts.

A *less circle* of a sphere is a section by a plane not passing through the centre.

Every circle, great or small, is supposed to be divided into 360 equal parts, called *degrees;* and every degree is subdivided into 60 *minutes.*

Degrees are marked °, and minutes ′. Thus,—4 deg. 15 min.; 4° 15′.

8. An *angle* is formed by two lines meeting in a point.

9. One line is said to be *perpendicular* to another, when it inclines not more on the one side than on the other.

10. A *right angle* is formed by one line being drawn perpendicular to another.

GEOGRAPHICAL DEFINITIONS.

1. The *terrestrial globe* is an exact representation of the earth, shewing the relative situations of all the places upon its surface.

2. A *map* is a representation of the earth, or of a part of the earth, upon a plane surface.

Maps are either universal or particular. The former exhibit the whole surface of the earth,—the latter only a part of it.

It being difficult to represent a globular surface upon a plane, maps of the world do not shew the true figure of all the different countries. In particular maps, especially when the country is not very extensive, the difference from the true figure is very small.

3. The *axis* of the earth is an imaginary line passing through its centre, round which it turns from west to east, once in 24 hours.

This is represented on the globes by the wire which passes through them, and on which they turn.

4. The *poles* are the two ends of the axis; one is called the *north,* and the other the *south,* pole.

5. The *equator* is that line supposed to be drawn round the middle of the earth, at an equal distance from both poles: it divides the earth into two equal portions, called the *northern* and *southern hemispheres.*

The equator is a *great circle*, and, when referred to the heavens, is called the *equinoctial*: it is sometimes called the *line*, or *equinoctial line*.

The equinoctial line on the earth passes through the middle of Africa, traverses the Indian Ocean, passes through the Isles of Sumatra and Borneo, and the immense expanse of the Pacific Ocean; then extends over the province of Quito in South America, to the mouth of the River Amazons.

6. *Meridians* are lines that are drawn from one pole to the other, directly across the equator.

Meridians are great circles perpendicular to the equator, and passing through the poles.

They are called meridians, because when any of them is, by the motion of the earth, brought directly opposite to the sun, it is always mid-day or noon there.

The meridians may be considered as indefinite in number; and all places lying directly north or south of each other are upon the same meridian. Sometimes by the meridian of a place is understood the half of a great circle passing through that place, the other half is called the opposite meridian.

The brass circle in which the globe hangs, and which is called the *brazen meridian*, may be made to represent the meridian of any place. It is divided into 4 quadrants, of 90 degrees each. On one semicircle the degrees are numbered from the equator towards the poles; on the other, from the poles towards the equator. The former is used in finding the latitude of places, the latter in elevating the globe.

On globes and maps of the world, meridians are drawn through every 10 or 15 degrees. On particular maps, they are sometimes drawn through every degree. They are always drawn from the top to the bottom of maps.

7. *Latitude* is the distance of any place, north or south, from the equator.

The latitude of a place is an arc of the meridian intercepted between the equator and the place, and is called north or south, according as the situation of the place is in the northern or southern hemisphere: it can never exceed 90 degrees, that being the distance of the poles from the equator. The latitude is reckoned by degrees and minutes on the brass meridian; in maps it is reckoned at the sides.

8. The *longitude* of a place is the distance of the meridian of that place, east or west, from the first meridian.

The longitude of a place is an arc of the equator contained between the first meridian and that of the place. On globes or maps of the world, it is reckoned on the equator; but, in particular maps, it is reckoned at the top or bottom.

Geographers in different countries have fixed upon different places for the *first meridian*. The latest geographers, particularly the Dutch, have fixed upon the Peak of Teneriffe; others on the Isle of Palm, one of the Canaries; and, lastly, the French, by order of the King, on the island of Ferro, another of the Canaries. In Great Britain the longitude is generally reckoned from the meridian of Greenwich.

The greatest longitude any place can have is 180 degrees, or half the circumference of the globe.

9. *Parallels of latitude* are less circles drawn parallel to the equator.

Parallels of latitude become smaller the further they are distant from the equator.

On globes and maps of the world they are drawn through every 10 degrees. In all maps they are the lines drawn from one side to the other.

10. The *difference of latitude* between two places is the shortest distance between the parallels of those places.

The difference of latitude between two places is an arc of the meridian, included between their respective parallels of latitude.

11. The *difference of longitude* between two places is the distance between the meridians of these places, counted upon the equator.

The difference of longitude between any two places is an arc of the equator intercepted between their respective meridians.

12. The *distance* between any two places is the shortest line that can be drawn between the two places.

The distance between any two places is an arc of a great circle intercepted between the two places.

SECTION I.

CONTAINING PROBLEMS RELATING TO LATITUDE AND LONGITUDE.

The first thing necessary is Geography is to obtain a clear view of the situation of places upon the earth. This can be best done by the globe, as is shewn in Problem I. It is then necessary to understand the method that has been adopted to lay down the situations of places upon the globe: by which means, as new discoveries were made, the places were easily inserted on maps and globes, and thus might easily be found by future navigators. The method adopted was this:—to determine the distance of the place *north* or *south* of the imaginary line called the equator; and this they called the latitude of the place. They next found its distance *east* or *west* of another imaginary line agreed upon, and which was called the first meridian: this distance they called the longitude of the place. By these means has the situation of all the places upon the earth been determined, and marked upon the globe.—Problems II. and III. shew how to find the latitude and longitude upon the globe, or on maps; and, from having the latitude and longitude, to find the place.—By Problems IV. and V. the difference of latitude and longitude may be found. The difficulty of remembering figures makes any expedient to assist the memory highly useful. Thus, those places that have the same latitude may be classed together; and the latitude of one being known, that of the whole will be remembered. This may also be done with those places that have the same longitude.—Problems VI. and VII. teach the method of doing this.

PROBLEM I.

To take a survey of the terrestrial globe.

Departing from Great Britain, and proceeding eastward, we soon land upon the continent of EUROPE. The states in the northern part of Europe are Denmark, Sweden, and Russia, whose shores are washed by the Baltic; those in the middle are France, the United Provinces, (commonly called Holland), Prussia, Germany, and Switzerland; in the south, Portugal, Spain, Italy, and Turkey in Europe.

South of Europe, and only separated from it by the Mediterranean Sea, lies AFRICA, a second grand quarter of the globe. In point of extent, it is more than double that of Europe; but the uncivilized state of the native inhabitants, the want of inland seas and navigable rivers, and the extensive deserts that run across it, must long render it one of the most uninteresting quarters of the world. Egypt, situated in the north-east part, from having been long under the dominion of Turkey, is deprived of the advantages which it might derive from the proverbial fertility of its soil, and a situation so favourable to commerce: it has the Mediterranean on the north, and the Red Sea on the east. The south part of Africa has been colonized by the Dutch; the chief place is the Cape of Good Hope, at present in possession of the English.

Returning once more to Europe, and then travelling eastward, we arrive at ASIA, another quarter of the globe. There is no natural boundary between Europe and Asia: it is joined to Africa by the Isthmus of Suez. The whole of the north part of Asia belongs to Russia, and is called Siberia, or Russian Tartary. In the middle may be reckoned the Chinese empire (including, besides China, Chinese Tartary, and Tibet); Independent Tartary, on the borders of the Caspian Sea; and Turkey in Asia, bordering on the Black Sea and the Mediterranean. Tracing the southern coast, we meet with Arabia, separated from Africa by the Red Sea; Persia; Hindostan, or the Western Peninsula of India, which has in all ages been the centre of great trade; and the Eastern Peninsula of India, including the Birman Empire, and Malaya, or Malacca. The Indian Ocean lies south of Asia, and east of Africa. The large island of Madagascar, a little to the east of Africa, and the island of Ceylon, to the south of Hindostan, are situated in this ocean.

There are several groups of islands to the east and south-east of Asia; viz. the Japanese Islands to the east of China, forming an independent empire, which, from its importance in that part of the world, has been styled the Great Britain and Ireland of Asia; the Philippine, Ladrone, and Caroline Islands; the Isles of Sunda, south of Malacca, containing Sumatra and Java; Borneo, supposed, till the discovery of New Holland, to be the largest island in the world; the Molucca and Pelew Islands, &c.

Going south, we now meet with New Holland, an island that, in size, is only a fourth part less than Europe. New Guinea, New Britain, and New Ireland, are contiguous to it.

The three continents we have passed over, with the islands and seas belonging to them, have been called the Eastern Hemisphere, and are generally represented together in maps of the world.

We now arrive at the Pacific Ocean, which is the largest of any on the globe, it being not less that 10,000 miles in breadth. There are several clusters of islands scattered up and down this immense ocean. In the North Pacific are the Sandwich Islands, discovered by Captain Cook in his last voyage, and where that eminent navigator lost his life. In the South Pacific are the New Hebrides, the Friendly Isles, Navigators' Isles, the Society Isles, the Marquesas, and farther to the south, New Zealand, consisting of two large islands.

Having traversed the Pacific, we arrive at AMERICA. This continent is nearly four times as great as Europe. It is divided into two parts, North and South. These are united by the isthmus of Darien, narrower than that of Suez, which unites Africa to Asia. The north-eastern part of North America, including Canada, New Brunswick, &c. belongs to Great Britain. In the middle are the United States: to the south are Florida, belonging to Spain; Louisiana, to the United States; and Mexico, to Spain. Nearly the whole of the western coast is unclaimed by any European power.

The western coast of South America, including Peru and Chili, belongs to Spain. Guiana, on the north-east, belongs partly to the Dutch and partly to France. Brazil is claimed by Portugal.

In the large bay between North and South America are situated the West-India Islands. The Atlantic Ocean is the eastern boundary of America. The Azore Islands are situated in the north part of this ocean, nearly half-way between Europe and America. Not far from the coast of Africa are the Madeira, the Canary, and the Cape Verd Isles. The Isles of St. Helena, Ascension, and St. Matthew, are in the south part of the Atlantic.

America, with the seas adjoining, is sometimes called the Western Hemisphere, or New World. Nothing material now remains to complete our survey of the globe, but to notice the half-explored country of Greenland, in the northern Icy Ocean, the Island of Iceland, situated near its shore, and Spitzbergen, north of Europe.

PROBLEM II.

To find the latitude and longitude of any place.

BY THE GLOBE.

Bring the given place to the brass meridian; then the degree of the meridian directly over it shews the latitude, and the degree of the equator under the meridian shews the longitude.

BY MAPS.

Take, with a pair of compasses, the distance of the place from the nearest parallel; apply this distance to either side of the map;—keeping one point of the compasses on the same parallel, the other will shew the latitude required.

For the longitude, lay a ruler over the place, so that it may cut the same degree at the top and bottom of the map,—and that degree is the longitude of the place.

The latitude of any place is found by taking the height of the sun, or one of the fixed stars.

The above rule for maps is applicable only to particular maps, or plain charts, where the meridians are straight lines, and the parallels of latitude are either straight lines or arcs of circles. When both the meridians and parallels are curve lines, find how often the distance of the place from the nearest parallel will reach the next parallel; and from that the latitude may be found sufficiently exact. Also, for the longitude, find how often the distance from the nearest meridian will reach the next meridian. Suppose Berlin to be the place whose latitude and longitude are required.

Its distance from the parallel of 50, taken four times, reaches 60. The fourth part of 10, added to 50, gives the latitude 52½°.

Its distance east from the meridian of 10, taken thrice, falls a little beyond the meridian of 20: hence the longitude is 13½°.

A little practice in finding the latitude and longitude upon maps will render this method very easy.

To distinguish east from west longitude.

RULE.—If the figures increase towards the right-hand, the longitude is *east;* if they increase towards the left-hand, it is *west.*

When the longitude is taken from Ferro Island, it may be reduced to the meridian of London by the following

RULE.—If the longitude be *east,* 17° 45′ must be subtracted; if it be *west,* the same number must be added; and the sum or difference will be the longitude from the meridian of London.

If the place lie between the meridians of Ferro and London, subtract the longitude *east* from Ferro, from 17° 45′; and the remainder will be the longitude *west* from London.

N. B. The above rule reversed will reduce the longitude from London to that from Ferro Island.

EXAMPLES.

1. Required the latitude and longitude of Edinburgh.

Bring Edinburgh below the meridian, we find, over it nearly, the 56th degree of North latitude (55° 58′), and the point where the meridian cuts the equator is nearly 3¼ (3° 12′) W. L. degrees west from London.

Required the latitude and longitude of the following capital cities of Europe.

Northern.

2 London	4 Stockholm	5 Petersburgh
3 Copenhagen		

Middle.

6 Paris	8 Vienna	10 Presburg
7 Amsterdam	9 Berlin	11 Berne

Southern.

12 Lisbon	14 Rome	16 Constantinople
13 Madrid	15 Naples	

What are the latitude and longitude of the following sea-ports in Europe?

17 Dunkirk	20 Nice	23 Port Mahon
18 Genoa	21 Revel	24 Rochelle
19 Malaga	22 Ismael	25 Tornea

What are the latitude and longitude of the following places, situated in Asia?

Northern, in Asiatic Russia.

26 Astracan	27 Tobolski	28 Irkutsk

Middle.

29 Pekin	31 Cashgar	33 Aleppo
30 Lassa	32 Samarcand	

Southern.

34 Ava	36 Delhi	38 Mecca
35 Calcutta	37 Ispahan	

EXAMPLES FOR A MAP OF ENGLAND.

What are the latitude and longitude of the following places?

39 Newcastle	42 Dover	45 Bristol
40 Hull	43 Portsmouth	46 Liverpool
41 Yarmouth	44 Plymouth	

EXAMPLES FOR A MAP OF GERMANY.

What are the latitude and longitude of the following places?

47 Ulm	50 Hanover	53 Magdeburgh
48 Francfort	51 Dresden	54 Olmutz
49 Leipsic	52 Munich	55 Stralsund

EXAMPLES IN REDUCING THE LONGITUDE FROM ONE MERIDIAN TO ANOTHER.

1. The Cape of Good Hope has 36° 9′ E. L. from the meridian of Ferro,—required the longitude from London?

	36°	9′ E.
	17	45 subtract.
Answ.	18	24 E. L. from London.

2. Gibraltar has 12° 8′ E. L. from Ferro,—what is its longitude from London?

	17°	45′
	12	23 E. subtract.
Answ.	5	22 W. L. from London.

3. Cape Horn has 49° 40′ W. L. from Ferro,—required its longitude from London?

4. Cape Comorin has 78° 5′ E. L. from London,—required the longitude from Ferro?

For more examples of this kind, take a map drawn from the meridian of Ferro; find, from it, the longitude of any number of places; reduce them to the meridian of London by the rule, and then compare them with a map drawn from the meridian of London.

PROBLEM III.

Having the latitude and longitude given to find the place.

BY THE GLOBE.

Bring the given longitude to the brass meridian; then, under the given latitude marked on the brass meridian, is the place sought.

BY MAPS.

Lay a ruler, by the given longitude, at the top and bottom of the map.

Take, with a pair of compasses, the distance between the given latitude and the nearest parallel; this distance, applied to the edge of the ruler, will point out the place required.

This problem is useful for laying down any place which is not already marked upon the globe or map. By it may also be seen where any ship is, from having the latitude and longitude given.

The rule for maps is applicable only to those on which the meridians are straight lines: when that is not the case, a similar method must be used with that mentioned in the last problem.

EXAMPLES.

1. What place is situated in 48° 23′ N. L. and 4° 39′ W. L. from London? *Answ.* Brest in France.

Required the names of the places situated in Africa, whose latitudes and longitudes are as follow?

	Latitude.			*Longitude.*		
2.	30°	3′	N.	31°	21′	E.
3.	36	47	N.	10	16	E.
4.	12	45	N.	37	30	E.
5.	14	0	N.	33	0	E.
6.	34	29	S.	18	23	E.

What are the names of the places situated in America, whose latitudes and longitudes are as follow?

7.	46°	47′	N.	71°	10′	W.
8.	39	57	N.	75	13	W.
9.	39	0	N.	77	10	W.
10.	19	26	N.	100	6	W.
11.	29	58	N.	89	59	W.
12.	0	13	S.	77	55	W.
13.	12	1	S.	76	49	W.
14.	34	35	S.	58	31	W.
15.	22	54	S.	44	44	W.
16.	6	0	N.	55	30	W.
17.	4	56	N.	52	15	W.

What are the names of the islands, situated in the Atlantic Ocean, whose latitudes and longitudes are as follow?

18.	32°	37′	N.	16°	56′	W.
19.	37	47	N.	25	42	W.
20.	27	47	N.	17	46	W.
21.	15	10	N.	23	5	W.
22.	1	30	S.	7	20	W.
23.	7	57	S.	13	59	W.
24.	15	55	S.	5	49	W.

EXAMPLES FOR A MAP OF FRANCE.

Required the names of those towns whose latitudes and longitudes are as follow?

Places seated on the River Seine.

	Latitude.		Longitude.		
25.	48°	18′ N.	4°	4′ E.	
26.	48	34 N.	2	40 E.	
27.	48	50 N.	2	20 E.	
28.	49	26 N.	1	10 E.	
	Places on the Loire.				
29.	46°	59′ N.	3°	9′ E.	
30.	47	54 N.	1	54 E.	
31.	47	24 N.	0	40 E.	Tours
32.	47	13 N.	1	33 W.	Angers
	Places on the Rhone.				
33.	45°	46′ N.	4°	49′ E.	Lyons
34.	45	0 N.	4	50 E.	Loire
35.	43	57 N.	4	48 E.	Montpellier

Note. The table of latitudes and longitudes will furnish more examples for this and the preceding problem.

PROBLEM IV.

To find the difference of latitude between two places.

If the latitudes be of the same name, subtract the less from the greater; if, of contrary names, add them together.

In doing this and the next problem, either *globes, maps,* or *tables of latitude and longitude,* may be used.

When the two places are in opposite hemispheres, their latitudes being reckoned *different* ways, their sum must be taken; but when they are in the same hemisphere, their latitudes being reckoned the *same* way, their difference only must be taken.

EXAMPLES.

1. What is the difference of latitude between the North Cape and Cape Matapan in Europe?

North Cape	71°	10′ N.	Subtract.
Cape Matapan	36	30 N.	
Answ.	34	40	

2. Between Tunis and the Cape of Good Hope, in Africa?

Tunis	36°	47′ N.	Add.
Cape of Good Hope	34	29 S.	
Answ.	71	16	

3. Between the middle of Nova Zembla and Cape Comorin, in Asia? 74 N

4. Between the mouth of Copper-Mine River and Acapulco, in North America? 66

5. Between Cape Vela and Cape Horn, in South America?

6. Between the most southern Cape in New Holland and Endeavour Straits?

7. Between Cape Wrath, in Scotland, and the Lizard Point, in Cornwall?

8. Between Dunkirk and Perpignan?

9. Between Madrid and Mexico?

10. Between London and Botany Bay?

11. Required the difference of latitude between St. Jago, one of the Cape Verd Isles, and St. Helena?

12. The Cape of Good Hope and Cape Comorin?

13. Calcutta and Batavia?

14. Manilla and Canton?

What is the difference of latitude between the following places, which are some of the principal sea-ports in Europe?

15. Archangel and Bergen?
16. Christiana and Gottenberg?
17. Stockholm and Tornea?
18. Petersburg and Dantzig?
19. Copenhagen and Hamburg?
20. Amsterdam and Dunkirk?
21. Brest and Bourdeaux?
22. Corunna and Oporto?
23. Lisbon and Cadiz?
24. London and Genoa?
25. Newcastle and Leghorn?

Required the difference of latitude between the following places.

26. St. Salvador and Surinam?
27. Porto Bello and the strait of Magalhaens?
28. Trinidad Island and Trincomalé?
29. Vera Cruz and Cape Horn?
30. St. Helena and Manilla?

When two places lie nearly under the same meridian, their difference of latitude, being then the shortest line that can be drawn between them, reduced to miles, will give their distance from each other.

It has been found, by actual measurement, that 1 degree of latitude is equal to 69 1-5th English miles; hence multiply the number of degrees by 69 1-5th, and the product will be miles :—or, to render the work more easy, 70 miles may be taken for 1 degree: and, if there be any odd minutes, they may be added in for miles.

By reducing the difference of latitude, in the eight first questions in this problem, to miles, the extent of the following countries from north to south is obtained.

Europe	2400 English miles.
Africa	4950
Asia	4656
North America	3574
South America	4725
New Holland......	2328
Great Britain......	590
France	590

PROBLEM V.

To find the difference of longitude between two places.

If the longitude be of the same name, subtract the less from the greater; if, of different names, add them together.

The distance of two places can never be greater than half the circumference of the globe, or 180 degrees—when, therefore, in adding, the sum exceeds that, subtract it from 360 degrees, for the true difference.

As the longitude may be expressed either in degrees and minutes, or in hours and minutes, the following rules are necessary.

To reduce degrees into hours.

Rule.—Divide the number of degrees by 15, and it will give the number of hours.

If there be any remainder, multiply it by 4 for minutes.

To reduce hours into degrees.

Rule.—Multiply the hours by 15, and the product will be degrees.

Note. When the number of degrees is less than 15, they may be brought to minutes of time by multiplying by 4.—The reason of this rule will be seen in Section III.

EXAMPLES.

1. What is the difference of longitude between Lisbon and Philadelphia?

Philadelphia	75°	13′ W.
Lisbon	9	4 W.
Answ.	66	9 in degrees.

15)66(4 hrs. 24 min. Answ. in time.
60
—
6
4
—
24
—

2. What is the difference of longitude between Newcastle and Moscow?

Newcastle	1°	18′ W.
Moscow	37	51 E.
Answ.	39	9 = 2 hrs. 36 min.

Required the difference of longitude between the following places, both in degrees and in time.

3. Contantinople and Pekin?
4. Otaheite and Tongataboo, in the Pacific Ocean?
5. London and Quebec?
6. Acapulco, on the west coast of America, and Macao, in China?
7. Port Sir Francis Drake, in America, and Nankin, in China?
8. Pico, one of the Azores, and Botany Bay?
9. Vera Cruz, on the Gulf of Mexico, and Siam, in the farther Peninsula of India?
10. Bergen and Bombay?

11. Bermudas Island and Island of Rhodes?

12. Mount Heckla and Mount Vesuvius?

13. Constantinople and Batavia?

14. Juan Fernandez and New Caledonia?

15. Easter Island and Tongataboo, one of the Friendly Islands?

16. Marquesas and Navigators' Islands?

17. Christmas Island and the Pelew Islands?

18. Owhyhee and the Ladrone Islands?

19. Oonalashka, on the north-west coast of America, and Jesso, on the north-east coast of Asia?

EXAMPLES EOR A MAP OF EUROPE AND ASIA.

What is the difference of longitude between the following places?

Sea-ports in Europe.

20. Gibraltar and Barcelona?
21. Malaga & Naples?
22. Toulon & Venice?
23. Rome & Athens?
24. Corinth & Akerman?
25. Marseilles & Ancona?
26. Bilboa & Leghorn?
27. Genoa & Azof?

Sea-ports in Asia.

28. Bombay & Calcutta?
29. Smyrna & Canton?
30. Calicut & Aracan?
31. Ormus & Okhotsk?
32. Mocha & Pondicherry?
33. Rhodes & Nankin?
34. Scanderoon & Madras?
35. Surat & Batavia?

PROBLEM VI.

To find all those places that have the same latitude with a given place.

BY THE GLOBE.

1. Bring the given place to the brass meridian, and observe the latitude.

2. Turn the globe round, and all places that pass under the latitude will be those required.

BY MAPS.

1. If a parallel of latitude be drawn through the given place, then observe all those places which lie on this parallel.

2. If a parallel do not pass through the given place, with a pair of compasses take its distance from the nearest parallel: move the compasses in this position, keeping one foot on the parallel, and all those places over which the other point passes have the same latitude with the given place.

The variety of the seasons, and the difference of the lengths of the days and nights, depending upon the difference of latitude, all places that have the *same* latitude, have their seasons exactly alike, except what difference may arise from the local situation of the place: they have also the days and nights of the same length at the same time; but the hours of the day are different.

EXAMPLES.

1. What places have nearly the same latitude with Stockholm?

Answ. Petersburgh; Vologda; Narym and Okhotsk, in Asia; Lake Athapescow; Churchill Fort, on Hudson's Bay; Cape Chidley, in Labrador; Cape Farewell, in Greenland; and Mainland, one of the Shetland Islands.

2. What places have nearly the same latitude as Edinburgh?

Answ. Elsinore, on the Sound; Memel, Polotsk, and Moscow, in Europe; Casan and Tomsk, in Asia; Bhering's Island; and Alashka and Severn-House, in America.

What places have nearly the same latitude as the following places?

3. London?	8. St. Helena?
4. Philadelphia?	9. Cape of Good Hope?
5. Jerusalem?	10. Cook's Strait, in New Zealand?
6. Jamaica?	11. Tranquebar?
7. Quito?	12. Batavia?

PROBLEM VII.

To find all those places that have the same longitude with a given place.

BY THE GLOBE.

Bring the given place to the brass meridian, and mark all those places then under the meridian, for the answer required.

BY MAPS.

Find the longitude of the given place; then observe all those places that are upon the same meridian, or that are situated at the same distance from the nearest meridian with the given place.

All those places that have the same longitude, have noon and midnight, and the other hours of the day, exactly at the same time.

EXAMPLES.

1. What places have nearly the same longitude as London?

Answ. Poictiers, in France; Valencia and Alicant, in Spain; Oran, in Barbary; and Cape Coast, in Guinea.

2. What places have nearly the same longitude as Genoa?

Answ. Christiansand, Bremen, Berne, Corsica, Sardinia, and Tunis?

What are the places whose longitude is nearly the same as that of the following places?

3. Cape of Good Hope?
4. Petersburgh?
5. Ispahan?
6. Pekin?
7. Jamaica?
8. Quebec?
9. Dublin?
10. Sandwich Islands?
11. Pelew Islands?
12. Stockholm?
13. Bombay?
14. Isle of Tinian?

QUESTIONS FOR EXERCISE IN SECTION I.

What are the latitudes and longitudes of,

1. Bergen?
2. Moscow?
3. Elsinore?
4. Barbadoes?
5. Archangel?
6. Syracuse?
7. Turin?
8. Upsal?
9. Alexandria?
10. Prague?
11. Acapulco?
12. Algiers?
13. Candy?
14. Jeddo?
15. Lubec?
16. Mocha?
17. Oporto?
18. Pitcairn's Is.

What places correspond to the following latitudes and longitudes?

	Latitude.			*Longitude.*		
19.	33°	20′	N. L.	44°	24′	E. L.
20.	6	15	S. L.	106	25	E. L.
21.	36	31	N. L.	6	12	W. L.
22.	51	6	N. L.	13	31	E. L.
23.	49	59	N. L.	19	50	E. L.
24.	30	12	N. L.	91	20	E. L.
25.	39	51	N. L.	3	54	E. L.
26.	57	58	N. L.	7	32	E. L.
27.	8	0	S. L.	78	35	W. L.
28.	11	29	N. L.	59	57	W. L.
29.	59	56	N. L.	30	19	E. L.
30.	35	54	N. L.	14	28	E. L.

	Latitude.			Longitude.		
31.	59°	21′	N. L.	18°	4′	E. L.
32.	8	32	N. L.	81	11	E. L.
33.	22	54	S. L.	42	44	W. L.
34.	50	6	N. L.	5	54	W. L.
35.	48	12	N. L.	16	23	E. L.
36.	55	58	N. L.	3	12	W. L.
37.	52	22	N. L.	4	51	E. L.
38.	31	13	N. L.	30	16	E. L.
39.	64	34	N. L.	38	58	E. L.
40.	34	29	S. L.	18	23	E. L.
41.	3	49	S. L.	102	10	E. L.
42.	34	55	S. L.	58	31	W. L.
43.	32	25	N. L.	52	50	E. L.

What is the difference of latitude between the following places?

44. London & Cape of Good Hope?

45. Madrid & Mexico?
46. Leghorn & Liverpool?
47. Pekin & Philadelphia?
48. Petersburgh & Naples?
49. Cape Farewell & C. Horn?
50. C. Finisterre & Comorin?

What is the difference of longitude between the following places?

51. Charlestown & Cork?
52. C. Bajador & P. Jackson?
53. Mecca & Calcutta?
54. Easter Is. & Norfolk Is.?
55. Canton & Havannah?
56. Malta & Bombay?

57. What places lie in the same parallel with the Azore Islands?

58. Lord Nelson beat the French fleet near latitude 31° 11′ N., longitude 30° 22′ E.: point out the place on the globe.

59. What places are the same distance from the equator as Mecca?

60. What places lie in the same latitude as the Cape Verd Isles?

61. What places are in the same longitude as Moscow?

62. What places have the same longitude as Delhi?

63. What places have the same longitude as Astrachan?

64. What places have the same longitude as Malacca?

65. Where is it midnight when it is midnight at Lima?

QUESTIONS FOR EXAMINATION IN SECTION I.

What is a great circle? What is a less circle? What circles on the globe are great circles? Into how many degrees is a circle divided? What is the axis of the earth? What are the poles? What is the equator? What are meridians? What is the brazen meridian? How is it divided and numbered? How are meridian lines drawn on maps?

What is latitude? How many kinds of latitude are there? What is the greatest latitude any place can have? Are there any places that have no latitude?

What is longitude? Which is the first meridian? How is longitude marked upon the globe, and how is it marked upon maps? What are parallels of latitude? How are parallels of latitude drawn on maps?

How are the latitude and longitude of any place found upon the globe? How are they found upon maps? How may east longitude be distinguished from west? When the longitude is taken from Ferro Island, how is it reduced to the meridian of London?

The latitude and longitude of a place being given, how is the place found? How is the difference of latitude between any two places found? How is the difference of longitude found? What is the greatest difference of longitude that can be between two places? If, in finding the difference of longitude between two places of different names, the sum is more than 180°, how is the true difference found?

How are degrees reduced into hours, and the contrary? How are all those places found which have the same latitude as any given place? How are all those places found which have the same longitude with a given place? Have places of the same longitude the same hours of the day at the same time?

SECTION II.

DEFINITIONS.

1. *Antoeci* are those who live under the same meridian, but on *different* sides of the equator, and at equal distances from it.

2. *Perioeci* are those that live under opposite meridians, but on the *same* side of the equator, and at equal distances from it.

3. *Antipodes* are those who live under opposite meridians, and in opposite parallels; or they are those who live diametrically opposite to each other.

4. The *horizon* is either *rational* or *sensible.*

5. The *rational horizon* is a great circle, dividing the upper from the lower hemisphere.

6. The *sensible horizon* is that circle which is the boundary of our sight, or which separates the visible from the invisible hemisphere.

These two horizons, though distant from one another by the semi diameter of the earth, will appear to coincide when continued to the sphere of the fixed stars; because the earth, compared with this sphere, is but a point.

The sensible horizon increases in proportion to the elevation of the spectator; thus a person at the top of a mountain has a more extensive prospect than another person at the bottom of the same mountain.

The horizon of every place varies according to both its latitude and longitude.

The horizon, on the globe, is a circular, flat piece of wood, which sustains the globe, and which represents the rational horizon: it determines the rising and setting of the sun, moon, and stars, in any particular latitude; for when any of them come to the eastern edge of the horizon, they are said to rise—and when they reach the western edge, they are said to set. It contains several useful circles; the innermost is marked with the points of the mariner's compass, of which the east, west, north, and south, are called *cardinal points;* and these are again each subdivided into eight parts, called *rhumbs.* The next exhibits the twelve signs of the zodiac, with their names and characters, and the number of degrees belonging to each; beyond which is a calendar, shewing the months and days of the months, corresponding with the signs and their respective degrees: these shew the sun's place in the ecliptic, called the *sun's longitude,* for any given day. The inner circle is used in finding the azimuth of the celestial bodies, and the position of one place from another.

7. The *zenith* is that point in the heavens directly over our heads, and is at an equal distance from all points of the horizon.

8. The *nadir* is that point in the heavens opposite the zenith, and is generally said to be the point directly under our feet.

The zenith and nadir are the poles of the horizon, being each 90° distant from it.

9. The *angle of position* between two places, is that formed between the meridian of one of the places and a great circle passing through the other place.

10. *Quadrant of altitude* is a thin slip of brass, divided into 90°: it can be screwed on any part of the brass meridian, and, turning on a pivot, serves to measure the distance of places, altitudes of the sun or stars, &c.

A quadrant may be made of a narrow slip of parchment, which will answer very well for measuring the distances of places.

OF THE RELATIVE SITUATION OF PLACES.

Having gone through the problems in the former section, it will be of further use to compare the relative situation of places upon the earth: thus, two places that have the same longitude, but opposite latitudes, the one place lying as many degrees on the one side of the equator, as the other place is on the other side of it, are said to be *antoeci* to each other.—Those who live at the equator have no antoeci.

The appearances to the antoeci are these :—

1. They have noon and midnight, and all the other hours of the day, at the same time.
2. They have contrary seasons at the same time: when it is summer with the one, it is winter with the other; and so as to spring and autumn.
3. The days of the one are equal to the nights of the other; and the nights of the one to the days of the other.
4. The stars that never set to the one never rise to the other; and contrarywise.

Two places may have the same latitude, but lie under opposite meridians, or have 180° difference of longitude.—The inhabitants of these places are said to be *perioeci* to each other. Perioeci signifies to live under opposite meridians.—Those who live at the poles have no perioeci.

The appearances to the perioeci are these :—

1. The hours of the day, though nominally the same, are really contrary; for when it is noon with the one, it is midnight with the other; and when it is two in the morning with the one, it is two in the afternoon with the other, &c.

2. They have the same seasons of the year at the same time.

3. The length of the day or night at any place is always the same as it is to the perioeci of that place.

4. The sun and stars rise to both places on the same point of the horizon, and are the same number of hours above or below it.

5. The same stars that never rise or set to the one place, never rise or set to the other.

Those people who live directly opposite, having both opposite latitudes and longitudes, are called *antipodes ;* a word which signifies to have their feet opposite. A line, supposed to be drawn from any place through the centre of the earth, and continued to the opposite side, will point out the antipodes of that place. The north and south poles are antipodes to each other.

The appearances to the antipodes are these :—

1. The hours of the day are contrary, it being noon to one when it is midnight to the other.

2. They have contrary seasons at the same time.

3. The days of the one are equal to the nights of the other; hence the shortest day to the one is the longest day to the other.

4. The sun and stars rise to the one when they set to the other, all the year round,—for they have the same horizon ; but the zenith to the one is the nadir to the other.

5. Those stars that are always above the horizon of the one place are always under the horizon of the other.

N. B. Some of these phenomena cannot be fully understood till the pupil has acquired a knowledge of the celestial globe; but it was thought better to insert them all here.

The three first problems in this section contain a number of examples relating to the antoeci, perioeci, and antipodes; the next shews how to elevate the globe for the latitude of any place; and the last teaches to find the distance and bearing of places,—with a great variety of examples.

PROBLEM VIII.

To find the antoeci of any given place.

BY THE GLOBE.

Bring the given place to the meridian; and, having found its latitude, count as many degrees from the equator towards the contrary pole,—and the point thus arrived at will be the antoeci required.

BY MAPS.

Having found the latitude and longitude of the place, find another place of the same longitude, and whose latitude is also equal to the former, but of a contrary name.

EXAMPLES.

1. What place is that, whose inhabitants are the antoeci of Malta?

Answ. The Cape of Good Hope, nearly.

2. What people are the antoeci of Potosi, in South America?

Answ. Those who live in Hispaniola.

3. What people are the antoeci of Quebec?

Answ. Those who live in Patagonia, in South America.

4. What place has its inhabitants the antoeci of Bass's Island, or Van Diemen's Land, in New Holland?

5. What people are the antoeci of Cape St. Mary, the south cape of Madagascar?

6. Who are the antoeci to Cape Horn?

7. What place has its inhabitants antoeci to the Island of Juan Fernandez?

8. Who are the antoeci to Kerguelen's Land, or Island of Desolation?

9. Required the antoeci of the Island of Bermudas.

10. Required the antoeci to the Falkland Islands.

11. What people are antoeci to Boston, in North America?

12. Point out the antoeci of Azof.

13. A ship in the Indian Ocean was in longitude 80° E. and in latitude 13° S.: required the antoeci to that place.

14. Required the antoeci of the Sandwich Isles.

Required the antoeci to the following longitudes and latitudes.

	Longitude.	*Latitude.*
15.	114° E.	22° S.
16.	30 E.	60 S.
17.	41 E.	21¾ S.
18.	9 W.	39 S.
19.	76 W.	18 S.
20.	25 W.	15 S.
21.	156 W.	20 S.
22.	150 W.	17 N.
23.	173 W.	20 N.

	Longitude.	Latitude.
24.	151° E.	34° N.
25.	165 E.	20 N.
26.	83½ E.	22½ S.

PROBLEM IX.

To find the perioeci of any given place.

BY THE GLOBE.

Bring the given place to the brass meridian, and set the index to the upper 12.

Turn the globe till the index point to the under 12, then that place which is below the meridian, and whose latitude is equal to that of the given place, is the perioeci required.

BY MAPS.

Subtract the longitude of the given place from 180°, and the remainder will be the longitude of the perioeci, of a contrary name.

Find, by Problem I. a place whose longitude is equal to this, and whose latitude is the same with the given place.

EXAMPLES.

1. What place has its inhabitants the perioeci of Newcastle upon Tyne?

Answ. The Aleouski, or Fox Islands.

2. What place has its inhabitants the perioeci of Quito, in South America?

Answ. Podang, in the Island of Sumatra?

3. Who are the perioeci of California, in North America?

4. Required the perioeci to St. John's, in Newfoundland.

5. Required the perioeci of Philadelphia.

6. What place has its inhabitants the perioeci of the Gulf of Siam?

7. What place has its inhabitants the perioeci to Cook's Strait, in New Zealand?

8. What people are the perioeci of Mindanao, one of the Philippine Islands?

9. Required the perioeci of Petersburgh.

10. What place has its inhabitants perioeci to the Sandwich Isles?

11. Required the perioeci to the Society Isles.

12. Required the perioeci of Martinique.

Required the perioeci to the following latitudes and longitudes.

	Longitude.	*Latitude.*
13.	179½° E.	45° N.
14.	132 W.	46 N.
15.	158½ W.	45 N.
16.	143 W.	35½ N.
17.	116 W.	40 N.
18.	102½ W.	28½ N.
19.	84 E.	19 N.
20.	127½ E.	47½ N.
21.	139 W.	21¾ N.

PROBLEM X.

To find the antipodes of any place.

BY THE GLOBE, OR MAPS.

Find the antoeci of the given place, and the perioeci of this will be the antipodes of the first place.

BY THE GLOBE ONLY.

Bring the given place to any part of the horizon, and the place at the opposite point of the horizon will be the antipodes.

EXAMPLES.

1. What place is that, the inhabitants of which are the antipodes to Pekin?

Answ. Near the mouth of the river Sauces, or Colerado, in Patagonia.

2. Where are the antipodes of London?

Answ. A little to the south of New Zealand, in longitude 180°, and 51° 31′ south latitude.

3. What place has its inhabitants antipodes to Cape Horn?

4. Where are the antipodes to Otaheite?

5. Where are the antipodes to New Caledonia?

6. Required the antipodes to Buenos Ayres.

7. Where are the antipodes to Falkland's Islands?

8. Required the antipodes to Madrid.

9. Where are the antipodes to the island of Juan Fernandez?

10. Required the antipodes to the Friendly Isles.

11. Required the antipodes to the Philippine Islands.

12. Required the antipodes of Sierra Leone.

13. What people are the antipodes of the Pelew Islands?

14. A ship, sailing in the Pacific Ocean, found its latitude $51\frac{1}{2}$° S. and longitude 180°,—required the antipodes.

15. Suppose a line drawn from the Island of Jamaica

through the centre of the earth, in what part would this line meet the surface of the earth on the opposite side?

16. Required the antipodes to Bermudas.

Required the antipodes of the following longitudes and latitudes.

	Longitude.	Latitude.
17.	73° W.	6° N.
18.	157 W.	$37\frac{1}{2}$ S.
19.	98 E.	23 S.
20.	174 E.	16 N.
21.	166 W.	38 S.
22.	162 W.	60 S.
23.	106 W.	$15\frac{1}{2}$ S.
24.	103 E.	12 N.
25.	$144\frac{1}{2}$ W.	32 S.
26.	165 E.	28 S.
27.	175 E.	36 S.
28.	177 E.	56 S.

PROBLEM XI.

To elevate the globe for the latitude of any place.

Elevate the pole, which is of the same name with the latitude, as many degrees as are equal to it, and bring the given place to the brass meridian.

When the globe is rectified for the latitude of any place, that place is in the zenith, and the wooden horizon represents the rational horizon of the place.

EXAMPLES.

1. Elevate the globe for Lisbon.

Answ. The latitude of Lisbon is 39° N.; hence the north pole must be raised 39° above the horizon.

2. Elevate the globe for the Cape of Good Hope.

Answ. The Cape of Good Hope has 35° S. L.; hence the south pole must be raised 35° above the horizon.

PROBLEM XII.

To find the distance between two places, and the angle of position.

BY THE GLOBE.

Case I.—When the distance is less than 90.

1. Lay the quadrant of altitude over both the places, so that the division marked O may be on one of the places; then the degree cut by the other place will shew the distance in degrees.

2. Multiply these degrees by 69½, and the product will be the distance in English miles.

The distance between two places, and the angle of position, may also be found in the following manner.

1. Elevate the globe for one of the places, and, having brought it to the meridian, screw the quadrant of altitude over it; then move the quadrant till it come over the other place, and observe what degree of it this last place cuts.

2. *Subtract* this distance from 90, and you have the distance in degrees.

3. The quadrant of altitude, on the horizon, will shew the angle of position.

Case II.—When the distance is greater than 90.

1. Find the antipodes of one of the places, and by Case I. measure the distance between this and the other place.

2. Subtract this distance from 180, and the remainder will be the whole distance required.

When the angle of position is required, this Case may be performed *in the following manner.*

1. Elevate the globe for the antipodes of one of the places, and, having fixed the quadrant over the same, bring its edge over the other place, and observe the degree cut by it.

2. *Add* this to 90, and the sum will be the distance required.

3. The quadrant will show the position: only, W. must be read for E.; E. for W.; N. for S.; and S. for N.

Note. The angle of position, as found by the above rules, must not be confounded with the *true bearing* of one place from another, or that course which a ship must constantly steer in order to sail from one place to the other. This bearing cannot be found, but by calculation, as is shown by writers on navigation.

To find the distance of places on particular maps.

1. Take the distance of the two places with a pair of compasses.

2. Apply this distance to the side of the map, and you will have the distance in degrees; or apply it to the scale adapted to the map, and you will have the distance in miles.

A ready way to measure the distance of places, on a map, would be to draw the scale adapted to the map on a long slip of drawing paper, or parchment, extending it to a proper length, and marking the divisions close to the edge; then apply the edge of the paper to the places proposed, and it will show their distance.

Instead of multiplying by 69½, to bring degrees into miles, they may be multiplied by 70, which will render the work easier.

Perhaps it would be of use if maps of Europe, Asia, &c. had one of the meridians graduated, on which distances might be measured with greater accuracy than on the sides. The latitudes of places would also be more easily found.

The bearing of places cannot be truly assigned by maps; but it may be observed, that the top of the map is the north, the right-hand the east, the bottom the south, and the left-hand the west.

EXAMPLES.

Required the distance, and angle of position, between London and the following places.

1. Copenhagen. *Answ.* 9°, = 625 miles N. E. by E.
2. Stockholm. *Answ.* 13 = 903 miles N. E. ½ E.
3. Petersburg.
4. Amsterdam.
5. Paris.
6. Berlin.
7. Vienna.
8. Berne.
9. Lisbon.
10. Rome.
11. Constantinople.
12. Grand Cairo.
13. Jerusalem.
14. Madras.
15. Botany Bay.
16. Otaheite.
17. Manilla.

18. What is the length of Europe, from Lisbon, in the west, to the Uralian Mountains, in the east?

19. What is the distance between Constantinople and Pekin?

20. What is the breadth of N. America, from the Promontory of Alashka to Cape Charles, the extreme point of Labrador?

21. What is the breadth of S. America, from Cape Blanco, in Peru, to Cape St. Roque, in Brazil?

22. What is the breadth of Africa, from Cape Verd, in the west, to Cape Guardafui, in the east?

23. What is the distance between Cape Verd, in Africa, and Cape Roque, in America?

24. What is the distance between Panama, in America, and Manilla, one of the Philippine Islands?

25. What is the distance between the Island of Bombay and Nootka Sound?

26. The following is the track pursued by Captain Cook, in his first voyage round the world,—required its length in English miles.

From Portsmouth to Cape Verd Isles
Cape Verd Isles to Cape Horn
Cape Horn to Otaheite
Otaheite to New Zealand, Cape South
New Zealand, Cape South, to Port Hicks, in New Holland
Port Hicks, in New Holland, to Endeavour Straits
Endeavour Straits to Batavia, in Java
Batavia, in Java, to the Cape of Good Hope
Cape of Good Hope to Ascension Island
Ascension Island to the Azores
Azores to England.

27. How many miles will be gone over in the following route:—From Newcastle to Carlisle, Lancaster, Liverpool, Shrewsbury, Birmingham, Gloucester, Bristol, Oxford, and London?

In the same manner may the pupil be made to make imaginary tours on the maps of other countries, measuring the distances as he proceeds.

The following examples of direct distances measured, are copied from Arrowsmith's "Companion to the Map of the World:" the distances are in marine leagues, 20 to 1 degree; but they may be reduced to English miles by multiplying by $3\frac{1}{2}$.

	Leagues
From Plymouth to Madeira	403
Madeira to St. Jago	369
St. Jago to St. Helena	706
St. Helena to the Cape of Good Hope	570
Cape of Good Hope to the Isle of Desolation	811

	Leagues
From the Isle of Desolation to Adventure Bay....	1078
Adventure Bay to Port Jackson	200
Adventure Bay to Queen Charlotte's Sound	400
Queen Charlotte's Sound to Otaheite......	784
Otaheite to Owhyhee..................	754
Owhyhee to Awatscha	980
Owhyhee to Nootka	740
St. Jago to Rio Janeiro.................	840
Rio Janeiro to Cape Horn	760
Cape Horn to Otaheite..................	1465
Cape Horn to Owhyhee..................	2130
Owhyhee to Cook's River................	800
Queen Charlotte's Isles to the east coast of Labrador	976
London to the Orkneys..................	150
The Orkneys to Cape Farewell...........	450
Cape Farewell to Disco..................	230
London to Smeringburg, in Spitzbergen....	570
Petersburgh to the East Cape, in Russia....	1320
Masuah, in the Red Sea, to Cape Verd	1050
Masuah to Cashna, centre of Africa........	530
Cape Coast, Guinea, to Cashna............	310
Tunis to Tombuctoo....................	420

QUESTIONS FOR EXAMINATION IN SECTION II.

What are the antoeci, and what is observed of their hours of the day and seasons of the year? What are the perioeci, and what is observed of their hours of the day and seasons of the year? What are the antipodes, and what is observed of their hours of the day and seasons of the year?

How is the horizon distinguished? What is the visible horizon? What is the rational horizon? When do the rational and visible horizon appear to coincide? What is the wooden horizon? Whether does it represent the rational or visible horizon? What is the rising and setting of the heavenly bodies? What are the different circles marked upon the wooden horizon, and what is their use?

What is the zenith of any place, and what is the nadir? What are the poles of the horizon? What is the angle of position? What is the quadrant of altitude, into how many degrees is it divided, and what is its principal use?

How are the antoeci, the perioeci, and the antipodes of any place found upon the globe, and how upon maps? Where must those people live that have no antoeci? What point upon the globe has no perioeci? Where are the antipodes to the north pole?

How is the globe elevated for the latitude of any place?

How is the distance of two places found, when that distance is less than 90°? How is the distance of two places found, when it is more than 90°? How are the distances of places found on particular maps? Why must degrees be multiplied by 69½ to bring them to English miles?

QUESTIONS FOR EXERCISE IN SECTION II.

Required the antoeci answering to the following latitudes and longitudes.

	Longitude.	*Latitude.*
1.	33° 16′ E.	34° 30′ S.
2.	72 18 W.	19 46 S.
3.	170 0 W.	14 0 N.
4.	13 43 E.	38 10 S.
5.	7 40 E.	45 4 S.

	Longitude.		Latitude.	
6	39°	59′ W.	29°	58′ S.
7.	149	36 W.	17	26 N.

What are the perioeci answering to the following longitudes and latitudes?

8.	20°	0′ W.	56°	0′ N.
9.	83	2 W.	17	0 N.
10.	100	8 W.	11	42 N.
11.	98	36 E.	32	3 N.
12.	167	53 E.	8	30 N.

Where are the antipodes corresponding to the following longitudes and latitudes?

13.	171°	30′ E.	52°	0′ S.
14.	160	0 E.	63	20 S.
15.	176	6 W.	39	51 S.
16.	105	49 E.	40	40 S.
17.	99	39 E.	8	48 S.

Required the distances between the following places.

18. Samarcand & Pekin.
19. Lisbon & Alexandria.
20. North Point of Madagascar & Otaheite.
21. C. Farewell, in Greenland, & C. of Good Hope.
22. Edinburgh & Petersburg.
23. Stockholm & Rome.
24. Cork & Philadelphia.
25. Plymouth & Gibraltar.
26. Madeira & Jamaica.
27. Madrid & Amsterdam.
28. Brest & Astracan.

29. Required the shortest distance between Africa and America.

30. Required the number of miles that an East India ship sails in her voyage from London to Madras.

Measure the distances of the following places on a map of Europe.

31. Newcastle & Hamburg. 32. Plymouth & Brest.

33. Lisbon & Toulon.
34. Genoa & Naples.
35. Venice & Corinth.
36. Gibraltar & Malta.
37. Rhodes & Bastia in Corsica.
38. Vienna & Berlin.

What is the distance between

39. Washington & Madrid.
40. Bermudas & St. Christopher's.
41. Toulon & Malta.
42. Bagdad & Ava.
43. Moscow & Pekin.
44. Riga & Quebec.
45. Newcastle & Cape Farewell, in Greenland.

46. How many miles must a ship sail in going from St. John's, in Newfoundland, to Nootka Sound,—and what is the difference between this distance and the direct distance between the two places?

47. How many miles does a ship sail in her voyage from London to Botany Bay, supposing her to go in as straight courses as possible?

48. What is the distance between the North and South Poles?

Measure the distances between the following places on a map of France.

49. Ushant I. & Strasburg.
50. Calais & Montpelier.
51. Bourdeaux & Narbonne.
52. Caen & Geneva.
53. Havre de Grace & Nice.
54. St. Maloe & Marseilles.
55. Toulouse & Paris.

SECTION III.

DEFINITION.

The *horary*, or *hour circles*, are small circles on the globe, placed at the north and south poles, having the hours of the day marked upon them, with an index to each. On most of the modern globes, the horary circles have a double row of figures.

On Cary's new globes the *horary circles* are small circles of brass, placed between the brass meridian and the surface of the globe; they are then moveable round the poles, and the brass meridian serves for an index.

On Adams's globes, the equator is made use of as an hour circle; a semicircular wire is placed over it, having two indices, one on each side of the brass meridian.

Bardin's new *British globes* have the hour circle fixed on the outside of the brass meridian, but made to slide along the brass meridian, when it is necessary to elevate the south pole.

THE TIME OF DIFFERENT PLACES COMPARED.

The earth, turning round on its axis from the *west* towards the *east*, causes a different part of its surface to be successively presented to the sun. When the meridian of any place is directly opposite to the sun, it is then noon to all places on that meridian.

The meridians that lie towards the east will come opposite to the sun before those that lie towards the west; and hence the people there will have noon so much sooner,— and the other hours of the day will be proportionably advanced.

The earth taking 24 hours to turn round on its axis, the rate at which it turns per hour may be found, by dividing 360 (the number of degrees in the circumference of the globe) by 24: the quotient, 15, is the number of degrees the earth turns in an hour. Thus, a place that lies 15° to the east will have noon 1 hour sooner; if it lie 30°

or 45°, it will have noon 2 or 3 hours sooner; and so on in the same proportion.

Places that lie 15°, 30°, or 45° to the west, will have noon 1, 2, or 3 hours later; and so on in the same proportion.

This shows the reason of the rules given in Problem IV. to reduce difference of longitude to difference of time,—and the contrary.

The two problems in this section show, from having the hour given at any place, how to find what hour it is in any other part of the world; and to find at what places it is noon at any given time.

PROBLEM XIII.

The hour being given at any place, to find what hour it is in any other part of the world.

BY THE GLOBE.

1. Bring the place, at which the time is given, to the meridian, and set the index to the given hour.

2. Turn the globe till the other place comes to the meridian, and the index will show the time required.

BY ADAMS'S GLOBES.

Where the equator is made use of as an hour circle.

1. Bring the place to the meridian at which the time is *required*, and set the index to the given hour.

2. Turn the globe till the other place comes to the meridian, and the index will show the time required.

If there be two sets of figures on the horary circle at the poles, make use of that set which increases towards the east, or right-hand; and whichever 12 be fixed upon for noon, the hours to the east, or right-hand, will be afternoon hours, *p. m.*; those to the west, or left-hand, will be morning hours, *a. m.*: Or those numbers that increase from the 12 made noon, point out the afternoon hours, and those that decrease, point out the morning hours.

On Adams's globes, the hours on the equator increase from the east towards the west; and the hours to the west of 12 at noon are afternoon hours,—those to the east are morning hours. This makes the above distinction necessary in performing this problem.

WITHOUT THE GLOBE.

Find the difference of longitude between the two places, and reduce it to time.

Add this difference of time to the given hour, if the place at which the time is required lie to the east; but subtract it, if it lie to the west.

1. If, in adding, the sum is greater than 12, take 12 away, and change the name from morning to afternoon hours, or from afternoon to morning hours.

2. If, in subtracting, the difference of time between the two places be greater than the given hour, add 12 to the given hour, and change the name as directed in the last note.

3. By this problem the longitude of places is determined; for if by astronomical observation, or any other means, it can be known what hour it is at London, and at the place whose longitude is to be determined, this difference of time, reduced to degrees, will give the longitude of that place; and which will be east or west according as the time is sooner or later.

EXAMPLES.

1. What hour is it at Boston, in America, when it is 3 *p. m.* at London? *Ans.* 18 min. past 10 *a. m.*

This example performed without the globe.

The longitude of Boston is 70° 30′, which, in this example, is the difference of longitude.

3) 70° 30′

3) 14 6

4 hrs. 42 min. difference of time.

Boston lying to the west, this must be subtracted; but the difference here being greater than the hour given, add 12 to the given hour, as directed in note 2, and change the name from *p. m.* to *a. m.*

Thus, 3 hrs.	0 min. *p. m.* given hour.	
12	0 added.	
15	0	
4	42 difference of time, subtracted.	
Ans. 10 hrs.	18 min. *a. m.*	

2. What is the hour at Pekin, when it is 9 *a. m.* at Lisbon? *Answ.* 22 min. past 5 *p. m.*

Calculation.

The difference of longitude is 125° 33′ = 8 hrs. 22 min.; and as Pekin is east of Lisbon, this must be added.

9 hrs.	0 min. *a. m.* given hour.
8	22 difference of time.
17	22
12	0 subtracted.
Answ. 5 hrs.	22 min. *p. m.*

Having the hour given at one place, required the hour at the other place given in the following examples.

Place where time is given.	*Given time.*	*Place where time is required.*
3. Newcastle	11 *a. m.*	Port Royal
4. ———	7 *a. m.*	Madras
5. ———	6 *p. m.*	Pelew Islands
6. ———	5 *a. m.*	Nootka Sound
7. London	Noon	Society Isles
8. Cairo	9 *a. m.*	Botany Bay
9. Lisbon	11 *p. m.*	Canton

Place where time is given.	Given time.	Place where time is required.
10. Port Royal	11 *a. m.*	Owhyhee
11. Oporto	6 *a. m.*	Damascus
12. Warsaw	10 *p. m.*	Astracan
13. Naples	9 *a. m.*	Lassa (Tibet)
14. Geneva	4 *a. m.*	Quito
15. Lyons	Midn.	Mexico
16. Edinburgh	3 *p. m.*	Delhi
17. Presburg	6 *p. m.*	Surat
18. Cherson	1 *a. m.*	Charlestown
19. Venice	2 *a. m.*	New York
20. Constantinople	8 *p. m.*	Lima
21. Calcutta	7 *a. m.*	Cayenne
22. London	Noon	Nankin
23. ———	4 *p. m.*	Rome
24. ———	4 *p. m.*	Madras
25. ———	4 *p. m.*	Barbadoes.

PROBLEM XIV.

Having the hour given at any place, to find where it is noon.

BY THE GLOBE.

Bring the given place to the meridian, and set the index to the given hour.

Turn the globe round till the index point to 12 at noon, and the places then under the meridian are those required.

BY ADAMS'S GLOBES.

Bring the given place to the meridian, and set the index to 12 at noon.

Turn the globe round till the index point to the given hour, and the places then under the meridian are those where it is noon.

WITHOUT THE GLOBE.

Reduce the number of hours between the given time and noon into degrees, and it will be the difference of longitude between the places.

When the given hour is in the morning, the place where it is noon will lie so many degrees to the eastward: hence the difference of longitude must be added to the longitude of the given place, if it be E.; but subtracted from it, if it be W.

When the hour is in the evening, the places where it is noon will lie to the westward of the given place: hence the difference of longitude must be added, if the longitude of the given place be W.; but subtracted, if it be E.;—and the sum, or difference, will be the longitude of the places required.

1. If, in subtracting, the difference of longitude be greater than the longitude of the given place, subtract the later from the former,—and the remainder, of a *contrary name*, will be the longitude of the places required.

2. If, in adding, the sum exceeds 180°, subtract it from 360°, and the remainder will be the required longitude, but of a *contrary name.*

3. By this problem, it may also be found where it is any other given hour; only, instead of turning the globe till the index points to 12, turn it till it points to the given hour.

EXAMPLES.

1. Where is it noon, when it is 5 o'clock *p. m.* at Paris?

Calculation.

5 hours = 70° the difference of longitude. As the given hour is in the evening, the places where it is noon will lie to the west. The longitude of Paris is 2° 20′ E.: from this, according to the rule, 75° ought to be subtracted; but as that cannot be done, subtract 2° 20′ from 75°, (by note 1), and the remainder, 72° 40′, will be the longitude of the places required, and will be W. being of a contrary name.

The places answering to this are,

Labrador, New England, and Pennsylvania, in North

America; Hispaniola; Terra Firma, Peru, &c. in South America.

2. Where is it noon, when it is 9 *a. m.* at Newcastle?

Answ. Nisney Novogorod, a town on the Wolga, in Russia; Armenia and Georgia, west of the Caspian Sea; Bagdad, a town on the river Tigris, in Irak Arabia; the middle parts of Arabia; Mocha, a sea-port of Arabia, on the Red Sea; the Strait of Babelmandel; the north-east part of Africa; and the western coast of Madagascar.

3. When it is 7 *a. m.* at Port Royal, in Jamaica, where is it noon?

Answ. At London, and all other places which are situated under the meridian of London.

4. When it is 40 min. past 2 *p. m.* at Ispahan, where is it noon?

5. Where is it noon, when it is 1 *a. m.* at New Zealand?

6. Where is it noon, when it is midnight at London.

7. When it is 7 *a. m.* at Jerusalem, where is it noon?

8. When it is midnight at Mexico, where is it 8 45 *a. m.*?

9. Where is it noon, when it is 4 *a. m.* at Botany Bay?

10. Where is it midnight, when it ½ past 10 *a. m.* at Bencoolen, in Sumatra?

11. When it is ¾ past 4 in the afternoon at Paris, where is it noon.

12. When it is ¾ past 7 in the morning at Shiraz, where is it noon?

13. When it is noon at London, at what place is it ¼ past 8 in the morning?

14. When it is 2 o'clock in the afternoon at London, at what place is it ¼ past 5 in the afternoon?

15. When it is noon at Bombay, where is it ¼ past 6 in the morning?

16. When it is midnight at Bursa, where is it 3 o'clock in the afternoon?

17. When it is ½ past 6 in the morning at Quebec, where is it 11 in the forenoon?

QUESTIONS FOR EXAMINATION IN SECTION III.

What are the horary circles? How does the earth turn on its axis? What is it that produces noon at any place? Whether do the meridians that lie to the east, or those that lie to the west, come soonest opposite to the sun?

How long is the earth in turning on its axis? At what rate does it turn per hour? How is that found? How many degrees of longitude make an hour difference of time? Places that lie in 30° E. L. have they the hours of the day more or less advanced than they are at London?

Having the hour given at any place, how is it found what hour it is at any other place? How is this found on Adams's globe? How is this found by maps? Having the hour given at any place, how is it found where it is noon? How is this found by Adams's globe, and by maps?

QUESTIONS FOR EXERCISE IN SECTION III.

1. When it is ten in the morning at London, what is the time at Calcutta and Canton?

2. When it is eight in the morning at Dublin, what o'clock is it at the Pelew Islands, Barbadoes, and Lima?

3. When it is midnight at Rome, what o'clock is it at Owhyhee and Easter Island?

4. When it is midnight at Lisbon, what o'clock is it at York, Moscow, Genoa, Syracuse, and Leghorn?

5. How much are the clocks of Barbadoes behind ours?

6. When it is ten in the morning at Port Jackson, what is the hour at Paris and Dublin?

7. When it is nine in the morning at London, what is the hour at Botany Bay?

8. When it is six in the morning at Kingston, in Jamaica, what is the hour in Bombay?

9. When it is one in the afternoon at Dublin, what is the hour at Boston, in New England?

10. Where is it noon, when it is three in the morning at Newcastle?

11. Where is it noon, when it is seven in the evening at Pekin?

12. When it is midnight at Mexico, where is it noon?

13. When it is eleven in the evening at Jamaica, where is it noon?

14. When it is three in the morning at Paris, where is it noon?

15. My watch was well regulated at London, and when I arrived at Madras, which was after a five months' voyage, it was 4 hours 50 min. slower than the clocks there. Had it gained or lost during the voyage, and how much?

16. When it is 7 *p. m.* at Edinburgh, what is the hour at Washington?

17. When it is 5 *p. m.* at Philadelphia, where is it midnight?

18. Are the clocks at Calcutta faster or slower than the clocks at London, and how much?

SECTION IV.

DEFINITIONS.

1. The *ecliptic* is a great circle in the heavens, described by the earth in its annual motion round the sun; or it is a great circle in the heavens, in which the sun always *appears* to move.

The ecliptic is proper only to the celestial globe; but, on account of its great use in performing many geographical problems, it is always drawn on the terrestrial: it crosses the equator obliquely, and extends 23° 28′ to the north of it on one side, and 23° 28′ to the south of it on the other side. The angle which it makes with the equator is called the *obliquity* of the *ecliptic*.

It is called the ecliptic, because eclipses generally happen when the moon is in or near this circle: it is divided into 12 equal parts, called signs, each containing 30 degrees; they are thus marked and named:

	Northern.			*Southern.*	
Spring.	Aries, or the Ram - -	♈	Autumn.	Libra, or the Balance -	♎
	Taurus, or the Bull - -	♉		Scorpio, or the Scorpion	♏
	Gemini, or the Twins -	♊		Sagittarius, or the Archer	♐
Summer.	Cancer, or the Crab - -	♋	Winter.	Capricornus, or the Goat	♑
	Leo, or the Lion - - -	♌		Aquarius, or the Waterman	♒
	Virgo, or the Virgin - -	♍		Pisces, or the Fishes -	♓

The winter and spring signs are termed *ascending*, and the summer and autumnal *descending*.

2. The *tropics* are two less circles, parallel to the equator, and distant from it 23° 28′: that which lies on the north side is called the *tropic of cancer*; and that which lies on the south side is called the *tropic of capricorn*.

The obliquity of the ecliptic determines the distance of the tropics from the equator; as they are drawn parallel to the equator, through those two points of the ecliptic, which are at the greatest distance from it. The northern tropic is called the tropic of cancer, because it passes through the sign cancer; the southern, the tropic of capricorn, because it passes through the sign capricorn.

The imaginary line, which corresponds to the tropic of cancer on the earth, passes Mount Atlas on the western coast of Africa, Syene in Ethiopia, thence over the Red Sea, to Mount Sinai, by Mecca, the city of Mahomet, across Arabia Felix, to the extremity of Persia, the East Indies, China, over the Pacific Ocean to Mexico, and the island of Cuba.

The tropic of capricorn passes through the country of the Hottentots, across Brazil to Paraguay and Peru.

3. The *polar circles* are two less circles, parallel to the equator, and as far distant from the poles as the tropics are from the equator: that which lies towards the north pole is called the *arctic* circle; and that which is towards the south pole is called the *antarctic* circle.

The distance of the polar circles from the poles depends upon the obliquity of the ecliptic; their distance from the poles being 23° 28′, their distance from the equator is 66° 32′.

4. The *equinoctial points* are those points in which the equator and ecliptic cross each other; they are the first points of aries and libra.

5. The *solstitial points* are those two point sof the ecliptic, that are at the greatest distance from the equator, and at which the ecliptic touches the tropics; they are the first points of cancer and capricorn.

6. The *colures* are those two meridians which pass through the solstitial and equinoctial points; that which passes through the equinoctial points is called the *equinoctial* colure, and that which passes through the solstitial points is called the *solstitial* colure.

7. *Declination* of the sun is its distance north or south of the equator.

8. *Altitude* of the sun is its distance above the horizon.

9. The *analemma* is a calendar of the months, placed on some vacant part of the body of the globe, extending from tropic to tropic: the months and days are so divided as to correspond to the sun's declination for every day in the year.

OF THE LENGTH OF THE DAYS AND NIGHTS.

Twice a year the days and nights are equal to all places upon the earth: these two days are, when the sun is in the first of aries and libra, or March 21st, and September 23d. These are called the *equinoxes*,—March 21st the *vernal*, and Sept. 23d the *autumnal equinox*. In places under the equator the days and nights are always equal.

In all places between the equator and the north pole the day is longest when the sun is in the first degree of cancer, June 21st,—and shortest when in the first degree of capricorn, December 21st; but in those places between the equator and the south pole the contrary happens,—the day is shortest when the sun is in the first of cancer, and longest when in the first degree of capricorn. June 21st is called the *summer solstice*, it being then summer to all places in the northern hemisphere; and December 21st, the *winter solstice*, it being then winter to the same places.

The days increase continually to all places in the northern hemisphere, whilst the sun is moving through the ascending signs, or from the first of capicorn to the first of cancer; i. e. from December 21st to June 21st:—but the contrary of this happens to all places in the southern hemisphere; the days there increasing whilst the sun moves from cancer to capricorn, or from the 21st of June to the 21st of December.

As, at the equator, the days and nights are always equal, so, of all other places, those that are the nearer to the equator have the less inequality in their days and nights; and the greater the latitude of the place, the greater is the length of its longest day. The length of the longest day at any place is always equal to the length of the longest night at the same place.

The sun's declination is *north* from March 20th to September 23d, and *south* the remainder of the year. Its greatest declination, either north or south, is 23½°.

The sun's altitude, or height above the horizon, will be increasing to any place, whilst the days are increasing at that place; and its altitude on the same day will be different to places, that have different latitudes: hence the sun's meridian altitude furnishes an easy method of determining the latitude of a place.

These propositions will be made evident by the problems in this section: these are to find the rising and setting of the sun at any place (and consequently the length of the day and night at that place), for any day of the year; also, when the sun is due east or west; its altitude, either at noon or at any other hour; and, from having its altitude, to find the latitude of the place.

Previous to performing these problems, some others are necessary; such as, to find the sun's place, and its declination for any day, and to rectify the globe for the sun's place.

All the problems in this section can be performed by either the terrestrial or celestial globe.

PROBLEM XV.

To find the sun's place in the ecliptic.

1. Seek the day of the month in the calendar on the horizon, and against it, in the adjoining circle, will be found the sign and degree in which the sun is for that day.

2. Find the same sign and degree in the ecliptic on the surface of the globe, and this is the sun's place for that day at noon.

The sun's place, or, as it is otherwise termed, the *sun's longitude*, may be found for any day of the year in White's Ephemeris, or in the Nautical Almanack. In White's Ephemeris it is marked in the first column of the right-hand page of every month.

EXAMPLES.

1. What is the sun's place for March 10th?

Answ. ♓ 20° 7′.

2. What is the sun's place on the 4th of June?

Answ. ♊ 13° 57′.

What is the sun's place for the following days?

3. January 1st?
4. February 2d?
5. March 3d?
6. April 4th?
7. May 5th?
8. June 6th?
9. July 7th?
10. August 8th?
11. September 9th?
12. October 10th?
13. November 11th?
14. December 12th?
15. March 22d?
16. June 22d?
17. September 23d?
18. December 22d?

PROBLEM XVI.

To find the sun's declination.

Bring the sun's place for the given day to the brass meridian, and the degree over it will be the declination sought; or bring the day of the month marked on the analemma to the brass meridian, and the degree over it will be the declination as before.

N. B. The sun's declination is given in White's Ephemeris for every day in the year, and also in Table II. at the end of this work.

1. The declination of the sun being its distance north or south from the equator, this problem is exactly the same as that for finding the latitude of a place.

2. The greatest north declination, 23° 28′, is when the sun enters cancer, June 21st,—that being the greatest distance of the ecliptic north of the equator. The greatest south declination, 23° 28′, is when it enters capricorn, December 21st,—that being the greatest distance of the ecliptic south of the equator.

EXAMPLES.

1. What is the sun's declination for March 10th?

Answ. 3° 54′ S.

2. What is the sun's declination for January 31st?

Answ. 17° 14′ S.

What is the sun's declination for the following days?

3. April 23d? 5. August 1st? 7. July 23d?
4. August 12th? 6. March 5th? 8. October 19th?

9. On what days has the sun no declination?
10. When has the sun the greatest declination north?
11. When has the sun the greatest declination south?
12. What is the sun's declination for to-day?

PROBLEM XVII.

To rectify the globe for the sun's place, and day of the month.

1. Find the sun's declination for the given day, by the last problem.

2. Elevate the pole, which is of the same name as the declination, as many degrees as are equal to it?

When the globe is rectified for the sun's place, and the sun brought to the zenith, the horizon will be the *terminator*, or boundary circle of light and darkness; it will therefore be day with all those places that are above the horizon, and night with all those that are below it.

EXAMPLES.

1. Rectify the globe for the sun's place on June 4th.

Answ. On June 4th the sun's declination is $22\frac{1}{2}°$ N.; therefore the north pole must be elevated $22\frac{1}{2}°$ above the horizon.

2. Elevate the globe for the sun's place on October 6th.

Answ. The sun's declination on October 6th is 5° S.; hence the south pole must be elevated 5° above the horizon.

PROBLEM XVIII.

To find the sun's rising and setting for any given day, at any given place.

1. Elevate the globe for the sun's declination, bring the given place to the meridian, and set the index to 12.

2. Turn the globe till the given place come to the eastern edge of the horizon, and the index will show the time of the sun's rising.

3. Bring the given place to the western edge of the horizon, and the index will show the time of the sun's setting.

If the hour circle have a double row of figures, make use of that which increases towards the *east*; the sun's rising and setting may then be found at once, by bringing the place only to the eastern edge of the horizon, for the index will point in one row to the hour of rising, and on the other (that which increases towards the *west*) to the hour of setting.

This problem may also be performed in the following manner.

1. Elevate the globe for the latitude of the place, bring the sun's place to the meridian, and set the index to 12.

2. Bring the sun's place to the eastern horizon, and the index will show the time of the sun's rising.

3. Bring it to the western edge of the horizon, and the index will show the time of setting.

BY ADAMS'S GLOBES.

Having elevated the globe for the sun's declination, brought the given place to the meridian, and set the index to 12 as before,—bring the given place to the western edge of the horizon, and the index will show the time of the sun's rising; bring it to the eastern edge, and the index will show the time of setting.

By this problem may be found the length of the day and night.

RULE.—1. Double the time of the sun's setting, and it will give the length of the day.

2. Double the time of the sun's rising, and it will give the length of the night.

In White's Ephemeris, pages 40 to 43, is given a table of the sun's semidiurnal arcs, or time of its half visible duration above the horizon, —by which may be found the time of the sun's rising or setting in any part of Great Britain or Ireland.

As this method is very easy, and may be of use, either to prove the method by the globes, or where a pair of globes is wanting, it is here inserted.

Find the declination in the Ephemeris, for the given day. On that page which is marked N. or S. according as the declination is N. or S. look down the left-hand column, marked degrees at the top, till you come to that degree which is equal to the sun's declination; then look for the latitude of the place at the top of the table, and, in that column against the sun's declination, will be found the time of its visible half duration above the horizon: this is its time of setting. Subtract this from 12, and the remainder will be the time of rising.

This method will give the time of the sun's rising and setting to within a few minutes; but if the latitude of the place, and the sun's declination, consist of degrees and minutes, and if greater accuracy be required, a small allowance must be made for the minutes, in both cases, in the following manner.

Find the nearest proportional part that the odd minutes are of one degree, and, first for the latitude, take the same proportional part of the difference between the column marked latitude and the next one.

For the odd minutes of the declination, take the proportional part of the difference between the degrees of declination and the next one. These two differences, added to the semidiurnal, are found in the table, when the sun's declination is north, but subtracted from it, when the sun's declination is south, will give the time of the sun's setting to a minute.

EXAMPLES.

1. Required the time of sun-rise and sun-set at Edinburgh on the 1st of June.

Answ. The sun rises at 27 minutes after 3, and sets 33 minutes after 8.

2. What time does the sun rise and set at London on July 17th, and what is the length of the day and night?

Answ. The sun rises at 4, and sets at 8; the length of the day is 16 hours, and the night 8 hours.

Required the rising and setting of the sun at the following places, on the respective days mentioned.

3. Pekin, April 10.
4. Newcastle, Oct. 13.
5. Gibraltar, Jan. 22.
6. Petersburg, June 21.
7. Hamburgh, Dec. 21.
8. North Cape, Dec. 21.
9. Botany Bay, May 25.
10. London, Aug. 29.

Required the rising and setting of the sun at Cape Horn, on the following days:

11. January 29.
12. March 2.

13. March 22.
14. April 6.
15. June 21.
16. July 21.
17. August 29.
18. October 14.
19. December 21.

Required the time of the sun's rising and setting at Edinburgh, on the following days.

20. January 29.
21. March 2.
22. ——— 22.
23. April 6.
24. June 21.
25. July 12.
26. August 29.
27. October 14.
28. December 21.

29. Required the time of the sun's rising and setting at the following places, on March 21st and September 23d:— Archangel, London, Vienna, Jerusalem, Quito, and the Cape of Good Hope.

What is the length of the longest and shortest day, at the following places, and what is the difference between them?

30. Archangel.
31. London.
32. Owhyhee.
33. Quito.
34. Quebec.
35. Cape of Good Hope.
36. Vienna.
37. Lima.
38. Alexandria.
39. St. Helena.
40. Washington.
41. Pekin.
42. Madras.
43. Borneo.
44. Calcutta.
45. Okhotsk.

What is the length of the day, and of the night, on December 26th, at the following places?

46. Dresden.
47. Turin.
48. Adrianople.
49. Shiraz.
50. Medina.

51. What is the hour of the sun's rising at Pekin, Naples, and Philadelphia, on August 29th?

52. How much longer is the sun above the horizon, on June 21st, to Edinburgh than to London?

53. How much longer is June 21st at Petersburgh, than at Jerusalem?

54. At what time does the sun rise and set at Spitzbergen, on April 5th?

EXAMPLES.

Of finding the sun's rising and setting in any part of Great-Britain or Ireland, by White's Ephemeris.

1. What is the hour of the sun's rising and setting at Newcastle, on May 31st?

The sun's declination on that day is 22° N. and the latitude of Newcastle is 55°. Look down the left-hand column of page 42d of the Ephemeris for 22; then against 22, in the column marked at the top latitude 55, stands 8 hrs. 26 min.—which is the time of the sun's setting on that day; and this, subtracted from 12, gives 3 hrs. 34 min. the time of rising.

2. Required the sun's rising and setting at Liverpool, on May 14.

The latitude of Liverpool is 53° 22′, and the sun's declination for May 14th is 18° 28′ N. Neglecting the minutes, look in page 40 for the declination, 18 degrees: then against that degree, in the column marked latitude 53, stands 7 hrs. 46 min. the time of the sun's setting on that day. If greater accuracy be required, the minutes may be allowed for thus:—on the line of 18° take the difference between the columns 53 and 54, which is 5 minutes: then 22′ being rather more than the third part of 60, 2 minutes of time may be allowed for it. For the odd minutes of declination (28), nearly equal half a degree, take half the difference of the hours and minutes in the column (latitude 53) standing against the respective lines 18 and 19; the difference in the present case is 7 minutes, —the half of which may be called 3. Hence, adding 2 minutes of time for the odd minutes of latitude, and 3 for the declination, the time of the sun's setting, on the above day, will be 7 hrs. 51 min.

It may be proper here to observe, that, without allowing for the minutes of latitude or declination, the table will give the sun's setting to within a few minutes of time,—as great an accuracy as can be obtained upon the globe

PROBLEM XIX.

To find the sun's meridian altitude at any given place, for any given day.

BY THE GLOBE.

1. Elevate the globe for the latitude of the given place by Problem XI.; find the sun's place for the given day by Problem XV. and bring it to the brazen meridian.

2. Fix the quadrant of altitude on the zenith, and bring it over the sun's place, then the degree upon the quadrant cut by the sun's place will be its meridian altitude.

Note, The sun's meridian altitude may be found without the quadrant, by counting upon the meridian the number of degrees intercepted between the horizon and the sun's place.

BY THE ANALEMMA.

1. Elevate the globe for the latitude, as before.

2. Bring the analemma to the brazen meridian, and the number of degrees intercepted between the day of the month marked on the analemma, and the nearest point of the horizon, either north or south, will be the meridian altitude required.

WITHOUT THE GLOBE.

1. Find, from White's Ephemeris, or from Table II. the sun's declination for the given day.

2. If the declination be of the same name as the latitude, their *difference* will be the zenith distance.

3. If the declination and latitude be of different names, their *sum* will be the zenith distance.

4. The zenith distance, taken from 90°, will give the altitude.

To know whether the sun's meridian altitude be north or south, observe the following

Rule.—1. When the declination and latitude are of different names, i. e. the one north and the other south, the altitude is always of the same name as the declination.

2. When the latitude and declination are of the same name, if the declination be the greater, the altitude is also of the same name, otherwise it is of a name contrary to that of the declination.

EXAMPLES.

1. Required the sun's meridian altitude, June 21st, at Archangel.

The latitude of Archangel is 64° 34′ N. and the sun's declination 23° 28′ N.; hence their difference is the zenith distance.

Lat.	64°	34′	N.
Dec.	23	28	N. subtract.
	41	6	zenith distance.
	90	0	
	41	6	subtract.
Answ.	48	54	meridian altitude, and which is

south, the latitude being greater than the declination.

2. What is the sun's meridian altitude at Bombay, on June 21st?

Dec.	23°	28′	N.
Lat.	18	57	N. subtract.
	4	31	zenith distance.
	90	0	
	4	31	
Answ.	85	29	altitude north, the declination

being greatest.

3. What is the sun's meridian altitude at the Cape of Good Hope, on May 15th?

Lat.	34°	29′ S.
Dec.	18	46 N. added.
	53	15 zenith distance.
	90	0
	53	15
Answ.	36	45 altitude north, being of the same name with the declination.

4. What is the sun's meridian altitude at Corinth, on March 21st?

On March 21st the sun has no declination; hence the zenith distance is equal to the latitude.

	90°	0′
	37	30
Answ.	52	30 altitude south.

5. Required the sun's meridian altitude at Newcastle, on the following days.

Dec. 21. March 21. June 21.

6. What is the sun's meridian altitude at Cairo, on

Dec. 21? March 21, or Sept. 23? June 21?

7. What is the sun's meridian altitude at Port Royal, in Jamaica, on

Dec. 21? March 21, or Sept. 23? June 21?

8. Required the sun's meridian altitude for the following places, on December 21st and June 21st.

Bergen.	Mocha (Arabia).	Botany Bay.
Quebec.	Batavia.	Cape Horn.
Athens.	St. Helena Isle.	

9. What is the sun's meridian altitude at the following places, on the following days?

Gottingen,	April 17th, and August 1st?
Canary Isle,	May 15th, and December 25th?
Port Mahon,	February 28th, and July 7th?
Smyrna,	May 1st, and November 11th?

To all places situated north of the tropic of cancer the sun's meridian altitude is always south; to all places situated south of the tropic of capricorn its meridian altitude is always north; and to those places situated between the tropics its meridian altitude is sometimes north and sometimes south.

From the above examples it will be seen that the difference between the sun's greatest and least meridian altitudes, at any place situated without the tropics, is equal to 46° 56′, or twice 23° 28′, the distance of each tropic from the equator.

PROBLEM XX.

To find the sun's altitude for any hour, having the latitude and the day of the month given.

BY THE GLOBE.

1. Elevate the globe for the latitude, bring the sun's place to the meridian, and set the index to 12 at noon.

2. Turn the globe till the index point to the given hour; and, having screwed the quadrant of altitude on the zenith, bring it over the sun's place.

3. Then the degree on the quadrant cut by the sun's place will be the altitude required.

EXAMPLES.

1. Required the altitude of the sun at Jerusalem, on October 21st, at 10 o'clock *a. m.* *Answ.* 38°.

2. What is the sun's altitude at Petersburg, on June 21st, at 6 o'clock *p. m.* *Answ.* 20°.

Required the sun's altitude at the following places and times.

3. Jamaica, Dec. 1st, 3 *p. m.*
4. London, May 1st, 10 *a. m.*
5. Spitzbergen, June 21st, midnight.
6. New Orleans, Dec. 21st, 4 *p. m.*
7. Cape of Good Hope, May 15th, 10 *a. m.*
8. Washington, Sept. 25th, 3 *p. m.*
9. Louisburg, March 27th, 11 *a. m.*
10. Edinburgh, Nov. 30th, 10 *a. m.*

For more examples, see Problem XVII. on the celestial globe.

PROBLEM XXI.

Having the sun's meridian altitude, to find the latitude of the place.

BY THE GLOBE.

Bring the sun's place to the meridian, and move the globe up or down, till the distance between the sun's place and the north or south point of the horizon (as the case requires) be equal to the given altitude; then will the elevation of the pole be the latitude required.

BY CALCULATION.

1. Subtract the altitude from 90°, for the zenith distance, which is north, if the zenith be north of the sun; or south, if it be the contrary.
2. If the zenith distance and declination be both north or both south, add them together; but if one be north and the other south, subtract the less from the greater, and the sum or difference will be the latitude of the same name with the greater.

EXAMPLES.

1. Observed the sun's meridian altitude on the 18th of May, and found it to be 42° 13′ S.; required the latitude.

In this example, the sun's altitude being south, the zenith will be north of the sun,—being always of the contrary name with the altitude.

Calculation.

	90°	0′
	42	13 S.
	47	47 zenith distance N.
Add	19	24 sun's declination N.
Answ.	67	11 N lat. the zenith distance and declination being of the same name.

2. What is the latitude of the place at which the sun's meridian altitude, on August 5th, is 74° 24′ N.?

Answ. 1° 36′ N.

Required the latitude of the places coinciding with the annexed meridian altitude of the sun, on the days subjoined.

3.	Sun's meridian altitude	38° S.	January 13th.
4.	————————	48 S.	February 17th.
5.	————————	18 S.	March 11th.
6.	————————	30 S.	April 24th.
7.	————————	64 S.	May 17th.
8.	————————	35 S.	June 4th.
9.	————————	25 N.	July 29th.
10.	————————	48 N.	August 6th.
11.	————————	50 N.	November 19th.

12. Observing the sun's meridian altitude, on June 5th, to be 70½° S.; and at the same instant observing a time-piece regulated for Greenwich, found it to be 10 min. past 11 *a. m.*; required the place of observation.

13. On March 21st the sun's meridian altitude was found, by observation, to be 52° 30′ S. and the difference of time between the place of observation and London was 1 hr. 32 min. sooner,—required the place.

14. The sun's meridian altitude, May 15th, was observed

to be 36° 45′ N. and it was 13 min. past 1 *p. m.* when it was noon at London,—required the place of observation.

15. Required the latitude and longitude of that place where the sun's meridian altitude, on May 21st, was 78° S. and where it was 3 *p. m.* when it was noon at London.

16. A ship, sailing from Jamaica, took the sun's meridian altitude on January 21st, and found it to be 50° S.; and at the same instant observing a time-keeper, regulated for London, to point to 42 min. past 2 *p. m.;* how far was the ship distant from Jamaica?

17. At a certain place, where the clocks are 2 hrs. faster than at London, the sun's meridian altitude was observed to be 30° to the south of the observer, on the 21st of March; required the place.

18. At a certain place, where the clocks are 3 hrs. 32 min. faster than they are at London, the sun's meridian altitude was observed to be 80½° S. on June 9th; required the place.

19. At a place where the clocks are 5 hrs. slower than at London, the sun's meridian altitude was observed to be 60° to the south of the observer, on April 16th; required the place.

PROBLEM XXII.

To find when the sun is due east or west, the latitude of the place and the day of the month being given.

1. Elevate the globe for the latitude of the place, bring the sun's place to the meridian, and set the index to 12.

2. Fix the quadrant of altitude in the zenith, and bring it, if the sun's declination be of the same name with the latitude, to the *eastern* point of the horizon; then turn the

globe till the sun's place come to the edge of the quadrant, and the index will shew the time when the sun is due east.

3. If the declination and latitude are of different names, bring the quadrant to the *western* point of the horizon, and turn the globe till the point in the ecliptic, opposite to the sun's place, come to the edge of the quadrant, and the index will shew the time when the sun is due east, as before.

4. Subtract the hour, when the sun is due east, from 12, and the remainder will be the time when it is due west.

When the declination and latitude are of the same name, the sun is due east after rising.

When the declination and latitude are of different names, the sun is due east before rising.

And, as it is not so convenient to observe when the sun is due east below the horizon, the opposite point of the ecliptic is brought due west, and the index then shows the time of the sun's being due east.

EXAMPLES.

1. When is the sun due east and west at Newcastle, on November 3d? *Answ.* East $\frac{1}{4}$ past 5.
West $\frac{1}{4}$ bef. 7.

2. At what hour is the sun due east and west at Leghorn, on June 21st? *Answ.* East $\frac{1}{4}$ bef. 8.
West $\frac{1}{4}$ past 4.

3. When is the sun due east and west at London, at the summer and winter solstices?

4. When is the sun due east and west at Liverpool, on April 23d and December 15th?

5. At what hours is the sun due east and west at the following places, on March 21st and September 23d; viz. Panama, on the Isthmus of Darien; Truxillo, in Peru; and Paramariboo, in Surinam?

6. At what hour is the sun due east and west at Buenos Ayres, on February 2d?

7. At what hour is the sun due east and west at Carlscrona, on April 4th?

8. At what hour is the sun due east and west at Bursa, on December 2d?

QUESTIONS FOR EXAMINATION IN SECTION IV.

What is the ecliptic? Why is it so called? What angle does it make with the equator? What is this angle called? Into how many parts or signs is it divided, and how many degrees does each contain?

What are the names of the six northern signs? Write their characters. What are the names of the six southern signs? Write their characters. Name the spring, summer, autumnal, and winter signs. Which are the ascending, and which are the descending signs?

What are the tropics, and at what distance are they from the equator? What are their names, and why are they so called? What is it that determines the distance at which they are drawn from the equator?

What are the polar circles? At what distance are they from the poles, and at what distance from the equator? What are the equinoctial points? What are the solstitial points?

What are the colures? Through what points does the equinoctial colure pass? Through what points does the solstitial colure pass? What is meant by the sun's altitude?

How often in the year are the days and nights equal to all places upon the earth?

What are these days called?

In what places of the earth are the days and nights always equal?

Which is the longest day to all places in the northern hemisphere?

What is this day called?

Which is the shortest day to all places in the northern hemisphere?

What is this day called?

Which is the longest and which is the shortest day to all places in the southern hemisphere?

During what time are the days constantly increasing to all places in the northern hemisphere?

During what time are the days increasing continually in the southern hemisphere?

What time of the year is the sun's declination north?

How is the sun's place in the ecliptic found?

How is the sun's declination found?

On what two days of the year is the sun's declination greatest, north or south?

On what days has the sun no declination?

How is the globe rectified for the sun's place and day of the month?

How are the rising and setting of the sun found by the globe?

How is the length of the day and night found?

How is the sun's meridian altitude found for any given day at any given place?

How is the sun's altitude for any hour of the day found?

Having the sun's meridian altitude, how is the latitude found?

How is it found when the sun is due east or west at any given place?

QUESTIONS FOR EXERCISE IN SECTION IV.

1. At what hour does the sun rise at the North Cape on December 21st?

2. Whether is June 21st longer at Jerusalem or Newcastle, and how much?

3. At which of these places is December 21st the longest?

4. Which is the longest day to Quito?

5. What is the difference between the longest and shortest day at Paris?

6. What is the sun's meridian altitude at Petersburg on the longest day?

7. How high will the sun ascend on Christmas-day at Bastia?

8. How high will the sun ascend at Samarcand on Michaelmas-day?

9. What is the sun's altitude on June 21st at the North Cape, at midnight?

10. What is the sun's altitude at Moscow, at 8 *a. m.* May 1st?

11. At what times of the year does the sun rise due east at Carlisle?

12. What time does the sun rise and set at Petersburg, Naples, and Canton, on January 24th?

13. At what hour does the sun rise and set at Dublin, Gibraltar, Teneriffe, and Vienna, on April 15th, July 4th, and November 20th?

14. What is the length of the day and night on April 22d, at London, Madrid, and Batavia?

15. What is the length of the day and night on June 10th, at St. Helena, Mexico, New York, and Canton?

16. What is the sun's declination on June 14th, and on August 31st?

17. What is the sun's meridian altitude at London on October 26th?

18. What is the sun's altitude at London on May 21st, at 9 *a. m.*?

19. What is the sun's altitude at Newcastle on May 21st, at 9 *a. m.*?

20. What is the sun's altitude at Constantinople on June 4th, at 3 *p. m.*?

21. How much longer is the 5th of June at Archangel than at Madras?

22. What is the sun's greatest altitude in Magalhaen's Strait?

SECTION V.

DEFINITIONS.

1. The surface of the earth is divided into five parts, called *zones*.

2. The *torrid zone* is that space of the earth included between the tropics.

It is bounded by the tropic of cancer on the north, and the tropic of capricorn on the south: its breadth is 46° 56′, that being the distance of the tropics from each other.

3. The two *temperate zones* are those parts lying between the tropics and polar circles.

The north temperate zone is bounded on the south by the tropic of cancer, and on the north by the arctic circle: its breadth is 43° 4′, that being the distance between the tropic of cancer and the arctic circle.

The south temperate zone is bounded on the north by the tropic of capricorn, and on the south by the antarctic circle: its breadth is the same as the north temperate zone.

4. The two *frigid zones* are those spaces included within the polar circles.

The north frigid zone is that space included within the arctic circle; and the south frigid that within the antarctic circle.

5. The inhabitants of these zones are distinguished by the different direction of their shadows arising from the sun.

6. Those who live in the torrid zone are called *amphiscii;* that is, having both kinds of meridian shadows.

7. Twice in the year they have no shadow at noon, and are then called *ascii.*

8. Those who live in the temperate zones are called *heteroscii;* that is, having only one kind of meridian shadow. Those who live in the south temperate zone have their shadows at noon always towards the south; and those who live in the north temperate zone always towards the north.

9. Those who live in the frigid zones have, when their days are more than 24 hours long, the sun moving all around them, and therefore their shadows are cast all round them; and hence they are called *periscii.*

10. The sun is said to be *vertical* when it is in the zenith, or in the point directly over head.

11. *Climate* is a part of the surface of the earth bounded by two less circles parallel to the equator, and of such a breadth, that the longest day in the parallel nearest the pole exceeds the longest day in that next the equator, by some certain space of time, as half an hour.

OF THE APPEARANCES OF THE SUN IN THE SEVERAL ZONES.

To all places in the torrid and temperate zones the sun rises and sets daily.

To all places in the frigid zones the sun, in summer, does not set for a certain number of days; nor rise in winter for the same number of days: at other times of the year it rises and sets daily, as in the torrid and temperate zones. The nearer the place is to the poles, the greater number of days is the sun above the horizon at one time; so that at the poles it sets not for one half of the year, and never rises for the other half. Those places in the polar circles have one day in which the sun never sets, and another in which it never rises.

To all places in the torrid zone the sun is vertical at noon twice in the year: thus an inhabitant of the equator has the sun vertical when it is in the equinoctial. And, at any other period, the places to which the sun is vertical are those whose latitude is equal to the declination of the sun, and of the same name with it: thus an inhabitant of 10° north latitude has the sun vertical to him when its declination is 10° north.

This may be further illustrated by observing, that the equator and equinoctial coinciding (i. e. the equinoctial being nothing more than the equator supposed to be continued to the heavens) when the sun is in the equinoctial, a perpendicular ray, coming from it to the earth, will fall upon the equator; and during a diurnal revolution of the earth, the equator will be formed or passed over by this ray. When the sun is not in the equinoctial, the perpendicular ray will fall as far to the north or south of the equator as the sun is distant north or south of the equinoctial; and, during a diurnal revolution of the earth, that parallel of latitude will be described by this ray, whose distance from the equator is equal to the sun's declination, and of the same name with it.

Whilst the earth, in its annual motion round the sun, is moving from cancer to capricorn, the sun appears to move from capricorn to cancer; hence its declination varies from 23½ S. to 23½ N.: and during that time, or in half a year, its rays will have been successively perpendicular to all places in the torrid zone.

Whilst the earth is moving through the other half o her orbit from capricorn to cancer, the sun appears to move from cancer to capricorn, and varies in declination from 23½ N. to 23½ S.; hence in the other half year it will be vertical to the same places, but in a retrograde order.

The tropic of cancer is the most northern circle described by the vertical rays of the sun; that of capricorn the most southern.

The sun is vertical only once a year at the tropics; at the tropic of cancer on June 21st, and at the tropic of capricorn on December 22d.

All places out of the torrid zone, being at a greater distance from the equator than the sun's greatest declination, can never have the sun vertical.

From the ecliptic being drawn upon the terrestrial globe, and the pupil knowing that it is the line in which the sun appears to move, he may be inclined to suppose that the sun moves daily round the earth in the oblique manner in which the ecliptic is drawn.

In order to correct this false notion, it may be observed, that the ecliptic is a circle peculiar to the celestial globe, where it really marks out the sun's apparent path among the stars; but on the terrestrial globe it is of no further use than to find the sun's declination on any day.

The sun's vertical rays form a sort of spiral line from tropic to tropic. This may be explained by supposing a quantity of silk string to be wrapped round the globe, from one tropic to the other. If the silk string be so contrived as to be thicker towards the equator, where the daily difference of declination is greatest; and if the number of times it requires to be wrapped round, before it covers the space between the tropics, be equal to half the number of days in one year, it will exactly represent the spiral line formed by the rays of the sun in six months. In the other six months the same sort of spiral line will be formed in a contrary direction.

Besides the division of the earth into zones, the ancients divided it also into what are called *climates.* It was observed that day is always 12 hours long at the equator, and that the longest day increases as we advance north or south on either side of it. Not having yet found accurate means of determining the latitude, they determined how far any place was north or south of the equator, from the greatest length of the day at that place. This made them conceive a number of circles parallel to the equator, which bounded the length of the day, at different distances from it:—and as they called the space contained between these circles climates, because they declined from the equator towards the pole, so the circles themselves may be called *climatical parallels.* There are 30 climates between the equator and each pole; in the first 24 the days increase by half hours, and are called *hour climates;* but in the remaining 6, between the polar circles and the poles, the days increase by months, they are therefore called *month climates.*

The climates are all unequal in breadth; and the greater the distance from the equator, the less is the breadth of the climate.

If we take several places, whose parallels are equally distant, their longest days will not exceed one another equally; but the difference will be greater where the places are most distant from the equator.

The first problem in this section shows the situation of the countries in the several zones: the next problems teach the method of finding on what two days of the year the sun is vertical to any given place in the torrid zone,—to what places the sun is vertical on a given day,—to what particular place the sun is vertical on a given day and hour,—to find the length of the longest day in the frigid zone,—and in what latitude the sun begins to shine, without setting, on any given day; and the last two problems relate to the climates.

PROBLEM XXIII.

To observe, on a globe or map of the world, what countries are situated in the several zones.

If the latitude of any place be less than $23\frac{1}{2}°$, it lies in the torrid zone; if it be more than $23\frac{1}{2}°$, and less than $66\frac{1}{2}°$, it is in one of the temperate zones; and if it be more than $66\frac{1}{2}°$, it is in the frigid zone.

1. What places are situated in the north frigid zone?

Answ. Lapland, Spitzbergen, Nova Zembla, the northern parts of Asia and America, and part of Greenland.

2. What countries lie in the north temperate zone?

Answ. All Europe, except Lapland; the States of Barbary, and part of Egypt, in Africa; the whole continent of Asia, except the north coast, part of Arabia, and the two Peninsulas of India; the greater part of North America; and the Azore, Canary, and Madeira Islands.

3. What countries lie in the torrid zone?

Answ. The greater part of Africa; the southern part of Arabia; the western and eastern Peninsulas of India; the Sunda, Molucca, Philippine, Pelew, Ladrone, and Caroline Islands, &c.; the northern part of New Holland; New Guinea; New Britain, &c.; almost all the groups of islands in the Pacific Ocean, as, New Hebrides, New Caledonia, the Friendly Islands, Navigator's, Society, and Sandwich

Islands; the West-India Islands; the greater part of South America; the Cape Verd Islands; and the Isles of St. Helena, Ascension, St. Matthew, and St. Thomas.

4. What countries lie in the south temperate zone?

Answ. The southern part of Africa and New Holland; New Zealand; and the south part of South America.

5. What countries are situated in the south frigid zone?

Answ. No land has yet been discovered within the south polar circle, though it was long supposed that a large continent was situated there, which was called *Terra Australis Incognita.* Our celebrated navigator, Cook, made many attempts to penetrate the icy fields, which abound in these seas, in search of this imaginary continent, but without success, he having penetrated no further than 72 degrees.

PROBLEM XXIV.

A place being given in the torrid zone, to find those two days of the year in which the sun is vertical to that place.

BY THE GLOBES.

1. Bring the given place to the meridian, and find its latitude.

2. Mark the degree of latitude, and, turning the globe round, observe the two points of the ecliptic that pass under this mark.

3. Look upon the calendar for the days corresponding to these points,—which days will be the answer required.

Otherwise by the analemma drawn upon the globe.

1. Find the latitude of the given place, and bring the analemma to the meridian.

2. Then, directly below this latitude, will be found, on the analemma, the two days required.

WITHOUT THE GLOBE.

1. Find the latitude, either from a table of latitudes and longitudes, or from maps.

2. Observe in White's Ephemeris, or in Table II. at the end of this work, on what two days of the year, the sun's declination is equal to the latitude, and of the same name with it: these are the days required.

The example to this problem may be proved by the following method. Find how many days there are from the time when the sun is vertical to the nearest solstice, and also how many there are from that solstice to the time when it is vertical again: if the number of days be equal, the solution is right.

EXAMPLES.

On what days is the sun vertical to the following places?

1. Otaheite? — — *Answ.* Jan. 30 and Nov. 11.
2. Rio Janeiro? — — —— Jan. 2 Dec. 9.
3. St. Helena?
4. Batavia?
5. Bencoolen?
6. Quito?
7. Borneo?
8. Pelew Islands?
9. Sierra Leone?
10. Tobago?
11. Port Royal?
12. Bombay?
13. Canton?
14. Friendly Isles?
15. Trincomale?
16. Guadaloupe?
17. Porto Bello?
18. Vera Cruz?
19. Tinian Isle?
20. Manilla?

The first of the above examples performed without the globe.

The latitude of Otaheite is about 17½ S. Look in White's Ephemeris, or in Table II. at the end of the book, for those two days on which the sun's declination is 17½ S. and they will be foundto be about Jan. 30, and Nov. 11. The sun varies so little in declination in one day, that it will be nearly vertical for three or four days.

Proof of the example.—From Nov. 11th to Dec. 21st are 40 days,—and from Dec. 21st to Jan. 30th are 40 days; hence the number of days from the time when the sun is vertical, to the nearest solstice, is equal to the number of days from that same solstice to the time when the sun is again vertical.

PROBLEM XXV.

To find all those places in the torrid zone to which the sun is vertical on a given day.

BY THE GLOBE.

1. Find the sun's place for the given day, bring it to the meridian, and mark the declination.

2. Turn the globe round, and all those places which pass under that mark of the meridian, will have the sun vertical on the given day.

BY THE ANALEMMA.

Bring the day of the month, marked upon the analemma, to the brazen meridian, and mark the declination: then the places will be found as above.

BY MAPS.

1. Find the sun's declination for the given day.

2. In a map of the world, find all those places whose parallel of latitude is the same as the declination,—and these will be the places required.

EXAMPLES.

1. To what places is the sun vertical on November 10th?

Answ. To Otaheite, the Great Cyclades, and New Hebrides, in the South Sea; Cape Grafton, in New South Wales; the Island of Madagascar; Monomotapa and Mataman, in Africa; Punta Gorda, in Brazil; and the southern parts of Amazonia and Peru, in South America.

2. To what places is the sun vertical on February 2d?

Answ. To the same as in the last example.

3. To what places is the sun vertical on the 16th of April and 28th of August?

4. To what places is the sun vertical at the summer solstice?

5. To what places is the sun vertical March 20th and September 23d?

6. To what places is the sun vertical May 16th and July 29th?

7. To what places is the sun vertical at the winter solstice?

8. To what places will the sun be vertical on May 1st?

PROBLEM XXVI.

The day and hour at any place being given, to find where the sun is then vertical.

BY THE GLOBE.

1. Find by Problem XVI. the sun's declination, and also by Problem XIV. those places where it is noon at the given time.

2. Of those places where it is noon, that place will have the sun vertical, whose latitude is the same as the sun's declination.

WITHOUT THE GLOBE.

Find the sun's declination from Table II. and, by Problem XIV. the longitude of those places where it is noon at the given time: thus are obtained the latitude and longitude of the place required.

EXAMPLES.

1. To what place is the sun vertical, when it is 39 min. past 6 *a. m.* at London, August 18th?

Answ. Madras.

Performed without the globe.

On Aug. 18th the sun's declination is 13° N. which is the latitude; and 5 hrs. 21 min. (the time it wants to be noon at London) reduced to degrees, gives the longitude, 80° 15′ E. This is found to answer to Madras, as may be seen on any map of Asia.

2. To what place is the sun vertical on the 24th of October, when it is 29 min. past 7 *p. m.* at Jerusalem?

Answ. To Lima.

On Oct. 24th the sun's declination is about 12° S.; and 7 hrs. 29 min. reduced to degrees, gives 112° 15′, which is the difference of longitude between Jerusalem and the place where it is noon; and this place must lie to the west, it being afternoon at Jerusalem: hence subtract the longitude of Jerusalem, 55° 25′, from 112° 15′, the remainder, 76° 50′, is the longitude of the place, and is west.

Having the times given at the following places, where is the sun then vertical?

DAY.		HOUR.	
3. September	23,	6 50 *a. m.*	at Bagdad?
4. August	1,	5 0 *p. m.*	Bristol?
5. April	30,	1 53 *p. m.*	Amsterdam?
6. June	21,	Noon.	Canton?
7. September	9,	6 30 *a. m.*	Jerusalem?
8. March	5,	0 30 *p. m.*	Canton?
9. May	4,	8 10 *a. m.*	Vienna?

DAY.		HOUR.	
10. May	20,	11 43 *p. m.*	Calicut?
11. January	1,	6 0 *p. m.*	Mexico?
12. February	12,	9 0 *a. m.*	Dublin?
13. July	28,	5 16 *p. m.*	Port Royal?
14. March	11,	6 10 *a. m.*	Malta?
15. December	9,	3 0 *p. m.*	London?
16. September	2,	3 0 *a. m.*	London?
17. November	6,	1 37 *p. m.*	C. of Good Hope?
18. July	28,	8 15 *a. m.*	Vienna?
19. December	21,	1 56 *a. m.*	London?

PROBLEM XXVII.

A place being given in the north frigid zone, to find when the sun begins to appear above the horizon, and when to disappear; also the length of the longest day and night.

BY THE GLOBE.

1. Elevate the globe for the latitude, and bring the ascending signs to the south point of the horizon: observe what degree of the ecliptic is cut by that point, and find, on the calendar, the day of the month answering to that degree; this will be the time of the sun's beginning to appear above the horizon at the given place; which is the end of the longest night.

2. Bring the descending signs to the south point of the horizon, and the day in the calendar, answering to the degree of the ecliptic cut by this point, will be that on which the sun disappears; which is the beginning of the longest night.

3. Bring the ascending signs to the north point of the horizon; and the degree of the ecliptic, noted as above,

will shew when the sun begins to shine continually; which is the beginning of the longest day.

4. Bring the descending signs to the same point, and in the same manner it will be found when the sun ceases to shine continually, or the end of the longest day.

5. From the end of the longest night to the beginning of the longest day, and from the end of the longest day to the beginning of the longest night, the sun rises and sets daily.

BY THE ANALEMMA.

1. Elevate the globe for the latitude, and bring the analemma to the south point of the horizon.

2. Then the two days of the month on the analemma cut by the horizon, will be the beginning and end of the longest night.

3. Bring the analemma to the north point of the horizon, and you will find in the same manner the beginning and end of the longest day.

WITHOUT THE GLOBE.

1. Subtract the latitude of the place from 90°; the remainder is called the *co-latitude*.

2. The sun being in the ascending signs, find, in Table II. at the end of this book, or in White's Ephemeris, on what day its declination is equal to the co-latitude, but of a *contrary* name; this will be the day on which the sun first appears above the horizon: find the same when the sun is in one of the descending signs: and this will be the day in which the sun entirely disappears.

3. Find, in the same manner, the two days when the sun's declination is equal to the co-latitude, and of the

same name with it: the one will be the beginning, and the other the end, of the longest day.

EXAMPLES.

1. Whale Island, discovered by Mackenzie, lies in lat. 69° 14′ N.; required the time when the sun first appears above the horizon, and when it disappears; also the length of the longest day and night there.

90°	0′	
69	14	N.
20	46	co-latitude.

The two days on which the sun's declination is 20° 46′ S. (of a contrary name to the latitude) are Jan. 17th and Nov. 25th; the former is the day on which the sun first appears above the horizon, the latter that on which it disappears.

The two days in which the sun's declination is 20° 46′ N. (of the same name with the latitude) are May 24th and July 20th; the former is the beginning, and the latter the end, of the longest day.

Hence, at Whale Island, the sun first appears Jan. 17th, and rises and sets daily till May 24th,—a space of 127 days: it continues above the horizon from May 24th to July 20th; therefore the longest day there is equal to 57 natural days. From July 20th it rises and sets daily till Nov. 25th, 127 days, and never rises again till Jan. 17th; its longest night is therefore equal to 53 days.

2. When does the sun begin to appear above the horizon at North Cape, in Lapland, lat. 72° N.; when does it disappear; and how many days are the inhabitants without seeing the sun?

Answ. The sun appears Jan. 26, and rises and sets daily till May 15; after which time it continues above the horizon till July 29; then it rises and sets daily till Nov. 16, when it entirely disappears till Jan. 26; the length of the longest night is therefore equal to 71 days.

3. When does the sun begin to appear above the horizon of South Cape, in Spitzbergen, lat. 76° N.; when does it begin to disappear; and what is the length of the longest day there?

4. The most northerly land discovered are seven islands, called the *Seven Sisters*, that lie to the north of Spitzbergen, in lat. 81° N. Captain Phipps, in his voyage towards the North Pole, was so completely surrounded with ice at this place, that he and all the ship's company were for some time under the dreadful apprehension of being obliged to pass the winter here. How long would they have been without seeing the sun?

5. What is the length of the longest day at the North Pole?

6. In 1819–20, Captain Parry wintered at Melville Island, in the Polar Sea, lat. 75°; how many days were he and his men deprived of the light of the sun?

PROBLEM XXVIII.

To find in what latitude, in the north frigid zone, the sun begins to shine, without setting, on any given day.

Find the sun's declination on the given day, subtract it from 90°, and the remainder will be the latitude required.

The given day must be between March 21st and June 21st.

In the same manner it may be found in what latitude, in the south frigid zone, the sun begins to shine, without setting, on any given day between Sept. 23d and Dec. 21st.

EXAMPLES.

1. In what latitude does the sun begin to shine, without setting, on April 23d? *Answ.* 77° 31′ N.

2. In what latitude does the sun begin to shine, without setting, May 15th? *Answ.* 71° 1′ N.

3. In what latitude does the sun begin to shine, without setting, June 1st?

4. In what latitude does the sun begin to shine, without setting, June 21st?

5. In what latitude does the sun begin to shine, without setting, April 2d?

6. Where does the sun begin to shine, without setting, on Nov. 5th?

7. Where does it begin to shine, without setting, on Dec. 1st?

PROBLEM XXIX.

Having the length of the longest day in any place, to find the latitude of that place, or to find the limits of the hour climates.

BY THE GLOBE.

1. Bring the first of cancer to the meridian, and set the index to 12.

2. Turn the globe westward till the index point to the hour of setting, which is equal to half the length of the day.

3. Raise or depress the pole, till the sun's place is observed to be exactly in the western horizon; then will

the elevation of the pole be equal to the latitude of the place.

By this problem it may be found in what latitude any day is of a given length, by bringing the sun's place for the given day to the meridian, and proceeding as above.

If Adams's globes be made use of, the globe must be turned eastward till the index point to the hour of setting, and the sun's place brought to the eastern side of the horizon.

The examples in this problem may be proved by Problem XVIII.

EXAMPLES.

1. In what latitude is June 21st, 16 hours long?

Answ. Lat. 49° N.

2. In what latitude is June 21st, 18 hours long?

Answ. Lat. 58½° N.

3. In what latitude is Dec. 1st, 14 hours long?

Answ. Lat. 32° 46′ S.

4. In what latitudes is January 21st?

5 hours long?	10 hours?	16 hours?
7 hours?	12 hours?	18 hours?

5. In what latitudes is February 20th?

7 hours long?	11 hours?	15 hours?

6. In what latitudes is May 15th, or July 29th?

6 hours long?	9 hours?	14 hours?	18 hours?

7. What are the limits of the hour climates?

In performing this problem, it is only necessary to find in what latitude June 21st is 12½ hours long; this will be the end of the first climate: then in what latitude it will be 13 hours; this will be the end of the second climate: and so on, increasing half an hour for every new climate. In this manner may the limits of the climates be determined, as in the following table, taken from Guthrie's Geography; but it must be observed, that in high latitudes, where the difference between each climate is small, great accuracy cannot be attained by the globe.

A TABLE OF HOUR CLIMATES.

Clim.	*Longest day.*		*Latitude.*		*Breadth.*	
1	12 h.	30 m.	8°	25′	8°	25′
2	13	0	16	25	8	0
3	13	30	23	50	7	25
4	14	0	30	25	6	30
5	14	30	36	28	6	8
6	15	0	41	22	4	54
7	15	30	45	29	4	7
8	16	0	49	1	3	32
9	16	30	52	0	2	57
10	17	0	54	27	2	29
11	17	30	56	37	2	10
12	18	0	58	29	1	58
13	18	30	59	58	1	29
14	19	0	61	18	1	20
15	19	30	62	25	1	7
16	20	0	63	22	0	52
17	20	30	64	6	0	44
18	21	0	64	49	0	43
19	21	30	65	21	0	32
20	22	0	65	45	0	26
21	22	30	66	6	0	19
22	23	0	66	20	0	14
23	23	30	66	28	0	8
24	24	0	66	31	0	3

Countries and towns in the hour climates, north of the equator.

Within the first climate lie the Gold and Silver Coasts, in Africa; Malacca, in the East Indies; Cayenne and Surinam, in Terra Firma, South America.

In the second lie Abyssinia, in Africa; Siam, Madras, and Pondicherry, in the East Indies; the Strait of Darien, between North and South America; Tobago, the Grenades, St. Vincent, and Barbadoes, in the West Indies.

The third contains Mecca, in Arabia; Bombay, part of Bengal, in the East Indies; Canton, in China; Mexico, Bay of Campeachy, in North America; Jamaica, Hispaniola, St. Christopher's, Antigua, Martinique, and Guadaloupe, in the West Indies.

4. Egypt, and the Canary Isles, in Africa; Delhi, capital of the Mogul Empire, in Asia; Gulf of Mexico, and East Florida, in North America; and Havannah, in the West Indies.

5. Gibraltar, in Spain; part of the Mediterranean Sea; the Barbary Coast, in Africa; Jerusalem; Ispahan, capital of Persia; Nankin, in China; California, New Mexico, West Florida, Georgia, and the Carolinas, in North America.

6. Lisbon, Madrid, Minorca, Sardinia, and part of Greece; Asia Minor, part of the Caspian Sea, Samarcand, Pekin, Corea, and Japan; Williamsburgh, in Virginia,—Maryland and Philadelphia, in North America.

7. Northern provinces of Spain; southern ditto of France; Turin, Genoa, and Rome; Constantinople, the Black Sea, the Caspian Sea, and part of Tartary; New York and Boston, in North America.

8. Paris and Vienna; New Scotland, Newfoundland, and Canada, in North America.

9. London, Flanders, Prague, Dresden, Cracow, the southern provinces of Russia, part of Tartary, and the north part of Newfoundland.

10. Dublin, York, Holland, Hanover, Warsaw, and Tartary; Labrador, and New South Wales, in North America.

11. Newcastle, Edinburgh, Copenhagen, Moscow.

12. South part of Sweden, Tobolski.

13. Orkney Isles, Stockholm.

14. Bergen, Petersburgh.

15. Hudson's Strait, North America.

16. Siberia, and the south part of Greenland.

17. Drontheim, in Norway.

18. Part of Finland, in Russia.

19. Archangel, on the White Sea.

20. Hecla, in Iceland.

21. Northern parts of Russia and Siberia.

22. New North Wales, in North America.

26. Davis's Strait, in North America.

24. Samoieda.

PROBLEM XXX.

To find the latitudes of those places in the frigid zone, where the sun does not set for a given number of days; or to find the limits of the month climates.

BY THE GLOBE.

1. Take half the number of the given days, and count so many degrees from the first of cancer towards the equinoctial point.

2. Bring the point, thus arrived at, to the brass meridian, and observe the degree cut by it.

3. Subtract this from 90°, and the remainder will be the latitude of the place.

The above method is not perfectly correct, because the sun does not advance one degree in the ecliptic every day, but takes 365¼ days to move through the whole 360 degrees in the ecliptic.

EXAMPLES.

1. In what latitude does the sun shine continually for 50 days? *Answ.* 69°.

2. In what latitude does the sun shine continually for the space of 76 days? *Answ.* 71° 30′.

3. Required the limits of the month climates.

Answ. Their limits are found as in the following table, each month being reckoned 30 days.

MONTH CLIMATES.

Clim.	*Longest day.*	*Latitude.*	
1	1 month.	67°	21′
2	2 months.	69	48
3	3 months.	73	37
4	4 months.	78	30
5	5 months.	84	5
6	6 months.	90	0

Countries in the month climates.

1. North part of Lapland.
2. West Greenland.
3. South part of Nova Zembla.
4. North part of ditto.
5. Spitzbergen.
6. Unknown.

QUESTIONS FOR EXAMINATION IN SECTION V.

Into how many zones is the earth divided?

What are the boundaries of the torrid zone?

What is its breadth?

How are the two temperate zones situated?

What is the breadth of each?

Which of the zones contains the greatest number of square miles?

What lines are the boundaries of the frigid zones?

In which of the zones does the sun rise and set daily?

In which does it not set for a certain number of days in summer, or rise for a certain number of days in winter?

What is meant by the sun's being vertical?

In which of the zones is the sun vertical twice a year?

At what hour of the day is the sun vertical to any place?

How often in the year is the sun vertical to places in the north temperate zone?

How often is the sun vertical at the tropics?

To what tropic is the sun vertical on June 21st?

At what tropic is the sun vertical on December 22d?

Why is the sun never vertical to places that are not in the torrid zone?

Into how many climates did the ancients divide the earth?

How many of these are called hour climates, and how many month climates?

What places lie in the north temperate zone? What places are situated in the north frigid zone? Name the countries in the torrid zone. What countries are in the south temperate zone? Name the countries in the south frigid zone.

How is it found on what two days of the year the sun is vertical to any place in the torrid zone? How is this found without the globe? How may the examples be proved?

How are the places found to which the sun is vertical on any given day? Having the day and hour given, how is it found where the sun is then vertical? A place being given in the north frigid zone, how is it found when the sun begins to appear above the horizon, and when it begins to disappear; also, the length of the longest day and night?

How is this found without the globe?

On any given day between the vernal equinox and summer solstice, how is it found in what latitude in the north frigid zone the sun begins to shine without setting?

What is the rule for finding the limits of the hour climates? How are the limits of the month climates found?

QUESTIONS FOR EXERCISE IN SECTION V.

1. To what places will the sun be vertical on April 9th?
2. Where will the sun be vertical on March 12th?
3. Where will it be vertical on August 15th?
4. When will the sun pass vertically over Surinam?
5. When will the sun pass vertically over the islands of Ascension, Mauritius, and Guam?
6. On what two days in the year will a person at St. Christopher's have no shadow at noon?
7. To what place will the sun be vertical on January 31st, when it it 9 in the morning at Newcastle?
8. On June 14th, when it is ½-past 8 in the morning at Newcastle, where is the sun vertical?

9. To what place will the sun be vertical on July 12th, when it is 9 in the evening at Jerusalem?

10. Where is the sun vertical on the 26th of June, when it is 7 in the morning at London?

11. Where is the sun vertical on July 10th, when it is 2 in the morning at Quebec?

12. Where is the sun vertical on Christmas-day, when it is midnight at Petersburgh?

13. Where is the sun vertical on November 10th, when it is 6 in the evening at Ormus?

14. Is the sun ever vertical at Jerusalem?

15. Is the sun ever more than 24 hours above the horizon at Archangel?

16. Suppose a person to pass the winter in 77° N. latitude, how long would he be without seeing the sun?

17. In what latitude does the sun begin to shine, without setting, on May 1st?

18. At what latitude does the first of the month climates commence?

19. In what latitude is the sun not seen for 50 days during winter?

20. In what latitude does the sun not set for 30 days?

21. In what latitude is the length of the longest day equal to 61 natural days,—92 days,—4 months and 10 days?

22. What are the places to which the sun begins to be constantly above or below the horizon on the 20th of May and 1st of November?

23. At what places will the sun be vertical, 20th May,—21st January?

24. What are the two days when the sun is vertical at Barbadoes?

SECTION VI.

DEFINITIONS.

1. A *right* or *direct sphere* is that which has the poles in the horizon, and the equator and all the parallels of latitude perpendicular to it.

2. An *oblique sphere* is that which has one of the poles elevated above the horizon less than 90 degrees, and the other depressed below it; the equator and parallels of latitude form, with the horizon, oblique angles.

3. A *parallel sphere* is that which has the equator in the horizon, and the poles in the zenith and nadir.

4. *Twilight* is that medium between light and darkness which happens in the morning before sun-rise, and in the evening after sun-set.

5. The *crepusculum* is a small circle parallel to the horizon, and 18° below it, where the twilight begins and ends.

In Adams's globes it is marked out by a wire circle, fixed 18° below the horizon.

OF TWILIGHT.

As soon as the sun comes within 18° of the horizon, its rays strike the higher parts of the atmosphere, and, being refracted and reflected to every part, occasion that agreeably gradual transition from darkness to light, called *twilight*.

In the same manner in the evening, after the sun sets, its rays strike upon the higher parts of the atmosphere, until it is more than 18° below the horizon: this prevents us from being suddenly deprived of the light of the sun.

The benefits of twilight are obvious. A change so great, as from the darkness of midnight to the splendour of noon-day, would probably be injurious to the sight; and it would be unpleasant to all, and in many cases very dangerous to travellers, to be involved in darkness without timely notice of its approach.

In all countries situated near the equator, twilight is of much shorter duration than it is in countries of high latitudes; for at the equator the sun rises and sets perpendicularly,—but to places at a great distance from the equator it rises and sets very obliquely; and hence it requires a longer time to go 18° below the horizon.

At the latitude of 49° N. twilight continues the whole night on June 21st; and, at places still farther north, it continues the whole night, for a certain number of days before and after the summer solstice. At London there is no total darkness from May 28th till July 20th.

Twilight continues, at the north pole, from September 22d, when the sun sets, to November 12th,—a space of 51 days. Twilight first appears again there about the 30th of January, and continues till sun-rise on March 21st. Thus, though the inhabitants (if any) at the north pole never see the sun for 6 months, yet, out of that time, they have twilight for 14 weeks. The time that they receive no light from the sun is only 12 weeks; and, during that time, the moon is 6 weeks above the horizon.

In this section it is attempted to show, by the globe, the cause of day and night, and also the cause of the variety of the seasons, by elevating the globe, first for the equinoxes, then for the summer and winter solstices. The next problem shows where the sun is rising and setting, and where it is noon and midnight at any time. Then follow two problems on the twilight; the first to find at what places it is twilight at any given time,—the next to find the duration of twilight on any given day, at any given place. By the last problem it may be seen at what places an eclipse of the moon will be visible.

PROBLEM XXXI.

To shew, by the globe, the cause of day and night.

The sun, shining upon the earth, illuminates only that half of it which is turned towards him; whilst the other half, being turned from him, is in darkness.

But, as the earth turns round on its axis, from west to east, once in 24 hours, every meridian upon the earth will, in that time, successively enjoy the light of the sun, and be deprived of it.

Having elevated the globe for the sun's declination, so that the sun may be in the zenith, the horizon will be the terminator, or boundary circle, of light and darkness; that half of the earth which is above the horizon being in the light, and that half which is below the horizon being in darkness.

Suppose, now, a patch to be put upon a globe to represent any place, and the globe to be turned round from west to east; when the place comes to the western side of the horizon, the sun appears to the inhabitants of that place to be rising in the east; but it is more properly the inhabitants of that place rising in the west. Continue to turn the globe round, and the place will ascend higher towards the meridian, which causes the sun to appear to ascend towards the meridian in a contrary direction.

When the place has arrived at the meridian, it will then be noon there, and the sun will be at his greatest altitude for that day.

As you continue to turn the globe, the place will gradually recede from the meridian, and descend towards the eastern horizon,—which will cause the appearance of the sun descending towards the west. When the place has arrived at the eastern horizon, as it is then going below the terminator, or boundary of light and darkness, the sun will appear to be setting in the west.

The place having gone below the horizon, and being now at a greater distance than 90° from that point where the sun is vertical, is deprived of his light, and continues in darkness till, by the revolution of the earth, it arrives again at the western horizon,—when the sun will appear to rise as before.

It is evident that the sun will be rising at the same instant of time to all places that are on the western side of the horizon, and that it will be setting at the same time to all places that are on the eastern side of the horizon.

PROBLEM XXXII.

To shew, by the globe, the cause of the variety of the seasons.

It may be seen, at any time, in what manner the globe is cut by the circle of light and darkness, by making the horizon to represent it. The sun's rays extending to the distance of 90° from the point to which he is vertical, when the sun is in the equinoctial, the boundary circle will pass through the poles, each being 90° distant from the equator; hence, when the sun is in the equator, that the horizon may be made to represent the terminator, or boundary circle of light and darkness, the poles must be made to coincide with it.

When the sun is in the tropic of cancer, being $23\frac{1}{2}^{\circ}$ farther to the north than before, his rays will extend $23\frac{1}{2}^{\circ}$ beyond the north pole on the opposite meridian? but they will not reach the south pole by $23\frac{1}{2}^{\circ}$, that is, they will extend only to the antarctic circle, being 90° distant from tropic of cancer: hence, to make the horizon the terminator in this case, the north pole must be elevated $23\frac{1}{2}^{\circ}$ above the horizon.

When the sun is in the tropic of capricorn, the reverse of this will take place; that is, the sun's rays will extend $23\frac{1}{2}^{\circ}$ beyond the south pole on the opposite meridian, but will extend only as far north as the arctic circle: hence, to make the horizon the terminator in this case, the south pole must be elevated $23\frac{1}{2}^{\circ}$ above the horizon.

We shall now proceed to place the globe in these three several positions.

1.—*To place the globe in the same situation as the earth is at the time of the equinoxes.*

Having brought both poles to coincide with the horizon, the equator and all the parallels of latitude will make right angles with the horizon; and the globe, in this position, is called a *right sphere.*

The equator, as well as the parallels of latitude, are cut into two equal parts by the horizon; hence the days and nights are then equal at all places.

This will be exemplified by taking three places that have the same longitude, but different latitudes:—Suppose London, a place upon the equator having the same meridian with London, and the antoeci of London. Put a patch upon each of these three places, bring them to the brass meridian, and set the index to 12 o'clock.

In performing this problem, make use of that row of figures on the hour circle which increases towards the *west*.

Turn the globe till they come to the western horizon, and the index will then be at 6 o'clock *a. m.* which will be the hour of the sun's rising.

Continue to turn the globe from west to east till the places have arrived at the eastern horizon, and the index will now point to 6 o'clock *p. m.* the time of the sun's setting; hence the length of the day to London, to the antoeci of London, as well as to the place upon the equator, will be 12 hours; and the case will be the same, whatever may be the latitude of the places fixed upon. But two places that are in opposite hemispheres can never have their days of the same length, except when the days and nights are equal in all parts of the world; therefore the days and nights are then equal in all places.

In turning the globe round, it will be observed, that all places upon the same meridian come to the horizon at the same time; hence, in a right sphere, the sun will rise at the same time to all places that have the same longitude.

II.—To place the globe in the same situation with respect to the sun, as the earth is at the time of the summer solstice.

The sun's declination being $23\frac{1}{2}°$ N. the north pole must be elevated so many degrees above the horizon.

Neither the equator, nor any of the parallels of latitude, will now be perpendicular to the horizon, but will form with it oblique angles; hence the globe, in this position, is called an *oblique sphere*.

The equator will still be cut into two equal parts by the horizon; but all the parallels of latitude will be cut into two unequal parts by it.

Of all the parallels in the northern hemisphere, more than one-half will be above the horizon; and the farther any parallel is distant north of the equator, the greater proportion of it will be above the horizon, till you arrive at the arctic circle, the whole of which will be above the horizon.

Of those parallels in the southern hemisphere, less than one-half will be above the horizon; and the farther any parallel is distant south of the equator, the smaller proportion of it will be above the horizon, till you arrive at the antarctic circle, the whole of which will be below the horizon.

Those parts of the parallels that are above the horizon at any time are called *diurnal arcs,* expressing the length of the day at that time; those parts that are below are called *nocturnal arcs,* expressing the length of the night: hence, at the equator, the diurnal and nocturnal arcs being equal, the days and nights are equal: north of the equator the diurnal being greater than the nocturnal arcs (and the more so in proportion to their distances from the equator), the days there are longer than the nights; and the greater the latitude the longer the day. No part of the parallels north of the arctic circle go below the horizon: this shews that, within the north frigid zone, they have then no night.

South of the equator, the diurnal being less than the nocturnal arcs (and the farther from the equator the greater the inequality), the days there are shorter than the nights; and the greater the latitude the shorter the day.

No part of the parallels south of the antarctic circle will be above the horizon; hence, within the south frigid zone, they have then no day.

This will be further exemplified, if we fix upon the same places as in the last problem, and also take two others, having the same longitude, one in the north, and the other in the south, frigid zone; bring them all to the brass meridian, and set the index to 12 o'clock; on turning the globe from west to east, it will be seen that the place in the north frigid zone never goes below the horizon. Of the other places, that will appear first upon the horizon, whose latitude north is greatest; the index will point out the hour. When the place upon the equator comes to the horizon, the index will be at 6 o'clock. The place marked for the antoeci of London will be much later in coming to the horizon; and the place in the south frigid zone will never appear above it.

All the places will come to the brass meridian at the same time; but, on continuing to turn the globe eastward, it will be seen that the place which appeared last on the western horizon will descend the soonest below the eastern; and that the place which ascended first above the western, is the last in descending below the eastern horizon.

Thus it is manifest, that, at the summer solstice, there is no night in the north frigid zone; the days are longer than the nights to all places in the northern hemisphere; at the equator the days and nights are equal; to all places in the southern hemisphere the nights are longer than the days; and in the south frigid zone there is continual night.

III.—To place the globe in the same situation, with respect to the sun, as the earth is at the time of the winter solstice.

The sun's declination being $23\frac{1}{2}°$ S. the south pole must be elevated so many degrees above the horizon.

The equator and parallels of latitude will form oblique angles with the horizon, as before; and hence the globe, in this position, is still called an *oblique sphere.*

The equator will still be cut into two equal parts by the horizon, but all the parallels will be cut into two unequal parts, though in a manner the reverse of what they were before. More than one-half of each of the parallels in the southern hemisphere will be above the horizon, and more than half of each of those in the northern below it. The whole of the antarctic circle will be above the horizon, and the whole of the arctic below it.

The same places being fixed upon as before, on turning the globe from west to east, it will be seen that the place in the south frigid zone never goes below the horizon. Of the other places, that will appear first upon the western horizon, whose latitude south is greatest; the place upon the equator will appear at the same time as before, viz. 6 o'clock; London will appear last; and the place in the north frigid zone will never appear at all above the horizon. Their order of going below the horizon will be the same as before; i. e. that place which rose last will set first, and that place which rose first will set last.

Thus it is manifest, that, at the winter solstice, there is no night in the south frigid zone; the days are longer than the nights to all places in the southern hemisphere, but shorter to those in the northern; at the equator the days and nights are equal, as before; and in the north frigid zone it is continually night.

PROBLEM XXXIII.

Having the hour given at any place, on any given day, to find where the sun is rising, where it is setting, where it is noon, and where it is midnight.

Find, by Problem XXVI. the place to which the sun is then vertical; elevate the globe for that place, and bring it to the meridian.

Then, to all those places in the western semicircle of the horizon, the sun is rising; to those under the upper semicircle of the meridian it is noon; to all places in the eastern semicircle of the horizon the sun is setting; and to those under the lower semicircle of the meridian it is midnight.

EXAMPLES.

1. At what places is the sun rising on June 4, when it is 4 *p. m.* at London?

Answ. At the north-east part of Siberia; at Kamtschatka; at the most westerly of the Sandwich Isles; and the most easterly of the Society Isles.

Where is it noon at the same time?

Answ. At Baffin's Bay, New Britain, Martinico, Trinidad, and the middle part of South America.

At what places is the sun then setting?

Answ. At Tobolsk, the Caspian Sea, Desert of Arabia, the middle of the Red Sea, Abyssinia, the unknown parts of Africa, and the country of the Hottentots.

At what places is it midnight at that time?

Answ. At Chinese Tartary, the east part of China, the Philippine Isles, and the western part of New Holland.

2. On April 27th, 6 hrs. 45 min. *a. m.* at Newcastle, required the places to which the sun is rising and setting: also where it is noon and midnight.

Answ. Rising—Greenland, the Azores, Cape Verd Isles, Ascension Isle.

Setting—Fox Islands, Queen Charlotte's Islands, eastern coast of New Holland.

Noon—Middle of Siberia, middle of the western Peninsula of India.

Midnight—Middle of North America, Mexico.

3. To what places is the sun rising and setting July 27, when it is 2 hrs. *a. m.* at Pico (Azores); and where is it noon and midnight at the same time?

4. May 24, 8 o'clock *p. m.* at Newcastle, where is the sun rising and setting, and where is it noon and midnight?

5. At what places is the sun rising and setting, and where is it noon and midnight, when it is 10 *p. m.* at Botany Bay on August 15th?

6. On April 4th, when it is 6 *a. m.* at Edinburgh, where is it noon and midnight, and where is the sun rising and setting?

7. On June 9th, when it is 3 *a. m.* at Glasgow, where is it noon and midnight, and where is the sun rising and setting?

PROBLEM XXXIV.

To find at what place it is twilight at any given time.

1. Find where the sun is then vertical, and elevate the globe for that place.

2. Observe what places are less than 18° below the horizon; to those below the western semicircle it is twilight in

the morning, and to those below the eastern semicircle it is twilight in the evening.

Otherwise.—Elevate the globe for the antipodes of the place to which the sun is then vertical, and observe what places are within less than 18° above the horizon.

EXAMPLES.

1. On March 10th, when it is 11 *p. m.* at New Orleans, where is it twilight?

Answ. Morning twilight—Great Britain, France, middle of Africa.

Evening twilight—Society and Sandwich Isles, Alashka.

2. When it is 6 hrs. 45 min. *a. m.* at Newcastle on April 27th, where is it twilight?

Answ. Morning—Labrador, Newfoundland.

Evening—Alashka, New Hebrides, New Caledonia, part of New Zealand.

3. Where is it twilight, when it is 3 o'clock *p. m.* at London, on June 4th?

4. On September 25th, when it is 10 *p. m.* at Trinidad, where is it twilight?

5. On December 16th, when it is noon at Easter Island, where is it twilight?

6. On April 4th, when it is 6 *a. m.* at Edinburgh, where is it twilight?

7. On June 9th, when it is 3 *a. m.* at Glasgow, where is it twilight?

PROBLEM XXXV.

To find the duration of twilight at any place, on any given day.

1. Elevate the globe for the latitude of the place, bring the sun's place to the meridian, and set the index to 12.

2. Turn the globe till the sun's place be just 18° below the horizon, and the index will shew the beginning of twilight; or that point in the ecliptic, opposite to the sun's place, may be brought 18° above the western horizon, and the index will shew the beginning of twilight.

3. Subtract the commencement of twilight from the time of the sun's rising (which may be found as in Problem XVIII.), and the remainder will be the duration of twilight.

BY ADAMS'S GLOBES.

Having rectified the globe, bring the sun's place 18° below the *western* horizon, and the index will shew the beginning of twilight.

EXAMPLES.

How long does twilight continue at London on the following days? *Answers.*

1. March 2d ? - - - -	1 hr.	50 min.
2. June 21st ? - - - -	No night.	
3. September 25th ? - - -	2	0
4. December 26th ? - -	2	10

How long does twilight continue to the following places on March 21st?

5. Cape of Good Hope ?
6. Quito ?
7. Jerusalem ?
8. Vienna ?
9. Petersburg ?

How long will twilight continue to the following places on June 21st?

10. Cape Horn?
11. Gilolo Isle?
12. Formosa Isle?
13. Pekin?
14. Petersburg?

PROBLEM XXXVI.

To find at what places an eclipse of the moon is visible.

1. Find, by Problem XXVI. the place to which the sun is vertical at the given time.

2. Elevate the globe for the antipodes of that place, and bring the antipodes to the meridian: then, to all the places which are above the horizon, the eclipse will be visible.

At an eclipse of the moon, the sun and moon are in opposite points of the ecliptic; and the place to which the moon is then vertical is the antipodes of that to which the sun is vertical.

EXAMPLES.

1. On May 10th, 1808, there was a total eclipse of the moon when it was eight o'clock in the morning at Greenwich; where was it visible?

Answ. North and South America, the islands in the Pacific Ocean, eastern coast of New Holland.

2. On April 30th, 1809, there was an eclipse of the sun, when it was 1 *a. m.* at London; where was it visible?

3. In 1811, March 10th, there was an eclipse of the moon, when it was 6½ hours *a. m.* at London; where was it visible?

4. On August 22d, 1812, there was an eclipse of the moon, when it was 3 *p. m.* at London; where was it visible?

5. If there be any eclipses of the moon this year, find where they will be visible.

QUESTIONS FOR EXAMINATION IN SECTION VI.

What is a right or direct sphere? What is an oblique sphere? What is a parallel sphere? What is it that produces twilight? In what countries is twilight of the shortest duration? In what latitude does twilight continue the whole night on June 21st? How long does twilight continue the whole night at London, and places of the same latitude as London?

What is it that occasions the vicissitude of day and night?

How far do the sun's rays extend from the point to which he is vertical?

How is the globe placed in the same situation as the earth at the time of the equinoxes?

How is the globe placed in the same situation as the earth at the time of the summer solstice?

How is the globe placed in the same situation as the earth at the time of the winter solstice?

How is it found where the sun is rising, where it is setting, where it is noon, and where it is midnight, at any given place and time?

How is it found where it is twilight at any given time?

How is the duration of twilight found at any place on any given day?

How is it found where an eclipse of the moon is visible?

QUESTIONS FOR EXERCISE IN SECTION VI.

1. Where is the sun rising and setting, and where is it noon and midnight, on June 14th, when it is 9 o'clock in the morning at Newcastle? Where is it twilight at the above time and place?

2. Required the same when it is 7 in the evening at Lima on June 21st; and where it is twilight then.

3. Required the same when it is 3 in the morning at St. Paul's Island on February 20th: and at what places it is then twilight.

4. How long will twilight continue at York on May 1st?

5. How long will twilight continue at Gibraltar on June 4th?

6. How many eclipses of the moon will happen this year, and to what places will they be visible?

7. To what places will the sun be rising on March 23d, when it is 3 in the morning at London?.

8. To what places will the sun be setting at the same time?

9. Where is it noon and midnight at that time?

10. Where is the sun rising, where is it setting, and at what places is it noon and midnight, on June 4th, when it is 3 in the morning at Rome?

11. Where is it twilight at that time?

12. When it is 5 in the morning at Jamaica, on December 25th, where is the sun rising and setting, and where is it noon and midnight? Where is it then twilight?

PART III.

CONTAINING PROBLEMS ON THE CELESTIAL GLOBE.

DEFINITIONS.

1. THE *celestial globe* is an artificial representation of the heavens, having the fixed stars delineated upon it, in their natural order and situation.

The celestial globe is not so just a representation of the heavens as the terrestrial globe is of the earth; because the stars are drawn upon a convex surface, and they appear in the heavens in an inverted order in a concave surface: but suppose the globe were made of glass, then, to an eye placed in the centre, the stars drawn upon it would appear in a concave surface, just as they do in the heavens.

2. The *solar system* consists of the sun and planets, with their satellites or moons. It is called the solar system from *sol*, the sun, because the sun is supposed to be placed in the centre, whilst the planets revolve round it at different distances.

3. The *fixed stars* are those bodies which shine by their own light, and are not subject to motion.

4. A *constellation* is a number of fixed stars lying in the neighbourhood of each other, which astronomers, for the sake of remembering with more ease, suppose to be circumscribed by the outlines of some animal or other figure.

5. *Planets* are either primary or secondary.

6. *Primary planets* are those bodies in our system, which regard the sun as the centre of their motions.

7. *Secondary planets*, or *satellites*, are the moons which revolve round the primary planets, in the same manner as those primary planets revolve round the sun.

8. The *celestial poles* are the extremities of the earth's axis produced to the heavens: they are those two points round which the stars appear to revolve.

9. The *equinoctial* is the equator supposed to be continued to the heavens.

10. *Parallels of declination* are less circles drawn parallel to the equinoctial.

They are the parallels of latitude supposed to be continued to the heavens.

11. *Celestial meridians* are lines drawn from pole to pole, directly across the equinoctial; they are also called *circles of declination*.

They are the terrestrial meridians supposed to be continued to the heavens.

12. The *declination* of the sun, moon, or stars, is their distance north or south from the equinoctial, reckoned upon the meridian.

The declination is an arc of the meridian, intercepted between any celestial object and the equinoctial.

13. *Right ascension* is that degree of the equinoctial which comes to the meridian with the sun, moon, or stars, reckoning eastward from the first point of aries; or it is that degree which comes to the horizon with the sun, moon, or stars, in a right sphere.

The right ascension of the sun, or of a star, is an arc of the equinoctial intercepted between the first point of aries and the circle of declination that passes through the sun or star. It may be reckoned either in degrees or in hours.

14. *Oblique ascension* is that degree of the equinoctial which comes to the horizon with the sun, or a star, in an oblique sphere.

Oblique ascension is an arc of the equinoctial, contained between the first degree of aries and that point of it which rises with the sun, or a star, in an oblique sphere.

15. *Ascensional difference* is the difference between the right and oblique ascension.

Ascensional difference, expressed in time, gives the sun's rising before or after 6 o'clock.

16. *Right descension*, *oblique descension*, and *descensional difference*, have the same reference to the setting of the sun, or of a star, as the above terms have to rising.

17. The *latitude* of any celestial body is its distance from the ecliptic, reckoned in degrees, minutes, &c. upon the arc of a great circle which is perpendicular to it. It is called north or south, as the body is on the north or south side of the ecliptic.

18. *Parallels of celestial latitude* are small circles parallel to the ecliptic.

19. The *longitude* of any celestial body is its distance from the first point of aries, reckoned eastward in signs, degrees, and minutes, upon the ecliptic.

20. *Circles of celestial longitude* are those great circles which pass through the poles of the ecliptic, and consequently intersect the ecliptic at right angles.

The latitude and longitude of celestial bodies have the same reference to the ecliptic, as the latitude and longitude of places upon the earth have to the equator.

21. The *rising* of any celestial object is when its centre appears in the eastern part of the horizon; and its *setting* is when its centre disappears in the western part of the horizon.

22. The *culminating* of any celestial object is when it comes to the meridian.

23. *Azimuth*, or *vertical circles*, are great circles which pass through the zenith and nadir, and are perpendicular to the horizon.

If the quadrant of altitude be fixed upon the zenith, and brought to any part of the horizon, it will represent the quadrant of a vertical circle.

24. The *prime vertical* is that vertical circle which passes through the east and west points of the horizon.

If the quadrant of altitude be fixed upon the zenith, and brought to the east or west points of the horizon, it will represent the quadrant of the prime vertical.

25. The *azimuth* of any celestial object is the distance of a vertical circle passing through the object, from the north or south points of the horizon, and is either easterly or westerly.

The azimuth of any celestial object is an arc of the horizon, contained between the north and south points and a vertical circle passing through the object.

26. *Amplitude* is the distance of any celestial object from the east or west points of the horizon, at the time of rising or setting,—and is either north or south.

Amplitude is an arc of the horizon, contained between the east and west points of the heavens and the centre of any celestial object at the time of its rising or setting.

The azimuth and amplitude are both found upon the wooden horizon; the amplitude being numbered from the east and west points towards the north and south, and the azimuth from the north and south points towards the east and west. If the azimuth be not marked upon the horizon, it may be found from the amplitude, being its complement, or what it wants of 90°.

27. The *zodiac* is a zone which surrounds the heavens, extending 8° on each side of the ecliptic: it contains 12 constellations, each bearing the name of some animal,—from which the signs of the ecliptic have their names.

The twelve signs in the zodiac are marked upon the wooden horizon; and on the outermost circle of the same is the calendar, by which may be found the sun's place on the ecliptic, on any day.

28. The *altitude* of any celestial object is the arc of a vertical circle, intercepted between the centre of the object and the horizon.

29. The *zenith distance* is an arc of a vertical circle contained between the centre of a celestial object and the zenith; or it is what the altitude wants of 90°.

30. The *meridian* altitude, or zenith distance, is the altitude or zenith distance when the object is in the meridian.

31. *Orbit* is the path which a planet describes in its revolution round the sun.

32. A body is in *conjunction* with the sun when it has the same longitude, and in *opposition* when the difference of longitude is 180°.

33. The *geocentric* place of a planet is its place in the heavens, as seen from the earth; the *heliocentric* place is its place as seen from the sun.

34. *Disc* of the sun or moon is its round face, which, on account of the great distance of the object, appears flat.

35. A *digit* is the twelfth part of the diameter of the sun and moon.

SECTION I.

OF THE STARS.

A clear winter evening affords one of the most brilliant prospects in nature. The canopy of the heavens is covered with an apparently innumerable multitude of stars, some shining with greater, and others with less, splendour. To the eye they appear to be all placed at the same distance from the earth; and their different apparent magnitudes and brightness we are apt to attribute to the size of the bodies themselves, rather than to the different distances at which they are placed. From the irregular manner in which they seem scattered about, as well as from their apparently infinite numbers, any attempt to arrange them in classes, or to count their numbers, would at first view appear impossible. Yet we find that this was done in the very infancy of astronomy. The shepherds of Chaldea are supposed to be the first who directed their attention to this subject: the nature of their employment invited them to the work, and the continued serenity of their sky enabled them to pursue it without interruption. In the time of Job some of the constellations were well known; hence the following apostrophe, " Canst thou bind the sweet influences of " Pleiades, or loose the bands of Orion? Canst thou " bring forth Mazzaroth in his season? or canst thou guide " Arcturus with his sons?"

But the history of astronomy is foreign to our purpose: we shall rather show the method adopted by ancient astronomers to assist the imagination and the memory in conceiving and retaining the number and position of the stars. in order to this, they divided them into certain classes or groups, called *constellations*, which, by a stretch of fancy, they supposed to resemble the figure of a man, an inferior animal, or some other object. The number of the ancient constellations was 48, but the present number upon the globe is 70, though, by some, it amounts to 91; of which 34 belong to the northern hemisphere, 12 to the zodiac, and the remaining 45 to the southern hemisphere: those stars which do not come into any of the constellations are called *unformed stars*. The stars visible to the naked eye are divided into six classes, according to their magnitudes; the largest are called of the *first* magnitude, the next of the *second*, and so on: those which cannot be seen by the naked eye are called *telescopic* stars. The stars in each constellation are marked with the letters of the Greek alphabet; the first letter, α, being put for the largest star in that constellation—the second letter, β, for the next largest—and so on: and when there are more stars in a constellation than letters in the Greek alphabet, the rest are marked by italic letters. This serves to point out the stars, as well as if particular names were given to each. But, besides this method of distinguishing them, some of the most remarkable have proper names assigned them.

The following is a catalogue of the stars in each constellation, with the names of the most remarkable stars. The figures placed against the principal stars denote their magnitudes.

1. CONSTELLATIONS NORTH OF THE ZODIAC.

Constellations.		*No. of stars.*	*Remarkable stars.*	*Mag.*
1. Ursa minor	The little Bear	24	Pole Star	2
2. Ursa major	The great Bear	87	Dubhee	1

	Constellations.		No. of stars.	Remarkable stars.	Mag.
3.	Perseus / Caput Medusa	Perseus / Medusa's Head	59	Algenib / Algol	2 / 2
4.	Auriga	The Waggoner	66	Capella	1
5.	Bootes		54	Arcturus	1
6.	Draco	The Dragon	60	Rastaben	2
7.	Cepheus		35	Alderamin	3
8.	Canes Venetaci, or Asterian & Chara	The Hounds, or Greyhounds	25		
9.	Cor Caroli	Charles's Heart	3		
10.	Triangulum	The Triangle	11		
11.	Triangulum minus	The little Triangle	5		
12.	Musca	The Bee, or Fly	6		
13.	Lynx		44		
14.	Leo minor	The little Lion	24		2 & 3
15.	Coma Berenices	Berenice's Hair	40		
16.	Camelopardalus	The Cameleopard	58		
17.	Mons Maenalus	Mount Maenalus	11		
18.	Corona Borealis	The N. Crown	21		2
19.	Serpens	The Serpent	50		2
20.	Scutum Sobieski	Sobieski's Shield	8		2 & 3
21.	Hercules cum Ramo et Cerbero	Hercules with the Branch & Cerberus	113	Ras Algiatha	3
22.	Serpentarius sive Ophiucus	Serpent Holder	67	Ras Alhagus	2
23.	Taurus Poniatowski	Poniatowski's Bull	7		
24.	Lyra	The Harp	22	Vega	1
25.	Vulpecula et Anser	The Fox and Goose	37		
26.	Sagitta	The Arrow	18		
27.	Aquila et Antinous	The Eagle	40	Altair	1
28.	Delphinus	The Dolphin	18		
29.	Cygnus	The Swan	73	Deneb Adige	1
30.	Equuleus	The Colt	10		
31.	Lacerta	The Lizard	16		
32.	Pegasus	The Flying Horse	85	Markab	2
33.	Andromeda		66	Almaac	2
34.	Cassiopeia	The Lady in the chair	55	Schedar	2

2. CONSTELLATIONS IN THE ZODIAC.

Constellations.		*No. of stars.*	*Remarkable stars.*	*Mag.*
1. Aries	The Ram	66		2
2. Taurus	The Bull	140	Aldebaran	
3. Gemini	The Twins	85	Castor & Pollux	1. 2
4. Cancer	The Crab	83	Acubens	3
5. Leo	The Lion	95	Regulus	1
6. Virgo	The Virgin	110	Spica Virginis	1
7. Libra	The Scales	51	Zubenich Mali	2
8. Scorpio	The Scorpion	44	Antares	1
9. Sagittarius	The Archer	69		2
10. Capricornus	The Goat	51		
11. Aquarius	The Waterbearer	108	Scheat	3
12. Pisces	The Fishes	112		

3. CONSTELLATIONS SOUTH OF THE ZODIAC.

1. Phœnix	The Phœnix	13		2 & 3
2. Officina Sculptoria		12		
3. Eridanus	The River	76	Achernar	1
4. Hydrus	The Water Snake	10		
5. Cetus	The Whale	80	Menkar	2
6. Fornax Chemica	The Chemical Furnace.	14		
7. Horologium	The Clock	12		
8. Reticulus Rhomboidalis		10		
9. Xiphias	The Sword Fish	7		
10. Cela Praxitellis	The Gravers	16		
11. Lepus	The Hare	19		
12. Columba Noachi	Noah's Dove	10		2
13. Orion		78	Betelguese	1
14. Argo Navis	The Ship Argo	50	Canopus	1
15. Canis major	The great Dog	30	Sirius	1
16. Equuleus Pictorius	The Painter's Easel	8		
17. Monoceros	The Unicorn	31		
18. Canis Minor	The little Dog	14	Procyon	1

	Constellations.		*No of stars.*	*Remarkable stars.*	*Mag.*
19.	Chameleon	The Chameleon	10		
20.	Pyxis Nautica	Mariner's Compass	4		
21.	Piscis Volans	The Flying Fish	8		
22.	Hydra	The Hydra	60	Cor. Hydra	2
23.	Sextans	The Sextant	4		
24.	Robur Carolinum	The Royal Oak	12		
25.	Machina Pneumatica	The Air Pump	3		
26.	Crater	The Cup	11	Alkes	3
27.	Corvus	The Crow	9	Algorab	3
28.	Crux	The Cross	6		1
29.	Musca	The Indian Fly	4		
30.	Apus Indica	The Bird of Paradise	11		
31.	Circinus	The Compass	4		
32.	Centaurus	The Centaur	36		1
33.	Lupus	The Wolf	24		
34.	Quadra Euclidis	Euclid's Quadrant	12		
35.	Triangulum Australe	The Southern Triangle	5		2 & 3
36.	Ara	The Altar	9		
37.	Telescopium	The Telescope	9		
38.	Corona Australis	The South. Crown	12		
39.	Pavo	The Peacock	14		2
40.	Indus	The Indian	12		
41.	Microscopium	The Microsoope	10		
42.	Octans Hadleianus	Hadley's Quadrant	43		
43.	Grus	The Crane	14		2
44.	Toucan	The Amer. Goose	9		
45.	Piscis Australis	The Southern Fish	20	Fomalhaut	1

4. NUMBER OF STARS OF EACH MAGNITUDE.

Number of constellations in		1.	2.	3.	4.	5.	6.	Tot.
the zodiac	12	5	16	44	120	183	646	1014
Northern hemisphere......	34	6	24	95	200	291	635	1251
Southern ditto...........	45	9	36	84	190	221	323	863
	91	20	76	223	510	695	1604	3128

By the above catalogue it will be seen that the number of stars has been estimated at about 3,000; and, of these, several are distinctly visible only through a telescope.—The number that can be seen at any one time, by the naked eye, may be reckoned a thousand; though, from their twinkling, and the indistinct manner in which they are viewed, their number appears almost infinite.

But if we take into the account the stars that are visible through good telescopes, their number may be said to be almost, if not altogether, infinite. The milky way, which is a broad track or path encircling the heavens, is nothing but an assemblage of stars, too remote to be seen singly, but so closely disposed as to give a luminous appearance to that part of the heavens. In the milky way Dr. Herschell has, in a quarter of an hour, seen 116,000 stars pass through his telescope.

" The distance of the stars has not been ascertained with any precision, but it is known with certainty to be so great, that the whole diameter of the earth's orbit, or 190 millions of miles, is but a point in comparison of it; and hence it is inferred that the distance of the nearest fixed star cannot be less than 100,000 times the length of the earth's orbit, or 19 billions of miles. This distance being immensely great, the best method of forming some clear conception of it, is to compare it with the velocity of some moving body, by which it may be measured. The swiftest motion with which we are acquainted is that of light, which is at the rate of 12 millions of miles in a minute; and yet light would be 3 years in passing from the nearest fixed star to the earth. A cannon ball, which may be made to move at the rate of 20 miles in a minute, would be 1,800,000 years in traversing the distance.—Sound, the velocity of which is 13 miles in a minute, would be more than 2,700,000 years in passing from the star to the earth: so that, if it were possible for the inhabitants of the earth to see the light, to hear the sound, and to receive the ball of a cannon discharged at the nearest fixed star,—they would not perceive the light of its explosion for 3 years after it had been fired, nor receive the ball till 1,800,000 years had elapsed, nor hear the report for 2,700,000 years after the explosion." *

It is probable that the stars are at as great a distance from each other as the nearest star is from the earth: and as objects appear smaller the greater their distance, this accounts for their different magnitudes. Stars of the second magnitude may be supposed at twice the distance, those of the third at thrice the distance, and so on.

The situation of the stars is determined with greater accuracy than the latitudes and longitudes of places upon the earth. The equinoctial serves as a line from which to calculate their distance north and south upon circles perpendicular to it: this is called their *declination*. That celestial meridian which passes through the point where the ascending part of the ecliptic cuts the equinoctial, serves as a first meridian from which to calculate their distance eastward: this is called their *right ascension*. The distance of the stars north or south of the ecliptic, is also determined: this is called their *latitude*. And their distance, reckoned, upon the ecliptic eastward from aries, is called their *longitude*.—The first three problems show how to find the right ascension, declination, latitude, and longitude, upon the globe; or, from having these, to find the star.

The motion of the earth upon its own axis, from west to east, causes the apparent motion of the stars in a contrary

* Scientific Dialogues, vol. ii. p. 244.

direction, from east to west: they all move round in circles parallel to the equinoctial; hence, when the equinoctial is perpendicular to the horizon, they rise and set perpendicularly, as may be seen by elevating the globe for a right sphere. This will shew the appearance of the heavens to those who live at the equator. The north pole star will always be upon the horizon, and all the other stars will rise and set: each star will be alternately 12 hours above, and as many below, the horizon.

When the equinoctial cuts the horizon obliquely, they all rise and set obliquely. This will be seen by elevating the globe for an oblique sphere; suppose for 55° N. L. But it will be better observed by having recourse to the heavens themselves, and watching the motion of the stars, for a few hours, in a fine winter's evening. The pole star will be seen stationary, as many degrees above the horizon as are equal to the latitude; and those stars whose distance from the pole is not greater than the latitude of the place, will be seen to turn round the pole, without ever going below the horizon:—all those stars that are within 55° of the south pole will never appear above the horizon in this latitude.—Of the stars that rise and set daily, those whose declination north is the greatest, continue the longest time above the horizon; and those whose declination south is greatest, the shortest time. Some are seen just to skirt above the southern horizon, and then disappear.

When the equinoctial coincides with the horizon, the stars neither rise nor set, but move round in circles parallel to the horizon. This will be seen by elevating the globe for a parallel sphere, which is done by placing the pole in the zenith. The stars in that hemisphere, whose pole is in the zenith, will never go below, and those in the opposite hemisphere will never appear above, the horizon.

Those stars that have, at any time, the same right ascension with the sun, come to the meridian at the same time with that body; and the other stars come to the meridian before or after the sun, according as they lie to the west or east of him. But, from the earth's annual motion in its orbit round the sun, the sun appears to advance eastward among the stars, at the rate of nearly 1° per day: one degree being equal to 4 minutes of time, this causes the stars to come to the meridian, on any day, 4 minutes sooner than on the day preceding. Those stars that are on the meridian at midnight will, the next night, be on it 4 minutes before 12; in 2 nights, 8 minutes, &c. From this cause, if the heavens be viewed at the same hour of any two days, at the distance of 6 months from each other, an entirely new assemblage of stars (with the exception of those that never go below the horizon) will be presented to the eye. By Problem IV. it may be found at what hour, on any day, any star comes to the meridian.

A revolution of one year bringing the sun exactly into the same situation, with respect to the stars, as it was on the same day of a former year,—on the same day of any year the same stars will always come to the meridian at the same time. Having the hour given at which any star comes to the meridian, the day may be found by Problem V. The altitude and azimuth of any star will vary with the latitude, the day of the month, and the hour of the day; and, from having any three of these terms, the other two may be found, as in Problems VI., VII., VIII. The hour of the night may be known at any time, by finding when any two stars have the same azimuth, as is shown in Problem IX. By Problem X. may be found the rising, culminating, and setting of any star; its continuance above the horizon; its oblique ascension and descension; and its eastern and western amplitude, for any given day and place. The principal stars in the heavens may very easily be distinguished, by representing, as in Problem XI., the face of the heavens for any given day and hour, in any given latitude. By Problem XII. may be found what stars never rise, and what stars never set, to any place.

PROBLEMS ON THE CELESTIAL GLOBE.

PROBLEM I.

To find the right ascension and declination of any star.

Bring the given star to the brass meridian; then the degree of the meridian over it shews the declination, and the degree of the equator under the meridian shows the right ascension.

The method of performing this problem is exactly the same as that for finding the latitude and longitude upon the terrestrial globe; the reason of which is, that declination on the celestial globe is the same thing as latitude on the terrestrial, and right ascension the same thing as longitude.

The right ascension may otherwise be found by elevating the globe for a right sphere (viz. bringing the poles to coincide with the horizon), and bringing the star to the eastern horizon; the point of the equator that comes to the horizon at the same time will be the right ascension.

The right ascension is reckoned eastward entirely round the globe from the first point of aries, and may be expressed either in degrees or hours.

The use of the declination is principally to find the latitude of any place by the altitude of the stars.

EXAMPLES.

1. **What are the right ascension and declination of Sirius?**

Answer. **Rt. as. 99° 0′, or 6 hrs. 36 min.**
Dec. 16 27 S.

2. Required the right ascension and declination of the pole star, Alruccabah, α.

Answer. Rt. as. 13° 0′, or 0 h. 52 min.
Dec. 88 14 N.

Required the right ascension and declination of the following stars.

3. Andromeda's Girdle, Mirach, β.
4. Ram's Following Horn, α.
5. Whale's Jaw, Menkar, α.
6. Medusa's Head, Algol, β.
7. Perseus' Side, Algenib, α.*
8. Brightest of the Seven Stars, η.
9. Bull's Eye, Aldebaran, α.
10. Auriga's Shoulder, Capella, α.
11. Orion's Foot, Rigel, β.
12. Bull's N. Horn, β.
13. Orion's Left Shoulder, Bellatrix, γ.
14. Orion's Girdle, ε.
15. Orion's Right Shoulder, Betelguese, α.
16. First Twin, Castor, α.
17. Little Dog, Procyon, α.
18. Second Twin, Pollux, β.
19. Bootes, Arcturus, α.
20. The Harp, Lyra, α.

* The star marked γ in Pegasus is on some globes named Algenib.

PROBLEM II.

Having the right ascension and declination of a star, to find it on the globe.

Bring the right ascension, marked on the equator, to the brass meridian; then, under the given declination marked on the meridian, will be the star required.

This problem is similar to Problem II. on the terrestrial globe: it is extremely useful in learning the names and relative situations of the fixed stars. Their right ascension and declination may be found in the catalogue of the fixed stars.

EXAMPLES.

Required the stars whose right ascension and declination are as follow.

	RIGHT ASCENSION.		DECLINATION.
	In degrees.	*In time.*	
1.	139° 15′	9h. 17m.	7° 48′ S.
		Answ. Alphard, Hydra's Heart.	
2.	149 15	9 57	12 56 N.
		Answ. Regulus, Lion's Heart.	
3.	162 15	10 49	57 27 N.
4.	162 45	10 51	62 50 N.
5.	174 30	11 38	15 41 N.
6.	191 15	12 45	57 3 N.
7.	198 30	13 14	10 7 S.
8.	209 30	13 58	65 20 N.
9.	211 30	14 6	20 13 N.
10.	219 45	14 39	15 12 S.
11.	226 30	15 6	8 38 S.
12.	231 30	15 26	27 24 N.
13.	244 15	16 17	25 58 S.

	RIGHT ASCENSION. In degrees.	In time.	DECLINATION.
14.	256° 15′	17h. 5m.	14° 38′ N.
15.	261 15	17 25	12 43 N.
16.	268 0	17 52	51 31 N.
17.	277 30	18 30	38 36 N.
18.	295 15	19 41	8 21 N.
19.	341 30	22 46	30 40 S.
20.	343 30	22 54	14 8 N.

PROBLEM III.

To find the latitude and longitude of a given star.

1. Bring the pole of the ecliptic, which is in the same hemisphere with the given star, to the brass meridian, and fix over it the quadrant of altitude.

2. Holding the globe steadily, move the quadrant till it come over the given star; then the degree of the quadrant cut by the star is its latitude, and the degree on the ecliptic cut by the quadrant is its longitude.

That part of the heavens north of the ecliptic is called the *northern* hemisphere, and the other part south of the ecliptic the *southern* hemisphere; so that a star may be north of the equinoctial, and yet have south latitude,—or south of the equinoctial, and have north latitude.

The longitude of celestial bodies is not reckoned in *degrees* and *minutes*, as the right ascension is, but in *signs*, degrees, and minutes, in the same manner as the sun's place, which is only another name for the sun's longitude.

The quadrant of altitude is fixed upon the pole of the ecliptic, because, in that position, it will be perpendicular to every point of the ecliptic, and therefore represent circles of longitude.

This problem may be reversed the same as the last; and from the given latitude and longitude may be found the star.

EXAMPLES.

1. Required the latitude and longitude of Taurus, β?

Answ. 5° 22′ N. L. ♊ 19° 47′ L.

2. Required the latitude and longitude of Pollux?

Answ. 6° 40′ N. L. ♋ 20° 28′ L.

Required the latitudes and longitudes of the following stars.

3. Regulus.
4. Scorpio, α.
5. Markab.
6. Atair.
7. Arided.
8. Schedar.
9. Draco, α.
10. Capella.
11. Fomalhaut.
12. Procyon.
13. Centaur, α.
14. EnarAcharnar.
15. Arcturus.
16. Dubhe.
17. Algol.
18. Aldebaran.
19. Spica Virginis.
20. Antares.
21. Rigel.
22. Canopus.

PROBLEM IV.

The day of the month being given, to find at what hour any star comes to the meridian.

BY THE GLOBE.

1. Bring the sun's place to the meridian, and set the index to 12 o'clock.

2. Turn the globe round till the given star comes to the meridian, and the index will show the hour.

If the star be to the east of the sun, it will come to the meridian after the sun, and hence the hour will be *p. m.*; but if the star be to the west of the sun, it will come to the meridian before the sun, and the hour will be *a. m.*

WITHOUT THE GLOBE.

1. Find the sun's right ascension for the given day, either by the table in White's Ephemeris, p. 44 and 45, or by Table III. at the end of this work; and find the right as-

cension of the star from Table IV. or from any catalogue of the stars.

2. Subtract the sun's right ascension from that of the given star (both being expressed in time), and the remainder will be the time of the star's coming to the meridian.

If the right ascension of the sun be greater than that of the star, add to it 24 before you begin to subtract; and the remainder, if less than 12, is the time of the star's coming to the meridian in the *afternoon*: if the remainder be greater than 12, take 12 away, and the last remainder is the time of the star's coming to the meridian in the *morning*.

EXAMPLES.

At what hours do the following stars come to the meridian on Feb. 9th?

1. Lyra? *Answ.* 9h. 1m. *a. m.*
2. Aldebaran? *Answ.* 6 55 *p. m.*
3. Arcturus?
4. Capella?
5. Sirius?
6. Regulus?
7. Castor?
8. Fomalhaut?
9. Markab?
10. Atair?

The first of the above examples performed without the globe.

The sun's right ascension, on Feb. 9th, is 21 hrs. 29 min.; the right ascension of Lyra is 18 hrs. 30 min.: to the last add 24, and from the sum, 42 hrs. 30 min., subtract 21 hrs. 29 min.: the remainder is 21 hrs. 1 min. From this remainder take away 12, and there is left 9 hrs. 1 min.; which is the time of the star's coming to the meridian in the morning.

	18 hrs.	30 m.	star's right ascension.
Add	24	0	
	42	30	
Subtract	21	29	sun's right ascension.
	21	1	
Subtract	12	0	
Answ.	9	1 *a. m.*	

Required at what time the following stars come to the meridian on the respective days.

11. Regulus,	October 24.
12. Draco, α,	September 20.
13. Bellatrix,	January 7.
14. Cassiopeia, β.	November 8.
15. Ras Algethi,	August 22.
16. Menkar,	May 5.

At what hour does Alphard (Hydra's Heart) come to the meridian on the following days?

17. January 29?	20. September 23?
18. May 15?	21. November 5?
19. August 12?	22. December 21?

At what hours do the following stars come to the meridian on the undermentioned days?

23. Mirach,	April 6?
24. Almach,	June 21?
25. Algol,	July 12?
26. Brightest of the seven stars,	August 29?
27. Procyon,	October 14?
28. Great Bear, α,	December 26?

PROBLEM V.

To find on what day of the year any star passes the meridian at any given hour.

BY THE GLOBE.

1. Bring the given star to the meridian, and set the index to the given hour.

2. Turn the globe till the index point to 12 at noon; and the day of the month, corresponding to the degree of

the ecliptic then under the meridian, will be the day required.

WITHOUT THE GLOBE.

1. If the star come to the meridian in the morning, add the time that it wants to noon to the right ascension of the star, and the sum will be the right ascension of the sun on the required day.

2. If the star come to the meridian in the evening, subtract the time from noon from the star's right ascension, and the remainder will be the sun's right ascension.

3. The day of the month, answering to this right ascension, may be found from Table III.

If, in adding, the sum is more than 24 hours, or 360°, subtract from it 24 hours, or 360°, and the remainder will be the sun's right ascension.

If, when you have to subtract, the right ascension of the star is less than the time from noon, add to it 24 hours, or 360°, before subtracting.

EXAMPLES.

1. On what day does Algenib, in Perseus, come to the meridian at midnight? *Answ.* Nov. 13th.

2. On what day does Spica Virginis come to the meridian at half past nine in the evening? *Answ.* May 18th.

The first of these examples performed without the globe.

	3h.	10m. right ascension of Algenib.
Add	12	0 time from noon.
	15	10 sun's right ascension.

The sun's longitude answering to this R. A. in Table III. is November 13.

On what days do the following stars come to the meridian at midnight?

Names of the stars.	*Constellations.*
3. Algol,	Caput Medusæ?
4. Betelguese,	Orion, α?
5. Acubens,	Cancer, α?
6. Alioth,	Great Bear, ϵ?

On what days do the following stars come to the meridian at nine o'clock in the evening?

7. Ras Alhagus,	Serpentarius, α?
8. Rastaben,	Dragon, γ?
9. Deneb,	Leo, β?
10. Scheat,	Pegasus, β?

Required the days on which the following stars come to the meridian, at five o'clock in the morning.

11. Sirius,	Great Dog, α?
12. ————————	Aries, α?
13. ————————	Taurus, β?
14. ————————	Great Bear, δ?
15. ————————	Serpent, α?
16. ————————	Andromeda α?

On what days do the following stars come to the meridian, at ten o'clock in the evening?

17. ————————	Orion, ϵ?
18. Acubens,	Cancer, α?
19. Alderamin,	Cepheus, α?

On what days does Arcturus come to the meridian, at the following hours?

20. Noon?	22. 9 *p. m.*?	24. 3 *a. m.*?
21. 3 *p. m.*?	23. Midnight?	25. 6 *a. m.*?

The examples in this problem may be proved by the last.

PROBLEM VI.

The latitude, hour of the night, and day of the month, being given, to find the altitude and azimuth of any star.

1. Elevate the globe for the given latitude, bring the sun's place to the meridian, and set the index to 12.

2. Turn the globe till the index point to the given hour?

3. Fix the quadrant of altitude on the zenith, and bring it over the star; then the degree upon the quadrant cut by the star will be its altitude, and the distance between the foot of the quadrant and the north or south points of the horizon will be the azimuth.

EXAMPLES.

1. Required the altitude and azimuth of Cor Leonis, at London, on May 11th, at 11 o'clock *p. m.*

Answ. Alt. 26° 50′.
Az. S. 76 30 W.

2. Required the altitude and azimuth of Capella, at Rome, on December 2d, at 5 in the morning.

Answ. Alt. 42°.
Az. N. 60 W.

What are the altitude and azimuth of the following stars, at Newcastle, October 6th, at the following hours?

3. Arided, Midnight?
4. Capella, 8 *p. m.*?
5. Castor, 10 *p. m.*?
6. Algenib (α, Perseus), 8 *p.m.*?
7. Menkar, 11 *p. m.*?
8. Atair, 9 *p. m.*?
9. Vega, 9 *p. m.*?
10. Arcturus, 7 *p. m.*?

Required the altitude and azimuth of the following stars, at London, December 21st, at 4 in the morning.

11. Spica Virginis.
12. Sirius.

13. Deneb (Leo, β).
14. Cor Hydræ.
15. Procyon.
16. Pleiades (Taurus, η).
17. Arided (Cygnus, α).

What are the altitude and azimuth of the following stars, at the Cape of Good Hope, on June 21st, at midnight?

18. Spica Virginis?
19. Antares (Scorpio, α)?
20. Arcturus?
21. Ras Alhagus?
22. Fomalhaut (S. Fish, α)?
23. Achernar (Eridanus, α)?

What are the altitude and azimuth of the following stars, at Jerusalem, August 9th, at 4 o'clock, *a. m.*?

24. Menkar (Cetus, α)?
25. Algol (Medusa's Head, β)?
26. Dubhe (Ursa Major, α)?
27. Phœnix, α?
28. Fomalhaut?

Required the altitude and azimuth of the following stars, at Quito, on March 22d, at 10 *p. m.*

29. Cor Hydræ.
30. Canopus (Argo, α).
31. Sirius.
32. Centaurus, α.
33. Cor Caroli.

What are the altitude and azimuth of all the stars, of the first and second magnitudes, that will be above the horizon of this place to-night at 9 o'clock?

PROBLEM VII.

The azimuth of any star and day of the month being given, to find the hour of the night and the altitude of the star, in a given latitude.

1. Rectify the globe as in the last problem.

2. Fix the quadrant of altitude upon the zenith, and bring it to the given azimuth.

3. Turn the globe round till the star come to the quadrant, then the index will show the hour, and the altitude of the star will be found upon the quadrant.

EXAMPLES.

1. The azimuth of Regulus, the Lion's Heart, at London, May 11th, was S. 76 W.; required the altitude and hour of the night. *Answ.* Hour, 11 *p. m.*
Alt. 27°.

2. The azimuth of Capella, at Rome, on Dec. 2d, was N. 60 W.; required the altitude and hour of the night.
Answ. Hour, 5 *a. m.*
Alt. 42°.

Having the azimuth of the following stars, required their altitude, and the hour, for London, on Sept. 1st.

Stars.	*Azimuth.*
3. Ras Alhagus,	S. 47° W.
4. Dubhe,	N. 23 W.
5. Delphinus, α,	S. 20 E.
6. Arided (Cygnus),	S. 55 E.

Having the azimuth of the following stars for Newcastle, on October 6th, required the hour and the altitude.

7. Brightest of the seven stars,	S. 88½° E.
8. Arcturus,	N. 81 W.
9. Aries, α,	S. 65 E.
10. Capella,	N. 40 E.
11. Auriga, β,	N. 52 E.
12. Betelguese,	S. 80 E.
13. Acubens (Cancer, α),	S. 70 E.
14. Procyon,	S. 29 E.

PROBLEM VIII.

The altitude of a star, the day of the month, and the latitude being given, to find the azimuth and time of the night.

1. Rectify the globe as in the former problems.

2. Having screwed the quadrant upon the zenith, turn the globe and move the quadrant till the star cut the quadrant at the given altitude; then the index will show the hour, and the quadrant will show the azimuth upon the horizon.

The stars having the same altitude twice every day, it is necessary to know whether the given star is to the east or west of the meridian; or else whether the hour required be in the evening or in the morning.

EXAMPLES.

1. The altitude of Rigel, in Orion, was observed at Boston (America) to be 15° in the evening of December 8th; what were the hour and azimuth?

Answ. 8 hrs. 1 min.; azimuth, S. E. by E. 7° E.

2. At Jerusalem, on the morning of August 9, the altitude of Alderamin (Cepheus, α) was 41°; required the hour and the azimuth.

Answ. Azimuth, N. 34° W.; hour, 4.

Having the altitudes of the following stars at London, on the days of the months mentioned below, required the time and azimuth.

		Stars.	*Altitude.*
3. Sept. 1,	Ev.	Alt. of Benetnasch, Ursa Major, η,	38°
4. Dec. 21,	Morn.	Deneb, Leo, β,	50
5. May 11,	Ev.	Regulus,	27
6. Sept. 1,	Ev.	Scheat Alp. β, Pegasus,	47
7. May 11,	Ev.	Castor.	18
8. Dec. 21,	Morn.	Sirius,	8

Having the altitudes of the following stars at Grand Cairo, on the undermentioned days, required the hour and the azimuth.

	Stars.	Altitude.
9. June 4, Ev.	Alphard,	$14\frac{1}{2}°$
10. ————	Spica,	43
11. Aug. 12, Morn.	Menkar,	57
12. ————	Sirius,	$14\frac{1}{2}$

PROBLEM IX.

Having the azimuth of a star, the latitude, and hour, to find the star's altitude and day of the month.

1. Elevate the globe for the latitude,—fix the quadrant of altitude on the zenith, and bring it to the given azimuth.

2. Bring the star to the edge of the quadrant, and set the index to the given hour; the altitude of the star will then be found upon the quadrant.

3. Turn the globe till the index point to noon; and the day of the month, answering to the degree of the ecliptic cut by the brass meridian, is the day required.

EXAMPLES.

1. At London, 11 o'clock *p. m.*, the azimuth of Spica Virginis was observed to be S. 17° W.; required the altitude of the star and the day of the month.

Answer. May 11th; alt. 27°.

2. At London, 9 o'clock *p. m.*, the azimuth of the star α, in the Northern Crown, was observed to be S. 89° W.; what were the altitude and the day of the month?

Answer. Sept. 1st; alt. 38°.

3. At Newcastle, 10 o'clock *p. m.*, the azimuth of Almaac (Andromeda, γ) was S. 84° E.; required the altitude and day of the month.

4. At Jerusalem, 4 o'clock *a. m.* the azimuth of Markab (Pegasus, α) was S. 71° W.; what were the day of the month and the altitude of the star?

5. At Jerusalem, at 4 o'clock in the morning, the azimuth of Alderamin was N. 34° W.; required the day of the month and the altitude of the star.

6. At the Cape of Good Hope, at midnight, the azimuth of the star Fomalhaut was S. 73° E.; required the day of the month and the altitude of the star.

7. At Rome, 5 o'clock *a. m.*, the azimuth of Capella was N. 60° W.; required the day of the month and the altitude of the star.

PROBLEM X.

To find the hour of the night, by observing when any two stars have the same azimuth.

1. Rectify the globe as in the preceding problems.

2. Move the globe and the quadrant, till the quadrant come over both stars; then the index will show the hour required.

It may be found when two stars have the same azimuth, by holding up a small line, with a plummet, between the eye and the stars; or, by observing when any two stars are in a line with the end of a house or wall, that is known to be perpendicular.

EXAMPLES.

1. May 11th, at London, Vega and Atair were observed to have the same azimuth; what was the hour?

Answer. 2 hrs. 15 min. *a. m.*

2. March 29th, Atair and Vega were observed to have the same azimuth at Stockholm; required the hour.

Answer. 4 o'clock *a. m.*

Required the hour at London when the following stars have the same azimuth on the annexed days.

	Days.	*Stars.*
3.	January 3,	Algol and Aldebaran.
4.	February 6,	Cor Caroli and Arcturus.
5.	May 12,	α, Cygnus, and α, Pegasus.
6.	Novem. 15,	Castor and Cor Hydræ.

7. Procyon and Sirius were observed to have the same azimuth at Rome, December 2d; what was the hour?

PROBLEM XI.

To find the rising, setting, and culminating of any star,—its continuance above the horizon,—its oblique ascension and descension,—and its eastern and western amplitude, for any given day and place.

1. Rectify the globe as in the preceding problems.

2. Bring the given star to the eastern horizon, and the index will show the hour of rising; the degree of the equinoctial that rises with the star is its oblique ascension; and the distance of the star from the east point of the horizon is its eastern or rising amplitude.

3. When the star is brought to the meridian, the index will show the time of culminating.

4. Bring the star to the western horizon, and its setting, oblique descension, and western amplitude, will be found in the same manner, as its rising, eastern amplitude, and oblique ascension.

5. The number of hours from rising to setting will be the time of its continuance above the horizon.

EXAMPLES.

1. Required the time that Sirius rises at London on March 14th; also the time that it comes to the meridian, and when it sets; how long it continues above the horizon; likewise its oblique ascension and descension, and its eastern and western amplitude.

Answer.

Rises at	2h.	24 m.	*p. m.*
Culminates	6	57	*p. m.*
Sets	11	30	*p. m.*
Above the horizon	9	6	
Oblique ascension......	120°	47′	
Oblique descension	77	17	
Amplitude............	27	0 S.	

2. Required the same for Fomalhaut, at the Cape of Good Hope, on December 10th.

Answer.

Rises	10h.	0m.	*a. m.*
Culminates............	5	30	*p. m.*
Sets..................	1	0	*a. m*
Above the horizon	15	0	
Oblique ascension	317°	0′	
Oblique descension......	5	0	
Amplitude	38	0 S.	

3. Required the same for Achernar in Eridanus, at Otaheite, on June 4th.

4. Required the same for Arcturus, at Newcastle, on March 11th.

5. Required the same for Rigel, at Jerusalem, on September 23d.

6. Required the same for Menkar, α, Cetus, at Rome, on October 12th.

To find, without the globe, the rising and setting, for the latitude of London, of 40 remarkable fixed stars, whose semidiurnal arcs are given in page 46 of White's Ephemeris.

Rule.—1. Find, by Problem IV., the time of the star's coming to the meridian on the given day.

2. From that time subtract the semidiurnal arc belonging to the star, and the remainder will be the time of the star's rising: add the semidiurnal arc to the time of the star's passing the meridian, and the sum will be the time of the star's setting.

EXAMPLES.

At what hours do the following stars rise and set at London, on the annexed days?

	Answers. Rises.	Sets.
	h. m.	h. m.
Markab, Feb. 9?	6 8 *a. m.*	8 42 *p. m.*
Sirius, ——?	4 31 *p. m.*	1 43 *a. m.*
Regulus, Oct. 24?	0 55 *a. m.*	3 17 *p. m.*
Bellatrix, Jan. 7?	3 31 *p. m.*	4 39 *a. m.*
Alphard, Nov. 5?	1 15 *a. m.*	0 3 *p. m.*
Mirach, April 6?	1 53 *a. m.*	10 7 *p. m.*

PROBLEM XII.

To represent the face of the heavens for any given day and hour, in any given latitude.

Adjust the globe as in the preceding problems, by bringing the sun's place to the meridian, putting the index to 12, and then turning the globe to the given hour; and the stars in the heavens will appear in the same situations as they are upon the globe, but in an inverted order.

EXAMPLES.

1. Required the situation of the stars for the latitude of Newcastle, on October 6th, at 8 o'clock in the evening.

In our present survey of the heavens, we shall commence at the north point of the horizon, and proceed round eastward, noticing the different constellations, and the relative situation of the principal stars in these constellations.

The first star which strikes the eye of the observer, in the north-east part of the heavens, is Capella, in the constellation *Auriga*, or the Waggoner: it is of the 1st magnitude, of the altitude of 23°, or nearly the fourth part of the distance from the horizon to the zenith. There are 2 stars of the 2d magnitude, which form with Capella a triangle:—the star which forms the short side of the triangle is in the right shoulder of Auriga, and is marked β; it lies at the distance of about 8° from Capella, further to the north; its altitude is 18°:—the star forming the longer side of the triangle is in the Bull's northern horn; its distance from Capella is more than 25°; its altitude not more than 5°, and azimuth N. E. There are 3 stars of the 4th magnitude, a little to the south of Capella, that bear the name of the *Kids*.

If a line be drawn through the two stars that form the upper side of the triangle, and continued to the horizon, it will point out Castor, α, in Gemini, just rising; azimuth, E. N. E.: it is between the 1st and 2d magnitude. The other stars in this constellation have not yet risen.

A line, drawn between Castor and Capella, and continued higher in the heavens, will point out *Perseus*, in which there are 3 stars,—one of the 2d magnitude, α, named Algenib,—and 2 of the 3d magnitude, one on each side of Algenib, at the distance of about 5°: they form a line, a little curved, on the side next Auriga. The altitude of Algenib is 37°; azimuth, N. E. by E.

A little to the south of Perseus is the head of *Medusa*, which Perseus is holding in his hand. Besides 2 or 3 smaller stars, it contains one of the 2d, and one of the 3d, magnitude: the name of the brightest is Algol; altitude, 33°; azimuth, E. N. E. Algol is only 10° distant from Algenib.

Directly below the head of Medusa, about 14° above the horizon, are the *Pleiades*, or Seven Stars: they are situated in the shoulder of *Taurus*, and are so easily known, that no description is necessary. Aldebaran, a star of the 1st magnitude, which forms the eye of Taurus, is just rising; azimuth, E. N. E. A vertical circle, drawn through Algol, will point to it. There are 2 stars of the 3d magnitude, and several smaller, very near Aldebaran, which form with it a triangle. The whole cluster is called the *Hyades*.

A line, drawn from Aldebaran through Algol, and continued to the zenith, will direct to *Cassiopeia*. This contains 5 stars of the 3d magnitude, besides several of the 4th: it is in form something like the letter Y, or, as some think, an inverted chair. It is situated above Perseus, within 30° of the zenith. The altitude of the brightest star, α, called Schedar, is 60°; azimuth, E. N. E.

Below Cassiopeia, and west of Perseus, is *Andromeda*, which contains 3 stars of the 2d magnitude. A line from Algenib, parallel to the horizon, towards the south, will pass very near these 3 stars; and as they are all of the same magnitude, and placed nearly at the same distance of 15° from each other, they may easily be known. The name of the star nearest Perseus, and which is in the foot of Andromeda, marked γ, is Almaack: its altitude is 49°, azimuth, E. N. E. The name of β, in the girdle, is Mirach: its altitude 44°; azimuth, E. The altitude of α, in the head of Andromeda, is 46°; azimuth, E. S. E.

About 18° below Mirach are two stars in *Aries*, not more than 5° distant from each other, forming with Mirach an isosceles triangle: the most eastern star, α, is of the 2d magnitude; the other, β, of the 3d, attended by a smaller star, marked γ, of the 4th magnitude. A line drawn from Mirach, perpendicular to the horizon, will pass between the two, and, besides, will point to a star of the 2d magnitude, directly E. not 3° above the horizon.

This star is the first of *Cetus*, marked α, and is of the 2d magnitude; it is named Menkar:—A line, drawn from Capella through the Pleiades, will also point to it. Cetus is a large constellation, and contains 8 stars of the 3d magnitude; they all lie to the west of Menkar; β, a star in the tail, is more than 40° distant from it. The azimuth of β is S. E. by E.; altitude nearly the same as Menkar.

The constellation *Pisces* is situated next to Aries; it contains 1 star of the 3d magnitude, marked α:—its altitude is 10°; azimuth, E. by S.: it is distant from Menkar 15°. A line drawn from Almaack, through α in Aries, will point to it.

If we return again to α, in the head of Andromeda, we shall find three other stars nearer the meridian, which, with it, form a square: these stars are in *Pegasus*, and are placed at the distance of 15° from each other; they are all of the 2d magnitude. The 2 stars forming the western side of the square are called, the upper one Scheat, which is marked β, and which is in the thigh of Pegasus; the under one, Markab, which is marked α, and which is in the wing: the lowest star in the eastern side of the square is in the tip of the wing, and is marked γ. The altitude of Scheat is 55°; azimuth, S. E. ½ E. Altitude of Markab, 43°; azimuth, S. E. by S. ½ E.

A line drawn through γ and β (the diagonal in the square of Pegasus), and continued to the meridian, will point out *Cygnus*, a remarkable constellation, in the form of a large cross, in which there is a star of the 2d magnitude, named Deneb, or Arided; it is marked α, and is almost directly upon the meridian, at the altitude of 80°. Cygnus contains 6 stars of the 3d magnitude.—The constellation *Cepheus*, which contains no remarkable stars, is situated between Cygnus and the north pole.

Below Pegasus, and nearer the meridian, is *Aquarius*, containing 4 stars of the 3d magnitude. A line drawn from α in Andromeda, through Markab, will point to α in Aquarius. Its altitude is 32°; azimuth, S. S. E.

A bright star of the 1st magnitude, named Fomalhaut, in *Piscis Australis*, is then upon the horizon; azimuth, S. S. E.

Delphinus is a small constellation, situated about 30° below Cygnus, upon the meridian: it contains 5 stars of the

3d magnitude; four of them are placed close together, and form the figure of a rhombus, or lozenge. A line, drawn through the two under stars of the square, will point to it: its altitude is about 50°.

A little to the west of Delphinus, but not quite so high, is *Aquila*, containing one very bright star, of the 1st magnitude, named Atair:—it may very easily be known, from having a star on each side of it, of the 3d magnitude, forming a straight line: the length of the line is only about 5°: Altitude of Atair, 40°; azimuth, S. S. W.

Considerably above Atair, and a little to the west of Cygnus, is *Lyra*, containing a star of the first magnitude, one of the most brilliant in the firmament. It is called Lyra, or Vega, and is 35° to the north-west of Atair: altitude, 60°; azimuth, W. S. W. Lyra, Atair, and Arided, form a large triangle.

We come now to notice three constellations, which occupy a large space in the western side of the heavens:—these are *Hercules*, immediately below Lyra; *Serpentarius*, between Hercules and the horizon, extending a little more towards the south; and *Boötes*, reaching from the horizon W. N. W. to the altitude of 45°.

Hercules contains 8 stars of the 3d magnitude: the star in the head, α, named Ras Algethi, is within 5° of α, in the head of Serpentarius. This last is a star of the 2d magnitude, and is named Ras Alhague: its altitude is 30°; azimuth, S. W. by W. ½ W. A line drawn from Lyra, perpendicular to the horizon, will pass between these 2 stars. The other stars in Hercules extend towards the zenith, and those in Serpentarius towards the horizon.

The constellation *Boötes* may easily be known from the brilliancy of Arcturus, a star of the 1st magnitude, and supposed to be the nearest to our system of any in the northern hemisphere; it is within 10° of the horizon; azimuth, W. N. W. Boötes also contains 7 stars of the 3d magnitude, mostly situated higher in the heavens than Arcturus. The star immediately above Arcturus is called Mezen Mirach, and is marked ϵ. The star in the left shoulder, δ, named Seginus, forms, with Mirach and Arcturus, a straight line.

Between Serpentarius and Boötes is *Serpens*, containing 1 star of the 2d, and 8 of the 3d, magnitude. α in Serpens is nearly at the same distance from the horizon as Arcturus; azimuth, W.

Above Serpens, and a little to the east of Boötes, is the *Northern Crown*, containing 1 star of the 2d magnitude, named Gemma, and several of the 3d, which have the appearance of a semicircle. A line, drawn from Lyra to Arcturus, will pass through this constellation.

We come now to *Ursa Major*, a constellation containing 1 star of the 1st, 3 of the 2d, and 7 of the 3d, magnitude. It may easily be distinguished by those 7 stars, which, from their resemblance to a waggon, are called Charles's Wain. The 4 stars in the form of a long square are the four wheels of the waggon; the 3 stars in the tail of the Bear are the three horses, which appear fixed to one of the wheels. The two hind wheels (α, named Dubhe, and β), are called the *pointers*, from their always pointing nearly to the north pole: hence the pole star may be known. The altitude of Dubhe is 30°; azimuth, N. by W. ½ W.:—the distance between the two pointers is 5°; the distance between the pole star and Dubhe, the upper pointer, is 30°.

Ursa Minor, besides the pole star, of the 2d magnitude, situated in the tail, contains 3 of the 3d, and 3 of the 4th, magnitude. These form some resemblance to the figure of Charles's Wain inverted, and may easily be traced.

Draco, containing 4 stars of the 2d, and 7 of the 3d, magnitude, spreads itself in the heavens near Ursa Minor; the 4 stars in the head are in the form of a rhombus, or lozenge; the tail is between the pole star and Charles's Wain.

Besides these constellations, there are a number of others, which, as they contain no remarkable stars, we have not described:—an enumeration of these will suffice.

The *Lynx,* between Ursa Major and Auriga; *Camelopardalus,* between Ursa Major and Cassiopeia; *Musca,* and the *Greater* and *Less Triangles,* between Aries and Perseus; *Equuleus,* close to the head of Pegasus; *Sagittarius,* setting in the S. W.; *Antinous,* and *Sobieski's Shield,* below Aquila; the *Fox* and the *Goose,* between Aquila and Cygnus: the *Greyhounds,* and *Berenice's Hair,* between Boötes and Ursa Major; and *Leo Minor,* below Ursa Major.

As one day brings the stars 4 minutes earlier into the same situation as they were on the preceding day, by making that allowance, the above view of the heavens will answer for September 6th, about 10 o'clock; September 21st, about 9 o'clock; or October 21st, about 7 o'clock in the evening.

2. Point out the situation of the stars, for the latitude of Newcastle, on January 1st, at 6 o'clock in the evening.

3. Required the situation of the stars at Newcastle, on March 21st, at 9 in the evening.

4. What are the principal constellations that will be

above the horizon of Edinburgh, on May 1st, at 10 o'clock in the evening?

PROBLEM XIII.

To find what stars never rise, and what stars never set, to any place.

BY THE GLOBE.

1. Elevate the globe for the latitude of the place.

2. Hold a pencil at the north point of the horizon, and by turning the globe round, draw a circle; then all those stars which are between that circle and the elevated pole will never set.

3. Hold a pencil at the south point of the horizon, and draw a circle as before; then all the stars between that place and the depressed pole will never rise.

4. If the place have south latitude, to find those stars that never set, hold the pencil at the south point of the horizon; and for those that never rise, hold it at the north point.

WITHOUT THE GLOBE.

1. Subtract the latitude of the place from 90°, and the remainder is the co-latitude.

2. If the declination of the star be greater than this, and of the same name, it will never set; if it be greater, and of a contrary name, it will never rise.

EXAMPLES.

1. What constellations never set at Newcastle, and what principal stars are alway visible there?

Answ. Constellations.—Ursa Major, part of Auriga, Perseus, part of Andromeda, Cassiopeia, Cepheus, Cygnus, Lyra, Draco, part of Hercules, Ursa Minor, part of Boötes.

Stars.—Lyra, Arided, Alderamin, Almaak, Algol, Capella, Dubhe, Alioth, Benetnasch.

2. What constellations never rise to Newcastle?

Answ. Phœnix, Eridanus, Horologium, Cela Praxitellis, Equuleus Pictorius, Dorado, Argo Navis, Piscis Volans, Centaurus, Crux, Chameleon, Lupus, Norma, Indus, Triangulum Australe, Ara, Telescopium, Pavo, Grus.

3. Are there any stars that never set at Jamaica?

Answ. Ursa Minor, part of Cepheus, part of Camelopardalus.

4. Are there any stars that never rise at Otaheite?

Answ. The same that never set at Jamaica.

5. How far north must I travel never to lose sight of Arcturus?

6. How far south of the equator must those people live who never see any part of the Great Bear?

7. In what parallel of latitude must I be never to see Lyra?

8. Where must I go never to see Sirius?

9. Where must I go never to lose sight of Sirius?

QUESTIONS FOR EXAMINATION IN SECTION 1.

What is the celestial globe? What is the solar system, and why is it so called? What are the fixed stars, and what is a constellation? What are the primary planets? What are the secondary planets, or satellites?

What are the celestial poles? What is the equinoctial?

What are parallels of declination? What are celestial meridians?

What are the declination and right ascension of any of the heavenly bodies? What is oblique ascension? What is ascensional difference? What are right descension, oblique descension, and descensional difference?

What are the latitude and longitude of a celestial body? What are parallels of celestial latitude, and circles of celestial longitude?

What is meant by the culminating of any celestial object? What is the azimuth of a heavenly body? What is the amplitude of a heavenly body?

What is the zodiac? How many degrees is it broad? Into how many signs, or constellations, is it divided?

What is meant by altitude and zenith distance? What is the orbit of a planet? When is a body in conjunction with the sun, and when is it in opposition?

What is meant by the geocentric place of a planet, and what is the heliocentric? What is a digit?

Into how many magnitudes are the stars divided? What are those stars called which are invisible to the naked eye? How are the stars in each constellation distinguished?

How many constellations are there? How many are in the northern, and how many in the southern, hemisphere?

What number of stars are visible to the naked eye? How many can be seen at any one time? How many stars are there of the first magnitude? How many of the second?

What is the milky way? What is the supposed distance of the nearest fixed star? What is the velocity of light? How long would a ray of light be in passing from the nearest star to the earth? At what rate does a ball fired from the mouth of a cannon move, and how long would it be in passing from the earth to the nearest star? What is the velocity of sound, and how many years would it require to pass the same distance?

Are the stars all placed in the same concave hemisphere, at the same distance from the earth?

What is it that occasions the apparent motion of the stars from east to west? How do the stars rise and set at the equator? How many degrees does the pole star appear above the horizon to any place north of the equator? Which star in the heavens appears always stationary?

How are the right ascension and declination of any star found? From what point on the globe is the right ascension reckoned? How is a star found on the globe from having its right ascension and declination given? How are the latitude and longitude of a star found?

The day of the month being given, how is it found at what hour any star comes to the meridian? How is it found on what day of the year any star passes the meridian at any given hour? Having the latitude, hour of the night, and day of the month given, how are the altitude and azimuth of any star found?

From having the azimuth of any star and day of the month given, how are the altitude of the star and the hour of the night in a given latitude found? From having the altitude of a star, the day of the month, and the latitude given, how are the azimuth and time of the night found?

From having the azimuth, the latitude, and hour given, how are the altitude of the star and day of the month found?

How is the hour of the night found, by observing when any two stars have the same azimuth? How are the rising, setting, and the culminating of any star found? How are the oblique ascension and descension found? How are the eastern and western amplitude found?

How may the globe be made to represent the face of the heavens, for any given day and hour, in a given latitude? How is it found what stars never rise, and what stars never set, to any place?

Point out, upon the globe, all the stars of the first magnitude. Which constellations in the heavens appear the most brilliant?

QUESTIONS FOR EXERCISE IN SECTION I.

1. Required the right ascension and declination of Alphard; Benetnasch; Antares; Canopus; Acubens.—Required the latitude and longitude of the same stars.

2. At what hours do the following stars appear on the meridian of London on March 24th:—Algol; Dubhe; Arcturus; Pollux; Bellatrix; Sirius; Capella?

3. At what hours do the same stars appear on the meridian of London on September 25th?

4. At what hours does Regulus come to the meridian on the following days:—January 1st; March 10th; June 14th; September 25th; October 25th; and November 5th?

5. What is the right ascension of the star β, in Auriga's shoulder?

6. What is the right ascension of β, in the Northern Scale?

7. On what days will the following stars be upon the meridian at midnight:—Capella; Aldebaran; Bellatrix; Arcturus; Fomalhaut; Pleiades; Vega; and Atair?

8. On what days do the same stars come to the meridian at 4 o'clock in the morning?

9. On January 1st, when it is half past eight in the evening at London, what are the altitude and azimuth of the following stars:—Algol; Pleiades; Menkar; Aldebaran; Sirius; Procyon; Taurus, β; Capella; Leo, γ; Cassiopeia, α; Cygnus, α; Vega; and Draco, α?

10. What are the altitude and azimuth of the following stars at London on May 1st, when it is 10 o'clock in the evening:—Cygnus, α; Corvus, α; Regulus; Cancer, α; Procyon; Dubhe; Perseus, α; and Capella?

11. On October 6th, the azimuth of Menkar, at Newcastle, was S. 52 E.; required the hour and the altitude.

12. At London, on December 21st, the azimuth of Cor Hydræ was S. 14 W.; required the hour and the altitude.

13. At the Cape of Good Hope, on June 21st, the azimuth of Spica Virginis was N. 89 W.; required the hour and the altitude.

14. On August 9th, the altitude of Phœnix, α, at Jerusalem, was 14°; required the hour and the azimuth.

15. At Quito, on March 22d, the altitude of Canopus (Argo, α) was 21°; what was the hour?

16. What was the hour at London, on September 1st, when the altitude of Arided was 80°?

17. The azimuth of the brightest of the Pleiades, at Newcastle, was S. 88½ E., when it was 10 in the evening; what was the day of the month, and what was the altitude of the star?

18. At Boston, in America, the azimuth of Rigel was S. E. by E. 7° E., when it was 8 hrs. 1 min. *p. m.*; required the day of the month.

19. What time does Dubhe set at Newcastle on February 28th?

20. When it was 5 in the morning at Rome, the azimuth of Capella was N. 60 W.; what was the day of the month?

21. What is the time of the rising, setting, and culminating of Castor; Sirius; Corona Borealis, α; Arcturus; and Procyon; at London, on January 31st?

22. How long is Sirius above the horizon at Petersburgh?

23. What time does Achernar rise at York on September 2d?

24. What is the time of the rising, setting, and culminating of Algenib, Menkar, Vega, and Cor Hydræ, at St. Helena, on October 6th?

25. What stars of the first and second magnitudes are above the horizon at London, on January 1st, at 9 o'clock in the evening?

26. Required the situation of the stars at York, on May 1st, when it is midnight.

27. What constellations never set at Rome? What constellations never rise there?

28. What stars never rise at the north pole? What stars never set there?

29. Are there any stars which never appear above the horizon at the equator?

30. Where must I go never to see Menkar?

31. Where must I go never to lose sight of Aldebaran?

SECTION II.

OF THE SUN.

The sun is the centre of the solar system, all the planets moving round it at different distances, and in different periods: its figure is nearly globular, and its diameter is almost equal to 111 times that of the earth, being about 883,217 miles; hence its surface is 12,300 times, and its bulk, or solid content, 1,380,000 times that of the earth: but the density of the matter of which it is composed is known to be four times less than the density of our globe. It is the attraction of the sun that retains the planets in their orbits, and to him they are indebted for light, heat, and motion. The sun is not absolutely at rest, but is found, by the spots on its surface, to turn round on its axis from west to east in about 25 days. The mean distance of the sun from the earth is 95,000,000 miles.

" The sun agrees with the fixed stars in the property of emitting light continually; and it is not improbable that they have many other properties in common. The sun is therefore considered as a fixed star comparatively near us, and the stars as suns at immense distances from us."

From being the source of light and heat, the sun was long supposed to be a body of fire: but Dr. Herschel, in two papers lately published in the Philosophical Transactions, supposes that the body of the sun is an opaque habitable planet, surrounded by a luminous atmosphere, which, being at times intercepted and broken, gives us a view of the sun's body itself, viz. the spots upon its surface. The sun's atmosphere, he thinks, is nearly 2000 miles in height; and he supposes that the density of the luminous solar clouds needs not be much more than that of our aurora borealis, to produce that degree of light and heat which we receive from him.

If this hypothesis be admitted, the sun, then, is similar to the other globes in the solar system, with regard to its solidity,—its atmosphere,—its surface, diversified with mountains and valleys,—the rotation on its axis,—and the fall of heavy bodies on its surface. It therefore appears to be a very eminent, large, and lucid planet, probably inhabited, disseminating light and heat to all the bodies with which it is connected.

The annual revolution of the earth produces the apparent motion of the sun among the stars in the ecliptic, by which he describes his annual path. This produces a daily change in right ascension and declination. The sun's amplitude and azimuth vary, both with the day of the month and the latitude of the place. The amplitude is always of the same name with the declination: the greatest amplitude north is, when the sun is in the north tropic; and south, when he is in the south tropic. Places that have the greatest latitude (not greater than $66\frac{1}{2}°$) have the greatest variation of amplitude; places at the equator have the least variation.

As all the problems relating to the sun may be performed on either globe, those that are given here must be considered as only supplemental to the problems relating to the sun given in Part II. Most of them are similar to the problems relating to the stars given in the last section; an enumeration of them here is, therefore, not necessary.

PROBLEM XIV.

To find the sun's right ascension and declination for any day.

Bring the sun's place to the brass meridian; then the degree over it shows the declination, and the degree of the equator under the meridian shows the right ascension.

This is the same as Problem I. Part III.

The sun's declination and right ascension may be found in Tables II. and III. or in White's Ephemeris, for any day of the year.

EXAMPLES.

Required the sun's right ascension and declination for the following days.

	RIGHT ASCENSION.		DECLINATION.	
	In degrees.	*In time.*		
1. Jan. 1.	282° 22′	18h. 17m.	22° 59′ S.	*Ans.*
2. Feb. 10.	324 22	21 37	14 10 S.	

3. March 22.
4. May 12.
5. June 22.
6. August 10.
7. September 22.
8. December 21.

PROBLEM XV.

To find the sun's oblique ascension, ascensional difference, eastern amplitude, and time of rising, on any given day, at any given place.

1. Elevate the globe for the latitude, bring the sun's place to the meridian, and set the index to 12.

2. Bring the sun's place to the eastern side of the horizon, and the degree of the equinoctial now at the horizon is the sun's oblique ascension.

3. The right ascension being found by the last problem,

the difference between it and the oblique ascension will be the ascensional difference.

4. The number of degrees on the horizon, intercepted between the east point and the sun's place, is the eastern or rising amplitude.

5. The hour shown by the index, when the sun is at the horizon, is the time of its rising.

From the ascensional difference, the time of the sun's rising may be found without the globe, thus:—If the sun's declination and the latitude of the place be of the same name, the ascensional difference, reduced to time, and subtracted from 6 o'clock, will give the time of the sun's rising. If the declination and latitude be of different names, the ascensional difference, added to 6, will give the time of the sun's rising.

EXAMPLES.

1. Required the sun's oblique ascension, ascensional difference, eastern amplitude, and time of rising, at London, May 1st.

	Answers.
Oblique ascension,	19° 0′
Ascensional difference,	19 48
Eastern amplitude,	25 0 N.
Rising,	4h. 40m.

The sun's rising found by the ascensional difference, thus:

$19° 48' = 1$ hr. 19 min.

The sun's declination and the latitude being of the same name, subtract 1 hr. 19 min. from 6, and the remainder, 4 hrs. 41 min. is the sun's rising.

2. Required the same for Gibraltar, November 25th.

Oblique ascension,	257° 7′
Ascensional difference,	15 41
Eastern amplitude,	26 9 S.
Rising,	7h. 4m.

3. Required the same for Halifax (America), December 25th.

	Answers.	
Oblique ascension,	300°	0′
Ascensional difference,	25	38
Eastern amplitude,	34	0 S.
Rising,	7h.	45m.

4. Required the same for Hanover, June 4th.
5. Required the same for Newcastle, July 29th.
6. Required the same for Petersburg, June 21st.

PROBLEM XVI.

To find the sun's oblique descension, descensional difference, western amplitude, and time of setting, on any given day, at any given place.

This problem is performed the same way as the last, only the sun's place must be brought to the western horizon.

The sun's setting may be found from the descensional difference, as in the last problem.

If the declination and latitude be of the same name, the descensional difference, added to 6 o'clock, will give the time of the sun's setting; if they be of different names, the descensional difference, subtracted from 6 o'clock, will give the time of the sun's setting.

The sun's ascensional and descensional difference, as found by the globe, being equal to each other, either of them may be used in finding the rising and setting of the sun.

EXAMPLES.

Required the sun's oblique descension, descensional difference, western amplitude, and time of setting, at the following times and places.

1. Cape of Good Hope, July 19th.

	Answers.
Oblique descension,	103° 44′
Descensional difference,	15 8
Western amplitude,	25 32
Setting,	5h. 0m.

2. Quebec, May 15th.

Oblique descension,	74° 0′
Descensional difference,	21 39
Western amplitude,	28 0 N.
Setting	7h. 23m.

3. Alexandria, January 21st.
4. Koningsburg, August 12th.
5. Liverpool, May 14th.
6. Washington (America), December 21st.
7. Archangel, June 21st.
8. Edinburgh, January 1st.

PROBLEM XVII.

The latitude, hour of the day, and day of the month being given, to find the sun's altitude and azimuth.

This problem is the same as Problem VI., page 294, only the quadrant of altitude must be brought over the sun's place, instead of being brought over the star.

EXAMPLES.

Required the sun's altitude and azimuth at the following places and times.

	h. m.	ANSWERS. Altitude.	Azimuth.
1. Lisbon, May 18,	7 30 *a.m.*	30°	N. 88° E.
2. Madrid, April 15,	10 0 *a.m.*	50	S. 47 E.

		h. m.
3. Jerusalem,	Feb. 22,	8 45 *a. m.*
4. Bombay,	March 20,	9 30 *a. m.*
5. Canton,	March 10,	8 0 *a. m.*
6. Ditto,		4 0 *p. m.*
7. Tongataboo,	Sept. 23,	4 0 *p. m.*
8. Oonalashka,	June 21,	7 0 *p. m.*
9. London,	May 1,	10 0 *a. m.*
10. Rome,	March 10,	9 9 *a. m.*

PROBLEM XVIII.

The day of the month and the sun's azimuth being given, to find the sun's altitude and the hour of the day, in a given latitude.

See Problem VII., page 295.

To all places in the torrid zone, when the sun's declination is greater than the latitude, and of the same name with it, the sun has the same azimuth twice in the forenoon and twice in the afternoon; and the examples, in that case, admit of two answers.

EXAMPLES.

1. At Gibraltar, on November 25th, the sun's azimuth was observed to be 50° from the south towards the east; what was the time?

Answer. Half-past 8 in the morning.

2. At Madras, the sun's azimuth was observed to be N. 70° E. in the morning of June 15th; required the time.

Answer. 24 min. past 7, or 52 min. past 8.

Having the sun's azimuth at the following places and days, required the hour and the sun's altitude.

			Azimuth.
3.	Tobolsk,	July 1,	S. 62° W.
4.	Astrakan,	Sept. 1,	S. 43 W.
5.	Cairo,	Dec. 1,	S. 56 W.
6.	Paris,	Nov. 5,	S. 30 W.
7.	London,	May 1,	S. 44½ E.
8.	Petersburg,	July 27,	S. 70 E.
9.	Lima,	May 2,	N. 55 W.
10.	London,	June 21,	S. 67 E.

PROBLEM XIX.

The sun's altitude, day of the month, and latitude of the place being given, to find the sun's azimuth, and hour of the day.

See Problem VIII., page 296.

The sun having the same altitude twice in the day, it must be known whether the time be in the morning or in the evening.

EXAMPLES.

1. At Newcastle, on May 15th, in the afternoon, the sun's altitude was observed to be 25°; required the hour and the sun's azimuth.

Answ. 5 o'clock; azimuth N. 88° W.

2. At Botany Bay, on April 23d, the sun's altitude in the morning was observed to be 25°; required the hour and the azimuth.

Answ. ¼ before 9; azimuth N. 55° E.

At the following places, having the sun's altitude on the under-mentioned days, required the hour and the sun's azimuth.

			Altitude.
3. Madras,	June 21,	Morning	19°
4. Cape Horn,	Dec. 22,	Evening	50
5. Petersburg,	July 15,	Morning	26
6. Batavia,	March 1,	Evening	46
7. London,	August 21,	Morning	36
8. Stockholm,	July 7,	Morning	12
9. Constantinople,	Dec. 7,	Morning	12
10. North Cape,	June 21,		5

PROBLEM XX.

The latitude, the sun's altitude and azimuth, being given, to find the day of the month, and the hour of the day.

1. Elevate the globe for the latitude of the place, fix the quadrant upon the zenith, and bring it to the given azimuth.

2. Turn the globe about, and that degree of the ecliptic which cuts the quadrant at the given altitude will be the sun's place,—from which the day of the month may be found.

3. Keeping the quadrant in the same position, turn the globe till the sun's place come to the meridian, and set the index to 12; then bring the sun's place again to the quadrant, and the index will show the hour.

Unless it be known whether the sun be in the ascending or descending signs, the examples to this problem will admit of a double answer.

EXAMPLES.

1. The sun was observed, in the summer season, to be 33° high, when its azimuth was S. 70° E. at Petersburg; required the day and the hour.

Answer. July 27, at 14 min. past 8 in the morning.

2. The sun was observed, at Lima, to be 45° high, when its azimuth was N. 50° W.; required the day and hour.

Answer. May 2, or August 10, at 33 min. past 2 in the afternoon.

3. At London, the sun's altitude was observed to be 17° high, when its azimuth was S. 17° E.; required the day and the hour.

4. At the Pelew Islands, the sun being in the descending signs, its altitude was found to be 37°, when its azimuth was S. 54° W.; required the day of the month and the hour.

5. At Owhyhee, the sun's altitude was 27°, when its azimuth was S. 74° W.; required the day and the hour.

6. At London, the sun's altitude was observed to be 46° 31′, when its azimuth was S. 44½° E.; required the day and the hour.

QUESTIONS FOR EXAMINATION IN SECTION II.

What is the diameter of the sun? What is its bulk compared with the earth? What is it that retains the planets in their orbits? Is the sun absolutely at rest? What is its distance from the earth? What is Dr. Herschel's opinion with respect to the sun?

What is it that produces the apparent motion of the sun among the stars?

How are the sun's right ascension and declination found for any day?

How are the sun's oblique ascension, ascensional difference, eastern amplitude, and time of rising found, on any given day, at any given place?

How are the sun's oblique descension, descensional difference, western amplitude, and time of setting found, on any given day, at any given place?

How may the time of the sun's rising be found from the ascensional difference?

From having the latitude, hour of the day, and day of the month given, how are the sun's altitude and azimuth found?

How are the sun's altitude and the hour of the day found in a given latitude, from having the day of the month and the azimuth?

From having the sun's altitude, day of the month, and latitude of the place given, how are the sun's azimuth and hour of the day found?

From having the latitude, the sun's altitude, and azimuth given, how are the day of the month and hour of the day found?

QUESTIONS FOR EXERCISE IN SECTION II.

1. Required the sun's right ascension and declination for the last day in each of the calendar months.

2. What are the sun's oblique ascension, ascensional difference, eastern amplitude, and time of rising, at the following times and places:—York, February 5th; Berlin, January 29th; Juan Fernandes, March 1st; Quito, June 21st; Samarcand, December 21st; Pegu, May 15th; Alexandria, August 10th; Bender, July 11th; Cape Horn, December 25th; Pelew Islands, November 5th?

3. Required the sun's oblique ascension, descensional difference, western amplitude, and time of setting, for the same places and times.

4. What are the sun's altitude and azimuth at the following places and times:—

Copenhagen, March 5th, 10 *a. m.*?
Marquesas, July 7th, 3 *p. m.*?
Pekin, August 12th, 7 *a. m.*?
Batavia, January 1st, 11 *a. m.*?
Cape of Good Hope, December 21st, 6 *p. m.*?
Guadaloupe, June 4th, $8\frac{1}{2}$ *a. m.*?

5. April 15th, in the afternoon, the sun's altitude at Madrid was 50°; required the hour and the azimuth.

6. At London, on May 1st, the sun's azimuth was S. $44\frac{1}{2}$° E.; required the hour and the sun's altitude.

7. At Canton, on March 10th, the sun's azimuth was S. 74° E.; what were the hour and altitude?

8. At Jerusalem, on February 22d, the sun's azimuth was S. 55° E.; required the hour and altitude.

9. At Rome, on March 10th, the sun's azimuth was S. E. 6° 24′ E.; required the hour and altitude.

10. In the latitude of $51\frac{1}{2}$°, the sun's altitude was observed to be $46\frac{1}{2}$°, on June 21st, what were the sun's azimuth, and the hour when the observation was made?

11. At Oonalashka, on June 21st, in the evening, the sun's altitude was 10°: required the hour and the azimuth.

12. At London, what are the sun's altitude, and the hour, when it is due east or west on the longest day?

13. At London, on June 21st, how far from the north does the sun rise and set?

14. At Paris, on November 5th, in the evening, the sun's altitude was 20°; required the hour and azimuth.

15. In the morning of June 21st, the sun's altitude at London was 46° 20′, what was the hour?

16. The sun being in the ascending signs, its altitude, at Newcastle, was observed to be 22°, when its azimuth was

N. 87° W.; required the day of the month and the hour of the day.

17. At Stockholm, in the summer season, the sun's altitude was 12°, when its azimuth was N. 63° E.; required the day of the month and the hour of the day.

18. At Edinburgh, on June 21st, how far from the north does the sun rise?

19. How many degrees are there between that point of the horizon in which the sun rises at Newcastle on June 21st, and that point in which it rises on December 21st?

20. In what part of the horizon does the sun rise at Quito, on June 21st and December 21st?

SECTION III.

Having gone through the problems relating to the stars and the sun, it will be necessary, previous to performing those respecting the planets, to give a short account of those bodies.

Planets signify, literally, *wandering stars*, in opposition to the fixed stars: they are seven in number; viz. Mercury, Venus, the Earth, Mars, Jupiter, Saturn, and Herschel. The two first are called *inferior* planets, because they are nearer the sun than the earth; the four last *superior* planets, because they are at a greater distance from the sun than the earth. The inferior planets are never seen in opposition to the sun: that is, they are never seen in the east when the sun is in the west, nor in the west when the sun is in the east; nor are they ever seen on the meridian at midnight. But the superior planets are often seen in opposition to the sun.

The planets all move round the sun in the order of the signs, that is, from the west towards the east; but their apparent motion, as seen from the earth, is very irregular: sometimes it is from west to east, called *direct;* and sometimes from east to west, called *retrograde:* at other periods, they appear for a while stationary. But this apparent irregularity is occasioned by their being viewed from a body, which is itself in motion. Suppose a person placed at the centre of a large circular area, and that several bodies are moving round that centre, all the same way, but at different distances from it, and with different velocities; these bodies, to the person placed at the centre, will all appear to be moving in the same direction; but if the person were placed at a distance from the centre, and carried round in one of those bodies, he would no longer see the rest moving in the same orderly manner as before. Such is the case with the planets seen from the sun, the centre of the system; they all pursue their regular courses from west to east:—but, viewed from the earth, one of the moving bodies, their apparent motion is very different from the real.

The motion of the inferior planets may be very familiarly illustrated by carrying a small ball, or globe, round a circular wire, having placed a candle at a distance on one side, and a screen on the other, to receive the shadow of the ball. Whilst the ball is carried round the circle, without ever changing its course, the shadow against the screen moves backward and forward, something like the vibrations of a pendulum. Such is the case with Mercury and Venus; they keep moving backward and forward in that part of the heavens in which the sun is; Mercury never going farther from the sun than 28°, and Venus than 48°.

To account for the retrogade motion of the superior planets, it may be observed, that when two bodies are moving the same way, with different velocities, that body which moves more slowly seems to recede from the other, with a motion equal to the difference of their velocities: thus, whilst the earth and one of the superior planets, suppose Jupiter, are both moving eastward (the planet being in opposition), the earth moving faster than Jupiter, he is left behind; and, though his real motion is eastward, he appears, to us, to be moving from east to west.

The orbits of the planets are not circular, but elliptical.

The distances of the planets, the velocities in their orbits, the respective times of their revolutions, &c. have all been determined with great accuracy. To be convinced of this, a person need only compare their situation, as given in an almanack, with their situation in the heavens.

That the planets are opaque bodies, similar to the earth, is evident; for, 1st, Mercury, Venus, and Mars, do not always shine with full faces, that part towards the earth, which is not towards the sun, being dark; 2d, Mercury and Venus, when they come in a line between the sun and the earth, appear like dark spots on the sun's disc; 3d, Jupiter and Saturn cast shadows, and eclipse their satellites, and therefore must be opaque bodies; and though the Herschel planet has not yet been seen to eclipse its satellites, yet, as it is a body similar to the other planets moving round the sun, we may conclude, by analogy, that it is opaque.

Since, then, these bodies are constructed similarly to our earth, it is probable that the all-wise Creator has adapted them to the same purpose of being the abode of intelligent creatures, whose natures and constitutions are, no doubt, suited to their respective habitations. This is the more probable, as those planets, that are remote from the sun, are furnished with moons, which can be of no use, unless to the inhabitants of those planets.

Mercury. ☿

This planet is the nearest to the sun of any that has yet been discovered: it is seldom visible, being generally lost in the sun's rays: its diameter is something more than 3,200 miles, and distance from the sun 37 millions of miles. —The time it requires to turn on its axis has not yet been discovered; it being so seldom visible, and that for so short a time. It turns round the sun in 87 days, 23 hours, 15 minutes, moving at the rate of more than 105,000 miles per hour.

Mercury being so much nearer the sun than the earth, the heat of the sun there will be 7 times greater than our summer heat. This being greater than the heat of boiling water, all the water on our globe would be evaporated, and every thing on its surface burnt to atoms, were it similarly situated. Hence the inhabitants of Mercury must be very different from us: but this is no argument against its being inhabited. The same Almighty Power that fitted us for the habitation of this globe, and that has fitted some creatures for living in water, has, no doubt, fitted the inhabitants of Mercury for the enjoyment of the situation which that planet is calculated to afford.

In order to form a better idea of the distances of the planets, we shall give the time that a cannon ball, flying at the rate of 20 miles in a minute, would take in going from the sun to each. To reach Mercury, it would require $8\frac{3}{4}$ years.

Venus. ♀

This planet may easily be known, from its being the most brilliant of all the planets in the heavens, and from its rising before the sun in the morning, when it is a *morning star*. or setting after the sun in the evening, when it is an *evening star*. Venus, viewed through a telescope, has all the phases of the moon, except that it never appears full. When it is nearest to the earth, its light is sometimes so strong as to be visible in the day-time.

The diameter of Venus is nearly equal to that of the earth, being 7,700 miles: the length of its day is also nearly the same as that of ours, being 23 hours, 21 minutes, the time that it takes to turn on its axis. This is known by the spots on its surface. Its distance from the sun is 68 millions of miles; and it finishes its journey round the sun in 224 days, 16 hours, moving at the rate of 75,000 miles per hour. The light and heat of the sun at Venus are double that which is enjoyed by the inhabitants of this globe. Venus, as well as Mercury, is sometimes seen to pass over the sun's disc: this is called a transit, and it furnishes astronomers with the means of determining the distances of all the planets. Captain Cook's first voyage to the South Sea was undertaken for the purpose of observing, at Otaheite, the last transit in 1769. The next transit of Venus will be on December 9th, 1874. A cannon ball would require more than 16 years in passing from the sun to Venus.

The Earth. ⊕

The next planet in the order of distance from the sun is that which we inhabit. It need not be thought degrading to our globe to be ranked among those bodies, which in the heavens appear so small; when it is recollected, that one of them is more than a thousand times larger than the earth.

The diameter of the earth is 7,970 miles, and the number of square miles upon its surface 199 millions. It turns upon its axis in 24 hours. Its distance from the sun is 95 millions of miles: and it finishes its annual revolution round the sun in 365 days, 5 hours, 48 minutes, 49 seconds, moving at the rate of 68,000 miles per hour, which is more than a thousand miles per minute.

The earth is surrounded with a thin, invisible, elastic fluid, called air, the whole body of which forms what is called the atmosphere. The lower parts of the atmosphere are denser than the higher; and the density gradually diminishes, the greater the altitude. The density of the air is not always the same, but is subject to be expanded by heat and contracted by cold: in its mean state it is about 850 times lighter than water. It is owing to the atmosphere that the rays of light coming from the sun are dispersed in all directions, and thus the whole heavens become illuminated. Without an atmosphere, we should derive no benefit from the light of the sun, except when our sight was directed to him; all the other parts of the heavens would appear dark, and the stars would be visible at noonday. It is also the atmosphere that produces twilight. By refracting the rays of light, it also causes the sun to appear in the morning before he is above the horizon, and in the evening after he is set. A cannon ball would take $22\frac{3}{4}$ years in flying from the sun to the earth.

The Moon. ☽

The Moon is the constant companion of the earth in its annual revolution round the sun, and, next to that body, it is to us the most remarkable one in our system; it supplies us with light during the absence of the sun, and furnishes us with a measure of time. The mean distance of the moon from the earth is 240,000 miles; its diameter is 2,180, being to that of the earth as 3 to 11. It turns round the earth in 27 days, 7 hours, 43 minutes, and is carried round the sun with the earth in 1 year. Between one new moon and another are 29 days, 12 hours, 44 minutes; this is the foundation of the division of time into months. It turns round its axis in the same time, and hence it always presents the same face to us.

As the moon shines by borrowed light, and the enlightened part is not always turned towards the earth, it is only in one position that the moon appears round; this is, when it is in opposition to the sun, the whole of the enlightened side being then turned towards the earth: this appearance is called *full moon.* When it is in conjunction with the sun, the enlightened side is turned from us, and the moon is consequently invisible: this is called *new moon.* A few days after conjunction, it is seen in the shape of a crescent, and it gradually enlarges till the whole of the enlightened side appears. After full moon, it again loses its circular form, and the enlightened part decreases as before it increased.

As the moon affords light to the earth, so the earth, in return, affords light to the moon; but the surface of the earth being 13 times greater than that of the moon, it affords 13 times more light to the moon. The length of the day and night to the moon being nearly 30 of our days, the sun will be 15 days above the horizon, and the night will be of the same duration.

If we could place ourselves in the middle of the lunar disc, we should enjoy a very singular spectacle; we should see our earth placed in the zenith, like a motionless lamp, or only turning on its axis; and we should probably be able to distinguish the continents, islands, &c. as they would reflect more light than the oceans. Supposing the moon inhabited, the inhabitants of that hemisphere next the earth will alway see the earth in the same place in the heavens, while the sun will appear to perform his revolution in a month. The inhabitants of the opposite hemisphere, on the contrary, will never see the earth; unless, prompted by curiosity, they make a voyage to behold the extraordinary phenomenon.

Mars. ♂

Next to the earth and moon is Mars, which may be known in the heavens by its dusky red appearance. Its diameter is little more than half that of the earth, being 4,218 miles; but the length of its day is nearly the same as ours, for it turns on its axis in 24 hours, 39 minutes. Its distance from the sun is 144 millions of miles; the length of its year is equal to 687 days, and therefore it travels at the rate of more than 53,000 miles per hour. Owing to its distance from the sun, the light and heat at Mars are only half of that which we enjoy. No moon has yet been discovered belonging to Mars. A cannon ball would take 34 years in moving from this planet to the sun.

Jupiter. ♃

We come now to Jupiter, the largest of all the planets, which is easily known by its peculiar magnitude and brilliancy. Its diameter is about 90,000 miles; and hence it is 1,300 times larger than the earth. It turns on its own axis in 9 hours, 45 minutes; and round the sun in 11 years, 314 days, 10 hours, moving at the rate of about 30,000 miles per hour.

Being about five times farther from the sun than the earth, viz. 490 millions of miles, the light and heat enjoyed by the inhabitants of Jupiter must be only the twenty-fifth part of that afforded by the sun to the earth. But this defect is partly supplied by 4 satellites, or moons, which constantly attend this planet, some of which will always be above the horizon. Jupiter, with his satellites, is a fine object when viewed through a good telescope. The eclipses of Jupiter's satellites furnish astronomers with an accurate method of determining the longitude of places upon the earth; and from them it has also been discovered that light is 8 minutes in travelling from the sun to the earth; consequently its velocity is 12 millions of miles in a minute. A cannon ball would take 118 years in flying from the sun to Jupiter.

Saturn. ♄

This, till within little more than 30 years, was considered the most remote planet of any in our system. Saturn shines with a pale, dead light; but it, as well as the other planets, may be known by not twinkling like the fixed stars. The diameter of Saturn is nearly 80,000 miles; so that, in point of size, it is the second in the system. It turns on its axis in 10 hours, 16 minutes. Its distance from the sun is 900 millions of miles; and it performs its journey round that luminary in little less than 30 years, and consequently travels at the rate of 20,000 miles per hour.

Being between 9 and 10 times farther from the sun than the earth, it enjoys 90 times less light and heat; but the day-light there is not so small as we should suppose, for it has been calculated to be 500 times greater than the light we enjoy from our full moon.

The Great Creator of the universe seems to have indemnified the inhabitants of Saturn for their great distance from the sun, by giving them 7 moons, and also by surrounding the planet with two broad rings, which are probably of considerable importance in reflecting the light of the sun to the planet. These rings present a singular appearance when viewed through a telescope. A cannon ball would take nearly 216 years in flying from the sun to Saturn.

Uranus, or Herschel. ♅

This planet was discovered, March 13th, 1781, by that great and indefatigable astronomer, whose name it bears. The diameter of Herschel is small in comparison of Saturn and Jupiter, being less than 35,000 miles; and its distance from the sun is 1,800 millions of miles. It requires 83 years to perform its journey round that luminary, though it travels at the rate of 16,000 miles per hour. The light of the sun, at Herschel, is 361 times less than at the earth; and it has been estimated at about 248 of our full moons. Six satellites have been discovered attending this planet. A cannon ball will require 431 years in passing from it to the sun.

NEW PLANETS.

On the 1st of January, 1801, M. Piazzi, astronomer at Palermo, in Sicily, discovered a new planet between Mars and Jupiter. He called it CERES (⚳ or ⚳). It is invisible to the naked eye; but, through a telescope, it appears like a star of the 8th magnitude. Its diameter is estimated, by Dr. Herschel, at 165 miles; and its distance from the sun is 260 millions of miles. It turns round the sun in about 4 years and 8 months.

March 28th, 1802, Dr. Olbers, of Bremen, discovered a new planet, to which he gave the name of PALLAS (⚴ or **P**). Its distance from the sun is 265 millions of miles; its diameter 80 miles; and it turns round the sun nearly in the same time as Ceres.

On September 1st, 1804, Mr. Harding, of Lilienthal, in the duchy of Bremen, discovered the planet, called by him JUNO (⚵ or **J**). It appears like a star of the 8th magnitude. Its diameter has not been ascertained; its distance from the sun is 290 millions of miles; and its periodical revolution round the sun is performed in 5 years, 182½ days.

Dr. Olbers, on March 29th, 1807, discovered a *fourth* new planet, called VESTA (⚶ or V). Its mean distance from the sun is less than Ceres; its diameter has not been ascertained. In size, it appears like a star of the 5th magnitude.

GENERAL VIEW OF THE SOLAR SYSTEM.

To show, by known and familiar measures, the small place which our planetary system occupies in the immensity of the universe, and much more the little figure which our earth makes in it, we shall take the liberty of making the following comparison. It is well calculated to humble the pride of those beings, who, occupying themselves only an infinitely small portion of that atom, think that the universe was made solely for them.

To form an idea of our system, compared to that of the universe, let us suppose a large garden, in the middle of which the sun is represented by a globe 9 feet 3 inches in diameter; the planet Mercury will be represented by a small globule of about one-third of a line * in diameter, and placed at the distance of 37 feet; Venus by a globe of something less than a line in diameter, moving at the distance of 68 feet from the same centre. At the distance of 95 feet, place a globe 1 line in diameter, and it will represent the earth, that theatre of so many passions and so much contention: on the surface of which the greatest potentates hardly possess a point; and a small space, often imperceptible, excites, among the animalculæ who cover it, so many disputes, and occasions so much bloodshed. Mars, rather less than the earth, will be represented by a globule of something less than a line, placed at the distance of 144 feet; Jupiter by a globe 10 lines in diameter, distant 490 feet; Saturn by a globe of about 7 lines in diameter, at the distance of 900 feet; and the Georgium Sidus by a globe 4 lines in diameter, at the distance of 1,800 feet.

But the distance from the latter planet to the nearest fixed star is immense. It might be supposed, according to the above supposition, that the nearest fixed star should be placed at the distance of 2 or 3 leagues; but, by a more correct calculation, it appears that the distance of the nearest fixed star should be more than 300 miles.

Our solar system is, therefore, at the same distance from the nearest of the fixed stars, as a circle 1,800 radius

* A line is the twelfth part of an inch.

from a concentric circle of 300 miles radius; and in the first circle our earth would occupy a space of only 1 line in diameter.

Another comparison will assist, to form some idea of the immense distance between the sun, the centre of our system, and the nearest fixed star. Light is known to move with such velocity, that it passes from the sun to the earth in about half a quarter of an hour; in one second and a half it would go to the moon, and return; or it would travel, in one second, fifteen times the circumference of the earth. In what time, then, may we suppose light would come to us from the nearest of the fixed stars? It would require no less than 108 days in travelling this distance; and should the annual parallax be only 2 or 3 seconds, which appears very probable, it would take more than a year.

What an immense distance, then, between this inhabited point and the nearest of its neighbours! Is it not probable that, in this vast interval, there are planets which will remain for ever unknown to the human species? *

PROBLEM XII.

To mark the places of the planets on the globe, from having their longitude and latitude.

1. Look on the right-hand page of White's Ephemeris for the day of the month.

2. Find out the column marked at the top with the character of the planet whose place you are seeking; then, in that column, opposite to the day of the month, is the longitude of the planet for that day at noon.

3. The latitude is given, at the top of the page, for 5

* Dr. Hutton's Mathematical Recreations.

days in every month, and seldom exceeds 2 or 3 degrees.

4. Find the longitude and latitude upon the globe, and put on a small patch with the character of the planet ;—and thus may all the planets be marked upon the globe for any day of the year.

Page 32d of White's Ephemeris is appropriated to the Herschel planet: its variations in longitude and latitude are so small, that they are given for only 3 days in a month.

EXAMPLES.

1. What is the situation of the inferior planets for May 13th, 1821 ?

Mercury,	♉	4°	8′	2°	7′	S
Venus,	♉	19	45	0	41	S

2. What is the situation of the superior planets on the same day ?

Mars,	♈	26°	11′	0°	45′	S
Jupiter,	♈	17	22	1	8	S
Saturn,	♈	21	0	2	17	S
Herschel,	♑	2	34	0	15	

3. Required the situation of all the planets for the first day of every month, during the present year.

PROBLEM XXII.

To find the right ascension and declination of the planets,—their rising, culminating, and setting,—their amplitude, azimuth, altitude, &c. for any given day, at any given place.

The situation of the planets being marked upon the globe for the given day, their right ascension and declination,—rising, culminating, and setting,—amplitude, azimuth, and altitude, may be found the same way as for the fixed stars.

EXAMPLES.

1. Required the right ascension and declination of all the planets on November 13th, 1821.

Answers.

	RIGHT ASCENSION.		DECLINATION.		
Mercury,	242°	30′	23°	0′	S.
Venus,	274	0	26	0	S.
Mars,	146	0	15	15	N.
Jupiter,	20	0	7	10	N.
Saturn,	19	30	5	45	N.
Herschel,	272	0	23	43	S.

2. At what time does Saturn set at London on November 1st, 1821?

Answ. It sets at 36 min. past 5 in the morning.

3. When do Jupiter, Mars, and Venus, set at London, on February 2d, 1822?

4. Required the situation of the planets for November 19th, 1822.

5. Which of the planets will be visible at Newcastle on the 25th of November, 1821, and whether in the evening or the morning?

6. Required the situation of the planets for the 1st day of every month during the present year, and what time they will respectively rise and set at Edinburgh on the same days.

PROBLEM XXIII.

To find when Jupiter and Venus are morning, and when they are evening, stars.

1. Find their situation, as before directed.

2. If it be to the east of the sun's place, they will be evening stars; if to the west, they will be morning stars.

When the planets are so near the sun as to rise and set nearly at the same time with it, they are invisible, being obscured by the sun's rays. This is almost always the case with Mercury, which can never be seen, but at its greatest distance from the sun.

EXAMPLES.

1. Whether will Jupiter and Venus be morning or evening stars on Dec. 7th, 1821?

Answer. Venus will be east of the sun, and will be an evening star: Jupiter will be east of the sun, and will also be an evening star.

2. During what time will Jupiter be a morning star this year, and what time will it be an evening star?

3. Required the same for Venus.

SECTION IV.

PROBLEMS RELATING TO THE MOON.

The motion of the moon is the most irregular of any of the heavenly bodies. This irregularity is occasioned by its being attracted both by the sun and the earth. It does not move in the ecliptic, but its orbit forms with the ecliptic an angle of $5\frac{1}{4}°$. The points where its orbit cuts the ecliptic are called its *nodes*, and are constantly changing.

The course which the moon appears to pursue in the heavens is always varying. Passing in a month through all the signs of the zodiac, its meridian altitude will vary in that time 47°. The full moon that happens in Cancer is the most beneficial to us in the northern hemisphere, for its altitude is then the greatest, and it continues longest above the horizon: but when the full moon happens in Cancer, the sun is in Capricorn; and our days being then at the shortest, we are the most in want of auxiliary light. The full moon that is of the least use to us is in Capricorn, for its altitude is then the least, and its stay the shortest above the horizon: but the sun being then in Cancer, our days are long, and the light of the moon is not needed. "This is a wonderful display of the Divine wisdom and goodness, in apportioning the quantity of light suitable to the various necessities of the inhabitants of the earth, according to their different situations.

"The full moon being always opposite to the sun, can never be seen by the inhabitants of the poles whilst the sun is above the horizon; but all the time the sun is below the horizon the full moons never set. Consequently to them the full moon is never visible in their summer: and in their winter they have it always before and after the full, shining for 14 of our days and nights without intermission. And when the sun is depressed the lowest under the horizon, then the moon has its highest altitude. This affords them, during their long winter, a fortnight's light and darkness by turns." *

ECLIPSES.

An *eclipse* of the moon is caused by its entering into

* Scientific Dialogues.

the earth's shadow; and consequently it must happen at the time of *full* moon, or when it is in opposition to the sun, as the shadow of the earth must lie opposite to the sun.—An eclipse of the sun is caused by the interposition of the moon between the earth and the sun: and therefore it must happen when the moon is in conjunction with the sun, or at the *new* moon.

If the moon moved in the ecliptic, there would be an eclipse of the moon every full moon, and an eclipse of the sun every new moon; but the moon being, in one part of its orbit, $5\frac{1}{4}^{\circ}$ to the north of the ecliptic, and in another part as far to the south, there can be no eclipse except the moon, at full or change, be near its nodes. When the moon is less than 17° from either of the nodes at the time of change, there will be an eclipse of the sun; when it is less than 12° from either node at the time of full, there will be an eclipse of the moon. These are called the *ecliptic limits;* and as they are nearly in the proportion of 3 to 2, there will be more solar than lunar eclipses in the same ratio. But more lunar than solar eclipses are seen at any place; because a lunar eclipse is visible to a whole hemisphere,—whereas a solar eclipse is visible only to a part. The greatest number of eclipses that can happen any year is 7,—and of these, 5 will be of the sun, and 2 of the moon—the least number that can happen is 2, and these must be both solar: the mean number is about 4.—The season of eclipses will return at an interval of about 9 or 10 days less than half a year; so that, if there be eclipses about the middle of January, the next will be about the first week of July.

The following are the principal problems relating to the moon:—To represent the moon's orbit for any time, by which a clear idea of the moon's nodes may be formed; to find the moon's diurnal motion in the heavens; to find the moon's exact place at any time,—also its declination, altitude, &c.—its rising, southing, and setting; rules for finding the moon's age, and to find when the sun or moon is liable to be eclipsed.

OF THE HARVEST MOON.

The moon rises about three quarters of an hour later on any day than on the day preceding; but in places of considerable latitude, as that in which we live, there is a remarkable difference about the time of harvest, when, at the season of full moon, it rises, for several nights together, only about 17 minutes later on one day than on the day preceding. By thus succeeding the sun before twilight is ended, the moon prolongs the light, to the great benefit of those who are engaged in gathering the fruits of the earth; and hence the full moon, at this season, is called the *harvest moon*. The full moon nearest the vernal equinox rises with the greatest difference of time, viz. an hour and a quarter later every day than on the former.—Problem XXIX. attempts to explain, by the globe, the phenomenon of the harvest moon; and Problem XXX. the equation of time.

PROBLEM XXIV.

To assign the orbit of the moon its proper situation in the heavens for any given time.

1. Find the moon's ascending node in White's Ephemeris: the descending node will be 180° distant from that. At the distance of 90° from these nodes, reckoning each way, count $5\frac{1}{4}°$ to the north of the ecliptic on one side, and $5\frac{1}{4}°$ to the south on the other side.

2. Fasten a silk line round the globe, to cut the ecliptic at the nodes, and to pass over those two points, made at the distance of $5\frac{1}{4}°$ on each side of the ecliptic; and this will represent the moon's orbit for the given day.

EXAMPLES.

1. Represent the moon's orbit for October the 25th, 1821.

The moon's ascending node is 1° 19′ in Pisces, and the descending node will be 1° 19′ in Scorpio:—make the silk line cut the ecliptic in these two points; and at the distance of 90° from these points, let it be $5\frac{1}{4}°$ to the north of the ecliptic on one side, and $5\frac{1}{4}°$ to the south on the other side, and it will represent the orbit for that day.

2. Point out the moon's orbit for the present month.

PROBLEM XXV.

To find the moon's diurnal motion in the ecliptic for any given day.

Find the moon's longitude for the given day, on the right-hand page of White's Ephemeris: subtract from this its longitude on the preceding day; or subtract this from the longitude of the succeeding day; and the difference will be the quantity of diurnal motion sought.

EXAMPLES.

Required the moon's diurnal motion on October 25th, 1821.

October 25th, moon's longitude	♎	25°	57′
October 24th,		14	6
	Answ.	11	51

From the moon's diurnal motion may be found her longitude for any hour, by the rule of three; thus,

As 24 hours is to the quantity of daily motion, so is the number of hours to the quantity of motion in that time.

EXAMPLE.

Required the moon's longitude for October 25th, 1821, at 9 o'clock, *p. m.*

As 24 : 11° 51′ : : 9 : 4° 27′ nearly, the motion in 9 hours.

The moon's longitude at noon will be ♎ 25° 57′; to this add 4° 27′, and its longitude, at 9 o'clock *p. m.*, will be ♏ 0° 24′.

PROBLEM XXVI.

To mark, upon the globe, the moon's place in the heavens for any given day and hour.

Find its longitude for the given hour by the last problem, and its latitude for the given day at noon from White's Ephemeris: put a small patch, with the moon's astronomical character marked upon it, on this place, and it will represent the moon.

The moon's declination, right ascension, altitude, azimuth, &c. may be found the same way as the declination, &c. of the sun or stars, but not with equal accuracy, on account of the moon's motion.

EXAMPLES.

1. Required the moon's place for November 28th, 1821, at 8 hrs. *p. m.*

November 28th, moon's longitude at noon	♑	17°	32′
November 27th, ditto	♑	5	26
Diurnal motion		12	6

As 24hrs. : 12° 6′ : : 8 hrs. : 4° 2′.

The moon's longitude at 8 will be ♑ 21° 34′, and its latitude at noon, given in the Ephemeris, 3° 19′ S.

2. Required the moon's declination for the present day at midnight, and its altitude and azimuth at Newcastle, if it be above the horizon there at that time.

PROBLEM XXVII.

To find the time of the moon's rising, southing, and setting, for any latitude and given day of the year.

From the Ephemeris, find the moon's latitude and longitude for the given day, and put on a patch to represent its place; then its rising, southing, and setting, may be found the same way as the rising, &c of the stars.

If greater accuracy be required,—after having performed the problem as above, find, by calculating for the moon's motion for the time from noon, as in Problem XXVI., her true place at rising, southing, and setting: from which the time, as found by the other method, may be corrected.

EXAMPLES.

1. Find the moon's rising and southing on December 10th, 1821, at London.

Answ. South, 0 hr. 52 min. *a. m.*
Rises 4 hrs. 59 min. *p. m.*

2. Required the moon's rising, southing, and setting, at Newcastle, on December 28th, 1822.

RULES FOR FINDING THE EPACT, THE MOON'S AGE, AND SOUTHING.

1. *For the epact.*

Divide the year by 19, multiply the remainder by 11, and divide the product by 30; the remainder will be the epact.

EXAMPLE.

What is the epact for 1822?

```
19)1822(95
    171
    ---
     112
      95
     ---
      17
      11
     ---
  30)187(6
     180
     ---
Answ.  7 Epact.
```

The epacts for the several months are :

	com. yrs.	leap yrs.		com. yrs.	leap yrs.
January,	0	0	July,	4	5
February,	2	2	August,	6	7
March,	0	1	September,	7	8
April,	2	3	October,	8	9
May,	2	3	November,	10	10
June,	4	5	December,	10	11

2. *To find the moon's age.*

Add the epact of the year, the epact of the month, and the day of the month; the sum (if less than 30) is the moon's age; if it be above 30, divide by 30, and the remainder will be the moon's age.

EXAMPLE.

What is the moon's age on December 28th, 1822?

```
Epact for 1822            7
Epact for the month      10
Day of the month         28
                         --
                     30)45(1
                         30
                         --
           Moon's age    15 Answ.
```

2. To find the time of the moon's southing.

Multiply the moon's age by 4, divide the product by 5,—the quotient is hours; and the remainder, multiplied by 12, gives minutes.

If the hours be more than 12, take 12 away, and the remainder is the time of the moon's southing after last midnight.—N. B. The answer by this rule will not be perfectly accurate.

EXAMPLE.

Required the time of the moon's southing on December 28th, 1822.

$$\begin{array}{rl} 15 & \text{Moon's age.} \\ 4 & \\ \hline 5)60 & \\ \hline \textit{Answ.}\ 12 & \text{hrs. or midnight.} \\ \hline \end{array}$$

PROBLEM XXVIII.

To find the time of the year when the sun or moon will be liable to be eclipsed.

1. Compare the sun's longitude, at the time of new moon, with the place of the moon's nodes; and if it be within 18°, there will be an eclipse of the sun.

2. Compare the same at the time of full moon; and if it be within 12°, there will be an eclipse of the moon.

As eclipses happen at an interval of 9 or 10 days less than 6 months, having found one month in which an eclipse of the sun or moon will happen, you may know at what time to expect a return.

EXAMPLES.

1. Will the moon be eclipsed in December, 1821?

Answ. Full moon will happen on the 9th; the place of the moon's node on that day will be ♒ 29°, the sun's longitude will be ♐ 17°: hence the moon will be 76° distant from its node, and consequently no eclipse will take place.

2. Will the sun be eclipsed in August, 1821?

Answ. New moon will happen on the 27th; the place of the moon's node on that day will be ♍ $4\frac{1}{2}$°; the sun's longitude will be ♍ $3\frac{1}{2}$°: hence the moon will be within 1° of its node, and consequently an eclipse of the sun will take place.

3. Find, by the globe, what eclipses of the sun or moon will happen this year.

PROBLEM XXIX.

To explain, by the globe, the phenomena of the harvest moon.

Elevate the globe for any northern latitude, suppose for *Newcastle.*

In September, when the sun is in the beginning of Libra, the moon, at full, must be in or near the beginning of Aries: and as the mean motion of the moon is 13° in a day, put a patch on the first point of Aries, and another 13° beyond it, on the ecliptic: this last will point out the moon's place the first night after full. Its place on the second, third, &c. night may be found by putting more patches at the distance of 13° from each other.

Bring the first patch to the horizon, and observe the hour: turn the globe till the second patch comes to the horizon, and the index will show that it rises only 17 minutes later than the former. Thus 17 minutes is the difference of the moon's rising on two successive nights. And the other patches will successively come to the horizon, in little more than that time, after each other; which shows that the difference of the moon's rising several nights successively is little more than 17 minutes for each night. The difference of the moon's rising for a week will not be 2 hours.

The small angle which that part of the moon's orbit makes with the horizon is the reason of its rising at that season, for several evenings, with so small a difference of time.

That part of the moon's orbit near Libra makes the greatest angle with the horizon; and the full moon that happens in Libra rises with the greatest difference of time. This may be seen by placing patches on the globe, from the first of Libra, to represent the moon's place for several successive nights,—when it will be seen that the difference of rising in two evenings will be 1 hour 17 minutes.

That point of the ecliptic which rises at the least angle with the horizon, sets at the greatest; and, therefore, when there is the least difference in the time of rising, there will be found to be the greatest in the time of setting.

PROBLEM XXX.

To explain, by the globe, the equation of time.

Mean or *equal* time is measured by a clock, that is supposed to go without variation, and to measure exactly 24 hours from noon to noon. *Apparent* time is that time as measured by a good sun-dial.

The sun's motion being in the ecliptic, and not in the equator, and equal portions of the ecliptic passing over the meridian in unequal times, causes a difference between *equal* and *apparent* time: the adjustment of this difference is called the *equation of time.*

To show this upon the globe, make pencil marks all round the equator and ecliptic, at equal distances (suppose 15°) from each other, beginning with Aries.

Then, on turning the globe, you will perceive that all the marks on the first quadrant of the ecliptic, that is, from

Aries to Cancer, come sooner to the brass meridian than their corresponding marks on the equator. Now time, as measured by the dial, is represented by marks on the ecliptic; that measured by a good clock, by those on the equator: hence, whilst the sun is in the first quarter of the ecliptic, the dial is faster than the clock.

On turning the globe, it will be found that the marks on the second quarter of the ecliptic, that is, from Cancer to Libra, come to the meridian later than those on the equator; and consequently the sun is slower than the clock. In the same manner it will be seen, that in the third quarter, from Libra to Capricorn, the sun is faster; and in the fourth quarter, from Capricorn to Aries, slower than the clock.

The earth's motion in its orbit not being uniform, is another cause of difference between mean and apparent time. The equation of time is given for every day in the year, in White's Ephemeris, and in the Nautical Almanac. On Bardin's British Globes, it is marked on the outer circle of the horizon. The days when the clock and sun agree, are April 15th, June 15th, Sept. 1st, and Dec. 25th. The days of greatest difference are Feb. 11th, May 15th, July 26th, and Nov. 4th.

QUESTIONS FOR EXAMINATION AND EXERCISE IN SECTIONS III. AND IV.

What is the literal signification of the word *planet?* How many planets are there, and in what order do they move round the sun? How many are called *inferior planets,* and why are they so called? Which of them are called *superior planets,* and why are they so called?

Are Mercury and Venus ever seen in the west in the morning, or in the east in the evening? Which of the planets may be seen on the meridian at midnight?

How do the planets appear to move as seen from the earth? What is the greatest distance, in degrees, that Mercury and Venus ever appear from the sun?

How is it known that the planets are opaque bodies, similar to the earth? Is it supposed they are habitable, and what renders this probable?

What is Mercury's mean distance from the sun? What is its diameter? How many months does it take in turning round the sun? Is it known how long it requires to turn on its own axis?

How much greater is the heat of the sun at Mercury than upon our earth? What would be the consequence of an equal degree of heat upon our globe? How long would a cannon ball, moving at the rate of 20 miles in a minute, be in moving from the sun to Mercury?

How may the planet Venus be known in the heavens? What appearance has it when viewed through a telescope? What is its diameter? What is the length of its day? What is its distance from the sun? How long is it in going round the sun? At what rate does it move per hour?

How much more light and heat do the inhabitants at Venus enjoy than we do? How long would a cannon ball be in passing from the sun to Venus?

What is the diameter of the earth? Required the time it takes to turn upon its axis,—its distance from the sun,—the time of its annual revolution round the sun,—and the rate at which it moves per hour.

What is the name of that fluid which surrounds the earth? What are some of the benefits which we derive from this fluid? How long would a cannon ball take in passing from the earth to the sun?

What is the diameter of the moon, its distance from the earth, and the time of its revolution round the earth?

What is the time between one new moon and another? Explain the phases of the moon. How much more light does the earth afford to the moon, than the moon does to the earth?

How may Mars be known in the heavens? What is the time it takes to turn on its own axis? Required its mean distance from the sun,—the length of its year,—and the rate at which it travels per hour. How long would a cannon ball be in moving from this planet to the sun?

What is the diameter of Jupiter? What is the length of its day and year? At what rate does it move per hour?

How much less light does the sun afford to Jupiter than to us? How is this defect supplied? How long would a cannon ball be in flying from the sun to Jupiter?

What appearance has Saturn in the heavens? How may all the planets be distinguished from the fixed stars? What is the diameter of Saturn? How long does it require to turn on its axis? What is the length of its year? What is its distance from the sun?

How much less light and heat do the inhabitants of Saturn enjoy than we do? How many moons has Saturn? In what respect does this planet differ from the others? How many years would a cannon ball take in flying from the sun to Saturn?

Which is the most remote planet yet discovered belonging to our system? What is the diameter of this planet? How long does it take in turning round the sun? How much light does the sun give to this planet? How many moons belong to it? How long would a cannon ball be in passing from it to the sun?

What are the names of the four new planets? By whom and when were they discovered?

Suppose the sun to be represented by a globe 9 feet 3 inches in diameter, what are the comparative diameters and distances of the other planets? According to the above supposition, what would be the comparative distance of the nearest fixed star?

How may the places of the planets be marked upon the globe?

How may their rising and setting, azimuth, altitude, &c. be found for any given day at any given place?

How may it be found when Jupiter and Venus are morning, and when they are evening, stars?

Required the situation of the planets this year, on the following days:—January 1st, March 20th, May 1st, September 17th, October 6th, and November 21st.

Which of the planets will be visible this year on these days, and whether in the evening or morning?

What angle does the moon's orbit make with the ecliptic? What are the moon's nodes? How long is the moon in passing through all the signs of the zodiac?

Whether does the full moon that happens in June, or that which happens in December, continue longer above the horizon in northern latitudes?

What is it that causes an eclipse of the moon? What causes an eclipse of the sun?

Supposing the north pole to be inhabited, how long would the inhabitants uninterruptedly enjoy the light of the moon in winter?

Within how many degrees of the nodes must the moon be, at the time of change, to produce an eclipse of the sun? Within how many degrees, at the time of full moon, to produce an eclipse of the moon?

What is the greatest number of eclipses that can happen in any year, and how many of these must be of the sun? What is the least number that can happen?

How may the moon's orbit be represented on the globe? How may the moon's diurnal motion in the ecliptic be found?

How may the moon's longitude for any hour be found? How may the moon's place be found for any day and hour?

How may the moon's rising and setting be found? What is the rule for finding the epact? How may the moon's age be found? How is the moon's southing found?

How can it be found when the sun or moon is liable to be eclipsed? Explain the phenomena of the harvest moon. How can the equation of time be explained by the globe?

CONSTRUCTION OF MAPS.

Maps are constructed by making a projection of the globe on the plane of some particular circle, by supposing the eye placed in some particular point, according to the rules of perspective.

1. TO CONSTRUCT A MAP OF THE WORLD.

1*st method.* A map of the world must represent two hemispheres, and they must both be drawn upon the plane of that circle which divides the two hemispheres. The first way is to project each hemisphere upon the plane of some particular circle by the rules of *orthographic projection*, forming two hemispheres upon one common base or circle. In this projection the eye is supposed to be placed at an infinite distance. When the plane of projection is that of a meridian, the maps will be the east and west hemispheres; the other meridians will be ellipses, and the parallel circles will be right lines. Upon the plane of the equinoctial the meridians will be right lines crossing in the centre, which will represent the pole,—the parallels of latitude will be circles having that common centre,—and the maps will be the northern and southern hemispheres. The fault of this projection is, that, nearer the outside, the circles are too close to one another; and, therefore, equal spaces on the earth are represented by very unequal spaces upon the map. The projection is seldom used.

2d method. Another way is to project the same hemispheres by the rules of *stereographic* projection; in which way all the parallels will be represented by circles, and the meridians by circles or right lines. In this projection the eye is supposed to be placed on the surface of the earth, and looking at the opposite hemisphere. And here the contrary fault happens; viz. the circles towards the outside are too far asunder; and those about the middle are too near together. Many of the maps of the world are drawn upon this projection.

3d method. As this method remedies the faults of the two former, it is now generally preferred; we shall, therefore, be more particular in the description of it.

Globular projection upon the plane of the meridian.

From the centre C, fig. 1, with any radius, as CB, describe a circle; draw the diameter AB and NS at right angles, and divide them into nine equal parts; likewise divide each quadrant into nine equal parts, each of which contains 10°. If the scale admit of it, every one of these divisions may be subdivided into degrees.

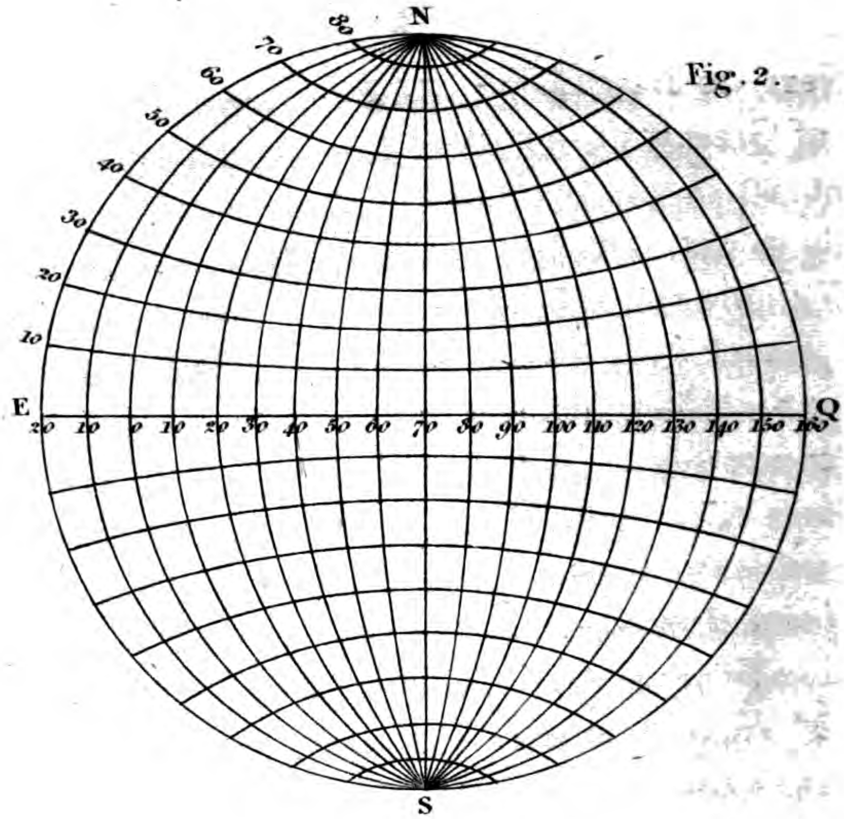

Fig. 2.

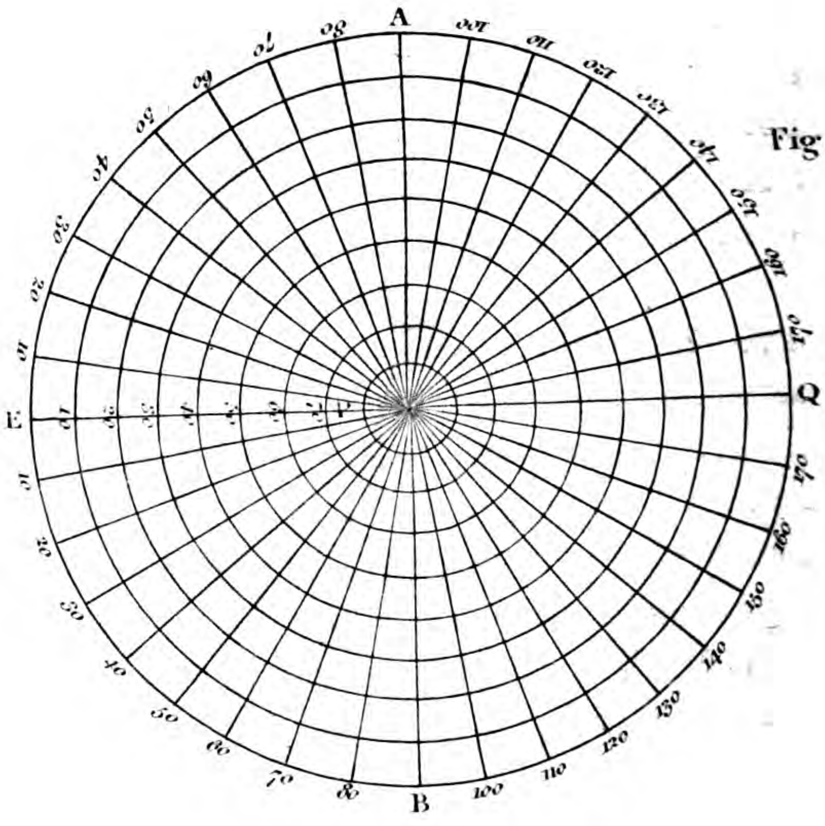

Fig. 3.

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Next, to draw the meridians, suppose the meridian 80° W. of Greenwich,—we have given the two poles, and the point 80 in the equator, or diameter, AB. Describe a circle to pass through these three points as follows:—

With the radius SC, set one foot of the compasses on S, and describe the semicircle XX; with the centre N, and the same radius, describe the semicircle ZZ; then remove the compasses to the point 80 on the equator, and describe the arcs 1, 1, and 2, 2; where they intersect the semicircle, make the point as at 1 and 2, and draw the lines from the point 2 through point 1, till they intersect BA continued in D: then will D be the centre whence the meridian of 80° W. L. from London must be drawn: the same radius will draw the meridian expressing 140° W. L. All the other meridians are drawn in like manner: suppose for 50° W. L. with the radius CB set one foot of the compasses in the point 50, and describe the arcs aa, bb; then draw the lines as before, and you will find the point E, the centre of 50° W. L.;—and so of all the rest.

For the parallels, suppose that of 60°; from the centre, O, with any radius describe the circle FGH; and from the points 60, 60, in the primitive circle, describe the arcs cc and dd, intersecting the circle FGH: through the points of intersection draw lines; and where these lines meet in NS continued, will be the centre of the 60th parallel. In the same manner are all the parallels drawn: only the circle FGH must always be drawn from that degree in the line NS through which the parallel you intend to draw must pass.—Figure 2 is a projection of this sort completed.

When the map is very large, the centres of both meridians and parallels will be found more easily by the following method:—

Having divided the quadrants, and also the diameters, into 9 equal parts, as before, find, by making use of any scale of equal parts, the length of the half chord of each of the arcs, and also the versed sine of half the arc; then, to the square of the half chord, add the square of the versed sine of half the arc; and this sum, divided by the versed sine, will give the diameter, one-half of which is the radius of the circle. In this manner may be found the radii of all the parallels and meridians.

Globular projection upon the plane of the equator.

For the north or south hemisphere, draw the circle AQBE for the equator (fig. 3), dividing it into the four quadrants EA, AQ, QB, and BE, and each quadrant into 9 parts, representing each 10° of longitude; and then from the points of division draw lines to the centre P, for the circles of longitude.

Divide any circle of longitude, as in the first meridian EP, into 9 equal parts, and through these points describe circles from the centre P, for the parallels of latitude, numbering them as in the figure.

In the globular projection, equal spaces on the earth are represented by equal spaces on the map, as near as any projection will bear; for a spherical surface can no way be represented exactly upon a plane. Then the several countries of the world, islands, towns, &c. are to be entered in a map according to the latitudes and longitudes.

In filling up the map, all places representing land are filled with such things as the countries contain; but the seas are left white, the shores being shaded. Rivers are marked by strong lines, or by double lines, drawn winding in form of the rivers they represent; and small rivers are

Fig 4.

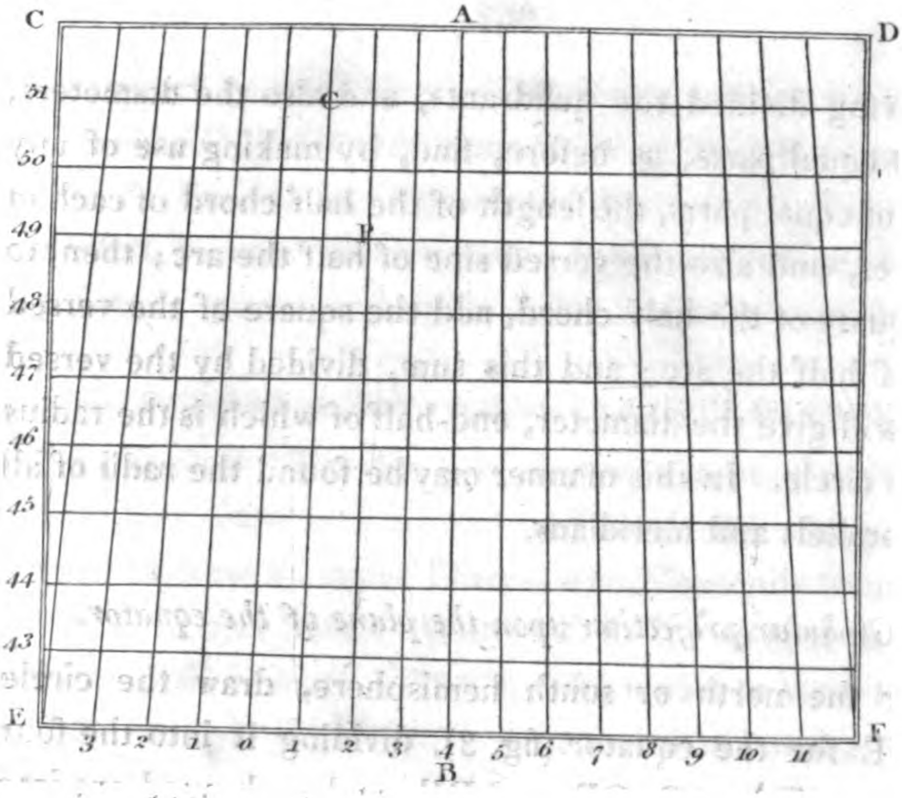
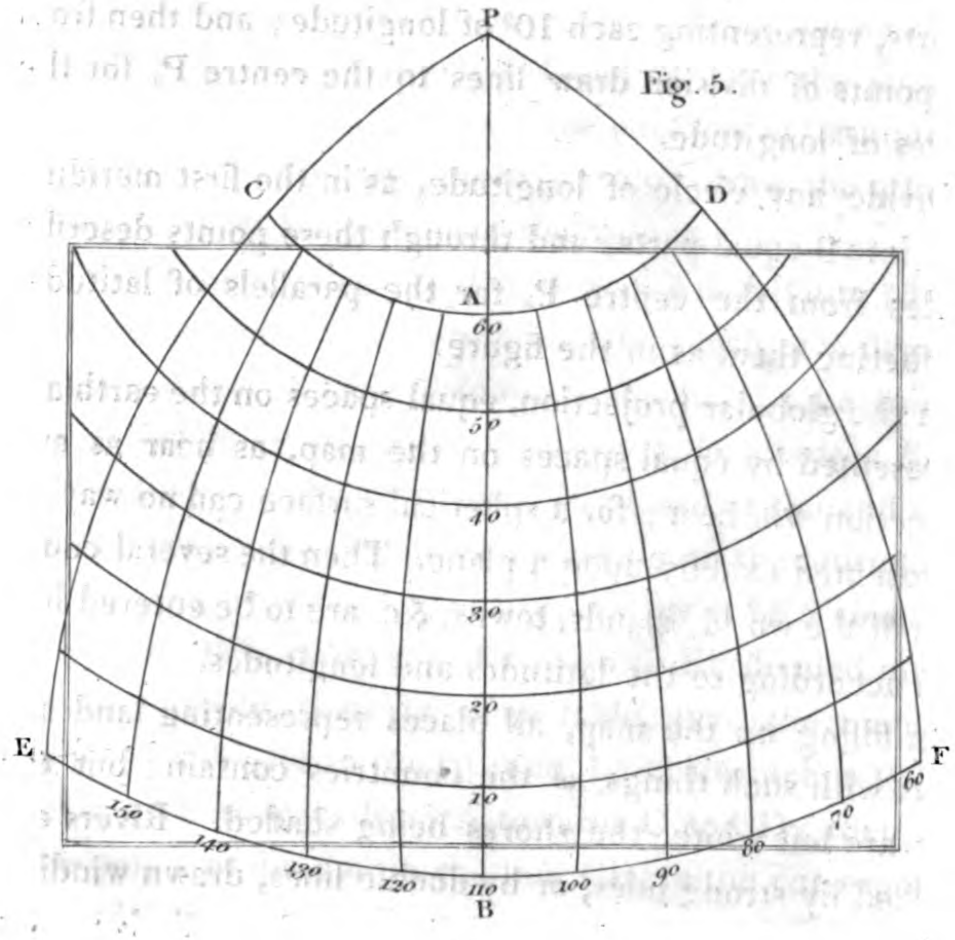


Fig. 5.



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expressed by small lines. Different countries are best distinguished by different colours, or at least the borders of them. Forests are represented by trees; and mountains shaded, to make them appear. Sands are denoted by small points or specks, and rocks under water by a small cross.

II. TO DRAW A MAP OF ANY PARTICULAR COUNTRY.

1*st method.* For this purpose, the extent of the country must be known as to latitude and longitude. Suppose you want to draw a map of France, which extends from 42° to 52° N. L. and from 4° W. to 12° E. L.; so that its extent from north to south is 10°, and from east to west 16°.

Draw the line AB (fig. 4), for a meridian passing through the middle of the country; on which set off 10° from B to A, taken from a convenient scale, A being the north, and B the south point: through A and B draw the perpendiculars CD, EF, for the extreme parallels of latitude: divide AB into 10 parts, through which draw the other parallels of latitude parallel to the former.

For the meridians, divide any degree in AB into 70 parts, or English miles; then, because the length of a degree in each parallel decreases towards the pole, take from the *table containing the length of a degree of longitude in English miles for every degree of latitude,* placed at the end of this book, the number of miles answering to the latitude of B (here 42°), which is $52\frac{1}{2}$ nearly, and set it off 8 times each way from B towards E and F;—so is EF divided into degrees. Again, from the same table, take the number of miles of a degree in the latitude A (52°), which is $42\frac{1}{2}$, and set it off both ways from A towards C and D; then, from the points of division in the line CD, to the corresponding points in the line EF, draw so many right lines for the meridians; number the degrees of latitude up both sides of the map, and the degrees of longitude on the top and bottom: also, in some vacant place, make a scale for miles, by dividing 1 degree into 70 parts, to serve for finding the distances of places upon the map.

Having the latitudes and longitudes of the principal places, it will be easy to set them down in the map; for any town must be placed where the circles of its latitude and longitude intersect: for instance, Calais, whose latitude is 50° 57′ N. and longitude 1° 51′ E. will be at C; and Paris, whose latitude is 48° 50′ N. and longitude 2° 20′ E. will be at P. The sea-coast may be described by setting down the capes and principal places situated upon it, and then drawing a continued line through them all. In the same manner rivers are delineated, by setting down the towns, &c. by which they pass.

2d method. A map of Europe, or of any other quarter of the globe, may be drawn in the same manner as the whole is drawn; but in partial maps an easier way is as follows:—having drawn the meridian AB (fig. 4), and divided it into equal parts, as in the last method, through all the points of division draw lines perpendicular to AB for the parallels of latitude: CD, EF, being the extreme parallels: then, to divide these, set off the degrees in each parallel, diminished after the manner directed for the two extreme parallels CD, EF, in the last method; and through all the corresponding points draw the meridians, which will be *curve* lines, and not straight lines, as they were in the last method. This method is proper for a large tract of country, and may also do for a map of Europe; in which case the meridians and parallels need only be drawn to every 5 or 10 degrees. This method is much used in drawing maps, as all the parts are nearly of their due magnitude, but a little distorted towards the outside, from the oblique intersection of the meridians and parallels.

3d method. For drawing a large map, suppose North America,—draw PB (fig. 5) of any convenient length, for a meridian; divide it into 9 equal parts, and through the points of division describe as many circles for the parallels of latitude, from the centre P, which represents the pole. Suppose AB the height of the map; then CD will be the parallel passing through the greatest latitude, and EF will represent the equator. Divide the equator into equal parts of the ssme size as those in AB, both ways beginning at B; divide also all the parallels into the same number of equal parts, but less in proportion to the latitudes, as directed in the last method for the rectilineal parallels: then, through all the corresponding divisions, draw curve lines, which will represent the meridians, the extreme ones being EC and FD: lastly, number the degrees of latitude and longitude, and place a scale of equal parts, either of miles or degrees, for measuring distances. If one of the meridians, in a vacant part of the map, be graduated or divided into degrees, it will serve for measuring distances, and also for the more accurately determining of the latitude of places. This is a very good way of drawing large maps, and is called the *globular projection*,—all parts of the earth being represented nearly of their due magnitude, excepting that they are a little distorted on the outside.

A TABLE

OF THE

LATITUDES AND LONGITUDES

OF THE

PRINCIPAL PLACES

MENTIONED IN THE PROBLEMS,

Supplemental to those already given in the Sea-ports of Europe.

Names of Places.	*Sea or Country.*	*Latitude.*		*Longitude.*	
Abbeville	France	50°	7′ N	1°	50′ E
Aberdeen	Scotland	57	5 N	2	21 W
Acapulco	Mexico	17	30 N	101	45 W
Achem	Sumatra	5	22 N	95	34 E
Acre	Syria	32	49 N	35	15 E
Adrianople	Turkey	44	5 N	26	31 E
Adventure (B.)	New Holland	43	23 S	147	30 E
Adventure (I.)	Pacific Ocean	17	5 S	144	18 W
Agadez	Africa	20	3 N	11	58 E
Agen	France	44	12 N	0	36 E
St. Agnes (Lights)	Scillies	49	56 N	6	46 W
Agra	India	27	10 N	78	0 E
Aire	France	43	42 N	4	56 E
Aix	France	43	32 N	5	26 E
Aix-la-Chapelle	France	50	47 N	6	4 E
Alashka (S. Pt.)	North America	54	45 N	163	11 W
Alby	France	45	56 N	2	8 E

Names of Places.	*Sea or Country.*	*Latitude.*		*Longitude.*	
Alençon	France	48°	28′N	0°	6′E
Aleppo	Syria	35	45 N	37	20 E
Alexandria	Egypt	31	11 N	30	16 E
Algiers	Barbary	36	49 N	2	13 E
Alkmaar	Holland	52	38 N	4	37 E
Allahabad (Ft.)	India	25	27 N	81	52 E
Altdorf	Switzerland	46	50 N	8	36 E
Altorf	Germany	49	17 N	11	11 E
Amboyna (I.)	India	4	25 N	127	25 E
Ambrym (I.)	Pacific Ocean	16	9 S	168	12 E
Amiens	France	49	54 N	2	18 E
Amsterdam (I.)	Pacific Ocean	21	9 S	174	46 W
Anabona (I.)	Atlantic Ocean	2	36 S	5	35 E
Anapolis Royal	North America	44	52 N	64	0 W
Andrew's (St.)	Scotland	56	17 N	2	58 W
Angers	France	47	28 N	0	33 W
Angouleme	France	45	39 N	0	10 E
Anspach	Germany	49	19 N	10	34 E
Antibes	France	43	35 N	7	7 E
Antigua	Caribbean Sea	17	4 N	62	9 W
Antioch	Syria	36	11 N	36	32 E
Aracan	India	20	3 N	93	30 E
Aracta	Asia	36	1 N	38	50 E
Arcot	India	12	57 N	79	33 E
Arles	France	43	40 N	4	37 E
Arras	France	50	18 N	2	45 E
Ascension (I.)	South Atlantic	7	56 S	13	59 W
Astracan	Siberia	46	28 N	47	58 E
Augsburg	Germany	48	16 N	10	52 E
St. Augustine (C.)	America	4	48 S	35	5 W
Aurora (I.)	Pacific Ocean	15	8 S	168	17 E
Ava	Asia	22	5 N	97	45 E
Avignon	France	43	57 N	4	48 E
Awatcha	Asia	53	1 N	158	30 E
Azoff	Europe	47	10 N	40	55 E
Babelmandeb (I.)	Red Sea	12	50 N	43	45 E
Babylon	Asia	32	25 N	44	29 E
Bagdad	Asia	33	20 N	44	24 E
Balasore	Asia	21	20 N	86	0 E

Names of Places.	*Sea or Country.*	*Latitude.*		*Longitude.*	
Bahama (I.)	Atlantic Ocean	26°	45′ N	78°	35′ W
Bangalore	India	13	0 N	77	42 E
Bantam	Java (I.)	6	15 S	106	25 E
Barbadoes (I.)	Atlantic Ocean	13	0 N	59	50 W
Barbuda (I.)	Atlantic Ocean	17	50 N	61	50 W
Barnevelt's (I.)	America	55	49 S	66	58 W
Basil	Switzerland	47	35 N	7	29 E
Basse Terre	Guadaloupe	15	59 N	61	54 W
Bassora	Asia	30	31 N	47	32 E
Batavia	Java (I.)	6	11 S	106	52 E
Bath	England	51	22 N	2	21 W
Bayeux	France	49	17 N	0	43 W
Bear Island	America	54	34 N	79	56 W
Beauvais	France	49	26 N	2	5 E
Belgrade	Turkey	45	3 N	21	27 E
Belle Isle	France	47	17 N	3	5 W
Benares	India	25	18 N	83	0 E
Bencoolen	India	3	49 S	102	9 E
Bengal	India	22	0 N	92	45 E
Berlin	Prussia	52	31 N	13	22 E
Berne	Switzerland	46	58 N	7	31 E
Berwick	Britain	55	47 N	2	5 W
Besançon	France	47	14 N	6	3 E
Cape Blanco	Africa	20	55 N	17	10 W
Cape Blanco	Peru	4	15 S	81	0 W
Bolabola	Pacific Ocean	16	32 S	151	52 W
Bologna	Italy	44	30 N	11	21 E
Bombay	India	18	57 N	72	54 E
Borneo	China Sea	5	3 N	114	20 E
Boston	America	42	25 N	70	59 W
Botany Bay	New Holland	34	0 S	151	21 E
Bourbon Isle	Indian Ocean	20	52 S	55	30 E
Brandenburgh	Prussia	54	37 N	20	17 E
Bridge Town	Barbadoes	13	5 N	59	41 W
Bridport	England	50	40 N	2	55 W
Brighthelmstone	England	50	50 N	0	5 W
Bristol	England	51	28 N	2	30 W
Bruges	Flanders	51	12 N	3	12 E
Brunswick	Germany	52	14 N	10	41 E

Names of Places.	*Sea or Country.*	*Latitude.*		*Longitude.*	
Brussels	Brabant	50°	51′ N	4°	21′ E
Buda	Turkey	47	28 N	19	51 E
Buenos Ayres	Brazil	34	35 S	58	31 W
Burhampoor	India	21	19 N	76	19 E
Bursa	Turkey	40	0 N	29	9 E
Buxar	India	25	24 N	83	58 E
Cabul	India	34	30 N	68	35 E
Cadiz	Spain	36	31 N	6	12 W
Caen	France	49	11 N	0	22 W
Caffa	Crimea	44	45 N	35	20 E
Cairo	Egypt	30	3 N	31	21 E
Calcutta	India	22	35 N	88	29 E
Calicut	India	11	18 N	75	52 E
Cambridge	England	52	13 N	0	4 E
Canary Isles (N. E. Pt.)	Atlantic Ocean	28	13 N	15	39 W
Candy	Ceylon	7	22 N	80	48 E
Canterbury	England	51	18 N	1	5 E
Canton	China	23	8 N	113	2 E
Cape Clear	Ireland	51	18 N	11	15 W
Cape Comorin	India	7	56 N	78	5 E
Cape Finisterre	Spain	42	52 N	9	17 W
Cape Horn	South America	55	58 S	67	26 W
Cape St. Vincent	Portugal	37	2 N	9	2 W
Cape Verd	Africa	14	45 N	17	33 W
Carthagena	America	10	26 N	75	27 W
Casan	Siberia	55	44 N	49	8 E
Cashgar	Asia	43	0 N	71	15 E
Cashmere	India	34	20 N	73	42 E
Cayenne	America	4	56 N	52	15 W
Celebez Isle (S. Pt.)	Indian Ocean	5	42 S	120	6 E
Ceylon (S. Pt.)	India	5	47 N	81	2 E
Chandernagore	India	22	49 N	88	28 E
Q. Charlotte (S.)	New Zealand	41	6 S	174	14 E
Charlestown	America	33	22 N	79	50 W
Cherburg	France	49	38 N	1	38 W
Chidley	North America	60	22 N	65	0 W
Christmas Isle	Pacific Ocean	1	30 N	155	30 W
St. Christopher's Isle	Atlantic Ocean	17	15 N	62	43 W
Churchill Fort	America	59	0 N	94	0 W

Names of Places.	*Sea or Country.*	*Latitude.*	*Longitude.*
Cochin	India	9° 56′ N	76° 10′ E
Coquet Island	England	55 20 N	1 30 W
Cork	Ireland	51 54 N	8 28 W
Cracow	Poland	49 59 N	19 50 E
Cusco	Peru	12 25 S	70 20 W
Cyprus (I.)	Asia	34 30 N	33 16 E
Damascus	Asia	33 0 N	36 41 E
Delhi	India	28 37 N	77 40 E
Diarbeker	Asia	37 28 N	40 0 E
Domingo (Cape Fr.)	America	19 46 N	72 18 W
Dover	England	51 8 N	1 18 E
P. Sir F. Drake	America	38 45 N	128 35 W
Dresden	Germany	51 6 N	13 31 E
Dublin	Ireland	53 20 N	6 6 W
Dunbar	Scotland	56 1 N	2 40 W
Dundee	Scotland	56 28 N	2 58 W
Durham	England	54 44 N	1 15 W
Easter Island	Pacific Ocean	27 6 S	109 47 W
Edinburgh	Scotland	55 58 N	3 12 W
Elbing	Poland	54 12 N	20 35 E
Ephesus	Asia	37 56 N	27 53 E
Erzerum	Asia	39 57 N	48 41 E
Falmouth	England	50 8 N	5 2 W
Faroe Islands	Northern Ocean	62 0 N	7 0 W
Cape Farewell	Greenland	59 38 N	42 42 W
Fayal Town	Azores	38 32 N	28 41 W
Ferro Island	Canaries	27 47 N	17 46 W
Florence	Italy	43 46 N	11 2 E
Florida Cape	America	25 47 N	80 35 W
Fowey	England	50 20 N	4 35 W
France, Isle of (S. W. Pt.)	Indian Ocean	20 27 S	57 16 E
Funchal	Madeira	32 38 N	17 6 W
Gallipagos Isles	Pacific Ocean	23 30 N	85 0 W
Gambia River	Africa	13 0 N	14 58 W
Ganjam	India	19 23 N	85 19 E
Geneva	Swisserland	46 12 N	6 0 E
Glasgow	Scotland	55 52 N	4 15 W
Goa	India	15 31 N	73 45 E

Names of Places.	*Sea or Country.*	*Latitude.*	*Longitude.*
Gondar	Abyssinia	14° 35′ N	34° 10′ E
Good Hope (C.)	Africa	34 29 S	18 23 E
Goree Isle	Africa	14 40 N	17 25 W
Gottingen	Germany	51 32 N	9 53 E
Granville	France	48 50 N	1 37 W
Greenock	Scotland	55 57 N	4 43 W
Greenwich Obs.	England	51 29 N	0 0
Guadaloupe	Atlantic Ocean	15 59 N	61 59 W
Guernsey	British Channel	49 30 N	2 52 W
Hague	Holland	52 4 N	4 17 E
Halifax	America	44 46 N	63 27 W
Hanover	Germany	52 22 N	9 48 E
Harwich	England	52 11 N	1 18 E
Havannah	Cuba	23 12 N	82 19 W
Heckla	Iceland	63 20 N	20 0 W
St. Helena	Atlantic Ocean	15 55 S	5 49 W
Hull	England	53 50 N	0 28 W
Jackson (Port)	New Holland	38 52 S	151 19 E
Jago (St.)	Cape Verd Isles	15 7 N	23 30 W
Jamaica (P. R.)	West Indies	18 0 N	76 44 W
Janeiro Rio	America	22 54 S	42 44 W
Jerusalem	Asia	31 47 N	35 20 E
Jesso (N. Pt.)	N. Pacific Ocean	45 0 N	145 0 E
St. John's	Newfoundland	47 32 N	52 26 W
Inverness	Scotland	57 36 N	4 15 W
Irkutsk	Siberia	54 30 N	104 30 E
Ispahan	Persia	32 25 N	52 50 E
Juan Fernandez	S. Pacific Ocean	33 45 S	78 37 W
Kamtschatka	Siberia	56 11 N	159 25 E
Kingston	Jamaica	17 57 N	76 33 W
Kiow	Russia	50 27 N	30 27 E
Ladrone Islands, Northernmost	Pacific Ocean	21 0 N	114 6 E
Lancaster	England	54 42 N	2 45 W
Land's End	England	50 6 N	5 54 W
Lassa	Asia	30 12 N	91 20 E
Leeds	England	53 48 N	1 34 W
Leipsic	Germany	51 19 N	12 20 E
Leith	Scotland	56 0 N	3 11 W

Names of Places.	*Sea or Country.*	*Latitude.*		*Longitude.*	
Lima	Peru	12°	1′ S	76°	49′ W
Limerick	Ireland	52	22 N	9	53 W
Liverpool	England	53	22 N	3	10 W
Lizard	England	49	58 N	5	11 W
London	England	51	31 N	0	6 W
Louisburg	North America	45	33 N	59	55 W
Lyons	France	45	46 N	4	49 E
Macao	China	22	12 N	113	46 E
Macassar	Celebes	5	9 S	119	49 E
Madeira	Atlantic Ocean	32	37 N	16	56 W
Madras	India	13	5 N	80	29 E
Madrid	Spain	40	25 N	3	12 W
Majorca	Mediterranean S.	39	35 N	2	30 E
Malacca	India	2	12 N	102	5 E
Malta	Mediterranean S.	35	54 N	14	28 E
Mangeea	S. Pacific Ocean	21	57 S	158	7 W
Manilla	Philippines	14	36 N	120	53 E
Mantua	Italy	45	2 N	10	15 E
Marquesas (P. Madre de Dios)	Pacific Ocean	9	56 S	139	9 W
Martinique (I.)	West Indies	14	35 N	61	9 W
Masulipatam	India	16	9 N	81	10 E
Matapan (C.)	Turkey	36	30 N	22	40 E
Mauritius (Port Louis)	Indian Ocean	20	10 S	57	30 E
St. Matthew (I.)	Atlantic Ocean	1	30 S	7	20 W
Mayo	Cape Verd Isles	15	10 N	23	5 W
Mecca	Arabia	21	40 N	41	0 E
Medina	Arabia	24	58 N	39	53 E
Melun	France	48	34 N	4	5 E
Mexico	America	19	26 N	100	6 W
St. Michael	Azores	37	47 N	25	42 W
Milan	Italy	45	28 N	9	12 E
Minorca	Mediterranean Sea	39	51 N	3	54 E
Mocha	Arabia	13	45 N	44	4 E
Montreal	Canada	45	50 N	73	11 W
Moscow	Russia	55	46 N	37	33 E
Namur	Netherlands	50	28 N	4	45 E
Nangasachi	Japan	32	32 N	128	46 E
Nankin	China	32	5 N	118	47 E

Names of Places.	*Sea or Country.*	*Latitude.*	*Longitude.*
Navigator's Islands	S. Pacific Ocean	14° 0′ S	172° 30′ W
Naze	Norway	57 58 N	7 32 E
Negapatam	India	10 43 N	80 2 E
Nevers	France	46 59 N	3 9 E
Nevis (I.)	Atlantic Ocean	17 11 N	62 52 W
Newcastle	England	54 59 N	1 30 W
New Orleans	North America	29 58 N	89 59 W
Nootka	America	49 36 N	126 43 W
Nore	England	59 28 N	0 46 E
Norfolk Island	Pacific Ocean	29 2 S	168 10 E
North Cape	Europe	71 10 N	25 57 E
Nova Zembla	Arctic Ocean	78 0 N	70 0 E
Nuremberg	Germany	49 27 N	11 12 E
Oaitipeha Bay	Otaheite	17 26 S	149 36 W
Oczakow	Turkey	45 12 N	34 40 E
Okhotsk	Russia	59 30 N	145 0 E
Olmutz	Moravia	49 43 N	17 37 E
Oonalashka (I.)	North Pacific Ocean	53 55 N	166 30 W
Orleans	France	47 54 N	1 54 E
Ormus (I.)	Persia	27 30 N	55 17 E
Osnaburg (I.)	Pacific Ocean	17 52 S	148 6 W
Oxford	England	51 46 N	1 16 W
Owhyhee (N. Pt.)	Pacific Ocean	20 17 N	155 58 W
Panama	America	8 48 N	80 21 W
Paramariboo	South America	6 0 N	55 30 W
Paris	France	48 50 N	2 20 E
Pegu	India	17 0 N	96 58 E
Pekin	China	39 54 N	116 27 E
Pelew Islands	Pacific Ocean	7 30 N	134 0 E
Philadelphia	America	39 57 N	75 13 W
Pico, Azores	Atlantic Ocean	38 29 N	28 26 W
Pitcairn's Island	Pacific Ocean	25 2 S	133 21 W
Plymouth	England	50 21 N	4 7 W
Polotsk	Russia	55 30 N	28 36 E
Pondicherry	India	11 42 N	79 52 E
Porto Rico (N.E. Pt.)	Atlantic Ocean	18 39 N	65 39 W
Portsmouth	England	50 48 N	1 6 W
Potosi	South America	19 0 S	67 30 W
Prague	Bohemia	50 5 N	14 24 E

Names of Places.	*Sea or Country.*	*Latitude.*		*Longitude.*	
Presburg	Hungary	48°	8′ N	17°	33′ E
Pylestaart	South Pacific Ocean	22	23 S	175	41 W
Quebec	Canada	46	48 N	71	10 W
Quiloa	Africa	9	30 S	39	9 E
Quito	Peru	0	13 S	77	55 W
Rangoon	Asia	16	47 N	96	9 E
Rajepoor	India	17	19 N	73	50 E
Ratisbon	Germany	49	2 N	12	1 E
Rhode Island	America	41	28 N	71	30 W
Rhodes	Mediterranean	35	27 N	28	45 E
Rio Janeiro	Brazil	22	54 S	42	44 W
Rochester	England	51	26 N	0	30 E
Rome	Italy	41	54 N	21	29 E
Roque (C. St.)	Brazil	5	0 S	35	43 W
Rotterdam Isle	Pacific Ocean	20	16 S	174	30 W
Salisbury	England	51	4 N	1	47 W
Samarcand	Tartary	39	45 N	64	20 E
Samos	Archipelago	37	46 N	27	13 E
Sancto Cruz	Teneriffe	28	27 N	16	16 W
Sandwich Isles, Northernmost	Pacific Ocean	22	0 N	159	30 W
Saratov	Russia	51	30 N	46	0 E
Saragossa	Spain	41	40 N	0	39 W
Savannah	North America	32	3 N	81	24 W
Scandaroon	Syria	36	35 N	36	25 E
Senegal	Negroland	15	53 N	16	31 W
Senlis	France	49	12 N	2	35 E
Sennaar	Africa	15	0 N	29	30 E
Seringapatam	India	12	32 N	76	52 E
Severn House	North America	56	10 N	88	0 W
Seville	Spain	37	21 N	6	4 W
Shiraz	Persia	29	0 N	54	30 E
Siam	India	14	20 N	100	50 E
Sierra Leone	Africa	8	30 N	12	7 W
Smyrna	Asia	38	28 N	27	26 E
Society Isles (N. W.)	Pacific Ocean	17	30 N	152	0 W
Spitzbergen (N. Pt.)	Arctic Ocean	80	0 N	13	0 E
Stockholm	Sweden	59	20 N	18	4 E
Suez	Egypt	29	50 N	33	27 E

Names of Places.	*Sea or Country.*	*Latitude.*	*Longitude.*
Sunderland	England	54° 55′ N	1° 20′ W
Surat	India	21 10 N	72 22 E
Surinam	South America	6 30 N	55 30 W
Tanjore	India	10 46 N	79 11 E
Tellicherry	India	11 42 N	75 30 E
Teneriffe	Canaries	28 17 N	16 29 W
Tinmouth	England	55 3 N	1 22 W
Tobago (N. E. Pt.)	Atlantic Ocean	11 29 N	59 57 W
Tobolski	Siberia	58 12 N	68 25 E
Tombuctoo	Africa	19 30 N	3 30 E
Tomsk	Siberia	56 30 N	84 59 E
Tongataboo (I.)	Pacific Ocean	21 9 S	174 46 W
Tonquin	India	20 50 N	105 55 E
Torbay	England	50 34 N	3 36 W
Tours	France	47 24 N	0 42 E
Toulouse	France	43 36 N	1 26 E
Trinidad	Atlantic Ocean	20 15 S	126 42 W
Tripoli	Barbary	52 53 N	13 5 E
Tritchinopoly	India	10 49 N	78 46 E
Troyes	France	48 18 N	4 4 E
Truxilla	South America	8 0 S	78 35 W
Tunis	Africa	36 47 N	10 16 E
Turin	Italy	45 4 N	7 40 E
Tyre	Syria	33 10 N	35 24 E
Uliateah (I.)	Pacific Ocean	16 45 S	151 31 W
Upsal	Sweden	59 52 N	17 39 E
Uraniberg	Denmark	55 55 N	12 45 E
Urbino	Italy	43 43 N	12 43 E
Utrecht	United Provinces	52 6 N	5 2 E
Valence	France	44 54 N	4 55 E
Vela Cape	America	12 15 N	71 20 W
Vellore	India	12 54 N	79 19 E
Vera Cruz	Mexico	19 9 N	96 0 W
Verona	Italy	45 26 N	11 18 E
Versailles	France	48 48 N	2 7 E
Vienna	Germany	48 13 N	16 23 E
Warsaw	Poland	52 14 N	21 0 E
Washington	North America	39 0 N	77 10 W
Wells	England	53 7 N	1 0 W

Names of Places.	*Sea or Country.*	*Latitude.*	*Longitude.*
Weymouth	England	52° 40′ N	2° 34′ W
Whale Isle (W. Pt.)	North America	69 14 N	135 0 W
Whitby	England	54 29 N	0 50 W
William (Fort)	Bengal	[See Calcutta.]	
Wrath (C.)	Scotland	58 40 N	4 50 E
Yarmouth	England	52 55 N	1 40 E
Yellow River	China	34 6 N	120 10 E
York	England	53 59 N	1 7 W
York (New)	North America	40 40 N	74 11 W
Zurich	Switzerland	47 22 N	9 21 E

TABLE I.

Containing the length of a degree of longitude in English miles for every degree of latitude.

Lat.	Deg. of Long.	Lat.	Long. Deg. of	Lat.	Deg. of Long.	Lat.	Deg. of Long.
0°	69.2000	23	63.6986	46°	48.0705	68	25.9230
1	69.1896	24	63 2177	47	47.1944	69	24.7992
2	69.1578	25	62.7167	48	46.3038	70	23.6678
3	69.1052	26	62.1963	49	45.3994	71	22.5294
4	69.0312	27	61.6579	50	44.4811	72	21.3842
5	68.9363	28	61.1001	51	43.5489	73	20.2320
6	68.8208	29	60.5237	52	42.6037	74	19.0743
7	68.6845	30	59.9293	53	41.6453	75	17.9103
8	68.5267	31	59.3162	54	40.6751	76	16.7409
9	68.3481	32	58.6851	55	39.6917	77	15.5665
10	68.1489	33	58.0360	56	38 6959	78	14.3874
11	67.9288	34	57 3696	57	37.6891	79	13.2041
12	67.6880	35	56.6852	58	36 6705	80	12.0166
13	67.4264	36	55.9842	59	35.6408	81	10.8250
14	67.1448	37	55.2659	60	34.6000	82	9.6306
15	66.8424	38	54 5303	61	33.5489	83	8.4334
16	66.5192	39	53.7788	62	32.4873	84	7.2335
17	66.1760	40	53.0100	63	31.4161	85	6.0315
18	65.8134	41	52.2259	64	30.3352	86	4.8274
19	65.4300	42	51.4253	65	29.2453	87	3.6219
20	65.0265	43	50.6094	66	28.1464	88	2.4151
21	64.6037	44	49.7783	67	27.0385	89	1.2075
22	64.1609	45	48.9313				

TABLE II.

Showing the declination of the sun for every day in the year.

Days.	MONTHS.											
	Jan. South.		*Feb.* South.		*March* S. & N.		*April.* North.		*May.* North.		*June.* North.	
1	23°	3′	17°	12′	7°	43′	4°	23′	14°	57′	22°	0′
2	22	58	16	55	7	21	4	47	15	15	22	8
3	22	53	16	38	6	58	5	10	15	33	22	16
4	22	47	16	20	6	35	5	33	15	51	22	24
5	22	40	16	2	6	12	5	55	16	8	22	31
6	22	33	15	44	5	48	6	18	16	25	22	37
7	22	26	15	25	5	25	6	41	16	42	22	43
8	22	18	15	6	5	2	7	3	16	59	22	49
9	22	10	14	47	4	38	7	26	17	15	22	55
10	22	1	14	28	4	15	7	48	17	31	23	0
11	21	52	14	8	3	51	8	10	17	47	23	4
12	21	43	13	49	3	28	8	32	18	2	23	8
13	21	33	13	29	3	4	8	54	18	17	23	12
14	21	23	13	8	2	41	9	16	18	32	23	16
15	21	12	12	48	2	17	9	37	18	46	23	19
16	21	1	12	27	1	53	9	59	19	0	23	21
17	20	49	12	6	1	30	10	20	19	14	23	23
18	20	37	11	45	1	6	10	41	19	28	23	25
19	20	25	11	24	0	42	11	2	19	41	23	26
20	20	12	11	3	0	19	11	23	19	54	23	27
21	19	59	10	41	0	5N	11	43	20	6	23	28
22	19	46	10	20	0	29	12	4	20	18	23	28
23	19	32	9	58	0	52	12	24	20	30	23	28
24	19	18	9	36	1	16	12	44	20	42	23	27
25	19	3	9	13	1	40	13	3	20	53	23	26
26	18	48	8	51	2	3	13	23	21	4	23	24
27	18	33	8	29	2	27	13	42	21	14	23	22
28	18	18	8	6	2	50	14	1	21	24	23	20
29	18	2			3	14	14	20	21	34	23	17
30	17	46			3	37	14	39	21	43	23	14
31	17	29			4	0			21	52		

TABLE II.

Showing the declination of the sun for every day in the year.

Days.	*July.* North.		*Aug.* North.		*Sept.* N. & S.		*Oct.* South.		*Nov.* South.		*Dec.* South.	
1	23°	10′	18°	10′	8°	28′	3°	1′	14°	19′	21°	46′
2	23	6	17	55	8	6	3	24	14	38	21	55
3	23	2	17	39	7	44	3	48	14	57	22	4
4	22	57	17	24	7	22	4	11	15	16	22	13
5	22	52	17	8	7	0	4	34	15	35	22	21
6	22	46	16	52	6	38	4	57	15	53	22	28
7	22	40	16	35	6	15	5	20	16	11	22	35
8	22	34	16	18	5	53	5	43	16	29	22	42
9	22	27	16	1	5	30	6	6	16	46	22	48
10	22	20	15	44	5	7	6	29	17	3	22	54
11	22	12	15	26	4	45	6	52	17	20	23	0
12	22	4	15	9	4	22	7	15	17	37	23	5
13	21	56	14	51	3	59	7	37	17	53	23	9
14	21	47	14	32	3	36	8	0	18	9	23	13
15	21	38	14	14	3	13	8	22	18	25	23	17
16	21	28	13	55	2	50	8	44	18	40	23	20
17	21	18	13	36	2	26	9	7	18	55	23	22
18	21	8	13	17	2	3	9	29	19	9	23	24
19	20	58	12	57	1	40	9	50	19	24	23	26
20	20	47	12	38	1	16	10	12	19	38	23	27
21	20	36	12	18	1	53	10	34	19	52	23	28
22	20	24	11	58	0	30	10	55	20	5	23	28
23	20	12	11	38	0	6	11	16	20	18	23	28
24	20	0	11	17	0	17S	11	37	20	30	23	27
25	19	47	10	57	0	41	11	58	20	42	23	26
26	19	34	10	36	1	4	12	19	20	54	23	24
27	19	21	10	15	1	28	12	40	21	5	23	22
28	19	7	9	54	1	51	13	0	21	16	23	19
29	18	53	9	33	2	14	13	20	21	27	23	16
30	18	39	9	11	2	38	13	40	21	37	23	13
31	18	25	8	50			14	0			23	9

TABLE III.

Of the sun's right ascension.

Days.	Jan. H. M.	Feb. H. M.	March. H. M.	April. H. M.	May. H. M.	June. H. M.	Days.
1	18 43	20 56	22 49	0 43	2 34	4 37	1
2	18 48	21 0	22 53	0 46	2 38	4 41	2
3	18 52	21 4	22 56	0 50	2 42	4 45	3
4	18 57	21 8	23 0	0 54	2 45	4 49	4
5	19 1	21 12	23 4	0 57	2 49	4 53	5
6	19 51	21 16	23 8	1 1	2 53	4 57	6
7	19 10	21 20	23 11	1 4	2 57	5 1	7
8	19 14	21 24	23 15	1 8	3 1	5 5	8
9	19 19	21 28	23 19	1 12	3 5	5 9	9
10	19 23	21 32	23 22	1 16	3 9	5 14	10
11	19 27	21 36	23 26	1 19	3 12	5 18	11
12	19 32	21 40	23 30	1 23	3 16	5 22	12
13	19 36	21 44	23 33	1 26	3 20	5 26	13
14	19 40	21 48	23 37	1 30	3 24	5 30	14
15	19 45	21 52	23 41	1 34	3 28	5 34	15
16	19 49	21 56	23 44	1 38	3 32	5 38	16
17	19 53	21 59	23 48	1 41	3 36	5 43	17
18	19 57	22 3	23 52	1 45	3 40	5 47	18
19	20 2	22 7	23 55	1 49	3 44	5 51	19
20	20 6	22 11	23 59	1 52	3 48	5 55	20
21	20 10	22 15	0 3	1 56	3 52	5 59	21
22	20 15	22 19	0 6	2 0	3 56	6 3	22
23	20 19	22 23	0 10	2 4	4 0	6 8	23
24	20 23	22 27	0 13	2 7	4 4	6 12	24
25	20 27	22 30	0 17	2 11	4 8	6 16	25
26	20 31	22 34	0 21	2 15	4 12	6 20	26
27	20 35	22 38	0 24	2 19	4 16	6 24	27
28	20 40	22 42	0 28	2 22	4 20	6 28	28
29	20 44	22 45	0 32	2 26	4 24	6 33	29
30	20 48		0 35	2 30	4 28	6 37	30
31	20 52		0 39		4 32		31

TABLE III.

Of the sun's right ascension.

Days.	July. H. M.	Aug. H. M.	Sept. H. M.	Oct. H. M.	Nov. H. M.	Dec. H. M.	Days.
1	6 41	8 46	10 42	12 30	14 26	16 30	1
2	6 45	8 49	10 45	12 33	14 30	16 34	2
3	6 49	8 53	10 49	12 37	14 34	16 39	3
4	6 53	8 57	10 53	12 41	14 38	16 43	4
5	6 57	9 1	10 56	12 44	14 42	16 48	5
6	7 1	9 5	11 0	12 48	14 46	16 52	6
7	7 6	9 9	11 3	12 52	14 50	16 56	7
8	7 10	9 12	11 7	12 55	14 54	17 0	8
9	7 14	9 16	11 11	12 59	14 58	17 5	9
10	7 18	9 20	11 14	13 3	15 2	17 9	10
11	7 22	9 24	11 18	13 6	15 6	17 14	11
12	7 26	9 28	11 21	13 10	15 10	17 18	12
13	7 30	9 31	11 25	13 14	15 14	17 23	13
14	7 34	9 35	11 29	13 18	15 18	17 27	14
15	7 38	9 39	11 32	13 21	15 22	17 31	15
16	7 42	9 43	11 36	13 25	15 27	17 36	16
17	7 46	9 46	11 39	13 29	15 31	17 40	17
18	7 50	9 50	11 43	13 32	15 35	17 45	18
19	7 54	9 54	11 47	13 36	15 39	17 49	19
20	7 58	9 58	11 50	13 40	15 43	17 54	20
21	8 2	10 1	11 54	13 44	15 47	17 58	21
22	8 6	10 5	11 57	13 48	15 52	18 3	22
23	8 10	10 9	12 1	13 51	15 56	18 7	23
24	8 14	10 12	12 5	13 55	16 0	18 11	24
25	8 18	10 16	12 8	13 59	16 4	18 16	25
26	8 22	10 20	12 12	14 3	16 9	18 21	26
27	8 26	10 23	12 15	14 7	16 13	18 25	27
28	8 30	10 27	12 19	14 11	16 17	18 29	28
29	8 34	10 31	12 23	14 14	16 22	18 34	29
30	8 38	10 34	12 26	14 18	16 26	18 38	30
31	8 42	10 38		14 22		18 42	31

TABLE IV. Of the mean right ascensions in time, declinations, and magnitudes of 40 *remarkable fixed stars; with their names, and literal characters.*

Names of the Stars.	*Ch*	*M*	*Rt. Ascen.*		*Declinat.*		
Polestar, Alruccabah	α	2	0*h*	52*m*	88°	14′	N
Andromeda's girdle, Mirach ..	β	2	0	59	34	33	N
Andromeda's foot, Almach. ..	γ	2	1	51	41	22	N
Ram's following horn	α	2	1	56	22	31	N
Whale's jaw, Menkar	α	2	2	51	3	18	N
Medusa's head, Algol	β	2	2	55	40	10	N
Perseus' side, Algenib	α	2	3	10	49	8	N
Brightest of the seven stars	η	3	3	36	23	29	N
Bull's eye, Aldebaran	α	1	4	24	16	6	N
Auriga's shoulder, Capella....	α	1	5	2	45	47	N
Orion's left foot, Rigel........	β	1	5	5	8	26	S
Bull's north horn	β	2	5	14	28	26	N
Orion's left shoulder, Bellatrix	γ	2	5	14	6	9	N
Orion's girdle	ε	2	5	26	1	20	S
Orion's right shoul. Betelguese	α	1	5	44	7	22	N
Great Dog, Sirius	α	1	6	36	16	27	S
1st Twin, Castor	α	1	7	22	32	19	N
Little Dog, Procyon..........	α	1	7	29	5	44	N
2d Twin, Pollux	β	2	7	33	28	30	N
Hydra's heart, Alphard........	α	2	9	17	7	47	S
Lyon's heart, Regulus	α	1	9	58	12	56	N
Great Bear, Lower Pointer....	β	2	10	50	57	27	N
Great Bear, Upper Pointer....	α	2	10	51	62	50	N
Lion's tail, Deneb............	β	2	11	39	15	42	N
Great Bear's tail, Aliah........	ε	2	12	45	57	3	N
Virgin's spike................	α	1	13	15	10	7	S
Dragon's tail	α	2	13	59	65	20	N
Bootes, Arcturus	α	1	14	6	20	14	N
Libra, South Scale	α	2	14	40	15	12	S
Libra, North Scale............	β	2	15	6	8	38	S
North Crown	α	2	15	26	27	24	N
Scorpion's heart, Antares......	α	1	16	17	25	58	S
Hercules's head, Ras Algethi..	α	2	17	5	14	38	N
Head of Serpentarius..........	α	2	17	26	12	43	N
Dragon's head, Rastaben	γ	2	17	52	51	31	N
The Harp, Lyra..............	α	1	18	30	38	36	N
The Eagle, Atair	α	2	19	41	8	21	N
S. Fish, Fomalhaut	α	1	22	47	30	41	S
Pegasus' wing, Markab	α	2	22	55	14	7	N
Andromeda's head............	α	2	23	58	28	10	N

GREEK ALPHABET.

Α α	Ἄλφα	Alpha	a
Β β ϐ	Βῆτα	Beta	b
Γ γ	Γάμμα	Gamma	g
Δ δ	Δέλτα	Delta	d
Ε ε	Ἐψιλον	Epsilon	e short
Ζ ζ ς	Ζῆτα	Zeta	z
Η η	Ἦτα	Eta	e long
Θ ϑ θ	Θῆτα	Theta	th
Ι ι	Ἰῶτα	Iota	i
Κ κ	Κάππα	Kappa	k c
Λ λ	Λάμβδα	Lambda	l
Μ μ	Μῦ	Mu	m
Ν ν	Νῦ	Nu	n
Ξ ξ	Ξῖ	Xi	x
Ο ο	Ὀμικρὸν	Omicron	o short
Π π ϖ	Πῖ	Pi	p
Ρ ρ ϱ	Ῥῶ	Rho	r
Σ ς σ	Σῖγμα	Sigma	s
Τ τ ϯ	Ταῦ	Tau	t
Υ υ	Ὑψιλὸν	Upsilon	u
Φ φ	Φῖ	Phi	ph
Χ χ	Χῖ	Chi	ch
Ψ ψ	Ψῖ	Psi	ps
Ω ω	Ὠμέγα	Omega	o long

APPENDIX,

CONTAINING

EXTRACTS FROM THE POPULATION RETURNS LAID BEFORE PARLIAMENT IN THE SESSION OF 1812.

The Summary of the Enumeration of 1801, *as compared with that of* 1811, *is as follows:*—

	Population, 1801.			Increase.	Population, 1811.		
	Males.	Females.	Total.		Males.	Females.	Total.
England	3,987,935	4,343,499	8,331,434	1,207,393	4,575,763	4,963,064	9,538,827
Wales	257,178	284,368	541,546	70,242	291,633	320,155	611,788
Scotland	734,581	864,487	1,599,068	206,620	826,191	979,497	1,805,688
Army, Navy, &c.	470,598		470.598	169.902	640.500		640,500
Totals	5,450,292	5,492,354	10,942,646	1,654,157	6,334,087	6,262,716	12,596,803

TABLE

Of Population throughout the last Century.

England and Wales.	
In the Year	Population.
1700	5,475,000
1710	5,240,000
1720	5,565,000
1730	5,796,000
1740	6,064,000
1750	6,467,000
1760	6,736,000
1770	7,428,000
1780	7,953,000
1785	8,016,000
1790	8,675,000
1795	9,055,000
1801	9,168,000
1805–6	9,828,000
1811	10,488,000

From this table it appears that England nearly doubled its inhabitants between the years 1700 and 1810.

GREAT BRITAIN.

Counties of	Population. 1801.	Population. 1811.	Area in square Miles (English.)	Annual Proportions, 1 Baptism to	Annual Proportions, 1 Burial to	Annual Proportions, 1 Marriage to
				Persons	Persons	Pers ns
Bedford	65,500	72,600	430	32	56	126
Berks......	112,800	122,300	744	34	53	144
Buckingham	111,000	121,600	748	33	49	129
Cambridge..	92,300	104,500	686	30	44	127
Chester	198,100	234,600	1,017	33	50	131
Cornwall....	194,500	223,900	1,407	32	62	141
Cumberland	121,100	138,300	1,497	35	54	138
Derby......	166,500	191,700	1,077	33	56	137
Devon......	354,400	396,100	2,488	33	52	113
Dorset	119,100	128,900	1,129	35	57	135
Durham	165,700	183,600	1,040	33	50	128
Essex	234,000	260,900	1,525	33	44	128
Gloucester..	259,100	295,100	1,222	36	61	120
Hereford....	92,100	97,300	971	36	58	150
Hertford....	100,800	115,400	602	34	55	163
Huntingdon	38,800	43,700	345	31	48	129
Kent......	317,800	385,600	1,462	30	41	118
Lancaster ..	695,100	856,000	1,806	29	48	108
Leicester ..	134,400	155,100	816	36	57	130
Lincoln	215,500	245,900	2,787	32	51	126
Middlesex ..	845,400	985,100	297	40	36	94
Monmouth..	47,100	64,200	516	47	64	153
Norfolk	282,400	301,800	2,013	30	50	128
Northampton	136,100	146,100	965	35	52	133
Northumberl.	162,300	177,900	1,809	37	53	137
Nottingham	145,100	168,400	774	32	52	119
Oxford	113,200	123,200	742	34	55	138

GREAT BRITAIN.

Counties of	Population. 1801.	Population. 1811.	Area in square Miles (English)	Annual proportions. 1 Baptism to	Annual proportions. 1 Burial to	Annual proportions. 1 Marriage to
				Pers.	Pers.	Pers.
Rutland	16,900	17,000	200	32	53	147
Salop, Shropsh.	172,200	200,800	1,403	36	57	143
Somerset	282,800	313,300	1,549	35	52	129
Southampton, (Hampshire)	226,900	253,300	1,533	31	49	106
Stafford	247,100	304,000	1,196	32	52	121
Suffolk........	217,400	242,900	1,566	31	53	128
Surrey	278,000	334,700	811	36	45	130
Sussex	164,600	196,500	1,461	30	55	129
Warwick	215,100	236,400	984	35	42	116
Westmoreland..	43,000	47,500	722	31	54	135
Wilts..	191,200	200,300	1,283	35	54	136
Worcester	143,900	165,900	674	32	52	132
Yorks. E. Riding	144,000	173,000	1,268	30	47	105
Ditto N. Riding	160,500	157,600	2,112	30	51	125
Ditto W. Riding	582,700	675,100	2,633	31	51	123
England	8,609,000	9,855,400	50,210	33	49	120
Wales	559,000	632,600	8,125	37	60	136
	9,168,000	10,488,000	58,335	34	50	122
Scotland..	1,652,000	1,865,000	29,167			
Great Britain ..	10,817,000	12,353,000	87,502			

The population here given may be taken as the true population of Great Britain: that given at page 385 includes the whole of the navy and army, part of which is supplied by Ireland.

WALES.

Counties of	Population.		Area in square Miles (English)	Annual Proportions.		
	1801.	1811.		1 Baptism to	1 Burial to	1 Marriage to
				persons	persons	persons
Anglesea	35,000	38,300	402	38	72	139
Brecon.........	32,700	39,000	731	38	54	129
Cardigan	44,100	52,000	726	41	73	141
Carmarthen....	69,600	79,800	926	42	62	131
Carnarvon	43,000	51,000	775	35	67	137
Denbigh	62,400	66,400	731	33	52	140
Flint..........	41,000	48,100	309	31	53	154
Glamorgan	74,000	88,000	822	37	53	121
Merioneth	30,500	32,000	691	40	62	129
Montgomery ..	49,300	53,700	982	36	63	152
Pembroke	58,200	62,700	575	43	64	135
Radnor	19,700	21,600	455	36	56	144
	559,000	632,600	8,125	37	60	122

From the population of 1811, the number of inhabitants to each square mile in Great Britain is 141—in England 180 nearly, and in Scotland 64 nearly.

OBSERVATIONS.

From the last Population Returns it appears, that throughout England and Wales, the proportion of burials in a year, to the number of inhabitants, is as 1 to 50: hence the number of people that die in a year, multiplied by 50, will give the whole number of inhabitants. The proportion of births annually is as 1 to 34, and of marriages 1 to 122. The annual proportion between the baptisms and marriages is as 357 to 100, or $3\frac{1}{2}$ to 1 nearly. The proportion between the sexes, as determined from the register of baptisms for 10 years, is as 100 males to 96 females—a proportion which exactly balances the number of those who die abroad in the employments of war and commerce. The same proportion determined from the whole population, including the army and navy, will be as 100 males to 99 females nearly.

The annual proportion between the number of burials in a country, and the number of inhabitants, has been usually stated as 1 to 33; whereas the proportion for England and Wales appears, as stated above, 1 to 50. So very great a difference indicates, either a decreased mortality to a considerable amount, or an error in former calculations.—The following remarks on this subject are taken from the "Preliminary Observations to the Enumeration and Parish Register Abstracts, 1811:"—"The annual number of burials authorizes a satisfactory inference of diminishing mortality in England since the year 1780. —The average number of burials, from 1780 to 1800, was 192,000 per annum—from 1800 to 1805, it was 194,000 per annum—and from 1805 to 1811, 196,000 per annum. It follows from hence that about the year 1780, one person in 40 died annually; in 1790, one in 45; in 1800, one in 47; and in 1810, one in 49 or 50."

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THE END.

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