Topic Test: OxfordAQA International GCSE Combined Science 9204 Physics

Particle model of matter

Name: _____

Class: _____

Date: _____

Time: **38 minutes**

Marks: **38 marks**

Comments:

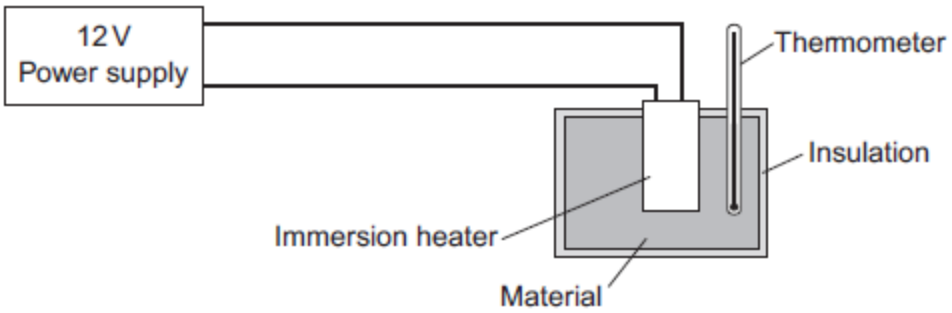
1 A student used the apparatus in **Figure 1** to compare the energy needed to heat blocks of different materials.

Each block had the same mass.

Each block had holes for the thermometer and the immersion heater.

Each block had a starting temperature of 20 °C.

Figure 1



The student measured the time taken to increase the temperature of each material by 5 °C.

(a) (i) State **two** variables the student controlled.

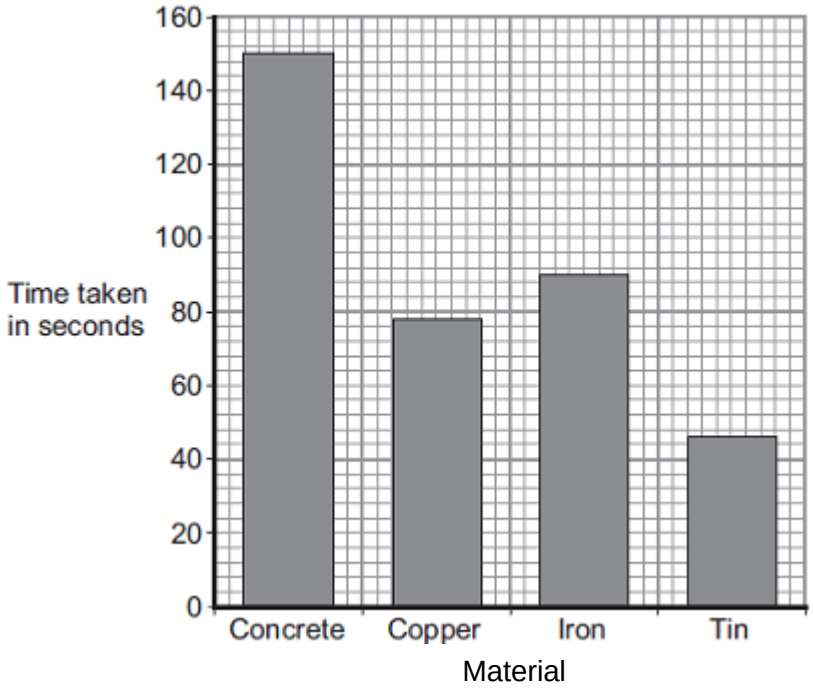
1. _____

2. _____

(2)

Figure 2 shows the student's results.

Figure 2



(ii) Why was a bar chart drawn rather than a line graph?

_____

_____

(1)

(iii) Which material was supplied with the most energy?

_____

Give the reason for your answer.

_____

_____

(2)

(iv) The iron block had a mass of 2 kg.

Calculate the energy transferred by the heater to increase the temperature of the iron block by 5 °C.

Use the correct equation from the Physics Equations Sheet.

The specific heat capacity of iron is 450 J / kg °C.

_____

_____

_____

Energy transferred = _____ J

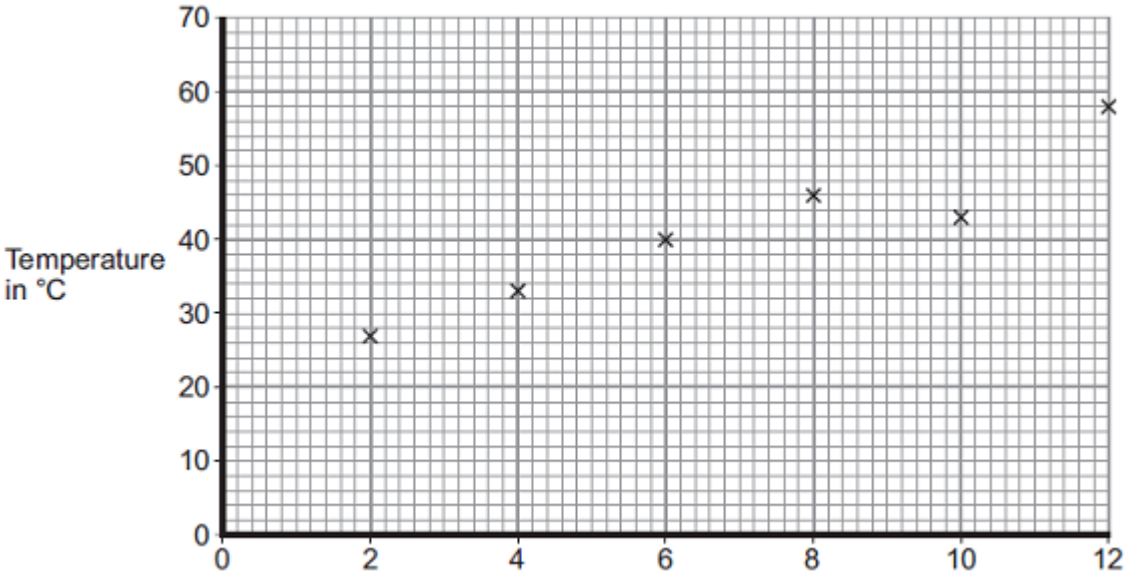
(2)

(b) The student used the same apparatus to heat a 1 kg block of aluminium.

He recorded the temperature of the block as it was heated from room temperature.

The results are shown in **Figure 3**.

Figure 3



(i) One of the student's results is anomalous.

Draw a ring around the anomalous result.

(1)

(ii) Draw the line of best fit for the points plotted in **Figure 3**.

(1)

(iii) What was the temperature of the room?

Temperature = _____ °C

(1)

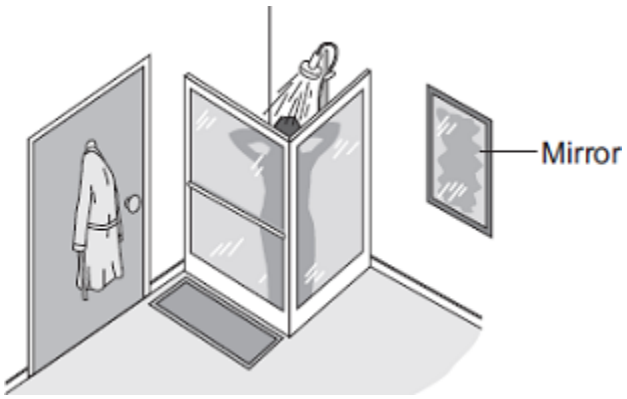
(iv) What was the interval of the time values used by the student?

Interval = _____ minutes

(1)

(Total 11 marks)

2 The picture shows a person taking a hot shower.



(a) When a person uses the shower the mirror gets misty.

Why?

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(b) The homeowner installs an electrically heated mirror into the shower room.

When a person has a shower, the heated mirror does **not** become misty but stays clear.

Why does the mirror stay clear?

(2)

(Total 5 marks)

3 Solid, liquid and gas are three different states of matter.

(a) Describe the difference between the solid and gas states, in terms of the arrangement and movement of their particles.

(4)

(b) What is meant by ‘specific latent heat of vaporisation’?

_____

_____

_____

_____

(2)

(c) While a kettle boils, 0.018 kg of water changes to steam.

Calculate the amount of energy required for this change.

Specific latent heat of vaporisation of water = 2.3×10^6 J / kg.

Use the correct equation from **Section B** of the Physics Equations Sheet.

_____

_____

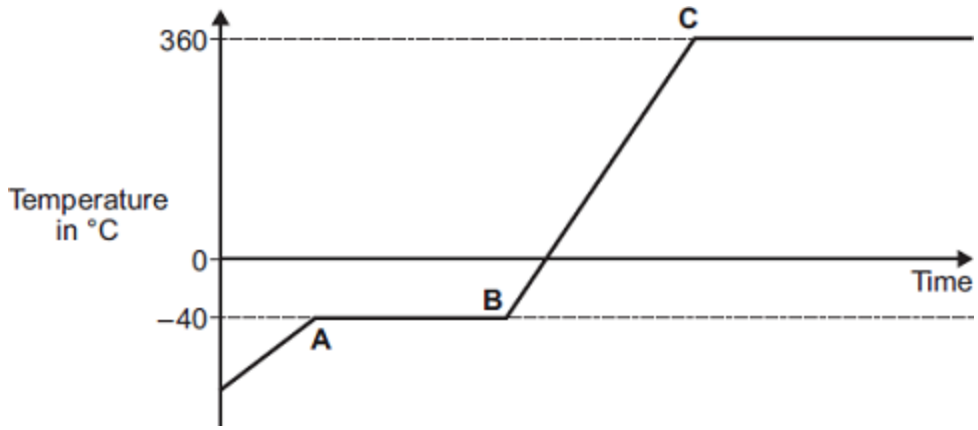
_____

Energy required = _____ J

(2)

(d) The graph shows how temperature varies with time for a substance as it is heated.

The graph is **not** drawn to scale.



Explain what is happening to the substance in sections **AB** and **BC** of the graph.

Section **AB** _____

_____

_____

_____

_____

Section **BC** _____

_____

_____

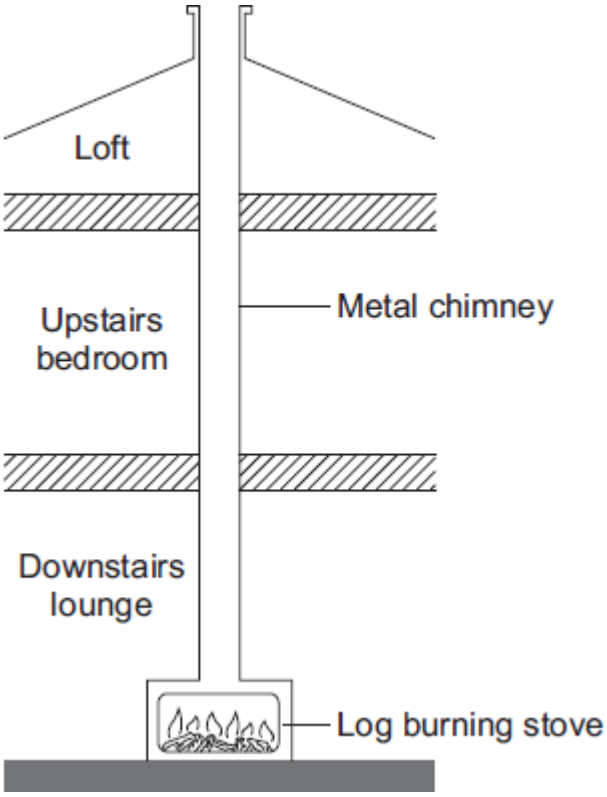
_____

_____

(4)

(Total 12 marks)

4 The diagram shows how the metal chimney from a log-burning stove passes through the inside of a house.



(a) Explain how heat is transferred by the process of convection from the inside of the stove to the top of the chimney.

_____

_____

_____

_____

_____

(2)

(b) Although the outside of the chimney becomes very hot, there is no insulating material around the chimney.

(i) Explain, in terms of the particles in a metal, how heat is transferred by conduction from the inside to the outside of the metal chimney.

_____

_____

_____

_____

_____

(2)

(ii) Suggest **one** advantage of having no insulation around the chimney.

_____

_____

(1)

(Total 5 marks)

5 The table gives information about some methods of conserving energy in a house.

Conservation method	Installation cost in £	Annual saving on energy bills in £
Cavity wall insulation	500	60
Hot water tank jacket	10	15
Loft insulation	110	60
Thermostatic radiator valves	75	20

(a) Explain which of the methods in the table is the most cost effective way of saving energy over a 10 year period. To obtain full marks you must support your answer with calculations.

_____

_____

_____

_____

(3)

(b) Describe what happens to the energy which is 'wasted' in a house.

_____

_____

_____

_____

(2)

(Total 5 marks)

1 (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]

2 (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]

3 (a) **solid**
<u>particles</u> vibrate about fixed positions

1

closely packed
accept regular

1

gas
<u>particles</u> 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]

4 (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]

5 (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]