

## Chapter 7

# Composition and Structure of Atmosphere

### Very Short Answer Type Questions

**1.By which elements is atmosphere made up of?**

**Answer:**

Atmosphere is made up of gases, water vapours and dust particles.

**2.What percent of earth mass is constituted by air and it is confined to what height?**

**Answer:**

The air is an integral part of the earth's mass and 99 percent of the total mass of the atmosphere is confined to the height of 32 km from the earth's surface.

**3.How does the composition of air keep changing in upper layers of the earth?**

**Answer:**

The proportion of gases changes in the higher layers of the atmosphere in such a way that oxygen will be almost in negligible quantity at the height of 120 km. Similarly, carbon dioxide and water vapour are found only up to 90 km from the surface of the earth.

**4.Ozone is an important constituent of atmosphere How?**

**Answer:**

Ozone is another important component of the atmosphere. It is found between 10 and 50 km above the earth's surface and acts as a filter. It absorbs the ultra-violet rays radiating from the sun. It prevents them from reaching the surface of the earth.

### **5.What do you mean by tropopause?**

#### **Answer:**

The zone separating the troposphere from stratosphere is known as the tropopause.

### **6.What is an important feature of stratosphere?**

**Answer:** The stratosphere is found above the tropopause and extends up to a height of 50 km. One important feature of the stratosphere is that it contains the ozone layer. This layer absorbs ultra-violet radiation and shields life on the earth from intense, harmful form of energy.

### **7.What is an important feature of troposphere?**

#### **Answer:**

The troposphere is the lowermost layer of the atmosphere. Its average height is 13 km and extends roughly to a height of 8 km near the poles and about 18 km at the equator. Thickness of the troposphere is greatest at the equator because heat is transported to great heights by strong convectional currents. This layer contains dust particles and water vapour. All changes in climate and weather take place in this layer. The temperature in this layer decreases at the rate of 1 C for every 165m of height.

### **8.Name the gases found in atmosphere.**

#### **Answer:**

The atmosphere is composed of gases, water vapour and dust particles. Nitrogen constitutes 78.8%, oxygen contributes 20.94% and argon contributes 0.93% in atmosphere. Other gases include carbon dioxide, helium, ozone, methane, hydrogen, krypton, xenon and neon, etc.

### **9.Explain important features of ionosphere.**

#### **Answer:**

The ionosphere is located between 80 and 400 km above the mesopause. It contains electrically charged particles known as ions, and hence, it is known as ionosphere. Radio waves transmitted from the earth are reflected back to the earth by this layer. Temperature here starts increasing with height.

### Short Answer Type Questions

#### 1. Write a short note on water vapours.

**Answer:**

Water vapour:

- The amount of water vapour decreases with the altitudes. In warm and wet tropics, it accounts for 4% of the air by volume whereas in dry and cold areas of deserts and polar regions, it may be less than 1% of the air.
- It also decreases from the equator towards the poles.
- It absorbs parts of the insolation received from the sun and preserves the earth's radiated heat and thus acts as a blanket by allowing the earth neither to become too hot nor too cold.

#### 2. Explain about dust particles.

**Answer:**

Dust particles:

- Dust particles are concentrated in the lower layers of the atmosphere but sometimes conventional currents take them to the higher height.
- Dust particles include sea salts, fine soil, smoke, ashes, pollens, dust, disintegrated particles of meteors.
- Dust particles and salt particles act as a hygroscopic nuclei around which water condenses into water vapour to produce clouds.
- Dust particles produce optical phenomenon which makes the sky look beautiful at dawn and dusk.
- Sky looks blue due to the presence of dust particles and water vapour which are scattered in the atmosphere.

#### 3. What do you understand by atmosphere?

**Answer:**

The atmosphere is composed of gases, water vapour and dust particles. The proportion of gases changes in the higher layers of the atmosphere in such a way that oxygen will be almost in negligible quantity at the height of 120 km.

Similarly, carbon dioxide and water vapour are found only up to 90 km from the surface of the earth.

#### **4.What are the elements of weather and climate?**

##### **Answer:**

Weather is conditions of temperature, humidity, pressure, etc at a given point of time while climate is condition of these elements for a longer period of time.

Following are the important elements of weather and climate:

- Temperature: It affects weather as well as climate.
- Pressure: Pressure keeps on decreasing with increase in height.
- Wind: The flow of wind also affects weather and climate.
- Humidity: Clouds and rain are important factors of climate.

#### **5.Describe the composition of atmosphere.**

##### **Answer:**

The atmosphere is composed of gases, water vapour and dust particles. Nitrogen constitutes 78.8%, oxygen contributes 20.94% and argon contributes 0.93% in atmosphere. Other gases include carbon dioxide, helium, ozone, methane, hydrogen, krypton, xenon and neon, etc. Nitrogen and oxygen together constitute 99% of the atmosphere. Neon, krypton, xenon are scarce gases. The proportion of gases changes in the higher layers of the atmosphere in such a way that oxygen will be almost in negligible quantity at the height of 120 km. Similarly, carbon dioxide and water vapour are found only up to 90 km from the surface of the earth.

#### **6.Why is troposphere the most important of all the layers of the atmosphere?**

##### **Answer:**

The troposphere is the lowermost layer of the atmosphere. Its average height is 13 km and extends roughly to a height of 8 km near the poles and about 18 km at the equator. It is most important layer of the atmosphere because:

- Thickness of the troposphere is greatest at the equator because heat is transported to great heights by strong convectional currents.
- This layer contains dust particles and water vapour.
- All changes in climate and weather take place in this layer.

- The temperature in this layer decreases at the rate of  $1^{\circ}\text{C}$  for every 165m of height.
- All biological activities take place in this layer.

### Long Answer Type Questions

#### 1. Write about elements of weather and climate in detail.

##### Answer:

The main elements of atmosphere which are subject to change and which influence human life on earth are temperature, pressure, winds, humidity, clouds and precipitation. These elements act and react on each other. These elements determine the direction and speed of wind, amount of sunlight received, cloud formation and amount of rainfall. These in turn affect weather and climate. These factors behave differently in different places. All these elements are affected by a number of factors in turn. For example, temperature is affected by latitude and height; humidity is affected by distance from the sun and pressure is affected by height from sea level.

#### 2. Write about the structure of atmosphere in detail.

##### Answer:

Structure of Atmosphere: The layers of atmosphere differ from one another with respect to density and temperature. On the basis of chemical composition the atmosphere is mainly divided into

1. Homosphere
2. Heterosphere

##### 1. Homosphere:

- It extends upto 90 km.
- It is uniform in chemical composition.
- It consists of three layers
  - Troposphere

- Stratosphere
- Mesosphere

### **Troposphere:**

- Lower most layer of atmosphere
- Average height is 13 km although it is roughly 8 km.
- The thickness of troposphere is greater at equator due to upward transportations of heat by conventional currents. This layer consists of dust particles and water vapours.
- The temperature decrease with height in this layer at a rate 1degree for every 165 m. this is known as Normal Lapse Rate.
- It is layer is important for all biological activities besides that all climatic and weather conditions takes place in this layer.

### **Tropopause:**

- The upper limit of troposphere separating it from stratosphere is called tropopause. It is very unstable at a thin layer and very thin layers of 1.5 km thickness.
- The temperature of tropopause is -80degree centigrade celsius at equator and -40 degree centigrade at poles.
- The jet planes at the other activities occur in this layer.

### **Stratosphere:**

- It extends upto 50km.
- It is thicker at poles then at equator.
- The temperature is almost constant in its lower portion upto 20 km and then it gradually increases upto 50 km due to the presence of Ozone which absorbs UV rays.
- The temperature rises in the upper limits of the stratosphere as there are no clouds, no conventional currents, no dust particles and the air moves in the horizontal direction. The upper' limit of stratosphere is called stratosphere which has concentration of Ozone gas.

## **Mesosphere:**

- It extends from 50\* to 90 km.
- Temperature decreases with height in this layer and false upto minus 100 degree centigrade at a height of 80-90 km. this is due to the clouds in high latitudes.
- The upper limit of Mesosphere is called as Mesopause.

## **2. Hetrosphere:**

- It has heterogeneous chemical.
- It consist of two layers
  - Ionosphere
  - Exosphere

## **Ionosphere**

- It extends from 80 to 400 km above the mesopause.
- It contains electrically charged particles known as ions.

## **Exosphere**

- It is the uppermost layer of the atmosphere above the thermosphere.

## **3.Describe the composition of the atmosphere.**

### **Answer:**

The composition of the atmosphere can be understood by considering following table.

### **Gases of the Atmosphere**

Constituent	Formulae	% by Volume

## Geography

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Nitrogen	N <sub>2</sub>	78.08
Oxygen	O.	20.95
Argon	Ar	0.93
Carbon dioxide	CO <sub>2</sub>	0.036
Neon	Ne	0.002
Helium	He	0.0005
Krypton	Kr	0.001
Xenon	Xe	0.00009
Hydrogen	H <sub>2</sub>	0.00005

The atmosphere is composed of gases, water vapour and dust particles. Nitrogen constitutes 78.8%, oxygen contributes 20.94% and argon contributes 0.93% in atmosphere. Other gases include carbon dioxide, helium, ozone, methane, hydrogen, krypton, xenon and neon, etc. Nitrogen and oxygen together constitute 99% of the atmosphere. Neon, krypton, xenon are scarce gases. The proportion of gases changes in the higher layers of the atmosphere in such a way that oxygen will be almost in negligible quantity at the height of 120 km. Similarly, carbon dioxide and water vapour are found only up to 90 km from the surface of the earth.



Carbon dioxide is meteorologically a very important gas as it is transparent to the incoming solar radiation but opaque to the outgoing terrestrial radiation. It absorbs a part of terrestrial radiation and reflects back some part of it towards the earth's surface. It is largely responsible for the green house effect. Ozone is another important component of the atmosphere. It is found between 10 and 50 km above the earth's surface and acts as a filter. It absorbs the ultra-violet rays radiating from the sun. It prevents them from reaching the surface of the earth.

Water vapour is such a variable gas in the atmosphere, which decreases with altitude. In the warm and wet tropics, it may account for four per cent of the air by volume, while in the dry and cold areas of desert and polar regions, it may be less than one per cent of the air. Atmosphere has a sufficient capacity to keep small solid particles, which may originate from, different sources and include sea salts, fine soil, smoke-soot, ash, pollen, dust and disintegrated particles of meteors.

#### **4.What would happen if there is no ozone in the atmosphere?**

##### **Answer:**

It is the special variety of oxygen gas which is found in small quantity in atmosphere between 10 to 15 km above the earth surface. It acts as a filter and absorbs UV radiation from the sun and prevents them from reaching the earth surface. If ozone is not there, then UV rays will reach the surface of the earth. There will be extreme skin problems, instances of cancer and in all probabilities life would not have been possible on the earth.

#### **5.What is the role of dust particles in atmosphere?**

##### **Answer:**

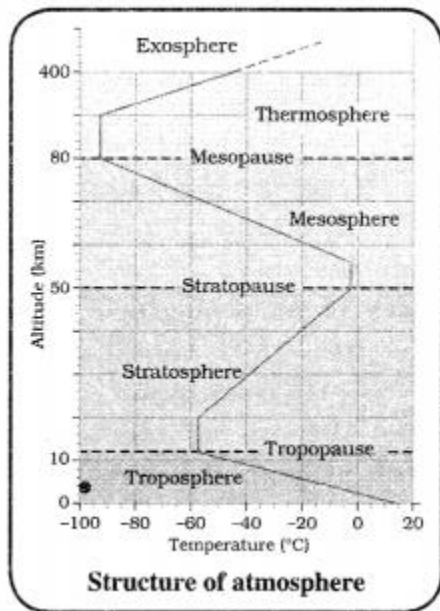
The atmosphere has sufficient capacity to keep small solid particles which may originate from different sources and includes sea salts, fine soil, smoke soot, ash, polan, dust and disintegrated particles of meteors. Dust and solid particles act as hygroscopic nuclei around which water vapour condenses to produce clouds.

**6. Draw a suitable diagram for the structure of the atmosphere and label it and describe it.**

**Answer:**

The atmosphere consists of different layers with varying density and temperature. Density is highest near the surface of the earth and decreases with increasing altitude. The atmosphere is divided into five different layers depending upon the temperature condition.

They are: troposphere, stratosphere, mesosphere, thermosphere and exosphere.



1. **Troposphere:** The troposphere is the lowermost layer of the atmosphere. Its average height is 13 km and extends roughly to a height of 8 km near the poles and about 18 km at the equator. Thickness of the troposphere is greatest at the equator because heat is transported to great heights by strong convectional currents. This layer contains dust particles and water vapour. All changes in climate and weather take place in this layer. The temperature in this layer decreases at the rate of  $1^{\circ}\text{C}$  for every 165m of height.

2. **Stratosphere:** The stratosphere is found above the tropopause and extends up to a height of 50 km. One important feature of the stratosphere is that it contains the ozone layer. This layer absorbs ultra-violet radiation and shields life on the earth from intense, harmful form of energy.

## Geography

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3. **Mesosphere:** The mesosphere lies above the stratosphere, which extends up to a height of 80 km. In this layer, temperature starts decreasing with the increase in altitude and reaches up to minus 100°C at the height of 80 km.

4. **Ionosphere:** The ionosphere is located between 80 and 400 km above the mesopause. It contains electrically charged particles known as ions, and hence, it is known as ionosphere. Radio waves transmitted from the earth are reflected back to the earth by this layer.

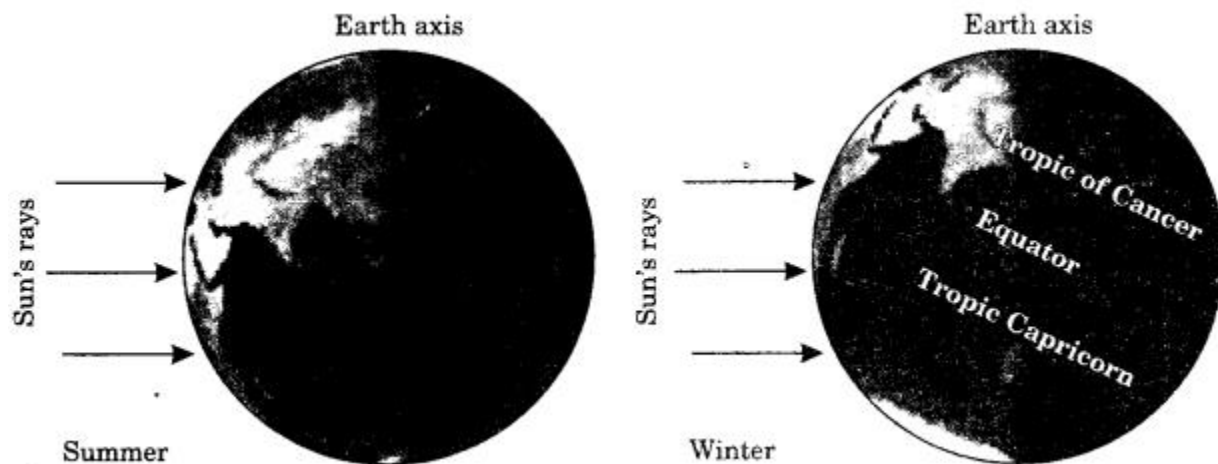
Temperature here starts increasing with height.

5. **Exosphere:** The uppermost layer of the atmosphere above the thermosphere is known as the exosphere. This is the highest layer but very little is known about it.

### MAP SKILL

1. Use a diagram to show summer solstice on a globe.

Answer:



### Multiple choice questions and Answers

**1.Which of the following is an important component of atmosphere?**

- (a) Water vapours
- (b) Dust particles
- (c) Gases
- (d) All of the above.

**Answer:**

- (d) All of the above

**2.What is the upper layer of mesosphere called?**

- (a) Mesosphere
- (b) Ionosphere
- (c) Troposphere
- (d) Stratosphere.

**Answer:**

- (a) Mesosphere

**3.Which layer of atmosphere has electronically charged particles?**

- (a) Mesosphere
- (b) Ionosphere
- (c) Troposphere
- (d) Stratosphere.

**Answer:**

- (b) Ionosphere

**4.Which of the following is the uppermost layer of the atmosphere?**

- (a) Exosphere
- (b) Ionosphere
- (c) Troposphere
- (d) Stratosphere.

**Answer:**

- (a) Exosphere

**5. Which of the following is the lowest layer of the earth?**

- (a) Mesosphere
- (b) Ionosphere
- (c) Troposphere
- (d) Stratosphere.

**Answer:**

- (c) Troposphere

**6. The air is an integral part of the earth's mass and 99 per cent of the total mass of the atmosphere is confined to the height of how many km from the earth's surface?**

- (a) 10 km
- (b) 12 km
- (c) 24 km
- (d) 32 km.

**Answer:**

- (d) 32 km

**7. To what height carbon dioxide and water vapours are found in atmosphere?**

- (a) 60 km
- (b) 75 km
- (c) 90 km
- (d) 100 km.

**Answer:**

- (c) 90 km

**8. To what height is ozone found?**

- (a) 10 to 50 km
- (b) 5 to 60 km
- (c) 30 to 80 km
- (d) 40 to 90 km.

**Answer:**

- (a) 10 to 50 km

**9. Which of the following layer of atmosphere is most important for life?**

- (a) Nitrogen
- (b) Oxygen
- (c) Ozone
- (d) Carbon dioxide.

**Answer:**

- (c) Ozone

**10. What are causes behind increasing density of carbon dioxide?**

- (a) Burning of fossil fuels
- (b) Killing animals
- (c) Exploitation of minerals
- (d) Ozone layer depletion.

**Answer:**

- (a) Burning of fossil fuels.

**11. Which one of the following gases constitutes the major portion of the atmosphere?**

- (a) Oxygen
- (b) Nitrogen
- (c) Argon
- (d) Carbon dioxide.

**Answer:**

- (b) Nitrogen

**12. Atmospheric layer important for human beings is:**

- (a) Stratosphere
- (b) Mesosphere
- (c) Troposphere
- (d) Ionosphere.

**Answer:**

- (c) Troposphere

**13. Sea salt, pollen, ash, smoke soot, fine soil these are associated with:**

- (a) Gases
- (b) Dust particles
- (c) Water vapour
- (d) Meteors.

**Answer:**

- (b) Dust particles

**14. Oxygen gas is in negligible quantity at the height of atmosphere:**

- (a) 90 km
- (b) 120 km
- (c) 100 km
- (d) 150 km.

**Answer:**

- (b) 120 km

**15. Which one of the following gases is transparent to incoming solar radiation and opaque to outgoing terrestrial radiation?**

- (a) Oxygen
- (b) Nitrogen
- (c) Helium
- (d) Carbon dioxide.

**Answer:**

- (d) Carbon dioxide.