

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) 1
allow answers in the range 730 – 780
- (e) $0.40 \times 199\,000$ 1
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 1
accept stearic acid is hotter than the surroundings
temperature will decrease until stearic acid is the same as the room temperature /
surroundings 1
- [9]**
- 2**
- (a) range of speeds 1
moving in different directions 1
accept random motion
- (b) internal energy 1
- (c) density = mass / volume 1
- (d) 0.00254 / 0.0141 1
0.18 1

accept 0.18 with no working shown for the 2 calculation marks

kg / m³

1
[7]

3 (a) dependent

1

(b) (probe) C

allow 103.2

1

largest difference between reading and actual temperature

reason only scores if C chosen

accept larger

it is 3.2 greater is insufficient

comparing C with only one other probe is insufficient

1

(c) (i) 12(°C)

accept a value between 12.0 and 12.2 inclusive

1

(ii) 140 (seconds)

accept an answer between 130 and 150 inclusive

1

temperature starts to rise

only scores if time mark awarded

accept the temperature was lowest (at this time)

1

(iii) increase

accept faster (rate)

1

[7]

4

(a) 78 (°C)

allow 2 marks for correct temperature change ie 22 °C

allow 1 mark for correct substitution

ie $46\,200 = 0.5 \times 4200 \times \theta$

or

$$\frac{46200}{0.5 \times 4200} = \theta$$

3

(b) 6.4 (W)

allow 2 marks for an answer that rounds to 6.4

allow 1 mark for correct substitution

ie $46\,200 = P \times 7200$

an answer of 23 000 or 23 100 or 385 gains 1 mark

2

[5]

5

(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

[11]

6

(a) **solid**
particles vibrate about fixed positions

1

closely packed
accept regular

1

gas
particles move randomly
accept particles move faster
accept freely for randomly

1

far apart

1

(b) amount of energy required to change the state of a substance from liquid to gas (vapour)

1

unit mass / 1 kg
dependent on first marking point

1

- (c) 41000 or 4.1×10^4 (J)
accept
 41400 or 4.14×10^4
correct substitution of
 $0.018 \times 2.3 \times 10^6$ gains 1 mark

2

- (d) **AB**
changing state from solid to liquid / melting

1

at steady temperature
*dependent on first **AB** mark*

1

BC
temperature of liquid rises

1

until it reaches boiling point
*dependent on first **BC** mark*

1

[12]

7

- (a) solid

1

- (b) decreased
correct order only

1

decreased

1

increased

1

- (c) (i) A
reason only scores if A chosen

1

uses least / less energy (in 1 year)
a comparison is required
accept uses least power
accept uses least kWh

1

- (ii) greater the volume the greater the energy it uses (in 1 year)

1

- (iii) a very small number sampled
accept only tested 3
accept insufficient evidence / data
*allow not all fridges have the same efficiency **or** a correct description implying different efficiencies*
only tested each fridge once is insufficient
there are lots of different makes is insufficient

1

[8]

8

- (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]

9

(a) infrared / IR
correct answer only

1

(b) any **two** from:

- increase the power / watts
allow increase the temperature of the oven or make the oven hotter
- decrease the speed
allow leave the biscuits in for longer
- put biscuits through again
increase radiation is insufficient
ignore changes to the design of the oven

2

(c) (inside) surface is a (good) reflector or poor absorber (of IR)
Ignore bounce for reflect
surface is a (good) reflector of light does not score
surface is a (good) reflector of light and infrared / heat does score

1

(and) outside surface is poor emitter (of IR)

1

(so) increases the energy reaching the biscuits
allow reduces energy loss or makes oven more efficient
*do **not** accept no energy losses*
keeps oven hotter is insufficient

1

[6]

10

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]

(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]

13

(a) conduction

must be in correct order

1

convection

1

(b) (i) 70

accept ± 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) ± 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]

14

(a) (i) temperature (increase) and time switched on are directly proportional

accept the idea of equal increases in time giving equal increases in temperature

answers such as:

- *as time increases, temperature increases*
- *positive correlation*
- *linear relationship*
- *temperature and time are proportional*

score 1 mark

2

(ii) any **one** from:

"it" refers to the metal block

- energy transfer (from the block) to the surroundings
accept lost for transfer
accept air for surroundings
- (some) energy used to warm the heater / thermometer (itself)
accept takes time for heater to warm up
- (metal) block is not insulated

1

(iii) 15 000

allow 1 mark for correct substitution, ie 50×300 provided no subsequent step shown

2

(b) lead

reason only scores if lead is chosen

1

needs least energy to raise temperature by 1°C

accept needs less energy to heat it (by the same amount)

lowest specific heat capacity is insufficient

1

[7]

15

(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]

16

- (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

6

- (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]

17

(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]

18

(a) (i) Z

1

(ii) X

1

(b) (i) moving randomly

1

(ii) stronger than

1

(c) (i) evaporation

1

(ii) any **one** from:

- becomes windy
- temperature increases
accept (becomes) sunny
“the sun” alone is insufficient
- less humid

1

[6]

19

(a) to reflect (the infrared)

accept (shiny surfaces) are good reflectors
ignore reference to incorrect type of wave

1

(b) black

1

best absorber (of infrared)

answer should be comparative
black absorbs (infrared) is insufficient
accept good absorber (of infrared)
ignore reference to emitter
ignore attracts heat
ignore reference to conduction

1

(c) to reduce energy loss

accept to stop energy loss
accept heat for energy
accept to stop / reduce convection

or

so temperature of water increases faster

accept to heat water faster
accept cooks food faster

or

reduces loss of water (by evaporation)

1

(d) 672 000

allow 1 mark for correct substitution, ie $2 \times 4200 \times 80$ provided no subsequent step shown

2

[6]

20

(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]

21

(a) (matt) black is a good emitter of infrared / radiation

accept heat for infrared / radiation

ignore reference to good absorber

attracts heat negates this marking point

1

to give maximum (rate of) energy transfer (to surroundings)

accept temperature (of coolant) falls fast(er)

accept black emits more radiation for 1 mark

black emits most radiation / black is the best emitter of radiation for 2 marks

1

(b) the fins increase the surface area

accept heat for energy

1

so increasing the (rate of) energy transfer

or

so more fins greater (rate of) energy transfer

1

(c) 114 000

allow 1 mark for correct temperature change, ie 15 (°C)

or

allow 2 marks for correct substitution, ie $2 \times 3\,800 \times 15$

answers of 851 200 or 737 200 gain 2 marks

or

substitution $2 \times 3800 \times 112$ or $2 \times 3800 \times 97$ gains 1 mark

an answer of 114 kJ gains 3 marks

3

(d) increases the efficiency

1

less (input) energy is wasted

accept some of the energy that would have been wasted is (usefully) used

or

more (input) energy is usefully used

accept heat for energy

1

[9]

22

(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]

23

(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]

24

(a) (i) random distribution of circles in the box with at least 50 % of circles touching

1

random distribution of circles occupies more than 50 % of the space

judged by eye

1

(ii) (large) gaps between particles

accept particles do not touch

accept particles are spread out

1

(so) easy to push particles closer (together)
or
forces between particles are negligible / none
an answer in terms of number of particles is insufficient

1

(b) (i) (both are) random

*accept a correct description of random eg unpredictable or move
around freely or in all directions
they take up all the space is insufficient
they are spread out is insufficient
they move in straight lines is insufficient*

1

(ii) (speed also) increases

1

[6]

25

(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]

26

(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]

27

(a) $E = P \times t$

91 (p)

an answer £0.91 gains 3 marks

an answer 0.91 gains 2 marks

allow 2 marks for energy transferred = 18.2 (kWh)

or

substitution into 2 equations combined, ie $2.6 \times 7 \times 5$

allow 1 mark for correct substitution into $E = P \times t$, ie $E = 2.6 \times 7$

or

allow 1 mark for multiplying and correctly calculating an incorrect energy transfer value by 5

3

(b) answers should be in terms of supply exceeding demand

accept there is a surplus / excess of electricity (at night)

1

(c) reduce (rate of) energy transfer (from ceramic bricks)

accept heat for energy

do not accept no energy / heat escapes

do not accept answers in terms of lost / losing heat if this implies heat is wasted energy

1

so keeping the (ceramic) bricks hot for longer

accept increase time that energy is transferred to the room

accept keep room warm for longer

or

to stop the casing getting too hot

accept so you do not get burnt (on the casing)

1

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

120

allow 1 mark for correct substitution

ie $9\,000\,000 = m \times 750 \times 100$

2

[8]

28

(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]

29

(a) any **two** from:

- black is a good emitter of (infrared radiation)
accept heat for radiation
ignore reference to absorbing radiation
- large surface (area)
- matt surfaces are better emitters (than shiny surfaces)
accept matt surfaces are good emitters
ignore reference to good conductor

2

(b) 90% or 0.9(0)

$$\text{efficiency} = \frac{\text{useful energy out} (\times 100\%)}{\text{total energy in}}$$

allow 1 mark for correct substitution, ie $\frac{13.5}{15}$

provided no subsequent step shown

an answer of 90 scores 1 mark

an answer of 90 / 0.90 with a unit scores 1 mark

2

(c) (producing) light

allow (producing) sound

1

(d) any **two** from:

- wood is renewable
accept wood grows again / quickly
accept wood can be replanted
- (using wood) conserves fossil fuels
accept doesn't use fossil fuels
- wood is carbon neutral
accept a description
cheaper / saves money is insufficient

2

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

2 550 000

allow 1 mark for correct substitution
ie 100 x 510 x 50
provided no subsequent step shown
answers of 1 020 000, 3 570 000 gain 1 mark

2

joules /J

accept kJ / MJ
*do **not** accept j*
for full credit the unit and numerical answer must be consistent

1

[10]

30

accept atoms / particles for ions throughout

(a metal has) free electrons

accept mobile for free

1

(kinetic) energy of (free) electrons increases

accept energy of ions increases
accept ions vibrate with a bigger amplitude
accept ions vibrate more
*do **not** accept electrons vibrate more*

1

(free) electrons move faster

1

or

electrons move through metal

accept electrons collide with other electrons / ions

(so) electrons transfer energy to other electrons / ions

accept ions transfer energy to neighbouring ions

1

[4]

31

(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]

32

- (a) (i) radiation

1

- (ii) traps (small pockets of) air
do not accept it's an insulator
do not accept reduces conduction and / or convection
do not allow it doesn't allow heat to escape

1

- (b) (i) bigger temperature difference (between the water and surroundings)
 at the start (than at the end)

do not accept water is hotter

1

- (ii) starting temperature (of the water)
accept thickness of fleece
do not accept same amount of fleece
do not accept thermometer / can
do not accept time is the same

1

- (iii) 18 (°C)

correct answer only

1

- (iv) **M**

1

smallest temperature drop (after 20 mins)

cannot score if M is not chosen

accept it's the best insulator

accept smallest loss in heat

accept keeps heat / warmth in for longer

1

[7]

33

(a) (i) 2(.0)

accept 2000 W or 2000 watt(s)

accept answer given in table

*do **not** accept 2000*

1

(ii) 4.5

allow 1 mark for correct substitution

ie 1.5×3

allow 1 mark for the answers 1.5 or 6(.0)

2

(iii) 54

or

their (a)(ii) $\times 12$ correctly calculated

allow 1 mark for correct substitution

ie 4.5×12

or

their (a)(ii) $\times 12$

allow 1 mark if correct answer is given in pounds eg £54

2

(b) (i) 6 pm

1

temperature starts to rise faster

only scores if 6 pm given

or

graph (line) is steeper / steepest

it refers to graph gradient or temperature

accept answers in terms of relative temperature rise

eg 5 to 6 pm 2°C rise, 6 to 7 pm 6°C rise

accept temperature rises sharply / rapidly / quickly

*do **not** accept temperature starts to rise*

1

(ii) middle box ticked

1

[8]