

# 2

## Uniqueness of the Earth as a habitat of living beings



The objective of this unit is to find facts about the uniqueness of the planet Earth in the solar system.



### Basic information about the earth

Distance from the sun	Duration of rotation	Speed of the rotation	Time for revolution	Speed of the revolution
150 million km	23 hours and 56 minutes	11.2 km per second	365 days and 6 hours	29.8 for a second

Source - <http://nssdc.gsfc.nasa.gov/planetary/factsheet> 21/02/2016

The Earth is a spherical object of 510 million square km. Though the Earth is considered as a globe the equatorial diameter is longer by 42 km, than the polar diameter. Therefore, it is not considered as a mathematical sphere.

- Equatorial diameter      12756 km
- Polar diameter            12714 km

### Location of the Earth in the solar system

In unit 1 you have studied that the Earth, our home planet, is the third planet from the Sun.

Study the following facts too.

- The average surface temperature on Mercury, located very close to the sun, is 167<sup>o</sup> C.
- The average surface temperature on Venus, the second planet from the sun, is 464<sup>o</sup>C.
- The average surface temperature on the Earth is 15<sup>o</sup>C.

- The average surface temperature on Neptune, the farthest planet from the sun is  $-225^{\circ}\text{C}$ .

Source - <http://www.planetary.org/explore> 22/03/2016

Temperature on the Earth is not as high as on the Mercury and Venus or not as low as on the Neptune as it is located in a middle position in the solar system.

- Presence of an atmosphere with favourable gases as well as water vapour congenial to living beings.

- Existence of water.

- Prevalence of a intermediate temperature.

- Occurrence of rotation and revolution.

- Existence of gravitational force.

Due to these factors the Earth has become a habitat for living beings. According to the experiments conducted so far, the Earth is the only planet with life. The Earth contains distinct features that cannot be compared to another planet in the solar system; hence, it occupies a unique place in the solar system.

## Latitudes and Longitudes

A network of imaginary lines has been drawn on the model globe to identify any place located on the Earth. These lines are named as latitudes and longitudes.

### Latitudes

The imaginary line that separates the Northern and Southern Hemispheres of the geographical globe is the  $0^{\circ}$  latitude known as the Equator. The latitudes that run parallel to the equator in the Northern Hemisphere up to  $90^{\circ}$  degrees are identified as Northern latitudes and the latitudes that run parallel to the equator up to  $90^{\circ}$  degrees in Southern Hemisphere are identified as Southern latitudes respectively. The circles of latitudes gradually become smaller when they are extended up to Northern and Southern poles. Ultimately it becomes a point in the South and North poles. (Fig. 2.1)

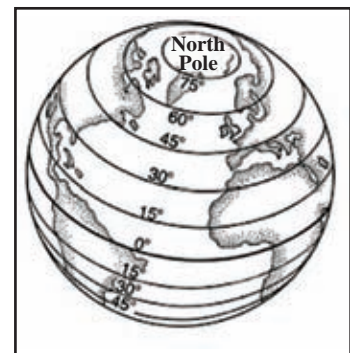


Fig. 2.1 - Latitudes

## Longitudes

The imaginary lines on the geographical globe that extend from the North pole to the South pole are called longitudes. The  $0^{\circ}$  degree longitude that runs across the city of Greenwich in England, is called the Greenwich Meridian. The longitudes that are located up to  $180^{\circ}$  east from the Greenwich meridian are called Eastern longitudes and those that extend up to  $180^{\circ}$  West are called west longitudes. But the longitude  $180^{\circ}$  is considered as one and it is not classified as western or eastern longitude.

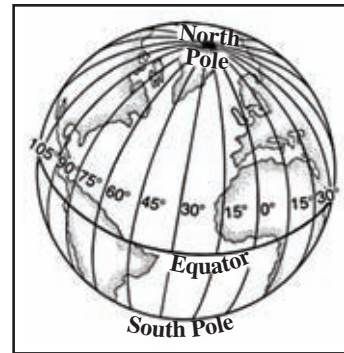


Fig. 2.2 - Longitude

## Rotation of the Earth

The movement of the Earth around its own axis is called rotation. The Earth rotates from West to East on this imaginary axis that runs from North pole to South pole. The Earth's axis tilts at an angle of  $23.5^{\circ}$  to the orbital plane.

Due to the rotation of the Earth, we see as if the Sun is rises in the East and sets in the West. The Earth takes 23 hours and 56 minutes for a complete rotation around its axis, but the duration of a day of the Earth is considered as 24 hours.

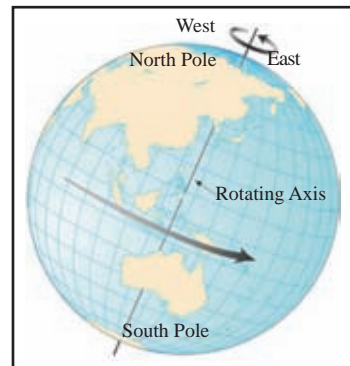


Fig. 2.3 - The Earth axis and rotation

## Occurrence of day and night

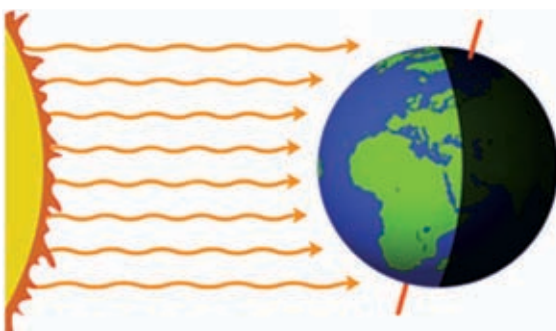
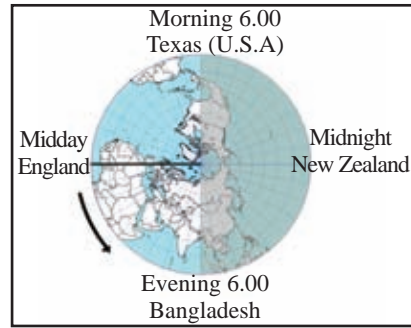


Fig. 2.4 - Occurrence of day and night

The rotation of the Earth results in the occurrence of day and night and regional differences in time.

While, rotating, the half of the Earth that receives sun light has day time. The other side that does not get sunlight has night time.

According to the location of the longitudes, the time too differs in different places in the world. Observe figure 2.5 to understand how time changes in the world. When the time is 12.00 noon on a longitude, the sun is overhead. The time is 12.00 midnight on its opposite longitude. The sun rises early in the countries located in the eastern part of the world as a result of the rotation of the Earth from the West to East and the Sun rises later in the Western countries.



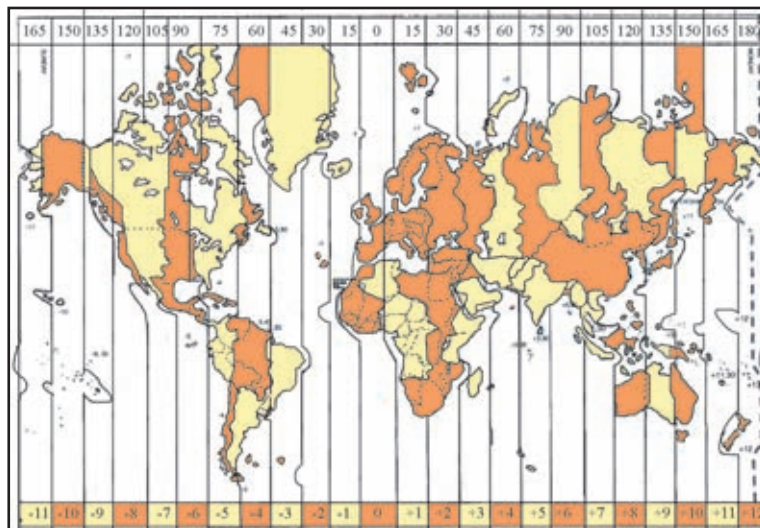
**Fig. 2.5 – how different places of the world are affected by the location of longitudes.**

**Source -** <http://www.nauticed.org/>

When the Earth rotates around its axis once, it moves  $360^{\circ}$  during 24 hours. Within one hour it moves  $15^{\circ}$  of longitude and requires 4 minutes to travel 1. Hence the time between 2 longitudes defers by 4 minutes. Accordingly, the difference of the time for  $15^{\circ}$  degrees is one hour.

## Standard time

The earth has been divided into 24 regions or time zones on the basis of longitudes for the use of internationally accepted standard time. Usually, a standard time is used in each of the zones. But, there are large countries that extend over several time zones in the world. The United States of America, Canada, Australia and Russia and some of them. The time zones of these countries the time relevant to the particular time zone is used. (See map 2.1)



**Map 2.1 - Standard time zones**



It is considered that the day breaks at 12.00 midnight. The Greenwich meridian is considered as the  $0^{\circ}$  longitude. From the Greenwich Meridian  $15^{\circ}$  longitudes towards East one hour is added to the time and one hour is reduced towards  $15^{\circ}$  longitudes to the west from the Greenwich meridian. The International Date Line is set based on  $180^{\circ}$  longitude and there is one day difference either side of this line.

For example, suppose that the time at Greenwich city is 12.00 noon on a Monday. From there, the time increases regularly towards the east till night. On this occasion, the time in Sri Lanka is 5.30 pm. In the same manner, the time decreases regularly up to morning from Greenwich city towards the west. On this occasion the time in Texas State in the United States of America is 6.00 am. According to this change, the time on International Date Line is 12.00 midnight.

Here, there is another factor to be understood. According to the above example, when moving towards  $180^{\circ}$  east from  $0^{\circ}$  longitude, the time is 12.00 midnight on Monday. When moving towards  $180^{\circ}$  west the time is 12.00 daybreak. So, the morning has just dawned or 12.00 midnight on Monday. Therefore, when crossing the  $180^{\circ}$  longitude, the clocks should be adjusted accordingly as there is a difference of one day on either side of it.

If  $180^{\circ}$  longitude is taken directly, it runs over some countries. Then, there is a problem in using the date. Hence, International Date Line (I.D.L) is marked avoiding the countries based on  $180^{\circ}$  longitude. (Map 2.1)

### Activities

1. State the specific features of the Earth that caused the formation and sustainability of life.
2. “The location of the Earth related to the Sun is the main factor that caused the existence of life”. Explain this.
3. State what is known as the rotation of the Earth and write its two main results.
4. State the time zone Sri Lanka belongs to and mention the difference of the time in relation to the Greenwich Mean Time (GMT).
5. Name three countries that observe the Local Standard time

## Revolution of the Earth

The movement of the Earth around the sun is called revolution, and its path is called the orbit. The Earth takes 365 days and 6 hours for a complete revolution. A duration of 365 days is considered as one year. We get a year with 366 days after every four years adding the balance of 6 hours. Such a year is called a leap year.

Since the Earth rotates on  $23.5^{\circ}$  inclined axis, the occurrence of over head sun in revolution differs by longitudes during the particular periods of the year. Therefore, the length of the day and night changes according to the location of latitudes and seasonal changes occur in upper latitudinal areas of the Earth.

### Equinoxes

The Sun is overhead on the  $21^{\text{st}}$  of March and on the  $23^{\text{rd}}$  of September on the Equator. The Sun being overhead on the equator on the  $21^{\text{st}}$  March is called the vernal equinox or spring equinox. Its overhead on the equator on the  $23^{\text{rd}}$  of September is called the autumnal or fall equinox.

### Solstices

The Sun is overhead on the Tropic of Capricorn on  $22^{\text{nd}}$  December and it is called the winter solstice. The Sun is overhead on the Tropic of Cancer on the  $21^{\text{st}}$  of June and it is called the summer solstice.

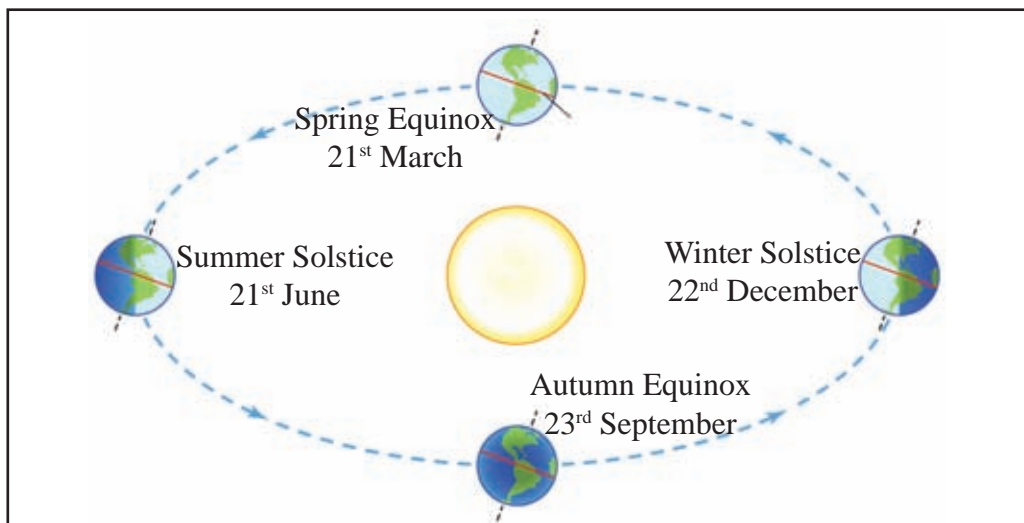


Fig 2.7 - Revolution and seasons

During the time equinoxes or when the Sun is overhead on the equator on the 21<sup>st</sup> of March and on the 23<sup>rd</sup> of September, the day and night times are equal to 12 hours through all latitudes of the Earth.

When the Sun is overhead on the Tropic of Cancer on June 21<sup>st</sup> the daytime is longer in the Northern hemisphere while the day in Southern hemisphere is shorter. The Southern hemisphere has a longer daytime when the Sun is overhead on the Tropic of Capricorn on 22<sup>nd</sup> December and the daytime of the northern hemisphere is shorter. Both the solstices and the equinoxes are directly connected with the seasons of the year.

According to the changes of the sun being overhead on different latitudes at different time periods of the year, seasons occur with different climatic features. Differences in seasons can be clearly visible in the areas located away from tropics.

### **There are four main seasons on Earth**

- **Summer**

In countries which have seasonal changes, the highest temperature is recorded during summer and the daytime is longer. Since the temperature is very high during this season, it is a difficult period for man and the other living beings. In the Northern hemisphere summer sets in June and in the southern hemisphere it falls in December.



**Fig. 2.7 - Summer**

- **Autumn**

During autumn the temperature decreases gradually. Autumn sets in for the countries located in the Northern hemisphere during the month of September and for the countries in the Southern hemisphere in March. Due to the gradual decrease of temperature the leaves begin to fall. Thus it is also called the 'Fall'.



**Fig. 2.8 - Autumn**



- **Winter**

When the temperature decreases to its maximum level, winter sets in the countries of the Northern hemisphere in December, and for the countries in the Southern hemisphere in June. During this time there is a longer period of night. The leaves completely fall off the trees. Snow falls in many areas and human activities are limited to a great extent.



**Fig. 2.9 - Winter**

- **Spring**

The temperature gradually rises up at the end of winter and spring sets in for the Northern Hemisphere in March and in the Southern hemisphere in September. During this period snow and ice begin to melt. Tender leaves appear on dormant trees and flowers will start to bloom and bear fruits.



**Fig. 2.10 - Spring**

### Activities

1. Briefly explain what is meant by the revolution of the Earth.
2. When the Sun revolves, the latitudes on which the Sun is overhead change in each of the time periods. Complete the following table.

Date	The Sun is overhead	It is called
21 <sup>st</sup> of March	.....	Spring equinox
21 <sup>st</sup> of June	.....	.....
23 <sup>rd</sup> of September	Equator	.....
23 <sup>rd</sup> of September	.....	.....

3. Explain how a Leap Year occurs.

## Gases

A specific feature of the Earth is the availability of gases congenial for the existence of life. The part that consists of various gases is called the atmosphere. The atmosphere is held by the Earth due to its gravitational pull. Wind is the air in motion in the atmosphere or the natural flow of air.

The main substances in the atmospheric composition are gases while water vapour, dust and salt particles are also found.

**Table 2.1 - Composition of the gases in the earth's atmosphere**

Type of the gas	Volume as a percentage
Nitrogen	78.09
Oxygen	20.95
Argon	0.93
Carbon dioxide	0.03
Ozone	0.00006
Other gases	Trace

Source - *Waugh David 2000, Geography An Integrated Approach*

### Importance of the Atmosphere

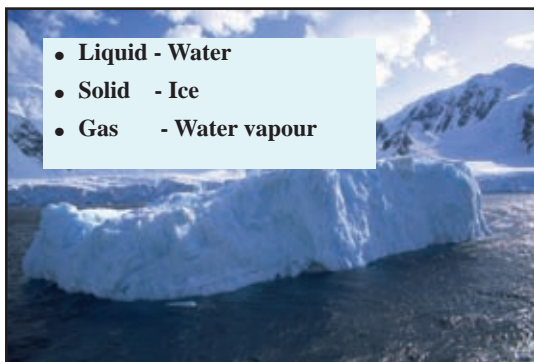
- Air is the main factor for the existence of life.
- It retains water vapour and helps in maintaining the water cycle. It causes the process of precipitation too.
- It controls the entry of harmful ultraviolet rays of solar radiation through the ozone layer located in the upper part of the atmosphere.
- It controls the falling of meteors to the Earth as they get burnt due to friction against the atmosphere.
- It controls the temperature on the surface of the Earth.

### Activities

1. Name the four most abundant gases in the atmosphere in the ascending order.
2. Write five benefits of the atmosphere.
3. Mention five human activities that caused for water pollution.

## Water

Water is found on Earth in different forms.



**Fig. 1.13 - Water in its liquid and solid forms (Ice)**

71% of the total land area or 3/4 of the Earth is covered by water. This is a special feature that can be seen on the Earth related to the other planets in the solar system.

### Distribution of water on earth

Oceans and seas	97%
ice caps and snow	1.75%
Ground water	1.75%
Fresh water	0.5%

This water circulates cyclically between the land and the atmosphere. This is called 'the water cycle', which is also known as the 'hydrological cycle'(H<sub>2</sub>O cycle)

### Importance of water,

- It is an essential factor for the existence of living beings.
- For domestic purposes. (washing, cleaning ,bathing and cooking)
- For all agricultural activities.(crop cultivation and livestock farming)
- For various industries.
- For transportation. (marine and inland waters)
- For generating electricity.(hydro-electricity)
- For recreational activities (water sports)

### Activities

1. Name the three main ways in which water exists on the Earth.
2. Explain the distribution of water on the Earth using the chart in the lesson.
3. Explain four uses of water.
4. Name three human activities which cause water pollution

## Sources

- <http://nssdc.gsfc.nasa.gov/planetary/factsheet> 21/02/2016
- <http://www.planetary.org/explore/space-topics/compare/planetary-facts.html> 22/03/2016
- <http://www.nauticed.org/sailing-> 27/2/2016
- <http://c.tadst.com/gfx/timezonemapdateline.jpg> 22/02/2016

## Glossary

• Surface temperature	මතුපිට උෂ්ණත්වය	÷©Ø£μ''   öÁ'' £{ ø»
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• Equator	සමකය	©zvˉ ÷Põk
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• Tropic of Cancer	කර්කටක නිවර්තනය	PhPU ÷Põk
• Summer	ග්‍රීෂ්ම/ගිම්හාන සෘතුව	÷Põøh Põ» ®
• Autumn	සරත් සෘතුව	Cø» ² v° Põ» ®
• Winter	ශීත/සිසිර සෘතුව	SÍ ° Põ» ®
• Spring	වසන්ත සෘතුව	Á\cu Põ» ®
• Water vapour	ජල වාෂ්ප	}μõÃ
• Water/Hydrological cycle	ජල චක්‍රය	}> ˉ À Ámh®
• Ozone layer	ඕසෝන් වායු ස්තරය	K ÷ \õß £øh
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