OUTDOOR GEOGRAPHY

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by

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PREFACE

The author has for many years taught Practical Geography to classes of teachers, and has found that there is a general feeling that outdoor work with the children is very desirable. The difficulty has been that such lessons have often been somewhat aimless and out of touch with indoor work.

The present book has been written to suggest a course of work which it is hoped will lead to observation and thought likely to make classroom both easier and more fruitful.

Each teacher must choose for himself the order in which he will give the lessons. It will depend upon the weather, the season, the situation of the school, and other circumstances. No attempt has been made to indicate even the age of the children who should attempt a certain exercise. An experienced teacher will judge of this best by his knowledge of the capacity of his pupils, and many of the exercises can be made easy or difficult as the teacher may wish. Some lessons should be repeated, e.g. §12 should be given several times at different seasons. There will probably, therefore, be enough material in the book for an outdoor lesson

once a fortnight, on the average, from Standard III to the top of the elementary school. The lower forms of the secondary school should work the harder exercises, some of them perhaps in a more advanced way.

The author is indebted to Miss F. C. Cliff, B.A., for help in choosing the quotations from English literature, to Mr. A. J. Fawthrop, B.Sc., for many valuable suggestions and criticisms, and to Mr. A. I. Burnley for general assistance, particularly with the illustrations.

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INTRODUCTION

Perhaps the best definition of Geography is "the study of the earth in its relations to man."

It is obvious that, in order to obtain a real knowledge of the earth, the child must observe for himself. Books and oral descriptions only give him second-hand knowledge. Maps, models, and sections provided for him are purely conventional and artificial, and cannot be properly understood unless he has constructed similar ones from nature.

Such observation is carried on to some extent by every child on his own account. Outdoor lessons, however, will be much more effective, because the teacher can call attention to the important points and direct the child's mind along the lines desired. The interest in geography so caused will lead to many valuable observations being made by the child when the teacher is no longer with him.

Books and maps will then have a much fuller value, because the knowledge they give is dependent upon the knowledge of the real world that the pupil possesses before he uses them. Outdoor work is therefore particularly valuable in the elementary school.

It is as impossible to learn geography well from books and maps only, as it is to learn chemistry or botany from books and diagrams only. In both cases

the value of such artificial aids comes in after some knowledge is obtained from experience of the real things which we are studying.

Many exercises in "practical" geography books consist of work on section-drawing from maps, drawing curves from statistics, etc. Such work may be valuable, but it should come *after* more truly practical observations based on facts themselves and not on artificial representations of facts.

Outside the classroom lies the great world of men. It is *that* which we have to study, and the best way to commence is to observe the part of it that we can reach. A knowledge of the regions beyond must be founded by comparison and contrast on what we can learn by the evidence of our senses.

CORRELATION WITH ENGLISH LITERATURE

There may be a danger of the treatment of geography becoming too cold and mathematical. If such a danger exists, it arises from the teacher and not from the subject. Certain branches of geography should be studies in the same way as science or geometry, but the poetic and romantic view of the subject also exists and should be given due prominence.

The following extracts have been chosen because of their bearing on outdoor geography. In the English lesson they should be discussed from other points of view. For instance, referring to the quotation on page 13, it should be explained that the conversation is between conspirators plotting an assassination. While their leaders are speaking aside, the others, no doubt in a state of nervous suspense, are talking, not of the coming tragedy which fills their minds, but of trivial matters in order to pass the time.

It is suggested that the quotations should be learnt by heart by the children after the lesson to which they relate has been given.

CHAPTER I

STUDY OF THE SKY

Astronomy is difficult to teach, even in the most elementary way, to children, because it is necessary to consider the earth from a distance as it were. A conception of the solar system, with its central sun and the earth and other planets revolving round it, is difficult to understand, because we always see the heavenly bodies from a point within the system.

It is best, therefore, until somewhat advanced work is possible, to consider the sun, moon, etc., *as we see them*. It is unnecessary to interfere with the child's original idea that the earth is flat. The sky is considered to be a great hemispherical dome, with the sun, moon, and stars wheeling round it in great curves.

According to the age and capacity of the children, some idea of the almost infinite distances of some of the heavenly bodies should be given. If an express train (60 miles an hour) could leave the earth for the sun and travel night and day, then if it started when a child was born it would not have covered half the distance when he was an old man, 80 years afterwards. Yet the distance of the *nearest* fixed star is enormously greater than this.

If the sun's distance from the earth be represented by 1 foot, the nearest star on the same scale would be over 50 miles away. Other stars are so much farther distant that all known methods of measurement have failed.

No lesson on the sky is complete which does not call attention to its beauty and grandeur. In the ugliest manufacturing or urban district teachers will here have an opportunity of developing the artistic sense of the children.

§1 THE SUN AT NOON — PART I

The first facts to be taught about the sun are that it is a globe of fire, of enormous size and at an enormous distance. Then the fact that it is in the south at noon is the starting-point for a consideration of direction.

Smoke some pieces of glass by holding them over a lighted candle or taper. Let the children look at the sun through these glasses. The idea that it is quite small may be removed by observing it when setting behind distant trees or buildings, when it will quite dwarf them.

Make a clear mark on the school playground. Let a child stand here at noon (remember that 1 p.m. summer time is really noon), and mark the position of the shadow of his head. Tell the children that "south" means towards the sun at noon. In other words "north" means the direction where shadows point at noon. Let the children walk south, i.e. towards the sun, and north, i.e. away from the sun.

Ask what buildings, hills, etc., lie to the north and to the south of the school. Let the children face north with their arms stretched out to the side. Tell them that their right arms point east and their left arms west. Show that the reverse is true if they face south. Let the class march east and west.

On another day let the same child stand on the same mark at noon. Make it clear that the shadow always points the same way at this time.

Some direction exercises may be done in the classroom, but it is more important to know direction outdoors than indoors. The distance and size of the sun can only be indicated in vague terms—figures are of no use.

I am the Angel of the Sun,
Whose flaming wheels began to run
When God's almighty breath
Said to the darkness and the night:
"Let there be light", and there was light.

— Longfellow

§2 THE SUN AT NOON — PART II

The last lesson may now be made more definite and a meridian may be drawn.

By indoor experiments, with a candle or lamp and a rod fixed in an upright position on a board, show that the shadow always points away from the light and that the length of the shadow depends upon the height of the lamp. A clear understanding of these points is essential.

Choose a place in the yard which will be in sunshine most of the day. Place a straight stick (5 or 6 feet long) in an upright position. Mark the end of its shadow at various times, some in the morning, some in the afternoon. Use Greenwich time, remembering that summer time is one hour later, e.g. 12 noon Greenwich is 1 p.m. summer time.

Take a long string, tie it to the bottom of the pole, and at noon (Greenwich) pull it out so that it lies along the shadow but stretches farther. In this way the noon shadow can be drawn longer. Draw the line.

Young children may call this the "noon line". Older children will be taught the name "meridian", or "line of longitude", and the fact will be pointed out that some noon lines are marked on most maps. If lengthened, all noon lines would reach the north and south poles. Older children will understand that all meridians, within a mile or so, are practically parallel, meeting at a very great distance, and that there are an infinite number of them. If possible, a "noon line" should be drawn in the classroom.

Let a child try to tread on his shadow at noon. As the shadow is to the north of him, he will be obliged to walk to the north.

Note 1.—Solar noon, even at Greenwich, may be as much as fifteen minutes different from clock noon. Also every degree of longitude makes a difference of four minutes in solar time. See Appendix IV. Of course, solar noon may be found by noting the time when shadows are shortest.

NOTE 2.—*Any* line drawn due north and south is part of a meridian, and not merely those which are an exact number of degrees east or west of Greenwich.

I feed the clouds, the rainbows, and the flowers
With their ethereal colours; the Moon's globe
And the pure stars in their eternal bowers
Are cinctured with my power as with a robe:
Whatever lamps on Earth or Heaven may shine,
Are portions of one power, which is mine.

— SHELLEY

§3 THE COURSE OF THE SUN — PART I

Some idea of the movement of the sun in the sky may now be given.

The teacher must judge for himself whether the observations can be made best by the children on a Saturday, or whether a few minutes several times a day can be spared for the purpose during school-time.

In either case the child must have a fixed position from which all the observations must be taken. A chalk circle large enough for the child's feet may be marked out. For direction it will be sufficient to say "over the market-place" or "just to the right of __ Hill", etc.

Questions such as the following should be considered, and next day a lesson should be devoted to talking them over and answering them:—

1. Where was the sun at 9 a.m.?

[A place about S.E.]

2. Where was the sun at noon?

[A place about S.]

3. Where was the sun at 3 p.m.?

[A place about S.W.]

4. When was the sun over X (a place due north)?

[Never.]

5. Did the sun appear to move to your right or to your left as you faced it?

[Right.]

6. When was it highest in the sky?

[Noon.]

7. Was it ever directly overhead?

[No.]

8. At noon was it nearer the ground or the overhead point (zenith)?

[If summer, nearer overhead point;
if winter, nearer ground.]

It may now be pointed out that we sometimes think that an object is moving when it is still and *we* are moving the opposite way. Refer to apparent movements when in a train. Tell the children that this apparent movement of the sun is due to the earth moving round like a top. Point out that as we look southwards the sun

seems to move from left to right, therefore we must be moving from right to left, i.e. from west to east.

I stand at noon upon the peak of Heaven,
Then with unwilling steps I wander down
Into the clouds of the Atlantic even.

— Shelley

§4 SUNRISE AND SUNSET

The next step is to observe when and where the sun rises and sets. For young children it is enough to notice that sunrise is towards the east and sunset towards the west. The points are exactly east and west, however, only on 21st March and 21st September. Older children should notice that in summer both rising and setting occur nearer the north, and in winter nearer the south.

In a period of fine, settled weather the children should be encouraged to notice the exact points of rising and setting from a known place of observation. Such observations must be made at each season of the year. The results may be tabulated as follows:—

Date.	Place of Rising.	Place of Setting.	Time of Rising.	Time of Setting.
About Mar. 21	About E.	About W.	About 6 a.m.	About 6 p.m.
,, June 21	,, N.E.	,, N.W.	,, 4 a.m.	,, 8 p.m.
,, Sept. 21	,, E.	,, W.	,, 6 a.m.	,, 6 p.m.
,, Dec. 21	,, S.E.	,, S.W.	,, 8 a.m.	,, 4 p.m.

The exact places and times will vary according to the position of the school.

In a formal lesson the class may be taken to the place of observation and the approximate path of the sun pointed out. It will then be clear that the sun has farther to go in summer, so that it must then be longer above the horizon.

DECIUS.
Here lies the east: doth not the day break here?

CASCA.
No.

CINNA.
O, pardon, sir, it doth; and yon grey lines
That fret the clouds are messengers of day.

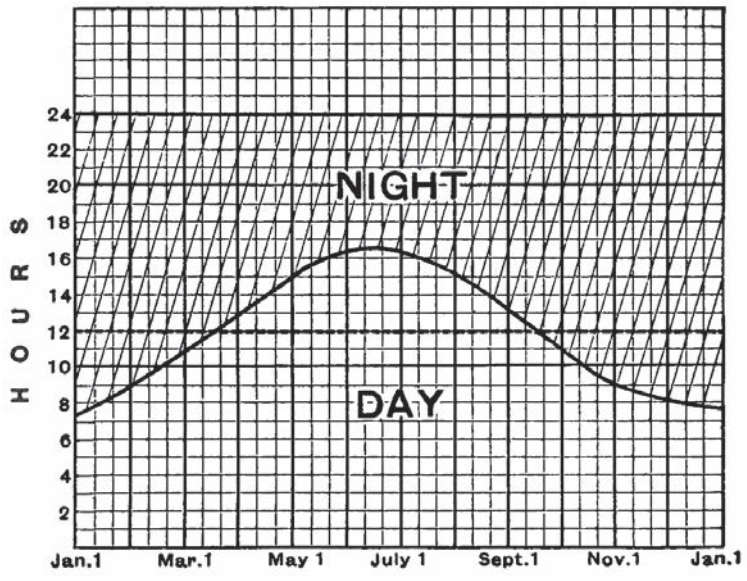
CASCA.
You shall confess that you are both deceiv'd.
Here, as I point my sword, the sun arises;
Which is a great way growing on the south,
Weighing the youthful season of the year.
Some two months hence up higher towards the north
He first presents his fire.
— Shakespeare

§5 THE LENGTH OF DAYLIGHT

Previous to this lesson, observations should be taken on the time of rising and setting of the sun. Should the sun set behind a hill, allowance must be made for this. Point out that darkness comes more quickly than it would if the hill were not there. Tables showing sunrise and sunset are common enough, and if the school is far north of London it may be shown that the sunset times are later in summer and earlier in winter than at London.

If possible, at least one observation a month should be made during a whole year.

By means of the table showing the hours when the sun is above the horizon—at London, draw a graph similar to the one shown. The side of one small square may represent 30 minutes, or a still larger scale may be used.



DURATION OF DAYLIGHT AT LONDON

	Hrs.	Mins.		Hrs.	Mins.
Jan. 1	7	50	July 1	16	39
Feb. 1	9	5	Aug. 1	15	31
Mar. 1	10	50	Sept. 1	13	40
April 1	12	54	Oct. 1	11	41
May 1	14	51	Nov. 1	9	4
June 1	16	23	Dec. 1	8	8

Point out that in more northerly latitudes the line will be more curved, i.e. it will be lower in January and December and higher in midsummer. In any place, however, the total hours of day in a year will equal the

total hours of night. This is shown by the fact that the shaded portion below the dotted line (at twelve hours) is equal to the unshaded portion above that line.

And still with laughter, song, and shout
Spins the great wheel of earth about.

— Stevenson

§6 THE COURSE OF THE SUN — PART II

The experiment described in §2 should now be worked more carefully, using a stick 6 to 8 feet long and marking the end of its shadow every half-hour, if possible, from 9 a.m. to 4 p.m. Greenwich.

At the same time the experiment may be done on a small scale, using a long needle fixed vertically in a sheet of paper on a drawing-board. Care must be taken to mark the exact position of the board, so that if it is accidentally moved it can be replaced.

The following questions should be considered:—

1. Which way does the 9 a.m. shadow point?

[N.W.]

2. In what part of the sky is the sun at 9 a.m.?

[S.E.]

3. Judging from the shadows, where would the 6 a.m. shadow point?

[West.]

Tell the children that the sun is always due east at 6 a.m. and due west at 6 p.m. In winter it is below the horizon at these times, and in summer it is well above the horizon. It is evidently inaccurate, therefore, to say that the sun rises in the east and sets in the west.

4. Where does it seem that the sun would be at midnight?

[North.]

Explain that in this country the sun is always below the horizon at midnight and therefore we never see it in the north.

5. At what time do the shadows stop growing shorter, and begin to lengthen?

[At noon.]

6. At what time of day is the sun highest?

[At noon.]

7. At what time of night is it lowest?

[At midnight.]

8. When in the whole year is it highest?

[Noon at midsummer.]

9. When in the whole year is it lowest?

[Midnight at midwinter.]

Explain how the sun lights up the sky when it is not far below the horizon, so that there is twilight for about an hour before sunrise and after sunset. Also the summer nights in England, and still more in Scotland, are not pitch dark at all unless cloudy.

§7 THE COURSE OF THE SUN — PART III

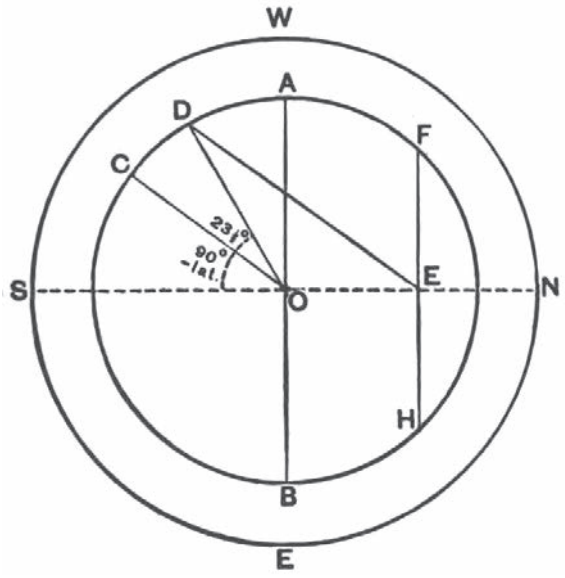
The observations of §6 should be made more definite by a model.

Take a large circular piece of cardboard to represent the district round the observer, whose position is supposed to be at the centre. Draw on it a rather smaller concentric circle. Prepare another disk of cardboard of the same size as this drawn circle. On a diameter of the latter cut a slit and push the smaller cardboard circle halfway through this slit.

If the small circle is inclined to the larger at the correct angle its circumference will represent the apparent path of the sun on 21st March and 21st September. The angle should be 90°, less the latitude of the place, i.e. it will equal the angle of the sun's altitude at noon on the dates mentioned.

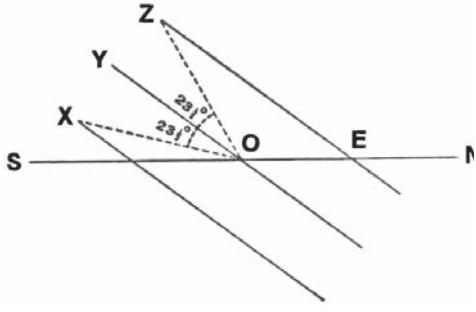
Now cut two other slits in the large disk, parallel to the first. They must be obtained by the construction shown in the diagram. Prepare two more cardboard circles of the same size as the lesser one previously made. Push one through a slit so that the greater portion of it is above the slit. Its circumference, if it is inclined at the same angle as the other one, will represent the sun's path on 21st June. Similarly, the third circle may be fixed to show the path on 21st December.

The diagram at the top of the opposite page is the plan of the large cardboard disk. AB is the first slit, at



right angles to SN. OC is drawn at an angle to SN equal to 90° diminished by the latitude of the place. COD is 23½°. DE is drawn parallel to CO. Through E is drawn FH parallel to AB. FH is the second slit. The third is drawn the same distance to the left of AB that FH is to the right.

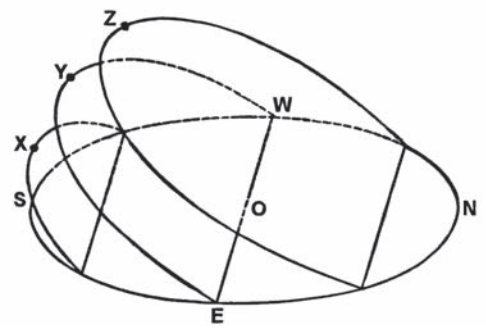
The diagram below is the end elevation of the model. X, Y, and Z are the highest points of the disks, i.e. they represent the noon positions of the sun at midwinter, the equinoxes and midsummer respectively.



§8 THE COURSE OF THE SUN — PART IV

The model should be taken outdoors on a sunny day. A drawing-pin may be fixed on the edge of one of the disks to represent the sun.

If circumstances have prevented a model being made, a diagram such as that shown may be substituted for it. The ellipse SWNE shows the district round O, the point of observation, seen in perspective. As before, XYZ are the noon positions of the sun at the various seasons.



Whether the model or the diagram is used, the facts in the previous lessons should be made more clear.

The children must quite grasp the fact that the sun appears to move in a circle, which is tilted always at the same angle for any particular place of observation. It should be next explained that this angle becomes greater as we travel south, till at the equator the sun is vertically overhead at noon on 21st March and 21st September.

Similarly, in places farther north the sun's path is tilted less, so that the sun rises and sets nearer the north in summer and nearer the south in winter. This gives longer summer days and shorter winter ones. If we go as far north as "the land of the midnight sun", we find that the sun fails to set at all on some midsummer days and fails to rise at all on some midwinter nights.

Show that the midnight sun is always in the north in our hemisphere.

Show how long the twilight is in northern latitudes and how short in the tropics.

Twilight and evening bell,
And after that the dark.

— Tennyson

The Sun's rim dips; the stars rush out;
At one stride comes the dark.

— Coleridge

§9 FINDING NORTH BY A WATCH

Let the children draw a circle, say of 6 inch diameter, on a sheet of cardboard and divide it into twenty-four equal parts. Make a movable pointer, fastened by a drawing-pin at the centre of the circle. At the end A put a vertical needle.

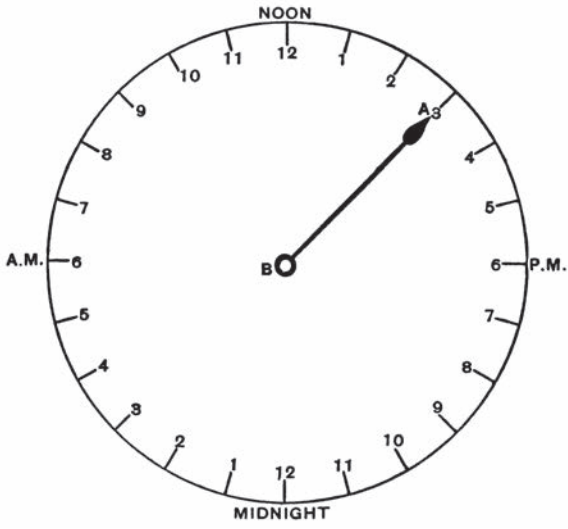
This may be considered as a watch face, but divided into twenty-four hours instead of twelve as an ordinary watch. The pointer stands for the hour hand. Set the pointer to the correct time of day.

Take it into a sunny position and direct the pointer towards the sun. This will be easy, for in the proper position the shadow of the needle at A will fall along the pointer AB. The point marked noon will now be south, that marked 6 a.m. will be east, and so on.

The children should have a clear idea of the sun going round the sky in a huge circle, part, of course, below the horizon, and tilted at an angle to the horizon. If so they will have little difficulty in understanding the above.

It may then be used as a simple sundial. It must be fixed so that the line joining the noon and midnight marks runs from south to north, and then when the pointer is turned to the sun it will show the time.

Explain that the circle on the cardboard represents the huge circle which the sun describes in the sky in twenty-four hours. The hour hand of a watch, however,

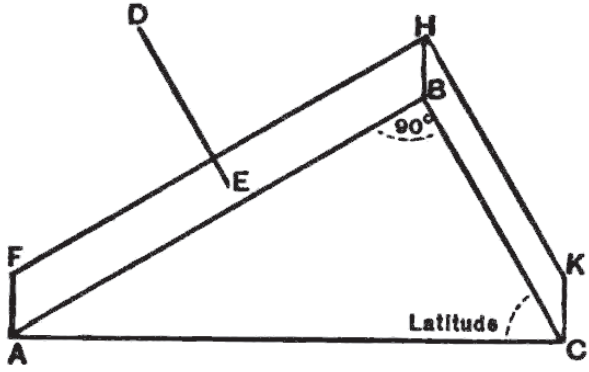


describes a circle in twelve hours, i.e. half the time that the sun takes to complete its circle. As the watch hand moves twice as quickly, we can use it as we do the above cardboard dial but we must halve the angle.

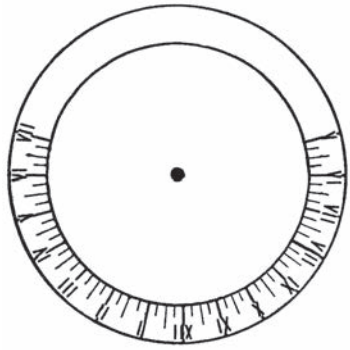
The rule, therefore, is as follows. Point the hour hand of the watch to the sun. Bisect the angle between the hour hand and the XII mark (or the I mark in summer time) and the bisecting line points south.

§10 THE SUNDIAL — PART I

In the woodwork lesson let the boys prepare a piece of wood as shown below. The face ABHF should be about 3 inches square. The other faces do not matter, but the angle BCA must equal the latitude of the school. The boys should find it from an atlas or wall-map. CBA is a right angle.



On a piece of paper let them draw two circles with radii 2½ inches and 3 inches Divide each circle into twenty-fourths, for the hours of the day, and these divisions into quarters. Of course the night hours need not be marked. Gum the paper on to the face ABHF so that the XII mark is lowest. In the centre of the paper fasten a stout needle, taking care that it is exactly perpendicular to the sloping face.



Fix the sundial so that the face ABC (and consequently a line from the needle to the XII mark) points exactly north.

§11 THE SUNDIAL — PART II

At half-hour intervals during the whole of a sunny day let the dial be compared with a clock. Record the results in the manner shown below.

Let children bring information respecting sundials they know of on neighbouring churches, etc. They should be told to be able to answer the following questions:—

1. Is the dial vertical, horizontal, or neither?

2. If vertical, which way does the wall face?

   [South.]

3. Why is this?

   [To have the sun almost all day.]

4. In what direction does the pointer (gnomon) lie?

   [N and S.]

5. What hours are omitted from the dial?

[Early and late.]

6. Why is this?

[The sun will not be shining.]

7. What angle does the gnomon make to the horizontal?

[Equal to latitude.]

8. To what point in the sky does the gnomon point?

[To the Pole Star.]

9. What motto is on the dial?

[Answers will differ.]

The lesson should be devoted to considering the above and discussion as to the weakness of the dial. Tell the class that the earth does not move always with the same speed, and therefore the sun does not apparently move at the same speed. Dial time, therefore, is sometimes fast and sometimes slow, like sun time is. Our clocks are regulated to *mean* or average sun time, as of course it would be difficult to make them hurry sometimes and slow down at other times to keep with the sun.

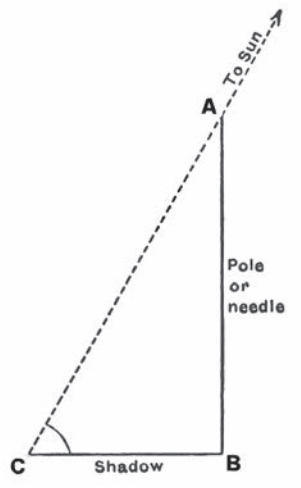
Clock Time.	Dial Time.	Dial Fast or Slow by Clock Time.
9 a.m. 9.30 a.m. 10 a.m. &c.	9.5 a.m. Sun obscure. 10 a.m. &c.	Five min. fast. ——— Correct. &c.

§12 HEIGHT OF THE SUN

To find the angle which the sun's rays make with the ground.

Let one of the children measure the length of the shadow of a vertical pole in the playground at noon. Let others measure the shadow of a vertical needle (see §6). The length of the pole and of the needle must also be accurately measured.

Make a drawing to scale as shown, preferably on squared paper. If AB is the length of the pole or the needle and BC is the length of shadow, then the angle ACB will give the angle to the sun, or what is called the altitude of the sun.



This experiment should be repeated, say every month, to show how the altitude of the sun at noon increases from midwinter to midsummer, and then decreases.

The approximately correct results for latitude 51½° are given below. One degree must be subtracted for every degree that the school is north of 51½°, and one degree added for every degree south of that latitude.

Date.	Altitude.	Date.	Altitude.
January 1.	15½°	July 1.	61¾°
February 1.	21¼°	August 1.	56¾°
March 1.	30½°	September 1.	47°
April 1.	42¼°	October 1.	35½°
May 1.	53¼°	November 1.	24¼°
June 1.	60½°	December 1	16¾°

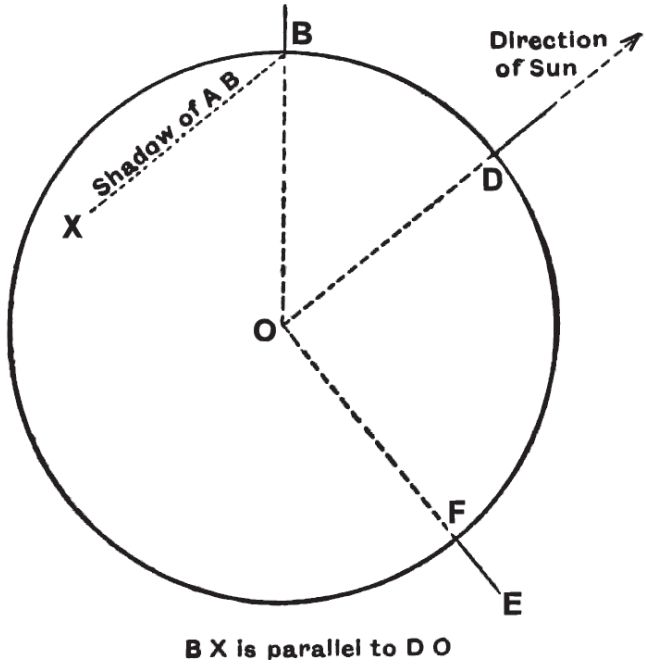
§13 ALTITUDE OF THE SUN AND LATITUDE

It is first necessary to show that the altitude of the sun varies inversely as the latitude, i.e. if the latitude of A is 3° more than that of B, then the sun's altitude at A at a certain time will be 3° less than the sun's altitude at B.

Draw a large circle in the playground to represent the earth. If drawn with a radius of 33 feet it will be on the scale of 1/10 inch to a mile (see §62).

Explain that by "down" we mean towards the centre of the earth. Objects fall towards the centre of the earth, and a vertical line is one drawn towards that point. AB, CD, EF represent vertical lines, and they are not parallel.

If the sun is in the direction shown on the diagram, a pencil erected at D will throw a shadow pointing towards O. This represents then a place where the sun



is vertical. Show that a pencil erected at F (90° from D) throws a shadow on the line which represents the ground. F then represents a place where the sun's altitude is 0°.

Moving 90° over the earth's surface has therefore changed the sun's altitude by 90°.

At B the number of degrees from a vertical sun is given by the angle BOD. The shadow there is not vertical but at an angle XBO to the vertical. But the angle XBO and BOD are equal.

The above is difficult for children, but they will understand that as we move away from a place where the sun is vertical the direction to the sun becomes less and less vertical.

§14 TO FIND THE SIZE OF THE EARTH BY OBSERVATION OF THE SUN

For this determination it is necessary to compare results with some other school far to the north or south. Suppose two schools, at Birmingham and Plymouth respectively, agree to work together. On a certain day the altitude of the sun at noon must be found from each place. It will probably be better to agree on several days, lest some should be cloudy.

Suppose the results are: Birmingham 55°, Plymouth 57¼°. Find from the map the distance that one town is north of the other. It is about 160 miles.

Work out a proportion sum. As the difference in altitude is 2¼°, and this corresponds to 160 miles, a difference of 1° would correspond with 160/2¼ = 71 miles.

The circumference of the globe is 360°. Therefore in miles it must be 360 x 71 = 25,560 miles.

Correct equatorial circumference = 24,872 miles.

§15 TO FIND LATITUDE FROM THE SUN

Find the noon altitude of the sun as in §12. Subtract this from 90° to find how many degrees the sun is from a vertical position.