Water in the Atmosphere

Standard difficulty · 20 questions · 40 marks · Time: 37 minutes

Name: _____ Date: _____ Score: ____ / 40

Write full answers in Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. Water vapour in the air varies from zero to about:
   (a) 0.04 per cent by volume **(b)** 78 per cent by volume
   (c) 40 per cent by volume **(d)** 4 per cent by volume

2. Which describes frost?
   (a) fog mixed with smoke
   (b) more moist than fog, visibility 1–2 km
   (c) ice crystals on cold surfaces, with the dew point at or below freezing
   (d) a cloud at the ground, visibility under 1 km

3. Which describes cirrus clouds?
   (a) layered clouds covering large parts of the sky
   (b) cotton-wool clouds with flat bases at 4,000–7,000 m
   (c) thin, feathery white clouds at 8,000–12,000 m
   (d) ice crystals lying on the ground

4. What causes cyclonic rain?
   (a) air rises along fronts in cyclones **(b)** moist air is forced up a mountain
   (c) the sun heats the sea at night **(d)** heated air rises in convection currents

5. At its temperature, air could hold 50 g of water vapour per cubic metre, but holds 48 g. What is its relative humidity?
   (a) 106 % **(b)** 4 % **(c)** 48 % **(d)** 96 %

6. A room is 4 m × 7 m × 4 m, and the air in it has an absolute humidity of 19 g per cubic metre. How many grams of water vapour are in the room?
   (a) 2,128 g **(b)** 532 g **(c)** 285 g **(d)** 112 g

7. Condensed moisture near the ground limits visibility to 100 m. What is it?
   (a) fog **(b)** frost
   (c) mist **(d)** clear air (visibility over 2 km)

8. A region receives 438 cm of precipitation a year. In which rainfall regime does it fall?
   (a) under 50 cm (low) **(b)** 50–100 cm
   (c) 100–200 cm (moderate) **(d)** over 200 cm (heavy)

Section B — Short answer — 8 × 2 = 16 marks

9. Distinguish between absolute and relative humidity.

10. Describe each form of condensation: (a) mist (b) fog

11. Is each cloud high, middle, low or of vertical development? (a) cumulonimbus (b) altocumulus

12. Describe each form of precipitation: (a) hail (b) sleet

13. Find the relative humidity: (a) capacity 10 g/m^3, holding 4 g/m^3 (b) capacity 20 g/m^3, holding 2 g/m^3. Which air is closer to saturation?

14. A hall holds 250 m^3 of air that could hold 18 g of vapour per m^3 but holds 16 g per m^3. How many more grams of vapour would saturate it?

15. On a calm, clear night, will moisture be deposited as dew or as frost if the dew point is (a) 7 °C (b) −3 °C?

16. Describe each type of cloud: (a) cumulus (b) nimbus

Section C — Longer answers — 4 × 4 = 16 marks

17. Describe the forms of condensation.

18. Match each with its description: (a) cumulus (b) cirrus (c) nimbus. Choose from: cotton-wool clouds with flat bases at 4,000–7,000 m; thin, feathery white clouds at 8,000–12,000 m; dark, dense, shapeless rain clouds near the surface.

19. A room is 12 m × 9 m × 5 m. Its air could hold 25 g of vapour per m^3 and holds 21 g per m^3. (a) What is the relative humidity? (b) How many grams of vapour are in the room? (c) What happens if the room cools below its dew point?

20. A station on the windward slope of a mountain range gets 404 cm of rain a year; one on the leeward side gets 89 cm. (a) How many cm more does the windward station get? (b) About how many times as much, to one decimal place? (c) Explain why the leeward side is dry.

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Answer key

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Q	Answer	Working
1	**(d) 4 per cent by volume**	—
2	**(c) ice crystals on cold surfaces, with the dew point at or below freezing**	—
3	**(c) thin, feathery white clouds at 8,000–12,000 m**	—
4	**(a) air rises along fronts in cyclones**	—
5	**(d) 96 %**	48 ÷ 50 × 100
6	**(a) 2,128 g**	4 × 7 × 4 × 19
7	**(a) fog**	fog: under 1 km; mist: 1–2 km
8	**(d) over 200 cm (heavy)**	—
9	**Absolute humidity is the weight of water vapour per unit volume of air; relative humidity is the percentage of moisture present compared with the air's full capacity at that temperature.**	—
10	**(a) more moist than fog, visibility 1–2 km (b) a cloud at the ground, visibility under 1 km**	—
11	**(a) vertical (b) middle**	—
12	**(a) rounded ice with concentric layers (b) frozen raindrops or refrozen melted snow**	—
13	**(a) 40% (b) 10%; air (a)**	4 ÷ 10 × 100; 2 ÷ 20 × 100
14	**500 g**	(18 − 16) × 250
15	**(a) dew (b) frost**	dew point above freezing: dew; at or below: frost
16	**(a) cotton-wool clouds with flat bases at 4,000–7,000 m (b) dark, dense, shapeless rain clouds near the surface**	—
17	**Dew on cool surfaces above freezing; frost as ice crystals below freezing; fog and mist as cloud near the ground; and clouds in the free air.**	—
18	**(a) cotton-wool clouds with flat bases at 4,000–7,000 m (b) thin, feathery white clouds at 8,000–12,000 m (c) dark, dense, shapeless rain clouds near the surface**	—
19	**(a) 84% (b) 11,340 g (c) The excess vapour condenses into droplets (dew**	21 ÷ 25 × 100; 540 × 21

Q	Answer	Working
	or mist).	
20	**(a) 315 cm (b) about 4.5 times (c) Descending air warms, so its capacity to hold moisture rises and it gives little rain: a rain-shadow area.**	404 − 89; 404 ÷ 89