Particulate Nature of Matter

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for 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. Matter is made up of tiny:
(a) waves only **(b)** magnets **(c)** cells **(d)** particles

2. Which state of matter has a fixed volume but takes the shape of its container?
(a) none of these **(b)** plasma **(c)** liquid **(d)** gas

3. At room temperature, methane is a:
(a) plasma **(b)** liquid **(c)** solid **(d)** gas

4. Iron melts at 1,538 °C. At 1,716 °C, iron is:
(a) not matter **(b)** a solid **(c)** a liquid **(d)** a gas

5. A sealed syringe holds 60 mL of air. Pushing the plunger squeezes it into 40 mL. By how much was it compressed?
(a) 40 mL **(b)** 20 mL **(c)** 100 mL **(d)** 60 mL

6. A permanganate crystal coloured hot water in 4 minutes and cold water in 12 minutes. How many times faster was it in hot water?
(a) 3 times **(b)** 4 times **(c)** 8 times **(d)** 12 times

7. Which of these can be COMPRESSED easily?
(a) oxygen in a balloon **(b)** water in a syringe
(c) milk in a bottle **(d)** a stone

8. 230 mL of water has sugar dissolved in it. The level rises by only 2 mL. What is the final volume?
(a) 232 mL **(b)** 230 mL **(c)** 250 mL **(d)** 228 mL

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

9. What are interparticle spaces?

10. Name the state of matter that (a) is easily compressed (b) has a fixed shape and a fixed volume

11. Is each a solid, liquid or gas at room temperature? (a) mercury (b) oxygen

12. The melting point of iron is 1,538 °C. At 1,568 °C, is it a solid or a liquid?

13. A syringe holds 70 mL of water. When the plunger is pushed hard, the volume is 69 mL. What does this show about liquids?

14. 244 mL of water and 40 cm^3 of sugar are mixed until the sugar dissolves. The final volume is less than 284 mL. Why?

15. Explain in terms of particles: (a) air being squeezed in a syringe (b) soap lifting oil off cloth

16. A 250 mL bottle of water is poured into 3 different containers, one after another. What volume does it have in the last one, and why?

Section C — Word problems — 4 × 4 = 16 marks

17. Compare solids, liquids and gases in terms of particles.

18. Permanganate crystals coloured hot water in 3 min, room-temperature water in 12 min and ice-cold water in 16 min. (a) Put these in order from fastest to slowest. (b) What does this show about particles? (c) How many minutes longer did ice-cold water take than hot water?

19. Draw the particles in carbon dioxide, oxygen, rice flour, mercury, and describe how they are packed and how they move.

20. Iron melts at 1538 °C and ice at 0 °C. (a) At 1,198 °C, is iron solid or liquid? (b) Why are their melting points so different? (c) Why does ice float on water when most solids sink in their own liquid?

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Answer key

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Q	Answer	Working
1	(d) particles	—
2	(c) liquid	—
3	(d) gas	—
4	(c) a liquid	1,716 is above the melting point
5	(b) 20 mL	60 − 40 = 20
6	(a) 3 times	12 ÷ 4 = 3
7	(a) oxygen in a balloon	—
8	(a) 232 mL	230 + 2 = 232 (sugar fills spaces between water particles)
9	The empty spaces between the particles of matter.	—
10	(a) gas (b) solid	—
11	(a) liquid (b) gas	—
12	liquid	1,568 is above 1,538
13	Water is practically incompressible: its particles are already close together.	70 → 69
14	Sugar particles fit into the spaces between water particles.	—
15	(a) gas particles have large spaces (b) soap particles join oil and water	—
16	250 mL; a liquid has a fixed volume, though its shape changes	—
17	Solids: particles closely packed, strong attraction, vibrate in place, fixed shape and volume. Liquids: particles close but able to slide past each other, fixed volume, no fixed shape. Gases: particles far apart with very weak attraction, move freely, no fixed shape or volume.	—
18	(a) Hot, room temperature, ice-cold (b) Particles move faster when they are hotter. (c) 13 min	—
19	carbon dioxide: far apart, moving freely; oxygen: far apart, moving freely; rice flour: closely packed in order, vibrating in place; mercury: close but disordered, sliding past each other.	—

Q	Answer	Working
20	**(a) Solid (b) The attraction between iron particles is much stronger, so more heat is needed to separate them. (c) In ice the particles are farther apart than in liquid water, so ice is less dense.**	—