

# Internal Energy

## Mark Scheme

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

**Time Allowed:** 48 minutes

**Score:** /48

**Percentage:** /100

**Grade Boundaries:**

**M1.(a)** conduction

1

(b) 35 000

1

(c) 500

*their (b) = 2 x c x 35 correctly calculated scores 2 marks*

*allow 1 mark for correct substitution,*

*ie 35000 = 2 x c x 35*

**or**

*their (b) = 2 x c x 35*

2

J / kg°C

1

(d) energy lost to surroundings

**or**

energy needed to warm heater

*accept there is no insulation (on the copper block)*

*do **not** accept answers in terms of human error or poor results or defective equipment*

1

[6]

**M2.(a)** conduction

1

(b) (i) there is a bigger temperature difference between the water and the surrounding air

*accept the water is hottest / hotter*

1

so the transfer of energy (from hot water) is faster

*accept heat for energy*

*ignore temperature falls the fastest*

1

(ii) 120

*allow 1 mark for converting kJ to J correctly, ie 4 032 000*

**or**

correctly calculating temperature fall as 8°C

**or**

allow 2 marks for correct substitution, ie  $4\,032\,000 = m \times 4200 \times 8$

answers of 0.12, 19.2 **or** 16.6 gain 2 marks

answers of 0.019 **or** 0.017 gain 1 mark

3

(iii) water stays hot for longer

1

so heater is on for less time

*accept so less energy needed to heat water*

1

so cost of the jacket is soon recovered from) lower energy costs / bills

*accept short payback time*

1

[9]

**M3.(a)** there are strong forces (of attraction) between the particles in a solid

*accept molecules / atoms for particles throughout*

*accept bonds for forces*

1

(holding) the particles close together

*particles in a solid are less spread out is insufficient*

1

**or**

(holding) the particles in a fixed pattern / positions

but in a gas the forces between the particles are negligible

*accept very small / zero for negligible*

*accept bonds for forces*

1

so the particles spread out (to fill their container)

*accept particles are not close together*

*gas particles are not in a fixed position is insufficient*

1

(b) (i) particles are (shown) leaving (the liquid / container)

*accept molecules / atoms for particles throughout*

*accept particles are escaping particles are getting further apart is insufficient*

1

(ii) *accept molecules / atoms for particles throughout*

*accept speed / velocity for energy throughout*

particles with most energy leave the (surface of the) liquid

*accept fastest particles leave the liquid*

1

so the mean / average energy of the remaining particles goes down

1

and the lower the average energy (of the particles) the lower the temperature (of the liquid)

1

[8]

**M4.** (a) any **two** from:

- (air) particles / molecules / atoms gain energy
- (air) particles / molecules / atoms move faster  
*do **not** accept move more*  
*do **not** accept move with a bigger amplitude / vibrate more*
- (air) particles / molecules / atoms move apart
- air expands  
*ignore particles expand*
- air becomes less dense  
*ignore particles become less dense*
- warm / hot air / gases / particles rise  
*do **not** accept heat rises*  
*answers in terms of heat particles negates any of the mark points that includes particles*

2

(b) (i) any **two** from

- free / mobile electrons gain (kinetic) energy  
*accept free / mobile electrons move faster*  
*accept vibrate faster for gain energy*
- free electrons collide with other (free) electrons / ions / atoms / particles
- atoms / ions / particles collide with other atoms / ions / particles  
*answers in terms of heat particles negates this mark point*

2

- (ii) (faster) energy / heat transfer to room(s) / house  
*accept room(s) / house gets warm(er)*  
*accept lounge / bedroom / loft for rooms*

1

[5]

**M5.** (a) (i) £150  
*gets 2*

Else  $1000 - (250 + 350 + 100 + 150)$  or  $1000 - 850$   
*gets 1*

2

(ii) (Named) floor covering  
**OR** Insulation under floor  
*for 1 mark*

1

(b) (i) Draught proof doors or fibre glass in loft or in cavity  
**For draught proofing**  
*gains 1 mark*

Very low cost/easy to install  
Repays for itself quickly/cost recuperated quickly  
Reasonable energy saving  
*any 2 for 1 mark each*

For loft insulation

Second lowest installation cost/easy to install  
Reasonable large energy savings for this cost  
Reasonable payback time  
*gains 1 mark*

**For foam filled cavity**  
Biggest energy/cash saving  
Cost effective  
*any 2 for 1 mark each*

3

- (ii) **Double glazing**  
*gains 1 mark*

Costs most  
Saves least energy  
Least cost effective  
*any 2 for 1 mark each*

3

[9]

- M6.** (i) currents of moving liquids/gases/fluids carrying/transferring energy  
(can name fluid)

1

- (ii) liquids/gases **expand** when their temperature rises/when they are heated  
the **density** of the heated liquid/gas is then **less** than that of the  
colder liquid/gas which has not been heated  
the warmer/less dense liquid/gas **then rises** through the colder/denser liquid/gas  
the **colder/denser liquid/gas falls** to replace the liquid/gas which has risen,  
and in turn becomes heated  
*for 1 mark each*

4

[5]

- M7.** (a) (i) the outlet mark  
hot water rises **or** floats up  
*do not accept heat rises*  
the inlet mark

1

cold water replacing any drawn off comes in at the bottom and does not mix with hot **or** cool the hot water

*do not accept descriptions of a convection current*

1

(ii) only heats top (of tank) **or** a small volume

*credit heats less water*

1

no mixing occurs with cold because hot water is less dense **or** water is a poor conductor

*no mixing because cold water is more dense*

1

(b) radiation (losses from tank)

*do not accept reflection of heat*

1

lower from light **or** white **or** shiny surfaces

*credit they are poor radiators for both marks*

1

[6]