

## Mark schemes

- 1.** (a) Student A's measurements had a higher resolution 1
- Student B was more likely to misread the temperature 1
- (b) a random error 1
- (c) 8.4 °C 1
- (d) 740 (seconds)  
*allow answers in the range 730 – 780* 1
- (e)  $0.40 \times 199\,000$   
79 600 (J) 1  
*accept 79 600 (J) with no working shown for 2 marks*
- (f) stearic acid has a higher temperature than the surroundings  
*accept stearic acid is hotter than the surroundings* 1
- temperature will decrease until stearic acid is the same as the room temperature / surroundings 1
- [9]**
- 2.** (a) surface area  
**or**  
duration of experiment  
*accept shape of beaker*  
*size of beaker is insufficient* 1

(b) any **two** from:

- takes readings automatically  
*ignore easier or takes readings for you*
- takes readings more frequently
- reduces / no instrument reading error  
*ignore human error*
- higher resolution  
*allow better resolution*
- don't need to remove probe to take reading
- more accurate

2

(c) (i) 0.07 (°C/s)

- allow 1 mark for obtaining a temperature drop of 7 (°C)*
- allow 1 mark for an answer between 0.068 and 0.069 (°C/s)*

2

(ii) rate of temperature change is greater at the start

- accept rate of evaporation is greater at the start*

**or**

rate of temperature change decreases

- allow rate of evaporation decreases*
- allow temperature decreases faster at the start*

1

(iii) A

- reason only scores if A is chosen*

lower temperature decrease (over 200 seconds)

- accept lower gradient*

1

(iv) no effect (as rate of evaporation is unchanged)

- allow larger temperature change (per second as mass of liquid is lower)*

1

(d) particles with more energy

- accept particles with higher speeds*

1

leave the (surface of the) liquid

1

(which) reduces the average (kinetic) energy (of the remaining particles)

- allow reference to the total energy of the liquid reducing*

1

- 3.** (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)  $5.1 \times 10^6$  (J)  
*accept  $5 \times 10^6$*   
*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

6

[18]

4.

(a) (i) any **two** from:

- mass (of block)  
*accept weight for mass*
- starting temperature
- final / increase in temperature  
*temperature is insufficient*
- voltage / p.d.  
*same power supply insufficient*
- power (supplied to each block)
- type / thickness of insulation  
*same insulation insufficient*

2

(ii) one of variables is categoric

**or**

(type of) material is categoric

*accept the data is categoric*

*accept a description of categoric*

*do **not** accept temp rise is categoric*

1

(iii) concrete

*reason only scores if concrete chosen*

1

(heater on for) longest / longer time

*a long time or quoting a time is insufficient*

*do **not** accept it is the highest bar*

1

(iv) 4500 (J)

*allow 1 mark for correct substitution ie*

*2 × 450 × 5 provided no subsequent step shown*

2

(b) (i) point at 10 minutes identified

1

(ii) line through all points except anomalous

*line must go from at least first to last point*

1

(iii) 20 (°C)

*if 20°C is given, award the mark.*

*If an answer other than 20°C is given, look at the graph. If the graph shows a correct extrapolation of the candidate's best-fit line and the intercept value has been correctly stated, allow 1 mark.*

1

(iv) 2 (minutes)

1

**[11]**

**5.**

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)