Chapter 10: Water in the Atmosphere

Exercises — Exercises

Q1 Multiple choice. Which one of the following is the most important constituent of the atmosphere for human beings?
(a) Water vapour
(b) Nitrogen
(c) Dust particle
(d) Oxygen

(a) Water vapour. It is the source of all condensation and precipitation (clouds, rain, snow), and it plays an important role in weather phenomena. Water moves continuously between the atmosphere, oceans and continents, which sustains life on land.

Q2 Multiple choice. Which one of the following process is responsible for transforming liquid into vapour?
(a) Condensation
(b) Transpiration
(c) Evaporation
(d) Precipitation

(c) Evaporation. It is the process by which water changes from liquid to gaseous state, mainly because of heat. Condensation is the reverse (vapour to water), and precipitation is the release of condensed moisture.

Q3 Multiple choice. The air that contains moisture to its full capacity:
(a) Relative humidity
(b) Specific humidity
(c) Absolute humidity
(d) Saturated air

(d) Saturated air. Air holding moisture to its full capacity at a given temperature cannot take any additional water vapour. The temperature at which this happens is the dew point.

Q4 Multiple choice. Which one of the following is the highest cloud in the sky?
(a) Cirrus
(b) Stratus
(c) Nimbus
(d) Cumulus

(a) Cirrus. Cirrus clouds form at high altitudes of about 8,000-12,000 m and are thin, detached, feathery and always white. Cumulus form at 4,000-7,000 m, and stratus and nimbus lie lower.

Q5 Name the three types of precipitation.

On the basis of origin, rainfall is of three types: convectional, orographic (relief) and cyclonic (frontal). The main forms of precipitation are rainfall (liquid), snowfall (fine flakes of ice crystals below 0 degrees C), and, less commonly, sleet and hail.

Q6 Explain relative humidity.

Relative humidity is the percentage of moisture present in the air compared with its full capacity at a given temperature. As temperature changes, the air's capacity to hold moisture changes, so relative humidity changes too. It is greater over the oceans and least over the continents.

Q7 Why does the amount of water vapour decrease rapidly with altitude?

Moisture enters the air from water bodies by evaporation and from plants by transpiration, so it is concentrated near the surface. With increasing height, temperature falls, so air can hold less vapour and the excess condenses. Hence water vapour decreases rapidly upward.

Q8 How are clouds formed? Classify them.

Clouds form when water vapour in free air, at considerable elevations, condenses around tiny nuclei such as dust, smoke and salt into minute water droplets or ice crystals. By height, expanse, density and transparency they are cirrus (high, feathery), cumulus (cotton-wool patches with flat base), stratus (layered sheets) and nimbus (dark, dense, rain-bearing).

Q9 Discuss the salient features of the world distribution of precipitation.

Rainfall generally decreases steadily from the equator towards the poles. Coastal areas receive more than continental interiors, and oceans receive more than landmasses. Between 35 and 40 degrees N and S, rain is heavier on eastern coasts and decreases westward; between 45 and 65 degrees N and S, the westerlies bring rain first to western margins, decreasing eastward. Where mountains run parallel to the coast, the windward coastal side gets more rain than the leeward side. By annual total: the equatorial belt, windward slopes on western coasts of cool temperate zones and monsoon coastal lands get over 200 cm; interior continental areas 100-200 cm; central tropical lands and eastern and interior temperate lands 50-100 cm; rain-shadow interiors and high latitudes under 50 cm. Distribution is even through the year in the equatorial belt and western cool temperate regions.

Q10 What are forms of condensation? Describe the process of dew and frost formation.

After condensation, moisture takes the forms of dew, frost, fog and mist, and clouds; they are classed by temperature and location, depending on whether the dew point is above or below freezing. Dew forms when moisture is deposited as water droplets on cool surfaces such as stones, grass blades and leaves. Ideal conditions are a clear sky, calm air, high relative humidity, and cold, long nights, with the dew point above freezing. Frost forms on cold surfaces when condensation occurs with the dew point at or below 0 degrees C, so excess moisture is deposited as minute ice crystals instead of droplets. Conditions are the same as for dew, except that the air temperature must be at or below freezing.