Composition and Structure of the Atmosphere

Exercises

I. Short Answer Questions.

Question 1.
What is known as atmosphere ?
Answer:
The blanket of air upto 1500 km surrounding the earth is known as atmosphere.

Question 2.
State the gaseous composition of the atmosphere.
Answer:
The atmosphere consists of 78% Nitrogen 21% oxygen and 1% other gases.

Question 3.
Mention any three functions of the atmosphere.
Answer:

1. Air has weight and exerts pressure. Being pressed down it always remains in contact with land and water.
2. Due to their physical contact, exchange of gases between air, land and water takes place on a continuous basis.
3. Soil absorbs oxygen and nitrogen due to this contact. Water vapours in air rise from oceans on account of evaporation.

Question 4.
Name the four layers of the atmosphere.
Answer:
Four layers of the atmosphere are :

1. Troposphere
2. Stratosphere,
3. Mesosphere
4. Thermosphere.

Question 5.
What is known as troposphere ?
Answer:
Troposphere is the lowest and densest layer of atmosphere touching the land surface. It extends from 8km to 18 km. in height

Question 6.
Mention the chief characteristics of stratosphere.
Answer:
There is total absence of water vapour in this layer. It extends upto a height of 50 km. The temperature remains constant up to – 55°C.

Question 7.
In which layer of atmosphere do all weather conditions occur ?
Answer:
Troposphere is the layer where all weather conditions occur in different forms.

Question 8.
Name the constituent gases of atmosphere which scientists consider responsible for climate change.
Answer:
Carbon dioxide and ozone are responsible for climate change, as carbon dioxide absorbs heat from sun and by radiation from the earth; ozone absorbs extremely hot ultra-violet rays controlling the ideal temperature conditions on the earth.

Question 9.
What is known as ozone layer ?
Answer:
Stratosphere contains sufficient amount of ozone which absorbs the extremely hot ultra-violet rays of the sun. It is known as ozone layer.

Question 10.
What is leading to depletion of ozone layer in the atmosphere ?
Answer:
Excessive emission of carbon monoxide and CFCs from industries and vehicles take out the oxygen from ozone layer to form different compounds (oxides). In this way the depletion of ozone layer takes place.

Question 11.
What is known as Global Warming?
Answer:
Global Warming is the increase in temperature of earth due to enhanced concentration of Greenhouse gases (CFCs) in the atmosphere.

Question 12.
Name important Greenhouse gases.
Answer:
The main Greenhouse gases are CFCs (Chlorofluorocarbons) and nitrogen oxides which are emitted by fertilizers industries and transport engines along with carbon dioxide and methane.

Question 13.
Name two chief characteristics of atmosphere.
Answer:
Atmosphere protects earth from harmful ultra-violet and infra-red rays of the sun. It controls the hydrological cycle and provide life giving gases.

Question 14.
What keeps the atmosphere in a dynamic state ?
Answer:
The atmosphere protects the earth from harmful ultraviolet and infrared rays of the sun. It has oxygen and nitrogen, the life sustaining gases. It helps in retaining the necessary warmth on the earth and helps in the circulation of water vapour as the source of rainfall. These functions of atmosphere keep it in a dynamic state.

Question 15.
What is called weather ?
Answer:
Weather is the physical condition or state of atmosphere (temperature, pressure, state of sky etc.) at a given locality or an area.

II. Explain the following terms/processes in detail

1. **Global Warming**
2. **Greenhouse Effect**
3. **Normal Lapse Rate of Temperature**
4. **CFCs**

Answer:

- **Global Warming :** The temperature on the earth is rising. This phenomenon known as Global Warming is the result of enhanced concentration of Greenhouse gases in the atmosphere caused mainly by human activities. Consequences of Global Warming:

1. Global temperature is likely rise by 2 to 5°C during the next century. Due to rise in temperature by 2 to 5°C, there is a chance of melting of ice caps on Earth's poles. This melting of ice will result in the rise of the sea level. Large stretches of low lying areas will submerge and many island countries will face deep encroachment by sea water. Some may disappear altogether.
2. As the increase in temperature will be uniform all over the surface of the world, there will be serious climatic changes. This will bring various changes in wind and rain patterns.
3. Higher temperature will cause rise in transpiration, which in turn, will affect the groundwater table.

4. As the climatic belts shift from equator towards pole, the vegetation would also shift away from the equator.
5. Insects and pests will increase in the warmer climatic conditions. Thus, pathogenic diseases will multiply.

- **Greenhouse Effect:** Greenhouse are built in cold areas to grow the plants within it in warm temperature. But, due to Global Warming the whole earth is becoming a Greenhouse due to increase in temperature, which indirectly disturb the normal life on earth by challenging nature and nature will originate many unwanted problems of change in climate, radiation imbalance, diseases etc.
  The rate of absorption of solar radiation by earth and its emission back into space as infra-red waves balances the heat on earth. This phenomenon plays a very important role in maintaining surface temperature of earth. The carbon dioxide and other gases form a blanket around the globe which prevent the passage of infra-red waves from earth back into space. Concentration of solar radiation produces much heat, making earth a very warm place. This phenomenon is similar to that of greenhouse in which the glass enclosed area gets heated up due to its insulation from the rest of the environment. Hence, warming of the atmosphere is due to the greenhouse effect. Hence, Global Warming is also known as Greenhouse Effect.
- **Normal Lapse Rate of Temperature :** The decrease in Temperature is known as normal lapse rate, which is calculated as average decrease of 1°C for every 166 metres altitude gained. The lapse rate works mainly in troposphere which results in various types of weather and climatic changes affecting the life on earth.
- **CFCs :** (Chlorofluorocarbons) are organic compounds that contain carbon, chlorine, fluorine produced as volatile deriatives of methane and ethane which catalyze the conversion of ozone (O_3) into O_2, while O_3 is more powerful to absorb ultra-violet rays than that of O_2. So CFCs disturb the ozone layer which is so essential for earth.

III. Long Answer Questions

Question 1.
Describe the structure of the atmosphere.
Answer:
In the atmosphere, there are concentric layers of air. Each layer has different density. The upper layers press down the lower one. So, the air of the lower layer is always heavier or denser, while the upper layers are thinner or less dense. In this way about 90 per cent of the mass of air lies within a height of about 20 km from the surface of the earth.
On the basis of the characteristics of temperature and air pressure there exist four thermal layers of the atmosphere. They are — Troposphere, Stratosphere, Mesosphere and Thermosphere. The Thermosphere is divided into Ionosphere and Exosphere.

Question 2.
How does atmosphere govern life on earth ?
Answer:
Stratosphere absorbs the harmful ultra-violet rays of the sun and the troposphere regulates all weather conditions e.g. ideal temperature, rainfall and their impact on human life.

Question 3.
Explain the factors responsible for depletion of ozone in atmosphere.
Answer:
Various occupations related to industries, transport and fertilizer cause large amount of CFCs emission along with nitrogen oxide and methane have disturbed the ozone layer depleting the oxygen particles. Volcanic eruptions emit sulphur dioxide creating harmful chemical reactions which dismantle the ozone layer.

Question 4.
Give a description of the recent studies about Global Warming.
Answer:
The Global mean temperature has increased by 0.6°C in the 20th century. It is estimated to increase by 1.4° to 5.8°C by the year 2100 from 1990. This has affected abnormal weather conditions in various parts e.g. less rainfall in Africa and Gulf Coast of U.S.A., more rainfall in Asian tropical region and some areas may get no rainfall. Increasing melting of ice and glaciers resulted in rise of oceanic water level by 10 to 25 cm. Warming of atmosphere will considerably increase its moisture carrying capacity. While the troposphere warms up, the stratosphe will cool down.
It is the balance between radiation coming into the atmosphere and radiation going out. Any change in this balance can have rapid impact on life forms on earth because it will have an impact on the sensitivity, adaptability and vulnerability of the whole biospheric system.
Climate change will bring about substantial changes in cereal production specially in the Tropics. Global freshwater conditions may worsen by 2025.

Question 5.
Why should we protect the atmosphere ?
Answer:
Atmosphere is necessary to sustain life on earth, because without atmosphere there would be no oxygen, no weather changes, rainfall etc, which are essential for activities of human life and ideal temperature on the earth.
The atmosphere protects the earth from harmful ultraviolet and infrared rays of the sun. It has oxygen and nitrogen, the life sustaining gases. It helps in retaining the necessaiy warmth on the earth and helps in the circulation of water vapour as the source of rainfall. These functions of atmosphere keep it in a dynamic state.

Question 6.
What is known as the Antarctic ozone hole ?
Answer:
Ozone hole above the Antarctic region was detected by NASA in the USA. This is due to the emission of CFCs etc. and absence of vegetation cover along Antarctic. CFCs deplete the ozone amount and there is no oxygen addition due to absence of vegetation realm.

Practice Questions (Solved)

Question 1.

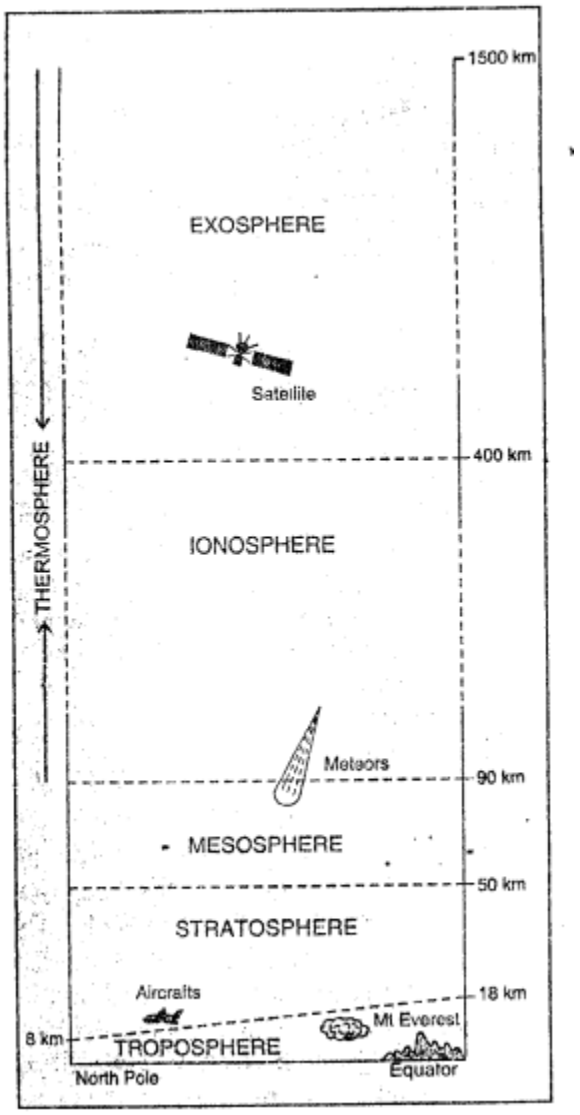
(a) What is 'Atmosphere' ?
(b) Explain the composition of the Atmosphere ?
(c) Name different layers of atmosphere. Describe the important characteristics of each layer.

Answer:

(a) The earth is surrounded by a coverage of air which extends to height of several hundred kilometres. This is called the atmosphere. Near the surface of the earth, the air is dense, as we go up higher, the atmosphere gets more and more rare field. About half the air composing the atmosphere is found within 5 kilometres of the earth surface.
(b) The most important gases composing the atmosphere are nitrogen 78% and oxygen (21%). Therefore, 99% of the atmosphere consists of nitrogen and oxygen. Of the remaining gases, argon accounts for 0.9%. The other gases are carbon dioxide, helium, hydrogen, methane, etc. These gases are called the fixed components of the atmosphere, because their relative proportion is constant in the lower layers of the atmosphere. In addition to fixed components, there are a number of variable components of the atmosphere. The quantity of these components varies from place to place.
(c) The atmosphere is composed of the following belts (layer):

1. **Troposphere :** This atmospheric layer lies closed to the earth's surface. It extends to a height from 8 km (Near the Poles) to 18 km (Near the Equator). Most of the weather phenomena occur in this layer of atmosphere. It is a dusty zone containing much water vapour and clouds.
2. **Stratosphere :** The next layer lying above the troposphere is the stratosphere. The thickness of this layer varies about 62 km (at the Equator) and about 72 km (at the Poles.) Temperature is almost constant. There is no clouds, water vapour of dust in this layer due to constant temperature in the vertical direction. Ozone gas is found in abundance which absorbed harmful ultra-violet radiation from the

sun.



Structure of the Atmosphere

3. **Mesosphere :** This third layer is above the stratosphere. 'Meso' meaning the intermediate, this region is marked by decrease in temperature with height. Temperature decrease from about 0°C at Stratopause to 100°C at Mesopause. This inversion of temperature is probably due to absence of ozone molecules beyond the stratosphere. This layer extends to 80 km. above the'earth.
4. **Thermosphere :** It lies above the Mesosphere and is divided into two parts-the Ionosphere and Exosphere.

- **Ionosphere :** The air layer lying behind the stratosphere is known as the Ionosphere. This extends to a height of 80 km to 480 km. Radio waves used in long distance radio communication are reflected back to earth by Ionosphere. In this way, radio massages can be transmitted round the curve of the Earth. This is about 970 km thick.

- **Exosphere :** The upper-most layer of the atmosphere is called Exosphere. It lies somewhere between 480 km. and above the Earth. It is known only to aerospaceships.

Question 2.
What is the significance of solid particles in the atmosphere ?
Answer:
The solid particles present in the atmosphere are of dust, smoke, pollen grains and emissions released from chimneys of factories.
Significance : The solid particles present in the atmosphere act as nuclei or the condensation of water vapour around them.

Question 3.
What is the significance of Ozone and what are the effects of its depletion ?
Answer:
Ozone in the atmosphere acts as a protective umbrella for us by absorbing harmful ultraviolet radiation coming from the sun.
Effects of Ozone depletion :

1. The ozone layer screens out more than 99 percent of the incoming solar energy. Ultraviolet radiation of these wavelengths are harmful to most forms of terrestrial life, causing eye irritation, skin cancer and many other diseases, depending on the amount of radiation.
2. It impairs the growth of certain crop plants and adversely affects a wide variety of organisms from bacteria to vertebrates.
3. Micro organisms may undergo a high rate of mutation because of high sensitivity of the DNA to ultraviolet light.
4. The increased ultraviolet radiation may lead to faster deterioration of plants, fabrics, plastics and other materials.

Effects of Global Warming : Global warming can cause changes in rainfall patterns leading to flooding in some areas and drought in others. Monsoon flooding is expected to cause great loss of life in India, Bangladesh and South-East Asian countries. Over the last 100 years, because of Global Warming, the ice reserves have melted and the sea level has risen by about 10 to 25 cm. If this trend continues, areas will be submerged under sea water.

Question 4.
Define the following

(a) Ozone hole
(b) Tropopause
(c) Global warming
(d) Greenhouse effect
(e) Stratosphere

(f) Troposphere
(g) CFC's
(h) Mesosphere
(i) Exosphere
(j) Thermosphere

Answer:

(a) Ozone hole : The large depletion of ozone layer in certain parts of the atmosphere is called Ozone hole.
(b) Tropopause : The upper limit of the troposphere is called Tropopause.
(c) Global warming : Gradual rise in Earth's average temperature is called Global Warming.
(d) Greenhouse effect : The warming up of the atmosphere due to trapping of the solar radiation reflected by the earth by gases like carbon dioxide is called Greenhouse effect.
(e) Stratosphere : The layer of the atmosphere above the troposphere is called Stratosphere.
(f) Troposphere : The atmospheric layer closest to the earth is called Troposphere.
(g) CFC's : These are chloro-fluoro carbons and are used as propellants in aerosol cans, refrigerants in refrigerators, air conditioning and as solvent cleaners in the microelectronic industry.
(h) Mesosphere : The layer of th® atmosphere which extends to a height of 80 km above the stratosphere is called Mesosphere.
(i) Exosphere : The topmost layer of the atmosphere is called the Exosphere.
(j) Thermosphere : Ionosphere, which extends from 80 km to 480 km is known as the Thermosphere.

Question 5.
What is Atmospheric pressure ?
OR
Is Atmospheric pressure the same on every place on the surface of the Earth ?
Answer:
Air has weight and, therefore, the atmosphere exerts pressure on the surface of the earth. It has been calculated that at sea level the pressure of air is about 1kg per square centimetre or enough to support a column of mercury 76 cm. in a tube. But with increase of height above sea level the pressure decreases because the overlying column of air goes on getting shorter.

Question 6.
Why does the atmosphere thin out at higher levels ?
Answer:
The atmosphere is held by the gravitational force of the Earth and is densest near the Earth's surface where gravity is maximum. There are concentric layers of air in the atmosphere. Each layer has a different density. The upper layers are continually

pressing down on the lower ones. Therefore, the air of the lower layer is always much heavier or denser, while the upper layers are thinner or less dense. Thus atmosphere thins out at higher levels and about 90 per cent of the mass of air lies within a height of about 20 km. from the surface of the earth.

Question 7.
What are the properties of Troposphere and Ionosphere?
Answer:
Properties of Troposphere :

1. It extends to a height of 18 km at the equator and declines gradually to a height of 8 km at the poles.
2. Most of the weather phenomena take place in this layer.
3. It contains almost all the water vapour and most of the dust particles. It is a turbulent zone.
4. The upper limit of troposphere is called tropopause.
5. In the troposphere, the temperature of air decreases at an average rate of 1°C for every 166 metres.

Properties of Ionosphere :

1. It extends from 80 km to 480 km.
2. It contains electrically charged gas molecules which reflect the radio waves used in long distance communication back to the earth.
3. The northern lights or aurora borealis are in this zone,
4. The temperature in this layer rises to a very high degree because the molecules in this layer absorb X-rays and ultra violet radiation coming from the sun.

Question 8.
Give reasons for the following :

1. The Earth does not experience extremes of temperature as in other planets.
2. The amount of water vapour in the atmosphere varies from place to place.
3. Solid particles play an important role in the atmosphere.
4. In the troposphere, the temperature decreases with height.
5. The stratosphere is crucial to life on Earth.
6. The ionosphere (thermosphere) is suited to long distance communication.
7. As a jet plane flies high in the sky, it leaves a white trail behind.
8. The exosphere allows the gas molecules to easily escape into space.
9. Dust particles plays a significant role in the atmosphere.

Answer:

1. The earth does not experience extremes of temperature as on other planets due to the presence of the atmosphere.
2. The amount of water vapour in the atmosphere varies from place to place due to difference in temperature.
3. The solid particles play an important role in the atmosphere because they act as nuclei for the condensation of water vapour around them.
4. The troposphere lies closest to the Earth's surface and contains all the water vapour, mostly dust particles and clouds. This layer is subjected to intense mixing due to both horizontal and vertical circulation. Thus, the temperature decreases with height in this layer.
5. The stratosphere is crucial to life on the earth because the ozone layer present in it absorbs the harmful ultraviolet radiation of the sun.
6. The ionosphere is suited to long distance communication because radio waves used for this purpose are reflected back to the earth by the electrically charged gas molecules in it.
7. As a jet plane flies high in the sky, it leaves a white trail behind because moisture from the engine forms condensation tracks which are not disturbed due to lack of air movement at that height.
8. The exosphere allows the gas molecules to easily escape into space due to lack of gravity.
9. Solid dust particles present in the atmosphere act as a nuclei for change of water vapour into raindrops around them.They also scatter Sun's radiation during Sunrise or Sunset, However, dust particles present in the lower layer of atmosphere may be harmful to us. They are the greatest health hazards.

Question 9.
'Atmosphere is the most dynamic element in Environment'. Discuss.
Answer:
Atmosphere keeps on changing day and night. So the weather changes day-to-day. Great contrasts are found in day and night temperatures. Clouds change wind velocity.

Question 10.
'The atmosphere acts as a blanket or a glasshouse'. Discuss.
Answer:
Atmosphere acts like a blanket keeping the earth warm. It absorbs incoming solar radiation and does not allow radiation to escape. So equable temperatures are found.