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11. Composition and Structure of The Atmosphere

EXERCISE

A. Answer the following questions :

1. What is the significance of atmosphere?

Ans. The significance of atmosphere :

- There is a continuous flux of energy and matter between the sea surface and lowermost layer of atmosphere to provide the conditions most suitable for existence of life.
- It consists of many major gases like Nitrogen, Oxygen, Carbon-dioxide etc , which are very important for life.
- The Ozone layer in the Stratosphere absorbs the burning ultraviolet radiation from the Sun. In its absence our planet would have been unfit for human habitation and other living beings.

2. State the components of the atmosphere.

Ans. The components of the atmosphere are:

Two main gases Nitrogen and Oxygen(78% and 21% respectively), make up about 99% of the clean dry air. The remaining gases are almost inert and constitute about 1% of atmosphere.

3. Name the different layers of the atmosphere.

Ans. The different layers of the atmosphere are:

- Troposphere, Stratosphere, Ionosphere and Exosphere.

4. State the important characteristics of each of the layers.

Ans. Important characters of the layers of the atmosphere are:

- **Troposphere:** It is the lower most atmospheric layer.
  - ➢ All weather phenomena that affect our life directly take place within troposphere.
  - ➢ It contains water vapour, a colourless, odourless gaseous form of water, which mixes perfectly with other gases. Excessive condensation leads to rain, hail or snow.
  - ➢ The dust particles present in this layer serves as nuclear centres around which the water vapour condenses to form cloud particles.
- **Stratosphere:** The lowermost limit of Stratosphere is tropopause.
  - ➢ It contains the ozone layer. It absorbs the burning ultraviolet radiation from the Sun. In its absence our planet would have been unfit for human habitation and other living beings.
  - ➢ No visible weather phenomena take place in this layer.
  - ➢ In this layer the temperature does not change with altitude.
- **Ionosphere:** It is above Stratosphere.
  - ➢ In this layer the ionisation of molecules and atoms occurs mainly as a result of ultraviolet rays, X-rays and gamma rays.
  - ➢ It reflects low frequency radio waves, but absorbs medium and high frequency waves. Thus this layer is especially important in long distance radio communication.
- **Exosphere:** It is the outermost layer of atmosphere.
  - ➢ It is highly predominant with rarefied Hydrogen and Helium gases.

5. What is the significance of atmosphere for the Earth?

Ans. Same as 1st.

6. What are the properties of Troposphere?

Ans. The properties of Troposphere are:

It is the lower most atmospheric layer.

- All weather phenomena that affect our life directly take place within troposphere.
- It contains water vapour, a colourless, odourless gaseous form of water, which mixes perfectly with other gases. Excessive condensation leads to rain, hail or snow.
- The dust particles present in this layer serves as nuclear centres around which the water vapour condenses to form cloud particles.

7. What is Tropopause?

Ans. The Tropopause is the boundary in the Earth's atmosphere between the troposphere and the stratosphere.

8. What is the significance of ozone in the atmosphere?

Ans. The significance of ozone in the atmosphere is :

- It is an important feature of the Stratosphere.
- It absorbs the burning ultraviolet radiation from the Sun.
- In its absence our planet would have been unfit for human habitation and other living beings.
- It protects us from these harmful rays.
- Thus, presence of this layer is a boon to human beings.

9. What are the causes of destruction of ozone layer?

Ans. The causes of destruction of ozone layer are:

- The emission of Nitrogen Oxide by a large number of supersonic transport aeroplanes may cause deterioration of ozone layer with the resultant serious damage to flora and fauna alike.
- A continuous release of synthetic chemicals primarily Chlorofluoro-carbons (CFCs) into the atmosphere.
- The CFC molecules are released in the Stratosphere where intense ultraviolet rays split them, freeing Chlorine atoms. These combine with oxygen to form Chlorine Monoxide.

10. Give the properties of Ionosphere.

Ans. The properties of Ionosphere are:

It is above Stratosphere.

- In this layer the Ionisation of molecules and atoms occurs mainly as a result of ultraviolet rays, X-rays and gamma rays.
- It reflects low frequency radio waves, but absorbs medium

and high frequency waves. Thus this layer is especially important in long distance radio communication.

11. What is meant by Greenhouse Effect?

Ans. Greenhouse effect is the process whereby radioactively active gases absorb and delay the loss of heat to space ,thus keeping the lower. Troposphere moderately warm throughout the radiation of infrared wavelengths.

12. What do you mean by 'Global Warming'? What are the consequences of 'Global Warming'?

Ans. Global warming is also referred to as climate change.

- It is the observed century-scale rise in the average temperature of the Earth's climate system, and its related effects.
- Because of the increasing level of CO_2 in the atmosphere the global temperature is likely to rise by 1◦C and perhaps may increase up to 3◦C.

Consequences of Global Warming:

- The coral reefs are being affected in nearly all the world oceans. 90% of the coral reefs in Indian Ocean has been wiped out.
- Increasing global temperature may affect the regional climate or atmospheric changes with regard to temperature precipitation, moisture etc. It may pose serious problems in the ecological balance, which in turn may affect the life of all living beings on Earth.

13. Name a few measures that could be taken to save the ozone layer.

Ans. The measures to be taken to save ozone layer are:

- Illegal trade is a major barrier, as substantial demand for these harmful chemicals still exists.
- Each country has to take strict decision to ban the use of such chemicals.
- Another step that can help is to create worldwide awareness against the use of CFCs to save further depletion of life saving ozone layer.

14. Name the three realms of the Earth.

Ans. The three realms of the earth are:

Lithosphere ,Hydrosphere and Atmosphere

15. State the composition of the Earth's atmosphere.

Ans. Same as 2nd answer.

16. How can we reduce global warming?

Ans. Global warming can be reduced by :

- Conservation of forests.
- Reducing industrial pollution.
- Reducing release of CO_2, in the atmosphere.
- By taking measures to save the Ozone layer from further depletion by controlling CFCs release in atmosphere.
- Increase in coral reefs

B. Define the following terms :

1. Troposphere

Ans. Troposphere: It is the lower most atmospheric layer.

- All weather phenomena that affect our life directly take place within troposphere.
- It contains water vapour, a colourless, odourless gaseous form of water, which mixes perfectly with other gases. Excessive condensation leads to rain, hail or snow.
- The dust particles present in this layer serves as nuclear centres around which the water vapour condenses to form cloud particles.

2. Stratosphere

Ans. Stratosphere: The lowermost limit of Stratosphere is Tropopause.

- It contains the ozone layer. It absorbs the burning ultraviolet radiation from the Sun. In its absence our planet would have been unfit for human habitation and other living beings.
- No visible weather phenomena take place in this layer.
- In this layer the temperature does not change with altitude.

3. Weather

Ans. Weather : The state of the atmosphere at a particular place and time as regards heat, cloudiness, dryness, sunshine, wind, rain, etc.

4. Greenhouse Effect

Ans. Greenhouse effect: It is the process whereby radioactively active

gases absorb and delay the loss of heat to space ,thus keeping the lower troposphere moderately warm throughout the radiation of infrared wavelengths.

5. CFC

Ans. CFC: Chlorofluoro-carbons are synthetic industrial chemical compounds containing Chlorine, Fluorine and Carbon atoms.

6. Thermosphere

Ans. Thermosphere: Atmospheric layer of upwardly increasing temperature lying above the Mesopause.

C. Distinguish between the following :

1. Troposphere and Stratosphere

Troposphere	**Stratosphere**
It is the lower most atmospheric layer.	It is above Troposphere
All weather phenomena that affect our life directly take place within troposphere.	No visible weather phenomena take place in this layer.
There is a decrease of temperature with increasing altitude.	In this layer the temperature does not change with altitude.

2. Stratosphere and Thermosphere

Stratosphere	**Thermosphere**
Consists of Thermosphere and Ionosphere.	The lower layer of atmosphere is called Homosphere.
Both the Thermosphere and Ionosphere function to filter harmful wavelength of solar radiation, protecting the Earth's surface.	It consists of Ozone layer which protects the earth from the harmful ultraviolet rays.

D. Give reasons for the following :

1. The layers of the atmosphere become thinner with altitude.

Ans. The layers of the atmosphere become thinner with altitude because:

- the gravity causes the upper layers of atmosphere to exert force on the lower ones. This causes the air to compress and hence the air becomes dense at the lower level in comparison, the air at height is thinner.

2. The Earth does not experience extremes of temperature.

Ans. The Earth does not experience extremes of temperature:

- It is neither too far, nor too near the sun.

3. Solid particles play an important role in the atmosphere.

Ans. Solid particles play an important role in the atmosphere:

- the solid particles like dust in the Troposphere serves as nuclear centres around which the water vapour condenses to form cloud particles.

4. The presence of ozone layer is a boon to human being.

Ans. Ozone layer in the stratosphere absorbs the harmful ultra violet ray, therefore, protects us from the harmful effects of UV ray.

5. Ionosphere is important in long distance radio-wave communication.

Ans. Ionosphere reflects low frequency radio waves. In this way ionosphere is important in long distance radio-wave communication.

E. Diagram :

Draw a self-explanatory diagram illustrating the structure of the atmosphere.

Ans. Students to do it themselves.

F. Choose the correct option.

1. The proportion of Nitrogen in the atmosphere is about_____.

(a) 80% (b) 21%

(c) 78% (d) 65%

2. Which of the following is the lower most layer of the atmosphere?

(a) Stratosphere (b) Troposphere

(c) Ionosphere (d) Exosphere

3. In which of the following layer in atmosphere, Normal lapse rate of temperature is observed?

(a) Stratosphere (b) Troposphere

(c) Ionosphere (d) Exosphere

4. Which of the following layer of atmosphere absorbs the ultra violet rays of Sun?
   (a) Ozonosphere (b) Troposphere
   (c) Ionosphere (d) Exosphere
5. _____ layer of atmosphere is important for long distance radio communication.
   (a) Stratosphere (b) Troposphere
   (c) Ionosphere (d) Exosphere
6. Which of the following chemical is responsible for the depletion of ozone?
   (a) Carbon dioxide (b) Nitric Acid
   (c) CFC (d) all of these
7. Which one is the outermost layer of atmosphere?
   (a) Ionosphere (b) Stratosphere
   (c) Exosphere (d) Troposphere
8. Which of the following is not a reason for global warming?
   (a) Rise in the sea level (b) Ozone depletion
   (c) Deforestation (d) Burning of fossil fuel
9. Different types of weather phenomena is seen in
   (a) Ionosphere (b) Stratosphere
   (c) Exosphere (d) Troposphere
10. Which of the following is not a greenhouse gas?
   (a) Ozone (b) CO_2
   (c) Helium (d) Methane

Answers

1. c 2. b 3. b 4. a 5. c 6. c 7. c 8. a
9. d 10. c

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12. Insolation

EXERCISE

A. Answer the following questions briefly :

1. What is insolation? State its importance.

Ans. Solar radiation that is intercepted by the Earth is known as insolation. The significance of insolation is:

- It results in the formation of temperature zones.

2. State the three processes by which the air gets heated. Explain in brief.

Ans. The three main processes by which the earth's atmosphere is heated are:

- **Convection:** The transmission of heat from one part of a liquid or gas to another by movement of particles themselves is called convention.
- **Conduction :** It is the process in which heat is transferred directly through matter from a point of high temperature. It transfers heat between adjacent molecules till the temperature is equal.
- **Radiation :** It is a process by which a body emits radiant energy. It causes a loss of heat and therefore leads to cooling.

3. State the various factors influencing the temperature of a place.

Ans. The various factors influencing the temperature of a place are: Latitude, altitude, distance from the sea, winds, Ocean currents, clouds and rainfall, slope of the land, vegetation and nature of soil.

4. Why does only 51% of the insolation reach the Earth surface?

Ans. Only 51% of the insolation reaches the Earth's surface:

- The rest is absorbed by water vapour, dust and clouds, or is reflected by the earth's surface and scattered by particles in the air.

5. What is the effect of latitude on temperature?

Ans. The effects of latitude on temperature are:

Places at lower latitudes:

- The Sun's rays are direct and have to travel a lesser extent through the atmosphere.
- have higher temperature and are hotter than places away from the Equator.

Places at higher latitudes:

- The Sun's rays are slanting and have to pass through a greater extent of atmosphere.
- Hence, these rays lose heat and so the area in the high latitude are not very hot as compared to the equatorial regions.

6. What causes the differential heating of land and water?

Ans. The differential heating of land and water is caused by :

- Land breeze and sea breeze

7. What is inversion of temperature? Under what conditions does it apply?

Ans.
- Normally , temperature decreases with height, but in some areas and during certain periods, temperature increases with height in the atmosphere. This is called the inversion of temperature.
- This occurs during the winter season over the land.

8. Which zone will have a higher range of temperature? Why?

Ans. The zone which has higher range of temperature is:
- Torrid zone is the one which will be having the higher range of temperature
- because it lies between the equator and the temperate zone.
- That's why it gets the maximum range of temperature.

9. Name the factors that affect the insolation over the Earth's surface.

Ans. The factors that affect the insolation over the Earth's surface are: Latitude, altitude, distance from the Sea, winds, Ocean currents, clouds and Rainfall, the slope of the land, vegetation and nature of the soil.

10. Why are the slanting rays less effective than the vertical rays in heating the atmosphere?

Ans. The slanting rays are less effective than the vertical rays in heating the atmosphere:
- They have to pass through a greater extent of atmosphere.
- Hence, these rays lose heat and so the areas in the high latitude are not very hot as compared to the equatorial regions.

11. How do winds modify the temperature of a place?

Ans. The winds modify the temperature of a place:
- **On-shore winds:** Winds, which blows from sea to land . They carry moisture.
- **Off-shore winds:** Winds, which blow from land to sea are dry, eg. a cold wind blowing from the interior of the continent during winter further reduces the temperature of the places along their path, eg, China.
- **Local winds:** Hot and dry local winds increases the temperature of a place, eg. Loo , whereas the Bora and the Mistral are the cold winds.

12. What does Normal Lapse Rate mean?

Ans. With the increase of height, temperature decreases. For every 165 metres the temperature falls by 1◦C. This is known as Normal Lapse Rate.

13. Explain with the help of a diagram how the slope of the land affects the temperature.

Ans. The effect of the slope of the land on the temperature of a place:

- A steep slope experiences a more rapid change in temperature than a gentle one.
- Mountain ranges that have an east- west alignment like the Alps show a higher temperature on the south-facing 'sunny slope' than the north- facing 'sheltered slope'.

14. Why does the temperature of a place in the atmosphere decrease with height?

Ans. The temperature of a place in the atmosphere decreases with height because:

- The atmosphere is mostly heated by conduction. Air is cooler at higher altitudes than near the Earth's surface. So the places near the Earth's surface are warmer than places higher up.
- With the increase of height, temperature decreases. For every 165 metres the temperature falls by 1◦C. This is known as Normal Lapse Rate.
- This is the reason why hill stations are cooler even in summer.

15. What causes Equable Climate?

Ans. The places close to the water bodies have oceanic or equable climate.

They have low diurnal and annual range of temperature as compared to those areas, which are far from the influence of the sea and which are in the interior without the moderating influence of the sea.

16. State the reason for the differential heating of land and water.

Ans. Same as 7th answer.

B. Explain the following terms :

1. Insolation

Ans. Insolation: Solar radiation that is intercepted by the Earth is known as insolation.

2. Conduction

Ans. **Conduction** : Conduction is a process in which heat is transferred directly through matter from a point of high temperature. Conduction transfers heat between adjacent molecules till the temperature is equal.

3. Normal Lapse Rate

Ans. **Normal Lapse Rate:** With the increase of height, temperature decreases.

For every 165 metres the temperature falls by 1◦. This is known as Normal Lapse Rate.

4. Inversion of Temperature

Ans. **Inversion of Temperature:** Normally , temperature decreases with height, but in some areas and during certain periods, temperature increases with height in the atmosphere. This is called the inversion of temperature.

C. Distinguish between the following pairs:

1. Insolation and Terrestrial Radiation

Insolation Radiation	**Terrestrial Radiation**
Incoming solar energy is in the form of short waves.	Outgoing radiation from the earth is in the form of long waves.
It heats the atmosphere.	It heats the earth's surface.

2. Convection and Radiation

Convection	**Radiation**
Convection : The transmission of heat from one part of a liquid or gas to another by movement of particles themselves is called *convection*.	It is a process by which a body emits radiant energy (energy received from Sun in the form of heat). It causes a loss of heat and therefore leads to cooling.

D. Give reasons for the following :

1. Land gets heated faster than the sea.

Ans. Land gets heated faster than the sea because:

- Land surface absorbs much more solar radiation than water

.Hence, land is heated faster, similarly, it cools faster.

2. The climate of continental interiors is of comparatively extreme type.

Ans. The climate of continental interiors is of comparatively extreme type because:

- Mid-latitude continental interiors have greater extremes in temperature than coastal areas because large areas heat up and cool off more quickly than oceans.
- Therefore, in the winter, the interiors of continents will be much colder than along the coast.
- Similarly, in the summer, the interiors heat up much more than the coastal areas. The colder winter temperatures and warmer summer temperatures of the interior result in a greater range of temperature.

3. Coastal climates are equable.

Ans. Coastal climates are equable:

- The coastal areas experience the cool, wet air from the sea throughout the year which modifies the weather along the coast to have uniform weather both in the winter and summer.
- This condition is said to be equable climate. It is otherwise called as Maritime climate.

4. South-facing slopes are much warmer than north facing slopes in the Northern Hemisphere.

Ans. South-facing slopes are much warmer than north facing slopes in the Northern Hemisphere because:

- South facing slope receive direct sunshine as these face towards equator
- these lies above tropical of cancer and sun never goes beyond that line.

5. The amount of insolation received on the earth surface is not uniform.

Ans. Due to the spherical shape of the earth the places near the equator receives vertical rays of the Sun but the places near the poles receives extremely slanting rays, therefore insolation amount is very less.

6. Hill stations are cooler even in the summer.

Ans. Due to the normal lapse rate phenomena of the atmosphere, the air is cooler at higher altitude than near the Earth's surface. Therefore, hill stations are cooler even in the summer.

E. Diagrams :

Draw a neat diagram showing the Effect of Latitude on Solar Insolation.

Ans. Students to do it themselves.

F. Choose the correct option.

1. The process through which heat passes from warmer to colder substances as long as temperature difference exists, is known as

(a) Convection (b) Conduction

(c) Radiation (d) Advection

2. Which of the following reason is responsible for the minimum insolation at poles?

(a) The earth is spherical in shape.

(b) Poles are far away from the equator.

(c) Poles get extremely slanting rays of the sun.

(d) All the above

3. Which of the following factor/factors are responsible for unequal temperature distribution in the earth?

(a) Altitude (b) Latitude

(c) Distance from the sea (d) All of these

4. 'Latitude is one of the important factor for controlling the temperature'- which of the following fact justifies this statement?

(a) The hill stations are cooler even in summer.

(b) The areas in the high latitude are not very hot as compared to the equatorial regions.

(c) Areas close to water bodies have low diurnal and annual range of temperature than the areas situated far away from the coast.

(d) All the above

5. 'Forest areas are cooler than the open places' which of the following reason is responsible for it?

(a) Forests receive more slanting rays of the sun than the open areas.

(b) All the forests are situated in the higher latitudinal areas.

(c) The vegetation cover checks the radiation from the upper layer of the soil.

(d) Forests are mainly situated in the mountains.

6. 'Tropical Deserts have high diurnal range of temperature'- which of the following factor/factors are responsible for it?

(a) Tropical deserts have cloudless sky.

(b) There is less presence of vegetation.

(c) Presence of sandy soil.

(d) All the above

7. Inversion of temperature mainly occurs during which season?

(a) Autumn (b) Spring

(c) Winter (d) Summer

8. The surface temperature of Sun is

(a) 10000°C (b) 6000°C

(c) 1000°C (d) 1500°C

9. Mumbai enjoys equable climate but Nagpur experiences extreme climate. Which of the following factor is responsible for this fact?

(a) Mumbai is situated in higher altitude than Nagpur.

(b) Mumbai is nearer to the coast than Nagpur.

(c) Mumbai is situated in higher latitude than Nagpur.

(d) Mumbai is getting the effect of a cold local wind but Nagpur does not get.

10. Solar radiation provides more than _____ of energy that heals the Earth.

(a) 89% (b) 17% (c) 99.9% (d) 50%

Answer

1. b 2. d 3. d 4. b 5. c 6. d 7. c 8. b
9. b 10. c

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