

Internal Energy

Mark Scheme 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.3 Particle Model of Matter
Sub-Topic	Internal Energy
Difficulty Level	Silver Level
Booklet	Mark Scheme 1

Time Allowed: 54 minutes

Score: /54

Percentage: /100

Grade Boundaries:

M1. 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]

M2.(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]

M3.(a) any **two** from:

- water evaporates
accept steam / water vapour for water molecules
accept water turns to steam
- water molecules / particles go into the air

- mirror (surface) is cooler than (damp) air
accept the mirror / surface / glass is cold
- water molecules / particles that hit the mirror lose energy
accept water molecules / particles that hit the mirror cool down
- cooler air cannot hold as many water molecules / particles

2

(causes) condensation (on the mirror)
accept steam changes back to water (on the mirror)

or particles move closer together

1

- (b) mirror (surface) is warm
mirror is heated is insufficient

1

(rate of) condensation reduced
accept no condensation (happens)

1

[5]

M4.(a) 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 refer to the information in the [Marking guidance](#).

0 marks No relevant content.

Level 1(1-2 marks) There is a basic explanation of **one** feature or a simple statement relating reduction in energy transfer to **one** feature.

Level 2(3-4 marks) There is a clear explanation of **one** feature or a simple statement relating reduction in energy transfer to **two** features.

Level 3(5-6 marks) There is a detailed explanation of at least **two** features or a

simple statement relating reduction in energy transfer to all **four** features.

Examples of the points made in response

extra information

accept throughout:

heat for energy

loss for transfer

plastic cap:

- plastic is a poor conductor
accept insulator for poor conductor
- stops convection currents forming at the top of the flask so stopping energy transfer by convection
- molecules / particles evaporating from the (hot) liquid cannot move into the (surrounding) air so stops energy transfer by evaporation
- plastic cap reduces / stops energy transfer by conduction / convection / evaporation

glass container:

- glass is a poor conductor so reducing energy transfer by conduction
- glass reduces / stops energy transfer by conduction

vacuum:

- both conduction and convection require a medium / particles
- so stops energy transfer between the two walls by conduction and convection
- vacuum stops energy transfer by conduction / convection

silvered surfaces:

- *silvered surfaces reflect infrared radiation*
accept heat for infrared
- *silvered surfaces are poor emitters of infrared radiation*
- *infrared radiation (partly) reflected back (towards hot liquid)*
- *silvered surfaces reduce / stop energy transfer by radiation*

- (b) (the ears have a) small surface area
ears are small is insufficient

1

so reducing energy radiated / transferred (from the fox)
accept heat lost for energy radiated
do **not** accept stops heat loss

1

[8]

M5.(a) (i) 5(.0)

1

- (ii) 35 **or** their (a)(i) $\times 7$ correctly calculated
allow 1 mark for correct substitution, ie 5 **or** their (a)(i) $\times 7$
provided no subsequent step shown

2

- (iii) 525(p)**or**(£) 5.25**or**their (a)(ii) $\times 15$ correctly calculated
if unit p or £ given they must be consistent with the numerical
answer

1

- (iv) decreases

1

temperature difference (between inside and outside) decreases
accept gradient (of line) decreases
do **not** accept temperature (inside) decreases
do **not** accept graph goes down

1

- (b) air (bubbles are) trapped (in the foam)
do **not** accept air traps heat

foam has air pockets is insufficient

1

(and so the) air cannot circulate / move / form convection current

air is a good insulator is insufficient

no convection current is insufficient

*answers in terms of warm air from the room being trapped
are incorrect and score no marks*

1

[8]

M6.(a) conduction

1

(b) (i) any **one** from:

- *starting temperature (of cold water)
temperature is insufficient*
- *pipe length
accept size of pipe*
- *pipe diameter*
- *pipe (wall) thickness*
- *volume of cold water
accept amount for volume*
- *temperature of hot water (in)*
- *time*

1

(ii) copper

1

greatest temperature change

only scores if copper chosen

accept heat for temperature
accept heated water the fastest
accept it was hottest (after 10 minutes)
accept it is the best / a good conductor

1

- (c) the pipe has a larger (surface) area
accept pipe is longer

1

(so) hot / dirty water (inside pipe) is in contact with cold / clean water (outside pipe) for longer

1

[6]

M7. (a) **B**

no mark for **B** - marks are for the explanation
first two mark points can score even if **A** is chosen

draught increases (the rate of) evaporation
accept more evaporation happens
accept draught removes (evaporated) particles faster
do **not** accept answers in terms of particles gaining energy
from the fan / draught

1

evaporation has a cooling effect
accept (average) kinetic energy of (remaining) particles
decreases

1

so temperature will fall faster / further

1

- (b) larger surface area

1

increasing the (rate of) evaporation

accept more / faster evaporation

accept easier for particles to evaporate

or

for water to evaporate from

accept more particles can evaporate

*accept water / particles which have evaporated are trapped
(in the bag)*

answers in terms of exposure to the Sun are insufficient

1

[5]