

Temp Changes, Specific Heat Capacity

Mark Scheme 1

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	Silver Level
Booklet	Mark Scheme 1

Time Allowed: 59 minutes

Score: /59

Percentage: /100

Grade Boundaries:

M1.(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

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M2.(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]

- M3.** (a) (i) conduction

1

convection

1

correct order only

- (ii) to keep the ceramic bricks hot for a longer time

1

(b) (i) $E = P \times t$

18.2

allow 1 mark for correct substitution ie 2.6×7 provided that no subsequent step is shown

2

(ii) 91 (p)

or their (b)(i) $\times 5$ correctly calculated

accept £0.91

*do **not** accept 0.91 without £ sign*

1

(c) $E = m \times c \times \theta$

2 250 000

allow 1 mark for correct substitution ie $120 \times 750 \times 25$ provided that no subsequent step is shown

answers 2250 kJ or 2.25 MJ gain both marks

2

[8]

M4. (a) (i) conduction

1

(ii) atoms gain (kinetic) energy

accept particles / molecules for atoms

*do **not** accept electrons for atoms*

or atoms vibrate with a bigger amplitude

accept vibrate faster / more

*do **not** accept start to vibrate*

or

atoms collide with neighbouring atoms

1

transferring energy to (neighbouring / other) atoms

do **not** accept heat for energy

or

making these other atoms vibrate with a bigger amplitude

accept faster / more for bigger amplitude

mention of (free) electrons moving and passing on energy
negates this mark

1

- (b) (i) 5 (°C) to 25 (°C)
either order

1

- (ii) a correct example of doubling temperature difference doubling heat transfer

eg going from 5 to 10 (°C) difference doubles heat transfer from 30 to 60 (J/s)

accept for heat transfer number of joules / it

allow **1** mark for correctly reading 1 set of data eg at 5 °C the
heat transfer is 30

or

for every 5°C increase in temperature difference heat
transfer increases by 30 (J/s)

no credit for stating they are directly proportional

2

- (iii) 1800

allow **1** mark for obtaining heat transfer value = 120

2

- (c) payback time calculated as 33 years
calculations must be correct to score the first mark point
explanations must relate to it not being cost effective

1

this is greater than lifetime of windows or total savings (over 30 years) = £4800 (1)

this is less than cost of windows (1) or

$$\frac{5280}{30} = 176 \text{ (1)}$$

this is more than the yearly savings (1)

1

[10]

M5. (a) (i) 20

1

(ii) convection

1

(iii) fit draughtproof strips

1

accept lay carpet

accept fit curtains

accept close doors / windows / curtains

accept any reasonable suggestion for reducing a draught

'double glazing' alone is insufficient

(b) air is (a good) insulator

1

or air is a poor conductor

accept air cavity / 'it' for air

reducing heat transfer by conduction

accept stops for reduces

ignore convection

*do **not** accept radiation*

*do **not** accept answers in terms of heat being trapped*

1

(c) (i) most cost effective

accept it is cheaper or lowest cost

accept shortest payback time

accept in terms of reducing heat loss by the largest amount

*do **not** accept it is easier*

ignore most heat is lost through the roof

1

(ii) 4

1

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- M6.**
- (a) (i) convection current correctly shown
with arrows extending to above
insulation label line
circulation must show water rising in the left half of the tank
*accept continuous **or** broken arrows **must** be at least **one***
*arrow up and **one** arrow down*
*allow **1** mark for correct diagram which does not extend high*
enough
- 2
- (ii) it expands or it gets less dense
*do **not** allow hot water rises*
*do **not** accept explanation in terms of molecules expanding*
***or** changing density*
*do **not** accept lighter **or** heavier*
- 1
- more dense water falls
allow cold water falls if qualified with a suitable reason
- 1
- (b) (i) reflects heat back into the room **or** where it came from
accept infrared or radiation or energy for heat
accept bounce for reflect if in correct context
- 1
- (ii) air is a (good) insulator or poor conductor **or** air stops conduction
*do **not** accept plastic foam is a good insulator **or** bad*
conductor
- 1
- air is trapped
- 1
- convection loss reduced or stopped
- 1

(c) **two** out of the following three:

any answer which gains credit must contain a comparison

rate of evaporation decreases

*accept less sweat can evaporate **or** evaporation is more difficult*

less heat energy removed from the body

higher *humidity* the less water vapour can be absorbed (into the air)

accept sweat for water vapour

*do **not** credit description of high humidity*

accept a correct answer in terms of dynamic equilibrium

2

[10]