

M1.	(a) range of speeds	1
	moving in different directions <i>accept random motion</i>	1
	(b) internal energy	1
	(c) density = mass / volume	1
	(d) 0.00254 / 0.0141	1
	0.18	1
	<i>accept 0.18 with no working shown for the 2 calculation marks</i>	
	kg / m ³	1
		[7]

- M2. (a) solid**
particles vibrate about fixed positions 1
- closely packed
accept regular 1
- gas**
particles move randomly
accept particles move faster
accept freely for randomly 1
- far apart 1
- (b) amount of energy required to change the state of a substance from liquid to gas (vapour) 1
- unit mass / 1 kg
dependent on first marking point 1
- (c) 41000 **or** 4.1×10^4 (J)
accept
41400 or 4.14×10^4
correct substitution of
 $0.018 \times 2.3 \times 10^6$ gains 1 mark 2
- (d) **AB**
 changing state from solid to liquid / melting 1

at steady temperature
*dependent on first **AB** mark*

1

BC
temperature of liquid rises

1

until it reaches boiling point
*dependent on first **BC** mark*

1

[12]

- M3.** (a) conduction
must be in correct order 1
- convection 1
- (b) (i) 70
*accept \pm half a square
(69.8 to 70.2)* 1
- (ii) 15
*accept 14.6 to 15.4 for 2 marks
allow for 1 mark 70 – 55
ecf from (b)(i) \pm half a square* 2
- (iii) C 1
- biggest drop in temperature during a given time
accept it has the steepest gradient this is a dependent 1
- (iv) starting at 70 °C and below graph for C
must be a curve up to at least 8 minutes 1
- (v) because 20 °C is room temperature
accept same temperature as surroundings 1
- (c) (i) 6720

correct answer with or without working gains 3 marks
6 720 000 gains 2 marks
correct substitution of $E = 0.2 \times 4200 \times 8$ gains 2 marks
correct substitution of $E = 200 \times 4200 \times 8$ gains 1 mark

3

(ii) the fastest particles have enough energy
accept molecules for particles

1

to escape from the surface of the water

1

therefore the mean energy of the remaining particles decreases
accept speed for energy

1

the lower the mean energy of particles the lower the temperature (of the water)
accept speed for energy

1

[16]

- M4.** (a) (black) is a good absorber of (infrared) radiation 1
- (b) (i) amount of energy required to change (the state of a substance) from solid to liquid (with no change in temperature)
melt is insufficient 1
- unit mass / 1kg 1
- (ii) 5.1×10^6 (J)
accept 5×10^6
allow 1 mark for correct substitution ie $E = 15 \times 3.4 \times 10^5$ 2
- (c) (i) mass of ice
allow volume / weight / amount / quantity of ice 1
- (ii) to distribute the salt throughout the ice 1
- to keep all the ice at the same temperature 1
- (iii) melting point decreases as the mass of salt is increased
allow concentration for mass
accept negative correlation
*do **not** accept inversely proportional* 1
- (d) 60 000 (J)

accept 60 KJ

allow 2 marks for correct substitution ie $E = 500 \times 2.0 \times 60$

allow 2 marks for an answer of 1000 **or** 60

allow 1 mark for correct substitution ie

$E = 500 \times 2.0$ **or** $0.50 \times 2.0 \times 60$

allow 1 mark for an answer of 1

3

- (e) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks

No relevant content

Level 1 (1–2 marks)

There is an attempt at a description of some advantages or disadvantages.

Level 2 (3–4 marks)

There is a basic description of some advantages **and / or** disadvantages for some of the methods

Level 3 (5–6 marks)

There is a clear description of the advantages and disadvantages of all the methods.

examples of the points made in the response

extra information

energy storage

advantages:

- no fuel costs
- no environmental effects

disadvantages:

- expensive to set up and maintain
- need to dig deep under road
- dependent on (summer) weather
- digging up earth and disrupting habitats

salt spreading

advantages:

- easily available
- cheap

disadvantages:

- can damage trees / plants / drinking water / cars
- needs to be cleaned away

undersoil heating

advantages:

- not dependent on weather
- can be switched on and off

disadvantages:

- costly
- bad for environment

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[18]

M5. Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1–2 marks)

Considers either solid or gas and describes at least one aspect of the particles.

or

Considers both solids and gases and describes an aspect of each.

Level 2 (3–4 marks)

Considers both solids and gases and describes aspects of the particles.

or

Considers one state and describes aspects of the particles and explains at least one of the properties.

or

Considers both states and describes an aspect of the particles for both and explains a property for solids or gases.

Level 3 (5–6 marks)

Considers both states of matter and describes the spacing and movement / forces between the particles. Explains a property of both solids and gases.

examples of the points made in the response

extra information

Solids

- (particles) close together
 - (so) no room for particles to move closer (so hard to compress)
 - vibrate about fixed point
 - strong forces of attraction (at a distance)
 - the forces become repulsive if the particles get closer
 - particles strongly held together / not free to move around (shape is fixed)
- any explanation of a property must match with the given aspect(s) of the particles.*

Gases

- (particles) far apart
- space between particles (so easy to compress)
- move randomly
- negligible / no forces of attraction
- spread out in all directions (to fill the container)

[6]