HELMET SERIES 011

GEOGRAPHY LEARNING RESOURCE FOR FIRST YEAR GEOGRAPHY STUDENTS IN SENIOR HIGH SCHOOLS

- LESSON ONE: THE CONCEPT OF GEOGRAPHY
- LESSON TWO: THE SOLAR SYSTEM
- LESSON THREE: EXPLORING THE EARTH'S SHAPE, MOTIONS AND COORDINATES
- SELF TESTS
- SAMPLE OBJECTIVE QUESTIONS

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LESSON ONE

THE CONCEPT OF GEOGRAPHY

The term 'Geography' originated from a Greek word '*Geographos*' where '*geo*' mean '*earth*' and '*graphos*' also mean '*to describe, write or draw*'. Therefore geography can be simply defined as the description of the earth. Geography is therefore a subject that describes the earth's surface and all the phenomena that takes place within it. Geography studies the earth's landscapes, people, places and the environment which include vegetation, the atmosphere, weather and climate as well as the relationship that exists between these phenomena. Geography as a subject can be divided into three namely Physical Geography, Human Geography and Practical Geography.

Physical Geography concerns itself with the understanding of the changes of the physical landscape and the environment. Physical geography deals with the study of

a. The changes in the earth's landscape (Geomorphology)
b. The changes in the earth's atmospheric conditions (Climatology)
c. The accumulation of water bodies on and beneath the earth (Hydrology)
d. The distribution of vegetation and soil on the earth's surface (Biogeography)

Human Geography involves the study and understanding of the changes in the culture of societies and the economy as a whole. It concerns itself with the study of the settlement pattern, population, soil, drainage patterns, relief features as well as other economic activities such as mining, lumbering, transportation among others.

Practical Geography deals with the various measurements and dimension taken to show the relationship between the distances on the map to that on the ground. It concerns itself with map reading and interpretation, statistical maps and diagram s as well as elementary surveying.

Regional Geography combines the study of physical/natural features with human/cultural changes in the society. It studies how natural occurrences affect man and other phenomena in the environment and society and how activities of man and other living organisms in the environment cause natural occurrences.

RATIONAL OR REASONS FOR THE STUDY OF GEOGRAPHY

1. The study of geography helps students to locate natural and cultural features on the earth surface.
2. It helps students to know the relationship, similarities and differences that exist between various features on the surface of the earth.
3. It helps students to develop a sense of appreciation of nature.
4. The study of geography helps students to know and understand natural occurrences at various places without necessarily going there.
5. It broadens students' understanding of the causes of some natural occurrences at places and enables them to come out with relevant solution to these occurrences.
6. It helps students to know places in the world.
7. It also helps students to choose a career for themselves such as Town and Country Planner, Geography Teacher, Hydrologist, Meteorologist, and many more.

CAREER PROSPECTS IN STUDYING GEOGRAPHY

There are career opportunities associated with the study of geography at higher levels. You can become a professional, based on the skills and expertise you acquire in studying geography. So, you see why it is important to study geography? You can build a career and earn a living in the following areas if you study geography successfully:

1. Surveyor: The one who determines and draws maps of land boundaries, zoning of areas, road routes and building locations.

2. Teaching: A geography teacher imparts geographical knowledge to learners like you. So you see, your geography teacher earns a living from the certificate and the skills they acquired by studying geography.

3. Health/Medical geographer: Deals with the occurrence and distribution of disease.

4. Town and country planning: Helps in the location of human structures in towns and cities.

5. GIS specialist/analyst: Helps in the digitisation of maps, locations and spread of activities in areas.

6. Cartographer: Making local maps and plans to be used by tourists, architects, and pilots.

7. Environmental protection specialist: Helps preserve the Earth as a planet through environmental education and acting as an agent of environmental conservation.

8. Meteorologist: Specializes in atmospheric activities such as predicting the weather.

SELF TEST

1. What does the word geography mean?

2. What are the three main branches of Geography?

3. Describe what is studied in each of the three branches of geography.

4. Identify three careers that are linked to geography

5. For the three careers you have chosen in question 4, describe the work people following each career might be doing.

6. State two things that make studying geography in secondary school important.

LESSON TWO

THE SOLAR SYSTEM

The universe is an embodiment of ourselves as well as the things that surrounds us and these include the solar system. The universe is made up of more than 100 billion galaxies which include the Milky Way Galaxy. The scientific study of the overall structure of the universe is known as Cosmology.

What Is the Solar System?

The solar system is made up of the sun, the planets and other heavenly bodies. Therefore, the solar system consists of the sun and all the objects that move around it. Gravity pulls them together to form a huge system called Galaxies. The solar system was formed at about 4.56 billion years ago and the materials that form the solar system are Volatile and Refractory materials. Volatile materials are materials that could exist on earth as gas. Hydrogen, helium, methane, ammonia, water and carbon mono oxide are examples of volatile materials. Refractory materials are materials that melt only at high temperatures and they condense to form solid particles of dust in the coldness of space.

THE SUN

The Sun is at the centre of the solar system and all the planets revolve around it in elliptical orbit. The pathway on which planet moves round the sun is known as Orbit. The sun is one of the over 300 billion stars that together form the Milky Way galaxy. The sun, by means of gravitational glue, holds many other objects in the solar system and these include the planets. The sun is a big star which is a source of light and heat to the planets as well as the objects that move around it. It has a surface temperature of about 6000°C.

THE PLANETS IN THE SOLAR SYSTEM

A Planet is a sizable spherical object orbiting or moving round a star and it may itself travel with a moon or several moons. The word ***planet*** comes from the Greek word ***planēs*** which mean "**wanderer**". There are nine planets in the solar system and these include Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto. The nine planets in the solar system have been divided into two namely the Inner Four and the Outer Four. The inner four is made up of the first four planets which are Mercury, Venus, Earth and Mars. They are also known as Terrestrial or Earth-like planets. The outer four is made up of the next four planets which are Jupiter, Saturn, Uranus and Neptune. They are also known as the Gas Giant or Jupiter-like planets. Pluto is not part of this division.

The planets in the solar system are distinguished from each other based on their distance from the sun, size, temperature and the period they take to rotate and revolve round the sun. The planets in the solar system are as follows;

MERCURY

Mercury is the closest planet to the sun and the smallest in the solar planet in the solar system. It has a temperature ranging between 18°C to 420°C making it inconvenient to live there. It is away from the sun with an average distance of about 60 million kilometers. Also, it has a diameter of 480 kilometers. Mercury takes approximately 59 days to rotate on its axis and 88 days to revolve round the sun. It has no satellite.

VENUS

Venus is the next planet after mercury. It is considered as the "Earth's Twin" due to its close similarities with the earth in size, mass and density.It has an average temperature of about 480°C and about 108 million kilometers away from the sun. It has a diameter of about 12,100 kilometers. Venus takes approximately 243 days to rotate on its axis and 225 days to revolve round the sun. It has no satellite.

EARTH

The earth is the third planet in the solar system. It has a conducive temperature which makes it the only planet in the solar system that supports man's life. It has a diameter of about 12,762kilometers. The earth takes approximately 24 hours to rotate on its axis and 365¼ days to revolve round the sun. The earth has one natural satellite, which is the moon.

MARS

Mars is the fourth planet in the solar system. It has many dust storms which give it a red appearance and for this, Mars is sometimes called "Red Planet". It has an average temperature of about 120°C and 228 million kilometers away from the sun. It has a diameter of about 600 kilometers. Mars takes approximately 24.5 hours to rotate on its axis and 626 days to revolve round the sun. It has two satellites.

JUPITER

Jupiter is the fifth planet in the solar system. It is the biggest and the heaviest planet in the solar system. In fact, it is heavier than all the planets put together. It has 1 ring around it. It has an average temperature of about 140°C and 780 million kilometers away from the sun. It has a diameter of about 134,700 million kilometers. Jupiter takes approximately 10 hours to rotate on its axis and 11.9 years to revolve round the sun. It has 50 moons or satellites.

SATURN

Saturn is the sixth planet in the solar system and the second largest planet. It also has 7 rings system around it. It has an average temperature of about 170 °C and 1427 million kilometers away from the sun. It has a diameter of about 101,000 kilometers. Saturn takes approximately 10.7 hours to rotate on its axis and 29.5 years to revolve round the sun. It has 53 moons or satellites.

URANUS

Uranus is the seventh planet in the solar system. It appears blue from the earth due to the presence of methane in its atmosphere. It has an average temperature of about 210°C and its 2870 million kilometers away from the sun. It has a diameter of about 700 kilometers. Uranus takes approximately 17 hours to rotate on its axis and 84 years to revolve round the sun. It is the only planet which revolves in the clockwise direction. It has 27 moons or satellites and 13 rings.

NEPTUNE

Neptune is the eighth planet the solar system. Like Uranus, Neptune also appears blue from the earth due to the presence of methane in its atmosphere. It has 6 rings around it. It has an average temperature of about 220°C and 4500 million kilometers away from the sun. Neptune takes approximately 16 hours to rotate on its axis and 165 years to revolve round the sun. It has 13 moons or satellite.

This a picture showing the sun with the nine planets in orderly manner starting from mercury, followed by Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

OTHER HEAVENLY BODIES

Other heavenly bodies are the objects that move round the sun apart from the planets. These include the moon, asteroids, meteorites and comets.

SATELLITES

They are smaller heavenly bodies that revolve round the planets. The moon is an object locked in orbit round a planet. Moon is a natural satellite of the Earth. It takes the moon approximately 27 days to orbit round the earth. The average distance from the earth to the moon is 384,400km.

ASTEROIDS

Asteroids are small bodies of solid rock or metal that orbit or move around the sun.

METEORITES

Meteorites are also solid objects in the solar system and they can fall from space and land on the earth. They range in sizes from smaller particles to boulders.

COMETS

Comets are small blocks of ice or frozen bodies in space that shed gas and dust.

IMPORTANCE OF THE SOLAR SYSTEM AND THE SUN

1. The Sun provides heat to the planets. The Sun heats the Earth, providing it with the right temperature for living beings to survive.
2. The Sun provides light to the Earth. Light helps provide energy to the Earth through electromagnetic energy. It also helps humans as well as animals to see day and night. The light also helps plants to grow by powering the process of photosynthesis.
3. The solar system, particularly the Sun, drives the water cycle and influences the climate. The Sun's heat causes evaporation and transpiration, leading to cloud formation and, eventually, rainfall. This cycle is essential for sustaining most life on Earth.
4. The solar system, through the Sun, provides an important source of energy on the planets. On Earth, some of the energy produced through electricity is directly or indirectly from the Sun, which is called solar energy.
5. The Sun's gravity helps keep the planets in the solar system in a stable orbit around the sun.
6. The solar system on the planet Earth provides a habitable home for living organisms. You see, we survive on the planet Earth because it has ideal conditions for living organisms like you and me.

SELF TEST

1. Define Solar System

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2. Complete the table below;

PLANET	ROTATION	REVOLUTION	NUMBER OF MOONS/ SATELLITES	NUMBER OF RINGS
Mercury	……	……	…….	None
Venus	……..	……	None	…….
Earth	…….	365¼ days	……	None
Mars	24.5 hours	…….	……..	……
Jupiter	…….	…….	…….	…….
Saturn	…….	……..	……..	……
Uranus	……..	84 years	…….	…….
Neptune	16 hours	…….	……..	……..

3. A sizeable solid object orbiting a star and it may itself travel with a moon or many moons is known as…….
4. I am located at the middle of the solar system and I also serve as a source of heat and light to the planets. What am I?.....
5. List three (3) heavenly bodies that also revolve round the sun aside the planets.
   a. ……
   b. ……
   c. ……
6. Explain the reason why Mercury is considered to be the hottest planet while Pluto is the coldest planet?

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7. Why is Venus considered as the ‘’Earth’s Twin’’?

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8. Why is Mars also called the ‘’Red Planet’’?

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9. Why does Uranus appears ‘’blue’’ when viewed from the Earth?

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10. Why is Earth considered as the only planet that supports man’s life?

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LESSON THREE

EXPLORING EARTH'S SHAPE, MOTIONS AND COORDINATES

Initially, the earth was believed to be flat. Research proved that the earth is not flat but spherical in shape. The earth is not a perfect sphere but an oblate sphere, which means, it is flattened at the poles. Therefore, the shape of the earth can be termed as Geoid.

PROOFS OF THE SHERICITY OF THE EARTH

There are several proofs that show that the earth is spherical in shape and these include the following;

1. Circumnavigation of the earth

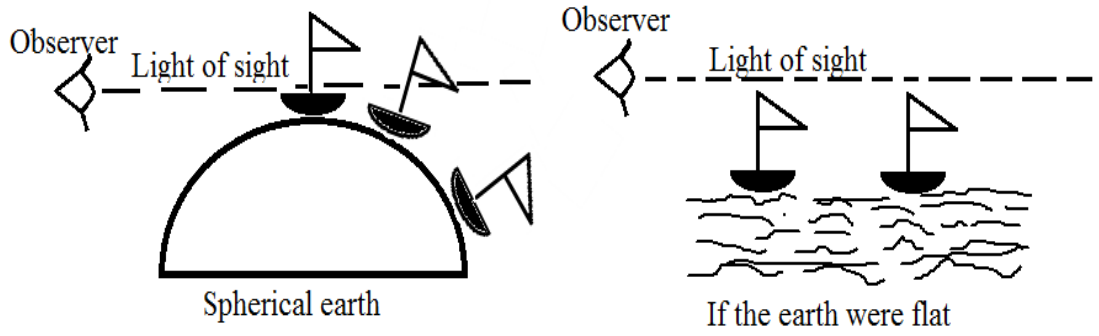
It has been proven that a person who travels on the sea towards the east or west across the world by sea will comeback to the area he or she started from only if he or she follows the same direction. No sharp edge will be met. This was proven beyond doubt by the first voyage around the world by Ferdinand Magellan (1519-1522) and Francis Drake who came back to where they started from.

2. The Circular Horizon of the earth

Viewing the horizon of the earth from the deck of a ship at sea or from a cliff on the land is always circular or spherical in shape. As height or altitude increases, the circular horizon of the earth enlarges or widens and it is on only spherical bodies this can seen.

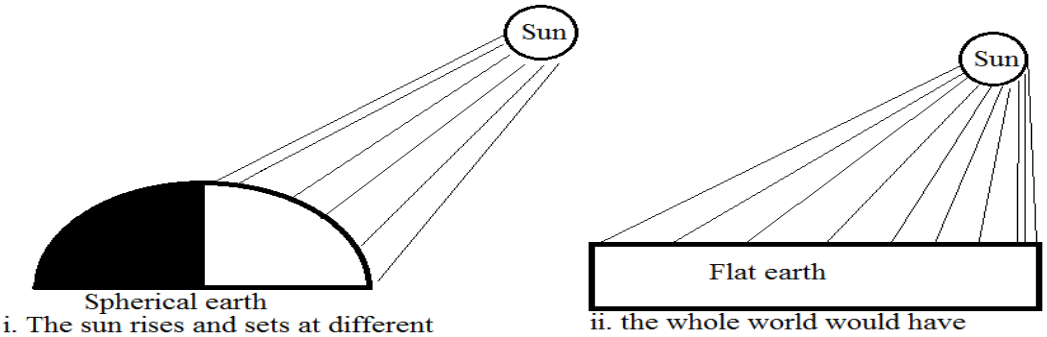
3. Ship's Visibility

Due to the spherical shape of the earth, when a ship appears over the distant horizon, the top of the mast is seen first before the hull then later the total body of the ship is seen. When the ship leaves the habour, its disappearance is gradual over the curved surface. The whole ship would have been seen at once if the earth was to be flat.



4. Sunrise and Sunset

Sunrise and sunset is not experienced equally at all places due to the spherical shape of the earth. Places in the East see the sun earlier than places in the West because the earth rotates from West to East.



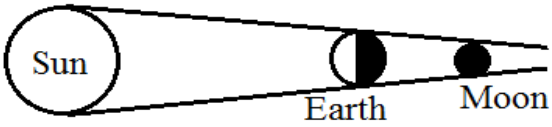
i. The sun rises and sets at different times in ddifferent places

ii. the whole world would have sunrise and sun set at the same time

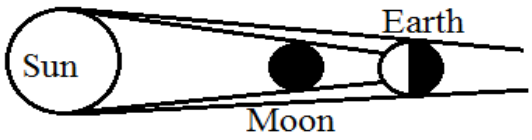
5. The Eclipse of the Moon

The eclipse of the moon is also known as Lunar Eclipse and this is the period where the earth comes between the moon and the sun. The shadow cast by the earth on the moon during the lunar eclipse is always circular and only spheres can cast this circular shape.

Eclipse of the Moon
(earth comes between moon and sun)



Eclipse of the Sun
(moon comes between earth and sun)

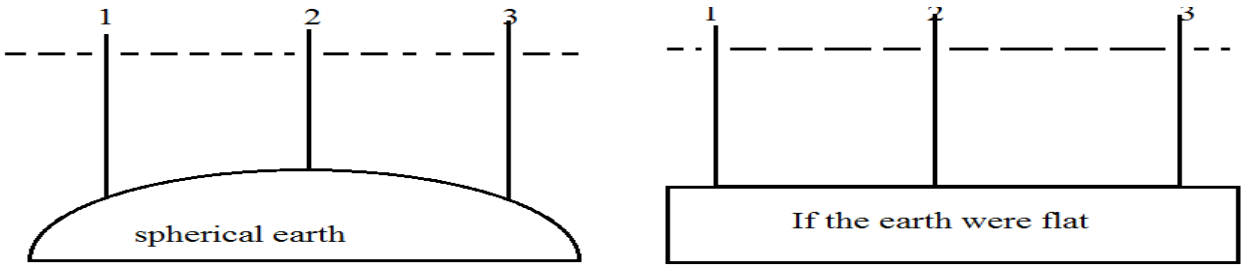


6. Aerial Photographs

Pictures taken from space by satellites, rockets as well as powerful devices at high altitude show clearly the curved edge of the earth. This is the most convincing and up-to-date proof of the earth's sphericity.

7. Driving Poles on Level Ground

Three poles planted on the earth's surface by engineers at equal intervals from one another were observed. It was observed that the three poles did not give a perfect horizontal. The middle pole was higher than the first and third poles and this was as a result of the spherical or circular nature of the earth.



Bedford Level Canal Experiment

8. Planetary Bodies

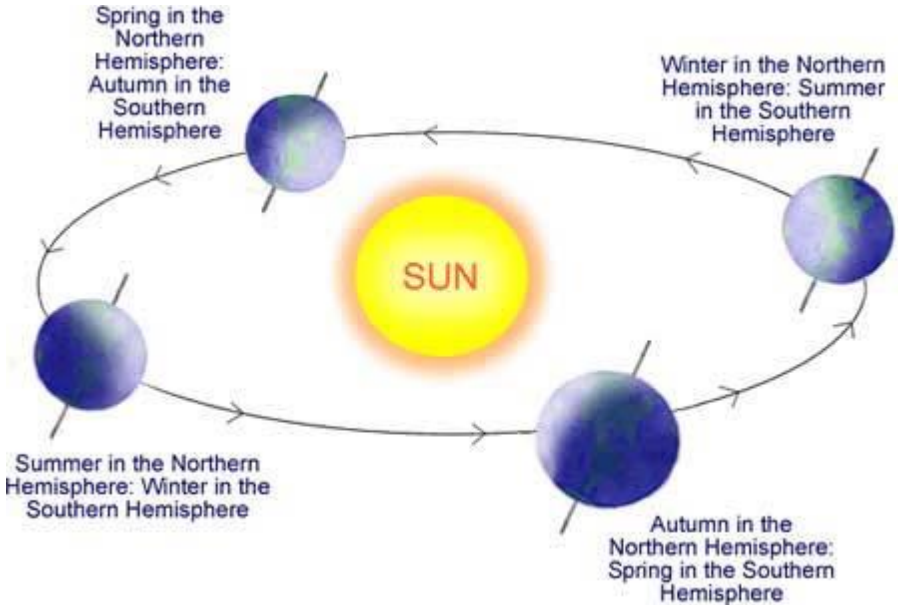
The various planetary bodies in space which include the moon, sun, stars and planets observed from a telescope revealed that they had circular shapes at every angle observed from, and the Earth which is a planet cannot be an exception.

THE MOVEMENTS OF THE EARTH

The earth is a mobile body that moves in space. The earth moves in two major ways which occur simultaneously and these are; Revolution and Rotation of the Earth.

REVOLUTION OF THE EARTH

This is the movement of the earth in its orbit around the sun. It takes 365 ¼ days (365 days 6hours) to make one complete revolution (30 kilometres per second). The Earth revolves in an anti-clockwise direction when viewed from space above the North Pole. The orbit is ellipsoid. On 3rd January, the Earth reaches its shortest distance from the sun (147.5 million km) and it is called ***Perihelion.*** On 4th July the Earth reaches its farthest distance from the sun (152.5 million km) and it is called ***Aphelion.***As the Earth revolves, it is tilted or inclined at angle of 66 ½ to the orbital plane and 23 ½ to the perpendicular of the plane. This is because the axis always points to the Polar Star (Polaris).



EFFECTS OF THE REVOLUTION OF THE EARTH

Varying lengths of day and night at different times of the year

The duration of the days and nights fluctuate in thesame time in the different parts of the year due to the revolution of the earth. As a result, it is observed that in the same latitude, the length of day and night fluctuate in different periods of the year. In the process of revolutionary motion the earth, on 2lst June reaches in such a position that the sun's rays fall vertically on the northern most position of the earth, that means, on 23.5° North latitude or on the Tropic of Cancer. At this time, the northern hemisphere remains inclined more towards the sun and the southern hemisphere remains at the furthest distance from the sun. That is why the length of the day is greater and the temperature is higher in the northern hemisphere. So, 21st June is the longest day and shortest night in the northern hemisphere. The sun reaches its northern most limit on 21st June and the date is known as Summer Solstice. The sunshines vertically over the equator on 21st March and 23rd September. On these two dates, the sun remains in equal distance from the north and south poles. So, on these two dates, the duration of the day and night is equal (12 hours day and 12 hours night) over the entire world. The day when the day and night are equal over the globe, is known as the Equinoxes. 21st March is spring in northern hemisphere. So, 21st March is called the Vernal Equinox, and 23rd September is Autumn northern hemisphere, so 23rd September is known as Autumnal Equinox. The southern hemisphere shows maximum inclination towards the sun on 22nd December. So, on that date it is the longest day and the shortest night in the southern hemisphere. The sun reaches its southernmost position on this day

and the date is known as the Winter Solstice. The sun gives its rays vertically over 23.5° South latitude or Tropic of Capricorn.

Changing altitude of the mid-day sun

The sun is seen to be located in different positions in different periods of the year. We can observe that on 21st March and 23rd September, the sun rises at a point due east on the horizon and sets at a point due west on the horizon. Again, we can see that on 21st June and 22nd December, the sun rises at north-eastern horizon and south-eastern horizon in the sky respectively. From 21st June to 23rdDecember, the sun seems to have an apparent motion towards south. This is known as southerly movement of the sun. Again from 22nd December to 21st June, it seems that the sun is apparently moving towards north and this movement of the sun is known as northerly movement.

Seasonal Changes

Due to the difference of temperature, the change of seasons does occur. The whole year is being divided into 4 divisions on the basis of the variation oftemperature. Each of the divisions is known as a season. These are the Summer, the Autumn, the Winter and the Spring. It is to be noted here that when summer prevails in the northern hemisphere, winter sets in the southern hemisphere. Again, when there is winter in the northern hemisphere, it is summer in the southern hemisphere. Similarly, when it is spring in the northern hemisphere, it is autumn in the southern hemisphere and it is spring in the southern hemisphere when it is autumn in the northern hemisphere.

It determines the length of a year

One complete revolution around the Sun takes approximately 365¼ days. This duration defines the time it takes for the Earth to complete its orbit and return to the same position relative to the Sun. The concept of a year is essential for calendars, agricultural cycles, and various cultural and religious celebrations.

ROTATION OF THE EARTH

The rotation of the earth refers to the movement of the earth on its axis from west to east. The earth takes 23 hours 56 minutes and 4 seconds or nearly 24 hours to rotate once on its axis. This period of 24 hours is regarded as one day. This diurnal movement of the earth is the rotation. One such full rotation of the earth is known as solar day. The earth takes a full day to complete rotation once on her axis. The speed of rotation is different in different places. The speed of rotation at the equator is highest. Here the speed of rotation is more than 1,610 kilometers per

hour. This speed decreases towards north and south of the equator. The speed of the rotation is nearly zero at the poles.

EFFECTS OF THE ROTATION OF THE EARTH

Occurrence of day and night

One of the effects of the earth's rotation is the occurrence of day and night. We know that the earth is round and it does not haveany light of its own. The earth becomes illuminated by the light of the sun. Due to diurnal motion, that part of the earth which faces the sun becomes illuminated. It is day in the illuminated portion of the earth. Sunlight does not reach the opposite part of the illuminated portion. So, it remains dark and it is night in thedark portion of the earth. Due to rotation of the earth, alternately the illuminated portion becomes dark and the dark portion becomes illuminated and that is why the day and night are changed. When the dark portion is illuminated, it becomes day there. Similarly the illuminated portion turns dark, it becomes night there. Thus day and night has been occurring alternately. So, in some places it is 12 hours of day and 12 hours of night.If the shape of the earth would have been flat instead of being round, the rotation of theearth would create only day or only night. In other words, either only day or only nightwould exist simultaneously over the globe. On a specific date, in some parts of theearth it is day whereas in other parts it is night. That means when a portion of the earth remains dark the other part becomes illuminated. The border of the lighted and thedark portion is called the shadow circle. Due to rotation, when the dark portion, aftercrossing the shadow circle faces the light, it is known as morning. The feeble light which precedes the morning is known as dawn and similarly the feeble light that precedes the evening is called twilight. In any place, when the sun reaches the highest elevation of thesky it is known as midday or noon and the time recorded is 12 O' clock. But in the opposite point of that place it is midnight.

Temperature differences

It is due to the spherical shape and also for rotation that a comparatively small portion of the earth, located in the tropical areas between 23.5°North latitude to 23.5° South latitude gets direct sunlight only for sometime of the year. The region where the sun gives its rays perpendicularly gets more heat. On the other hand, the areas located north and south of the region mentioned above get slanting rays and so these areas get less heat.

Ocean currents, Tide and ebb and wind circulation

Diurnal motion of the earthcreates rotational force which is responsible to change the direction of wind and oceancurrents. So, as an effect of earth rotation, ocean current and the winds are deflectedtowards right in the northern hemisphere and towards left in the southern hemisphere.

Determining the time

Due to the rotation of the earth, calculate time has become easier. This is because the period of one complete rotation of the earth can be divided into 24 parts and each of the parts can be calculated as an hour. Again the hour can be sub-divided to sixty divisions and the period of each of the divisions can be taken as a minute. Similarly, the minute can again be divided into sixty divisions taking each division as one second.

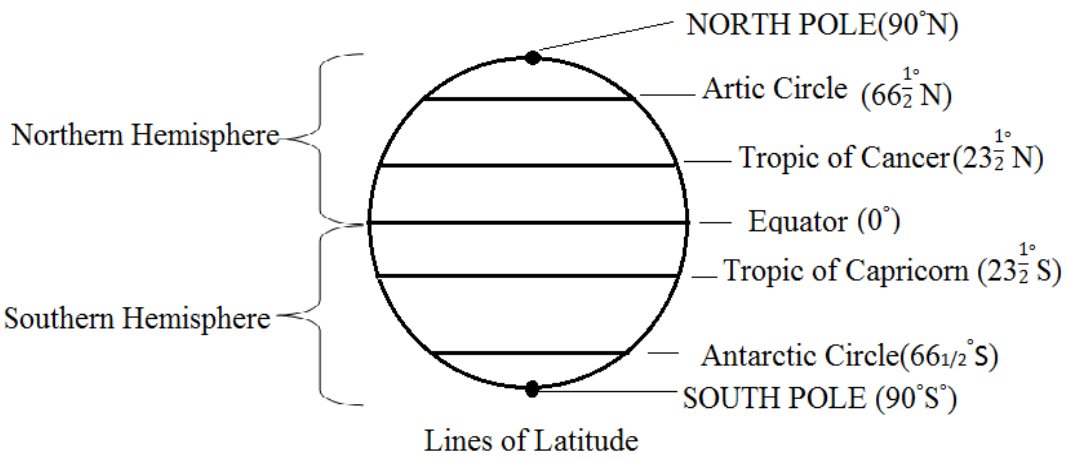
Influence on nature and living creatures

If due to rotation of the earth, any change occurs in the field of temperature and light then such change influences the production, growth and character of living organisms. Had there been no diurnal motion some of the regions would remain ever dark and no plant could grow, while some other regions due to continuous sunshine would have been converted into desert.

LATITUDES AND LONGITUDES

LATITUDES

Latitudes are imaginary lines drawn on the globe that are parallel to the equator. The equator which is also latitude divides the earth into Northern and Southern hemisphere. It has an angle of 0°. Other important latitudes are the Tropic of Cancer (23½°N), Tropic of Capricorn (23½°S), the Arctic Circle (66½°N) and the Antarctic Circle (66½°S).



CHARACTERISTICS OR FEATURES OF LATITUDES

1. Latitudes are parallel lines. Therefore they are sometimes known as Parallels.
2. They are measured in degrees from 0 to 90 either north or south of the equator.
3. Lines of latitude are of the same length.
4. They run from east to west.
5. The equator divides the earth into two equal halves. The equator is the only great circle among the latitudes.
6. They are imaginary lines.

DETERMINATION OF DISTANCE USING LATITUDE

There is a distance of 111km between two places with 1° apart.

Principle: Earth's POLAR circumference is approximately = 40,008km if 360° = 40,008km

therefore 1° = 111.13 km (correct to 2dp)

Procedure in calculation of distance

The procedure used in calculating distances between two places at different latitudes on the same line of longitude Locate the two places involved;

1. Find the difference in latitudes in degrees

a. Where it is North-North, subtract (−)

b. Where it is South-South, subtract (−)

c. Where it is North-South or South-North, add (+)

d. Where it is Equator (0°) to Northern Hemisphere/South Hemisphere, add (+)

2. Multiply the answer by 111.13 km to get the distance

EXAMPLE

Calculate the distance between place ‘X’ on the equator and ‘Y’ on latitude 5°N.

Solution

Procedure 1: Locate places involved Place ‘Y’ = 5°N

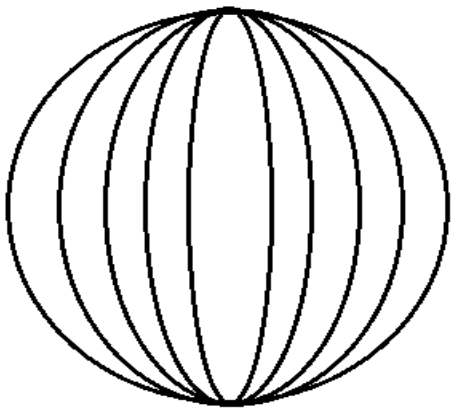
Procedure 2: Find the difference in latitudes Difference in latitudes = 0° + 5°N = 5°

Procedure 3: Multiply the answer by 111.13km to get the distance Distance between Place X and Place Y = 5 × 111.13km

= 555.65km

LONGITUDES

Longitudes are imaginary lines drawn from the North Pole to the South Pole. They are the angular distance east or west of the Greenwich Meridian. The Greenwich Meridian, which is also known as the Prime Meridian, has an angle of 0° and it passes through Greenwich, which is a place near London in U.K, and Tema in Ghana.



Lines of longitudes

CHARACTERISTICS OR FEATURES OF LONGITUDES

1. They are measured in degrees from 0 to 180, either east or west of the Greenwich Meridian.
2. Lines of longitudes are of the same length.
3. Lines of longitudes meet or converge at the poles.
4. They are all great circles since each is capable of dividing the earth into two equal halves or hemispheres i.e. Eastern and Western hemispheres.
5. They are also known as Meridians or mid-day lines.
6. They run from the North Pole to the South Pole.
7. They are imaginary lines.
8. Each set of lines of longitude forms a semicircle.

DETERMINATION OF TIME USING LONGITUDES

Time refers to the continuous progression of events and the measure of their duration. Time differences between places can be calculated by working out the approximate time represented by one degree of longitude. Once the time represented by one degree is calculated and the difference in longitude is known then the time difference can be determined

There is a difference of 1 hour between two meridians that are 15° apart. Therefore, if the time in Accra is 12.00 noon, the time in Lagos, which is 15°E is 1.00pm. Also, there is a difference of 4 minutes between two longitudes that are 1° apart.

Procedure in calculation of time

1. Locate the two places and their longitudes.

2. Find or calculate the longitudinal differences between the two places.

Note that the rule is, if:

a. the two given places are on the lines in the same hemisphere (i.e., both West or both East = Subtract (−)

b. the two given places are the lines in different/opposite hemispheres (i.e. one east one west) = Add (+)

c. one place is on Greenwich Meridian (0°) and the other is on a line in Eastern Hemisphere or Western Hemisphere = Add (+) / Subtract (−)

3. Convert or change the longitudinal differences to time. Note: 24 hours = 360° 1 hour = 15° 4 minutes = 1°

4. If the time at one place is known calculate the difference in latitude between the two places and convert this to hours and minutes. To calculate the different time, use the hours and minutes and add or subtract it from the known time. If the place is to the EAST of the known time add the hours (Gain/Add/Ahead of time) and if it is to the WEST subtract (Loss/Subtract/Behind time

EXAMPLE

The longitude of Station X is 0°and that of Station Y is 45°E.

a. Is Station Y ahead or behind Station X and by how many hours?

b. Calculate the time of Station Y if the time at Station X is 3 pm.

Solution:

Longitude of Station X = 0°

Longitude of Station Y = 45°E

Longitudinal Differences = 45° − 0° = 45°

But 15° = 1 hour (60minutes) Therefore 45° = 45°/15°

Therefore, time difference = 3 hours

Time at Station X = 3 pm

Time at Station Y = 3 pm + 3 hours (since Station X is on the Greenwich Meridian and Y is to the East of Station X, it is ahead of time, so the rule is to add the hours)= **6 pm**

Therefore, the time at Station Y is **6 pm**

GREAT CIRCLE

A great circle is any circle which divides the globe into two equal halves or hemisphere. The equator is the only great circle among the latitudes but all the longitudes are great circles. This is because, each longitude divides the earth into two equal halves and any two opposite longitudes make one complete great circle. The shortest route between two places is provided by the great circle that passes through them.

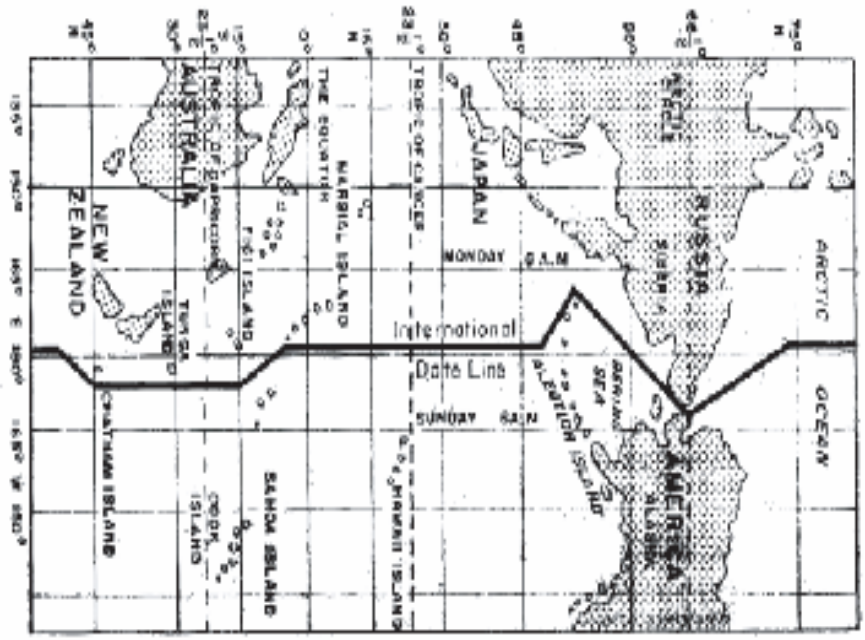
STANDARD TIME AND GREENWICH MEAN TIME

Standard time is fixed for use by all countries. It is divided into 24 zones each of 15° apart. It may sometimes be extended beyond 15° for political reasons. Greenwich Mean Time (GMT) is a local time fixed on longitude 0° only. Local time refers to the actual time on a particular longitude. It has no time zone and all time are related to Greenwich Mean Time and this makes it more international.The Greenwich Mean Time is also known as the Standard Time.

THE INTERNATIONAL DATE LINE

The International Date Line is an imaginary line drawn north to south of the globe through Mid-Pacific Ocean. The line is located approximately on the longitude 180°E or 180°W. This line does not follow longitude 180° throughout. It rather deviates from longitude 180° in certain places to avoid passing through land areas. If the line is crossed Westward, for instance, from

San Francisco in USA to Tokyo in Japan, a day of 24 hours is lost. On the other hand, if the line is crossed Eastward, for instance, from Tokyo in Japan to New York in USA, a day is repeated or gained.



ESSENTIAL TERMS UNDER THE MOVEMENTS OF THE EATH

1. **SOLSTICE**

   This is the period where the sun is directly overhead the Tropics of Cancer or Capricorn. This leads to the experience of long day and short nights or long nights and short days at different places. During December 22, winter solstice is experienced while summer solstice is experienced on June 21.

2. **EQUINOX**

   This is the period where the sun is directly overhead the equator. This leads to the experience of equal day and night. During March 21 and September 23, equal day and night is experienced on earth.

3. **TWILIGHT**

   This is the period between sunset and complete darkness.

4. **DAWN**

   This is the period between sunrise and complete or full daylight.

5. SOLAR ECLIPSE

This is the period where the moon comes in between the earth and the sun.

Eclipse of the Sun
(moon comes between earth and sun)

6. LUNAR ECLIPSE

This is the period where the earth comes in between the moon and the sun.

Eclipse of the Moon
(earth comes between moon and sun)

SELF TEST

1. The Earth is spherical in shape. What is the name of the shape of the Earth?.....
2. Describe four (4) evidences that show that the Earth is spherical in shape.
   a. ……
   ……
   ……
   ……
   ……
   ……
   b. ……
   ……
   ……
   ……
   ……
   ……
   c. ……
   ……
   ……
   ……
   ……
   ……
   d. ……
   ……
   ……
   ……
   ……
   ……
3. Differentiate between the following;
   a. Rotation and Revolution
   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……
   b. Latitude and Longitude

……
……
……
……
……
……
……
……

c. Solstice and Equinox

……
……
……
……
……
……
……
……

d. Twilight and Dawn

……
……
……
……
……
……
……
……

4. State three (3) effects of the Earth's rotation.

a. ……
……
……

b. ……
……
……

c. ……
……
……

5. Outline three (3) effects of the Earth's revolution.

a. ……
……
……

b. ……
……
……

c. ……
……
……

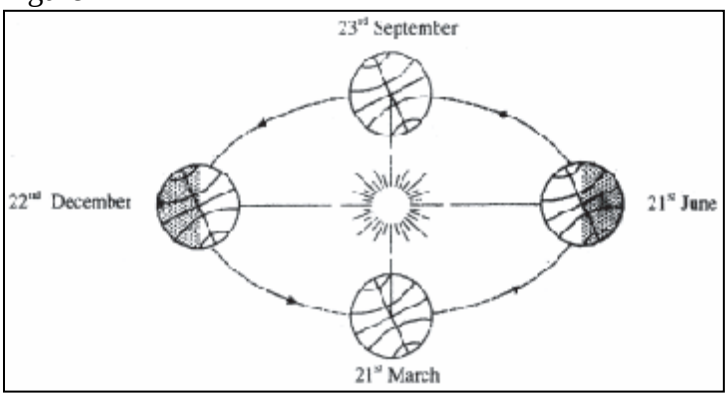
6. Give four (4) characteristics of latitudes.
   a. ……
   ……
   b. ……
   ……
   c. ……
   ……
   d. ……
   ……
7. List four (4) characteristics of longitudes.
   a. ……
   ……
   b. ……
   ……
   c. ……
   ……
   d. ……
   ……

8. a. Dhaka is located at 90° east longitude and Bangalore is situated at 80° East longitude. If the local time of Dhaka is 12 noon what is the local time in Bangalore then?

b. As a school prefect, you are asked to plan an excursion trip with your tourism club. One observation site is located at 41° N, and another is at 61° N. Calculate the approximate distance between these two sites in kilometres.

9. Sadid reached in Dhaka Airport on 14th March Friday for flying to London. Their plane flew for London at 11 pm. When the plane landed in Heathrow Airport, Sadid found it was 1 am Saturday at the airport clock. But the watch he wore in his wrist showed him 7 am Saturday.
   a. What is the cause of the difference of time?
      ……..……
      …….....
      .....
      .....
      .....
      .....
      .....
   b. Explain what is the importance of Prime Meridian?
      ……
      ……
      ……
      ……
      ……
      ……
      ……
      ……

10. Figure A



Describe Figure A?

……
……
……
……
……
……
……
……

SAMPLE OBJECTIVE QUESTIONS ON SOLAR SYSTEM AND EXPLORING EARTH'S SHAPE, MOTIONS AND COORDINATES

1. Which of the following planets has no satellite?
   a. Uranus
   b. Venus
   c. Neptune
   d. Jupiter
   e. Mars
2. An eclipse of the moon occurs when the earth is
   a. Revolves around the moon
   b. comes between the moon and the sun
   c. rotate on its axis
   d. revolves around the sun
   e. comes between the moon and the stars
3. During a football match, the referee observed that the local was noon whiles the Greenwich Mean time was 16.16 hours. What is the longitude of the place where the match was being played?
   a. 56° E
   b. 60°E
   c. 60°W
   d. 64°E
   e. 64°W
4. The distance of leningrade (lat 60°N, long 30°E) from the equator is approximately
   a. 8880 km
   b. 6660 km
   c. 5700km
   d. 3330km
   e. 1110km
5. Which of the following planets has the shortest orbit?
   a. Mars
   b. Mercury
   c. Venus
   d. Earth
6. The rotation of the earth on its axis round the sun causes
   a. Day and night
   b. Eclipse of the sun
   c. The season
   d. Eclipse of the moon
7. On which of the following dates does the Arctic Circle experience twenty-four hours sunshine?

a. 21st March
b. 21st June
c. 23rd September
d. 22nd December

8. The separation of the ancient Gondwanaland into different landmasses was caused by
   a. Isostatic shift
   b. Earthquakes
   c. Vulcanicity
   d. Continental drift
9. The earth lies between the planets
   a. Mercury and Venus
   b. Mars and Jupiter
   c. Venus and Mars
   d. Jupiter and Saturn
10. The availability of sunlight to one half of the earth's surface at a time is best explained by the earth's
   a. Revolution round the sun
   b. Inclination at the angle of 66½
   c. Spherical shape in relation to the sun
   d. Rotation on its inclined axis round the sun
11. Countries in the northern hemisphere experience shorter days and longer nights when the sun is overhead on the
   a. Tropic of Capricorn
   b. Equator
   c. Tropic of cancer
   d. Arctic circle
12. How many degrees of latitude will the earth spin through within one hour?
   a. 5°
   b. 15°
   c. 25°
   d. 30°
13. The planet with the longest orbit round the sun is
   a. Mars
   b. Mercury
   c. Pluto
   d. Venus
14. The earth's crust consists of the
   a. Sial and sima
   b. Mantle and hydrosphere
   c. Sial and atmosphere

d. Mantle and sima

15. The main cause of four seasons is the earth's
    a. Rotation round the sun on its inclined axis
    b. Rotation round the sun on its conjunction with the moon
    c. Revolution round the sun in conjunction with other planets
    d. Revolution round the sun on its inclined axis
16. In which of the following countries will summer be at its height during the month of December?
    a. Great Britain
    b. New Zealand
    c. Canada
    d. Japan
17. The sun is never vertical overhead on latitude
    a. 25°N
    b. 17°S
    c. 1°S
    d. 5°N
18. Which of the following countries experiences winter from June to August?
    a. Norway
    b. New Zealand
    c. Canada
    d. Japan
19. Which of the following statements is false?
    a. The towns on the same longitude will have the same standard of time
    b. London has its Monday's sun before New York does
    c. Local time is determined by the latitude of a place
    d. A country may have one standard time but several local times

20. A Great Circle rout is the
    a. Shortest distance between the earth and the sun
    b. Shortest distance between the earth and the moon
    c. Distance along any line of latitude except the equator
    d. Distance along any line of longitude
21. The planet with the shortest orbit round the sun is
    a. Pluto
    b. Earth
    c. Mercury
    d. Mars
22. Which of the following continents was part of Gondwanaland?
    a. North America

b. Europe
c. Asia
d. Africa

23. All the following are proofs of the earth's spherical shape except
    a. The earth's rotation and revolution
    b. The earth's shadow on the moon during eclipse
    c. The circular appearance of the horizon
    d. Circumnavigation
24. Which of the following planets is nearest to the sun than the earth?
    a. Mercury
    b. Mars
    c. Neptune
    d. Jupiter
25. An eclipse of the sun occurs when
    a. There is a corona around the sun
    b. The moon comes between the sun and the earth
    c. The earth is revolving round the sun
    d. The earth comes between the sun and the moon
26. When the noonday sun is vertically overhead on the Tropic of Capricorn, there will be
    a. Equal night and equal days at the poles
    b. Longer nights and shorter days in the southern hemisphere
    c. Longer days and shorter night in the southern hemisphere
    d. Longer days and shorter night in the northern hemisphere
27. The largest planet in the solar system is the
    a. Jupiter
    b. Saturn
    c. Uranus
    d. Neptune
28. The ancient super continent which broke up to form the continents of Africa, South America and Australia was known as
    a. Pangea land
    b. Australasia
    c. Gondwanaland
    d. Eurasia
29. The rotation of the earth on its axis result in the following except
    a. Day and nigh
    b. Time differences between the meridians
    c. The daily rise and fall of the tides
    d. The seasons
30. In the northern hemisphere, the Spring Equinox falls on

a. 21st March
b. 21st June
c. 23rd September
d. 22nd December

31. The planet with the shortest orbit round the sun is
    a. Venus
    b. Saturn
    c. Earth
    d. Mercury
32. Which of the following is the correct sequence of the components of the earth's structure?
    a. Atmosphere, mantle, core, crust
    b. Crust, core, mantle, atmosphere
    c. Core, mantle, crust, atmosphere
    d. Mantle, core, atmosphere, crust
33. Great circle are formed by all lines of
    a. Latitude excluding the equator
    b. Longitude and equator
    c. Longitude and latitude
    d. Longitude excluding the Greenwich Meridian
34. Which of the following proves that the earth rotates on its axis?
    a. The rising and setting of the sun
    b. The phases of the moon
    c. The seasons
    d. The changes in weather pattern
35. What will be the time at a place located on longitude 90° East when it is 1:00pm Greenwich Mean Time?
    a. 6:20 am
    b. 6:20 pm
    c. 7:20 am
    d. 7:20 pm
36. In the course of the year the sun appears to move between the
    a. Equator and the south pole
    b. North and south poles
    c. Tropic of cancer and the equator
    d. Tropics of Cancer and Capricorn
37. Shorter days and longer nights occur in the Northern Hemisphere when
    a. The sun is overhead on the Tropic of Capricorn
    b. There is an eclipse of the sun
    c. There is excessive precipitation

d. The sun is overhead on the Tropic of Capricorn

38. How many Standard Time Zones will a country with a longitudinal width of 135° have?
    a. 6
    b. 8
    c. 9
    d. 10
39. Which of the following revolve round the sun?
    a. The moon
    b. The stars
    c. Man-made satellites
    d. The planet
40. Which of the following continents was part of Laurasia?
    a. North America
    b. South America
    c. Australia
    d. Africa
41. All the following are effects of the eath's rotation except the
    a. Longitudinal difference in time
    b. Deflection of wind and ocean currents
    c. Daily rising and falling of tides
    d. Varying lengths of day and night
42. The apparent movement of the earth occurs within the
    a. Arctic circle and Antarctic circle
    b. Tropic of Cancer and Tropic of Capricorn
    c. North Pole and South Pole
    d. Equator and North Pole
43. Which of the following is the digest planet in the solar system?
    a. Uranus
    b. Saturn
    c. Jupiter
    d. Neptune
44. Which of the following is true about lines of longitudes?
    a. Each line of longitude has different time zone along it
    b. All lines of longitude cause the season
    c. All lines of longitude form concentric circle
    d. Each lines of longitude originate from the poles
45. All the following prove the spherical shape of the earth except
    a. The lunar eclipse
    b. Sunrise and sunset
    c. Longer days and shorter nights

d. The curved horizon of the earth

46. Which of the following planets is comparatively small?
    a. Saturn
    b. Neptune
    c. Mercury
    d. Jupiter
47. Commercial aircraft usually follow Great Circle routes to help
    a. Reduce flight distance and time
    b. Avoid airspace of enemy countries
    c. Avoid vast stretch of ocean
    d. Maintain uniform temperate in aircraft cabin
48. Which of the following statements is false?
    a. A leap year has 366 days
    b. The summer solstice occurs on 21st June
    c. Longitude 150°
    d. The seasons are caused by the rotation of the earth
49. Places in the North Pole experience twenty-four hours of darkness on
    a. 21st March
    b. 21st June
    c. 22nd December
    d. 23rd September
50. The International Date-line passes close to
    a. Greenland
    b. New Zealand
    c. South Korea
    d. Switzerland
51. Which of the following planets has the longest orbit?
    a. Saturn
    b. Pluto
    c. Jupiter
    d. Neptune
52. Evidence of the earth's rotation can be observed by the
    a. Type of weather we experience each day
    b. Movement of the moon at night
    c. Movement of the milky way galaxy
    d. Apparent movement of the sun each day
53. Which of the following countries experience summer from June to August?
    a. South Africa
    b. Australia
    c. Canada

d. Argentina

54. The reason why the International Date Line zig-zag is to
    a. Enable different countries have the same time
    b. Shorten the distance ship travel eastwards and westwards of the line
    c. Make it avoid groups of islands in the Pacific Ocean
    d. Make it pass through many countries
55. Lines of latitude are referred to as Great Circles when they
    a. Are greater than the equator
    b. Divide the earth into two equal parts
    c. Run from north to south
    d. Help to determine standard time
56. The Bedford Level Canal experiment which was performed by A.R. Wallace proved that the earth
    a. Has one natural satellite
    b. Has a spherical shape
    c. Revolves round the sun
    d. Has an elliptical orbit
57. The equinoxes are time of the year when
    a. The length of day and night are the same everywhere on the earth's surface
    b. The days are longer than the nights in the northern hemisphere
    c. The South pole experiences twenty-four hours of day light
    d. Parts of the earth's surface experience total darkness
58. What is the local time at a place on longitude 45° West when the time at another place on longitude 30° East is 1:30 pm?
    a. 6:30 pm
    b. 7:30 pm
    c. 8:30 pm
    d. 10:20 pm
59. Which of the following pairs of longitudes form a great circle?
    a. 60° East and 120° West
    b. 70° West and 40° West
    c. 100°Est and 40° West
    d. 60° East and 120° West
60. Which of the following is true about the International Date Line?
    a. Areas immediately east and west of it has a difference of 24 hours
    b. It follows the 180° meridian completely from north to south
    c. It runs parallel to the equator
    d. The equator intersects it at two points
61. In the northern hemisphere the spring equinox occurs on
    a. 21st March

b. 21st June
c. 3rd September
d. 22nd December

62. All the following continents were part of the Gondwanaland except
    a. Africa
    b. Australia
    c. North America
    d. South America
63. The curvature of the earth and the angle at which the rays of the sun strike different parts of the earth's surface explain why……..
    a. Tornados are common in the mid-latitudes
    b. Insolation generally decreases from the Equator towards the poles
    c. Temperature decreases with increasing altitude
    d. The windward side of highland receive more rainfall
64. The outer layer of the earth is the
    a. Mantle
    b. Lithosphere
    c. Core
    d. Hydrosphere
65. The planet with the shortest orbit round the sun is the
    a. Pluto
    b. Earth
    c. Mars
    d. Mercury
66. How many Standard Time Zones (STZ) will a country which spans longitude 45° west to longitude 165° west have?
    a. 2
    b. 4
    c. 8
    d. 14
67. The season that occurs between May and July in the southern hemisphere is
    a. Summer
    b. Winter
    c. Spring
    d. Autumn
68. Which of the following planets is closest to the sun?
    a. Jupiter
    b. Venus
    c. Mercury
    d. Mars

69. The plane surface on which the planets revolve are the planes of the
    a. Solstice
    b. Equinox
    c. Elliptic
    d. Aphelion
70. Lines of longitude are
    a. Drawn from west to east
    b. Used in determining local time
    c. Called parallel lines
    d. Used in calculation distances
71. An aircraft takes off from town A (longitude 20°E) at 12.00 hours on a direct flight to town B (longitude 20°W). What will be the local time in Town B at take off?
    a. 8.30 am
    b. 9.20 am
    c. 8.20 am
    d. 9.30 am
72. The approximate distance between town X, latitude 10°N and town Y located on latitude 13°N is
    a. 554.2 km
    b. 333.3km
    c. 233.4km
    d. 113.2km
73. The body at the centre of the solar system is the
    a. Earth
    b. Sun
    c. Jupiter
    d. Pluto
74. The farthest planet in the solar system is the
    a. Saturn
    b. Mars
    c. Jupiter
    d. Pluto
75. Which of the following is not a proof that the Earth is spherical in shape?
    a. Circumnavigation of the earth
    b. Rise and fall of tides
    c. Sunrise and sunset
    d. Circular horizon
76. The tropical regions of the world lie within
    a. 66½° to 90° North and South of the Equator
    b. 0° to 66½° North and South of the Equator

c. 0°to 23½° North and South of the Equator
d. 23½° to 90° North and South of the Equator

77. If the local time in station Y, longitude 20°E is 8.00am, what is the local time in station Z on longitude 35° west?
    a. 4.20 am
    b. 5.50 am
    c. 6.20 am
    d. 7.50 am
78. The largest planet in the solar system is the
    a. Mars
    b. Jupiter
    c. Venus
    d. Earth
79. The greatest contrast between the planet Mercury and Jupiter is in their
    a. Direction of orbit
    b. Inhabitability
    c. Size
    d. Shape
80. The inclination of the earth's axis at the angle of 66½° result in
    a. Lunar eclipse
    b. Different seasons and varying lengths of day and night
    c. Eclipse of the sun
    d. Rise and fall of tides
81. When it is 11 am in London, longitude 0°, what is the local time in town X longitude 75°W?
    a. 4.00 am
    b. 6.00 am
    c. 4.00 pm
    d. 6.00 pm
82. The earth's crust is made up of
    a. Sial and sima
    b. Sima and nife
    c. Nife and sial
    d. Sima and alumina
83. Uranus is unique among the planets in the solar system because it
    a. Is larger than all other planets
    b. Has no satellite
    c. Revolves in clockwise direction
    d. Has circular light and dark band round it

84. If someone in a town A (20°E) telephones a friend in another town B (16°W) at 10.00 am, at what local time will his friend receive the call?
    a. 7:36 am
    b. 9:36 am
    c. 12:24 pm
    d. 12:36 pm
85. The chemical composition of the core of the earth is
    a. Silica and magnesia
    b. Silica and copper
    c. Iron and nickel
    d. Iron and mica
86. The outermost layer of the earth is the
    a. Mantle
    b. Core
    c. Lithosphere
    d. hydrosphere
87. How many times is the sun vertically overhead at the equator in a year?
    a. Two times
    b. Three times
    c. Four times
    d. Six times
88. The solid portion of the earth is termed as
    a. Lithosphere
    b. Hydrosphere
    c. Atmosphere
    d. troposphere

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