Composition and Structure of Atmosphere

Standard difficulty · 20 questions · 40 marks · Time: 36 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. About 99 per cent of the atmosphere's mass lies within a height of:
   (a) 120 km **(b)** 400 km **(c)** 8 km **(d)** 32 km

2. Which describes the stratosphere?
   (a) the uppermost, very rarefied layer
   (b) charged particles reflect radio waves back to the earth
   (c) it contains the ozone layer
   (d) temperature falls to minus 100 °C at about 80 km

3. What is the role of water vapour in the atmosphere?
   (a) act as nuclei for condensation
   (b) the life-giving gas for humans and animals
   (c) the largest share of the air by volume
   (d) keeps in the earth's heat like a blanket

4. In which layer of the atmosphere is a point 293 km above the surface?
   (a) ionosphere **(b)** mesosphere **(c)** troposphere **(d)** stratosphere

5. In the troposphere the temperature falls about 1 °C for every 165 m. If it is 40 °C at sea level, what is it at 4,620 m?
   (a) 7 °C **(b)** 68 °C **(c)** 17 °C **(d)** 12 °C

6. Dry air is about 78.08% nitrogen, 20.95% oxygen and 0.93% argon by volume. How many litres of nitrogen are in 350 litres of dry air?
   (a) 273.28 L **(b)** 304.78 L **(c)** 73.33 L **(d)** 3.25 L

7. In the warm, wet tropics water vapour may be 4% of the air by volume. How many cubic metres of water vapour would 550 cubic metres of such air hold?
   (a) 23 m^3 **(b)** 26 m^3 **(c)** 22 m^3 **(d)** 55 m^3

8. The ionosphere extends up to:
   (a) 400 km **(b)** 50 km **(c)** 8 km **(d)** 120 km

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

9. What is the atmosphere?

10. Give one feature of each layer: (a) troposphere (b) ionosphere

11. What is the role of each in the atmosphere? (a) water vapour (b) dust particles

12. Name the layer of the atmosphere at each height: (a) 305 km (b) 24 km

13. At sea level it is 40 °C. Using a fall of 1 °C per 165 m in the troposphere, what is the temperature at 9,075 m, and why does it fall with height?

14. Using nitrogen 78.08% and oxygen 20.95% by volume, how many litres of each are in 3,400 litres of dry air?

15. Give the height: (a) carbon dioxide and water vapour are found up to (b) the ionosphere extends up to

16. At the tropopause it is about minus 80 °C over the equator and minus 45 °C over the poles. Suppose it is 33 °C at the equator's surface. How much colder is the tropopause above it, and how much colder is the equatorial tropopause than the polar one?

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

17. Describe the composition of the atmosphere.

18. Match each with its feature: (a) ionosphere (b) stratosphere (c) exosphere. Choose from: charged particles reflect radio waves back to the earth; it contains the ozone layer; the uppermost, very rarefied layer.

19. Using a fall of 1 °C per 165 m in the troposphere: the surface is 36 °C. (a) What is the temperature at 3,300 m? (b) At 9,735 m? (c) Name the zone at the top of the troposphere, and say why the troposphere is thickest at the equator.

20. A sample holds 1,700 litres of dry air. (a) How many litres of nitrogen (78.08%)? (b) Of oxygen (20.95%)? (c) Of argon (0.93%)? (d) Why is carbon dioxide important even though its share is tiny?

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Answer key

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Q	Answer	Working
1	**(d) 32 km**	—
2	**(c) it contains the ozone layer**	—
3	**(d) keeps in the earth's heat like a blanket**	—
4	**(a) ionosphere**	troposphere to about 13 km, stratosphere to 50 km, mesosphere to 80 km, ionosphere 80–400 km
5	**(d) 12 °C**	4,620 ÷ 165 = 28; 40 − 28
6	**(a) 273.28 L**	78.08% of 350
7	**(c) 22 m^3**	4% of 550
8	**(a) 400 km**	—
9	**A mixture of gases, water vapour and dust particles that envelops the earth.**	—
10	**(a) all weather happens here and temperature falls with height (b) charged particles reflect radio waves back to the earth**	—
11	**(a) keeps in the earth's heat like a blanket (b) act as nuclei for condensation**	—
12	**(a) ionosphere (b) stratosphere**	troposphere to 13 km, stratosphere to 50 km, mesosphere to 80 km, ionosphere 80–400 km
13	**−15 °C; the air is heated from below by terrestrial radiation, so it is cooler higher up.**	9,075 ÷ 165 = 55; 40 − 55
14	**nitrogen 2,654.72 L, oxygen 712.3 L**	78.08% and 20.95% of 3,400
15	**(a) 90 km (b) 400 km**	—
16	**113 °C colder; 35 °C colder**	33 − (−80); −45 − (−80)
17	**Gases (mostly nitrogen and oxygen, with argon, carbon dioxide and others), water vapour up to 4 per cent, and dust particles; oxygen is negligible by 120 km and carbon dioxide and water vapour reach only 90 km.**	—
18	**(a) charged particles reflect radio waves back to the earth (b) it contains the ozone layer (c) the uppermost, very rarefied layer**	—

Q	Answer	Working
19	**(a) 16 °C (b) −23 °C (c) the tropopause; strong convection currents carry heat higher at the equator.**	36 − 20; 36 − 59
20	**(a) 1,327.36 L (b) 356.15 L (c) 15.81 L (d) It lets sunlight in but absorbs outgoing heat, causing the greenhouse effect.**	78.08%, 20.95% and 0.93% of 1,700