

Temp Changes, Specific Heat Capacity

Mark Scheme

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.3 Particle Model of Matter
Sub-Topic	Temp Changes, Specific Heat Capacity
Difficulty Level	Gold Level
Booklet	Mark Scheme

Time Allowed: 54 minutes

Score: /53

Percentage: /100

Grade Boundaries:

M1.(a) random

accept in all directions

1

description must be of random motion

(b) heating increases the temperature of the gas

1

temperature is proportional to kinetic energy

1

if kinetic energy increases speed increases

1

(c) energy is needed to change the state of the water

1

to break the bonds

1

(d) $1000 = m / 2.5 \times 10^{-5}$

1

$m = 2.5 \times 10^{-5} \times 1000$

1

$m = 0.025 \text{ (kg)}$

1

$E = 0.025 \times 2\,260\,000$

1

$$E = 56\,500 \text{ (J)}$$

1

allow 56 500 (J) without working shown for 5 marks

0 marks awarded for $E = m \times L$

(e) any **four** from:

- because the water is preheated) the change in temperature of the water is less
- so less energy is used to heat the water ($E=mc\Delta\theta$)
- therefore they (condensing boilers) are more efficient
- so less energy is wasted
- less gas is burned to heat the same amount of water
- less waste gas (CO_2) is produced by the boiler **or** (because less gas is used) they are cheaper to run / save money

4

[15]

M2.(a) conduction

1

(b) 35 000

1

(c) 500

their (b) = $2 \times c \times 35$ correctly calculated scores 2 marks

allow 1 mark for correct substitution,

ie $35000 = 2 \times c \times 35$

or

their (b) = $2 \times c \times 35$

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]

M3.(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]

M4. (a) (i) £190

nb mention idea of cost per J in £ will come to an approx figure full credit given

allow 1 mark for showing that the energy loss through the roof is $\frac{1}{4}$ of the total energy loss ie $150 / 600$

2

(ii) £142.50

allow ecf 50 % of their (a)(i) $\times 1.5$ ie their (a)(i) $\times 0.75$

1

(b) transferred to surroundings / atmosphere

or becomes spread out

1

[4]

M5. (a) four calculations correctly shown

$$200 \times 10 - 1800 = \text{£}200$$

$$100 \times 10 - 2400 = -£1400$$

$$50 \times 10 - 600 = -£100$$

$$20 \times 10 - 75 = 125$$

accept four final answers only **or** obvious rejection of solar water heater and underfloor heating, with other two calculations completed any 1 complete calculation correctly shown **or** showing each saving $\times 10$ of all four calculations = 1 mark answers in terms of savings as a percentage of installation cost **may** score savings mark only

2

hot water boiler

correct answers only

1

(b) less electricity / energy to be generated / needed from power stations

accept less demand

1

reduction in (fossil) fuels being burnt

accept correctly named fuel

accept answer in terms of:

fewer light bulbs required because they last longer (1 mark)

less energy used / fuels burnt in production / transport etc. (1 mark)

ignore reference to CO₂ or global warming

ignore reference to conservation of energy

1

[5]

M6. (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]

M7.	(a)	loft insulation	1
		energy saved in 10 years £600	1
		net saving (600 – 110) £490	1
		OR	
		hot water jacket	1
		energy saved in 10 years £140	1
		This is the highest percentage saving on cost	1
	(b)	transferred to environment / surroundings	1
		as heat / thermal energy	1

[5]