Chapter 7: Composition and Structure of Atmosphere

Exercises — Exercises

Q1 Multiple choice question (i): Which one of the following gases constitutes the major portion of the atmosphere? (a) Oxygen (b) Nitrogen (c) Argon (d) Carbon dioxide

(b) Nitrogen. It forms the largest share of the air, far more than oxygen, argon or carbon dioxide. (The chapter text itself does not state the percentage; this is the standard composition of dry air.)

Q2 Multiple choice question (ii): Atmospheric layer important for human beings is: (a) Stratosphere (b) Mesosphere (c) Troposphere (d) Ionosphere

(c) Troposphere. It is the lowest layer, holding dust and water vapour. All weather and climate changes occur in it, and it is the most important layer for all biological activity.

Q3 Multiple choice question (iii): Sea salt, pollen, ash, smoke soot, fine soil — these are associated with: (a) Gases (b) Dust particles (c) Water vapour (d) Meteors

(b) Dust particles. The atmosphere holds small solid particles from sources such as sea salts, fine soil, smoke-soot, ash, pollen and disintegrated meteor particles, all grouped as dust particles.

Q4 Multiple choice question (iv): Oxygen gas is in negligible quantity at the height of atmosphere: (a) 90 km (b) 120 km (c) 100 km (d) 150 km

(b) 120 km. The proportion of gases changes in the higher layers, so that oxygen is almost negligible at about 120 km, whereas carbon dioxide and water vapour are found only up to 90 km.

Q5 Multiple choice question (v): 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

(d) Carbon dioxide. It lets incoming solar radiation pass but absorbs part of the outgoing terrestrial radiation and sends some back towards the earth's surface, which is why it is largely responsible for the greenhouse effect.

Q6 Answer in about 30 words: (i) What do you understand by atmosphere?

The atmosphere is the envelope of a mixture of gases, water vapour and dust particles surrounding the earth on all sides. It is colourless and odourless, is an integral part of the earth's mass, and supports life. About 99 per cent of its mass lies within 32 km of the surface.

Q7 Answer in about 30 words: (ii) What are the elements of weather and climate?

The main elements of weather and climate are temperature, pressure, winds, humidity, clouds and precipitation. They keep changing and influence human life on earth. They are discussed in detail in the following chapters (8, 9 and 10).

Q8 Answer in about 30 words: (iii) Describe the composition of atmosphere.

The atmosphere is composed of gases, water vapour and dust particles. Gases such as nitrogen, oxygen, carbon dioxide and ozone make up the air; water vapour is variable, and dust particles are mostly concentrated in the lower layers. Gas proportions change in the higher layers.

Q9 Answer in about 30 words: (iv) Why is troposphere the most important of all the layers of the atmosphere?

The troposphere is the lowest layer and contains the dust and water vapour. All weather and climate changes happen in it, so it directly affects people. Because of this it is the most important layer for all biological activity, and geographers study it first.

Q10 Answer in about 150 words: (i) Describe the composition of the atmosphere.

The atmosphere consists of gases, water vapour and dust particles. The proportion of gases changes in the higher layers: oxygen is almost negligible at 120 km, while carbon dioxide and water vapour occur only up to 90 km.

Gases: Carbon dioxide is meteorologically very important because it is transparent to incoming solar radiation but opaque to outgoing terrestrial radiation; it absorbs part of this radiation and reflects some back to the earth, and is largely responsible for the greenhouse effect. Its volume has been rising because of burning of fossil fuels, raising air temperature. Ozone, found between 10 and 50 km above the surface, absorbs the sun's ultraviolet rays and prevents them from reaching the earth.

Water vapour: It is variable and decreases with altitude and from the equator towards the poles. It may form about 4 per cent of the air in the wet tropics but under 1 per cent in deserts and polar areas. It absorbs part of insolation, holds earth's radiated heat like a blanket, and affects air stability.

Dust particles: Sea salt, fine soil, smoke-soot, ash, pollen and meteor particles are concentrated in the lower layers and more in subtropical and temperate regions. They act as hygroscopic nuclei around which water vapour condenses to form clouds.

Q11 Answer in about 150 words: (ii) Draw a suitable diagram for the structure of the atmosphere and label it and describe it.

Diagram (to be drawn): a vertical column marking, from bottom upwards, the troposphere (up to about 13 km average), tropopause, stratosphere (to 50 km, with the ozone layer), mesosphere (to 80 km) with the mesopause, thermosphere (ionosphere between 80 and 400 km) and exosphere at the top, merging with outer space. Show temperature falling in the troposphere, rising in the stratosphere, falling in the mesosphere and rising in the thermosphere.

Description: Density is highest near the surface and decreases with altitude. The atmosphere is divided into five layers by temperature. The troposphere has an average height of 13 km (about 8 km at the poles, 18 km at the equator); temperature falls 1 degree C per 165 m, and all weather occurs here. The tropopause separates it from the stratosphere; its temperature is nearly constant, about minus 80 degrees C over the equator and minus 45 degrees C over the poles. The stratosphere extends to 50 km and holds the ozone layer that absorbs ultraviolet radiation. The mesosphere extends to 80 km, where temperature falls to about minus 100 degrees C. The ionosphere contains charged ions and reflects radio waves back to earth, with temperature rising with height. The exosphere is the uppermost, extremely rarefied layer, gradually merging with outer space.