

Primary 4 · Science · P4 Advanced Papers

Matter, heat and living things

Time **50 min** Marks **36** Questions **18**

Answers are printed in red after each question, with the working where it matters. Marks in brackets show how a marker would split them.

Part I

36 marks

Questions 1 to 18 carry 2 marks each.

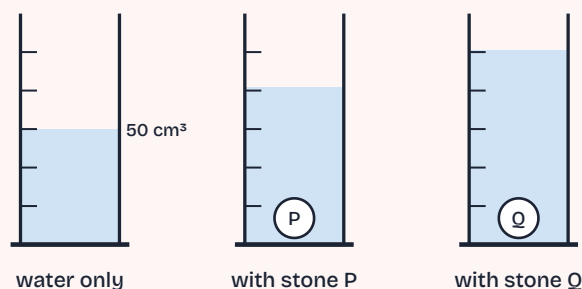
- 1 Study the labelled parts of a torch that is switched on: the metal casing, the glass lens, the light it gives out, the warmth of the casing, and the air trapped inside. [2]
Someone sorted them into two groups as shown.

Group P	Group Q
light warmth glass lens	metal casing air inside

- (1) Light
(2) Warmth
(3) ✓ Glass lens
(4) Air inside

Group P holds things that are not matter (light and heat have no mass and take up no space). A glass lens is matter, so it is wrongly placed.

- 2 Devi wanted to compare the volumes of two stones, P and Q. She placed each stone in turn into a measuring cylinder that held 50 cm³ of water and read the new water level. [2]



	Volume of P / cm ³	Volume of Q / cm ³
(1)	8	34
(2) ✓	18	34
(3)	68	84
(4)	34	18

Volume of the stone = new reading – 50. Q raised the water further, so Q is larger: $P = 68 - 50 = 18$, $Q = 84 - 50 = 34$.

- 3 Three boxes of the same size contain sand (total mass 300 g), feathers (total mass 60 g) and marbles (total mass 300 g). Which diagram shows how a lever balance would look with the boxes placed on it? [2]



(1) Diagram 1

(2) ✓ Diagram 2

(3) Diagram 3

(4) Diagram 4

A balance tips towards the heavier side. Sand and marbles have the same mass (1 is wrong); the 300 g sand is heavier than the 60 g feathers (2 is right, 4 is wrong); marbles are heavier than feathers, so 3 should tip left.

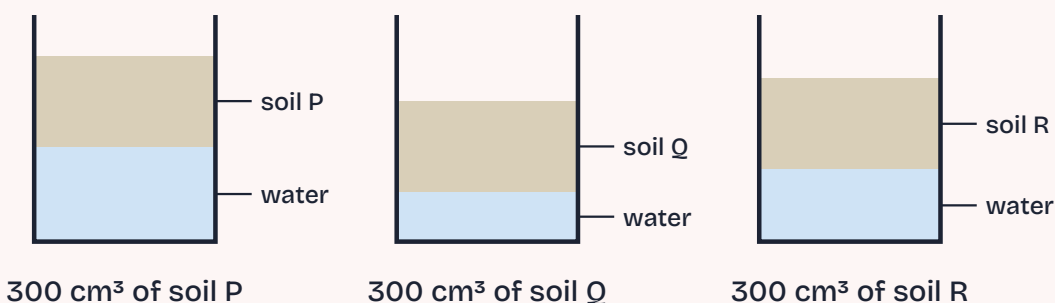
- 4 Hakim filled three identical balloons, X, Y and Z, with equal volumes of three different gases and hung them on lever balances. Balloon Y was heavier than X, and Z was heavier than Y. He was given the table below and told that each balloon holds one of the gases listed. [2]

Gas	Mass of 1 m ³ / kg
Helium	0.2
Air	1.2
Oxygen	1.3
Carbon dioxide	1.8

	Gas in X	Gas in Y	Gas in Z
(1) ✓	Helium	Air	Carbon dioxide
(2)	Air	Carbon dioxide	Oxygen
(3)	Oxygen	Air	Helium
(4)	Carbon dioxide	Oxygen	Helium

Equal volumes, so the heavier balloon holds the gas with the greater mass per cubic metre. X must be lightest and Z heaviest: only option 1 rises from left to right.

- 5 Wei Ling set up three identical beakers to find out how much air is trapped in three kinds of soil, P, Q and R. She put 300 cm³ of each soil into a beaker and poured 350 cm³ of water into each. The diagram shows the beakers after 15 minutes. [2]



- (1) P, R, Q
 (2) ✓ Q, R, P
 (3) Q, P, R
 (4) R, Q, P

Water sinks into the air spaces in the soil. The less water left above the soil, the more air the soil held. Q has the least water on top, then R, then P.

- 6 A sealed container of 800 cm^3 holds 300 cm^3 of water; the rest is air. A pump pushes in 120 cm^3 of air while a tap lets out 100 cm^3 of water at the same time. What is the volume of air in the container at the end? [2]

(1) 500 cm^3

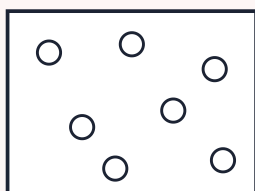
(2) ✓ 600 cm^3

(3) 620 cm^3

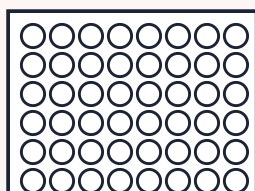
(4) 720 cm^3

Air spreads out to fill whatever space the water leaves: $800 - (300 - 100) = 600 \text{ cm}^3$. The air pumped in is squeezed into that same space; it does not add to the volume.

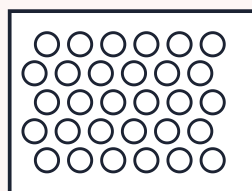
- 7 Substance Y melts at 12°C and boils at 95°C . Which diagram best shows the particles of substance Y at 120°C ? [2]



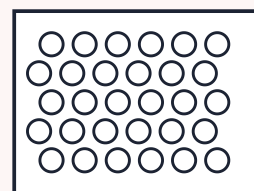
(1)



(2)



(3)



(4)

(1) ✓ **Diagram 1**

(2) Diagram 2

(3) Diagram 3

(4) Diagram 4

120°C is above the boiling point, so Y is a gas: particles far apart and spread through the whole container.

- 8 Nurul could not unscrew the metal lid of a glass jam jar. Which action would most help her to open it? [2]

(1) Hold the lid under cold running water.

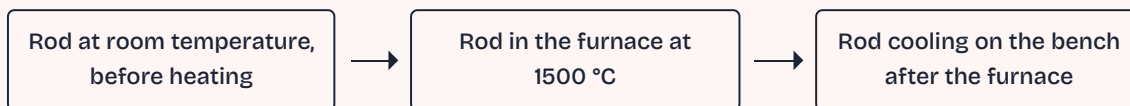
(2) Put the whole jar in the freezer for ten minutes.

(3) ✓ **Hold only the metal lid under hot running water.**

(4) Stand the jar in a bowl of iced water.

Heating the lid alone makes the metal expand more than the glass beneath it, loosening the seal. Cooling makes the lid contract and grip more tightly.

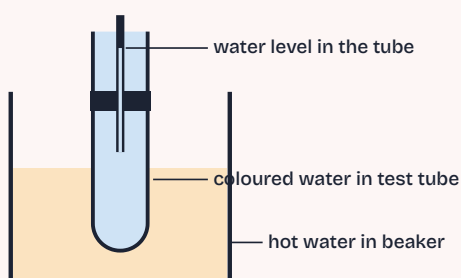
- 9 A steel rod was placed in a furnace at 1500 °C and later taken out to cool on a bench. [2]



	Mass	Volume
(1)	Increases	Increases
(2)	Decreases	Decreases
(3) ✓	Stays the same	Increases
(4)	Stays the same	Decreases

Heating makes the rod expand (volume increases) but adds no matter, so its mass stays the same.

- 10 Jun Hao fitted a test tube of coloured water with a stopper and a thin glass tube, then stood the test tube in a beaker of hot water. What would he observe in the first two minutes? [2]



- (1) The water level in the glass tube falls.
- (2) ✓ The water level in the glass tube rises.
- (3) The water level in the glass tube does not change.
- (4) The water level in the glass tube falls, then rises.

The coloured water gains heat from the hot water and expands, so it is pushed up the tube.

- 11 The table shows the temperatures at which four substances change state.

[2]

Substance	Melts at / °C	Boils at / °C
P	-5	80
Q	15	210
R	30	150
S	48	190

(1) P only

(2) ✓ P and Q only

(3) Q and R only

(4) R and S only

A substance is liquid at 25 °C if 25 lies between its melting and boiling points. P (-5 to 80) and Q (15 to 210) qualify; R and S have not yet melted.

- 12 For questions 12 and 13, read the description below.

[2]

Ruth dropped a handful of frozen peas into a pot of boiling water. The water stopped boiling at once. A few minutes later it began to boil again. Why did the water stop boiling when the peas went in?

(1) The boiling water gained heat from the pot.

(2) ✓ The boiling water lost heat to the frozen peas.

(3) The boiling water gained heat from the peas.

(4) The boiling water lost heat to the air above it.

Heat moves from hotter to colder: the water lost heat to the much colder peas, so its temperature dropped below boiling point.

- 13 Why did the water start to boil again after a few minutes?

[2]

(1) The water gained heat from the peas.

(2) ✓ The water gained heat from the stove flame.

(3) The water gained heat from the air in the kitchen.

(4) The water gained heat from the pot lid.

The stove kept supplying heat, so the water warmed back up to its boiling point.

- 14** An egg was lowered into each of four pots of boiling water at the same moment. The pots held 200 ml, 150 ml, 80 ml and 50 ml of water at 100 °C, as shown in the table. Arrange the set-ups from the shortest time to the longest time needed to cook the egg. [2]

Set-up	Volume of water at 100 °C
A	200 ml
B	150 ml
C	80 ml
D	50 ml

(1) ✓ A, B, C, D

(2) A, C, B, D

(3) D, C, B, A

(4) D, B, C, A

All the water is at the same temperature, but a larger volume stores more heat and can pass more of it to the egg, so the egg cooks fastest in the largest pot.

- 15 The classification key below sorts small animals by their features. Use it to identify animal X, which has three pairs of legs and two pairs of wings of the same size. [2]

Step	Feature	Go to / Name
1a	No legs	Go to 2
1b	Three pairs of legs	Go to 4
2a	Body soft, with a shell	Snail
2b	Body soft, no shell	Go to 3
3a	Body in rings	Earthworm
3b	Body not in rings	Roundworm
4a	Two pairs of wings	Go to 5
4b	One pair of wings	Go to 7
5a	Wings covered in scales	Go to 6
5b	Wings clear	Go to 8
6a	Feathery antennae	Moth
6b	Club-shaped antennae	Butterfly
7a	Piercing mouthparts	Mosquito
7b	No piercing mouthparts	Housefly
8a	Both pairs the same size	Damselfly
8b	Pairs of different sizes	Mayfly

(1) Mayfly

(2) Housefly

(3) ✓ **Damselfly**

(4) Butterfly

1b → 4; two pairs of wings → 5; nothing in the question says the wings are scaly, and 'clear' fits → 8; same size → damselfly.

- 16** Four identical potted seedlings were sealed under bell jars. The table describes each set-up. Which pairs of set-ups can be used to test the aims listed? [2]

Set-up	Light	Carbon dioxide inside jar	Temperature
J	Sunlight	Present	25 °C
K	Sunlight	Removed by a chemical	25 °C
L	Jar painted black	Present	20 °C
M	Sunlight	Present	20 °C

	Set-ups	Aim of experiment
(1)	J and M	To find out if plants need light to grow.
(2)	K and L	To find out if plants need carbon dioxide to grow.
(3) ✓	J and M	To find out if temperature affects plant growth.
(4)	J and K	To find out if plants need carbon dioxide to grow.

A fair test changes one variable only. J and M differ only in temperature (option 3 correct). J and K differ only in carbon dioxide, so option 4 is also a fair pairing; K and L differ in three ways and J and M do not differ in light. Where two options are correct, accept 3 or 4.

- 17 Siti wanted to find out whether the number of leaves on a plant affects how much water its roots take in. She prepared eight similar bean plants in identical test tubes of water. The table shows each set-up. Which set-ups should she use for a fair test? [2]

Set-up	Number of leaves	Layer of oil on the water	Roots
A	8	Yes	Present
B	4	Yes	Present
C	8	No	Present
D	2	Yes	Present
E	8	Yes	Removed
F	4	No	Removed
G	2	No	Present
H	0	Yes	Present

(1) ✓ A, B, D

(2) A, C, G

(3) B, F, H

(4) C, E, H

Only the number of leaves should change. A, B and D all have roots and an oil layer (which stops evaporation from the water surface); they differ only in leaves.

- 18 Ravi photographed an old rain tree in the park. In the photograph, a bird sits on a branch, a line of ants climbs the trunk, several caterpillars are on the leaves, and bracket fungi grow near the base. Which statements are observations, and which are inferences? [2]

A There are fungi at the base of the tree.

B The ants are climbing the trunk to look for food.

C Caterpillars are on the leaves.

D The bird is waiting to eat the caterpillars.

E There are more ants than caterpillars on the tree.

	Observations	Inferences
(1) ✓	A, C, E	B, D
(2)	A, C	B, D, E
(3)	B, D	A, C, E
(4)	A, E	B, C, D

An observation is something seen directly (fungi, caterpillars, the number of each). An inference explains why something happens and cannot be seen in the picture.

ANSWERS AT A GLANCE

1 3	2 2	3 2	4 1	5 2	6 2
7 1	8 3	9 3	10 2	11 2	12 2
13 2	14 1	15 3	16 3	17 1	18 1

Marking notes

- Two marks for each correct choice, no marks for a wrong or missing answer.
- Question 16 has two fair pairings (options 3 and 4); accept either.

END OF PAPER