Topic 3 Particle Model of Matter H

Name: _____

Class: _____

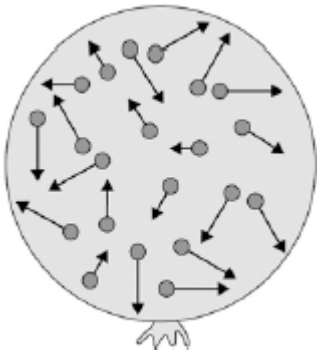
Date: _____

Time: **39 minutes**

Marks: **39 marks**

Comments:

Q1. The figure below shows a balloon filled with helium gas.



(a) Describe the movement of the particles of helium gas inside the balloon.

.....

.....

.....

.....

(2)

(b) What name is given to the total kinetic energy and potential energy of all the particles of helium gas in the balloon?

Tick **one** box.

External energy ☐

Internal energy ☐

Movement energy ☐

(1)

(c) Write down the equation which links density, mass and volume.

.....

(1)

(d) The helium in the balloon has a mass of 0.00254 kg.

The balloon has a volume of 0.0141 m^3.

Calculate the density of helium. Choose the correct unit from the box.

m^3 / kg	**kg / m^3**	**kg m^3**

.....

.....

.....

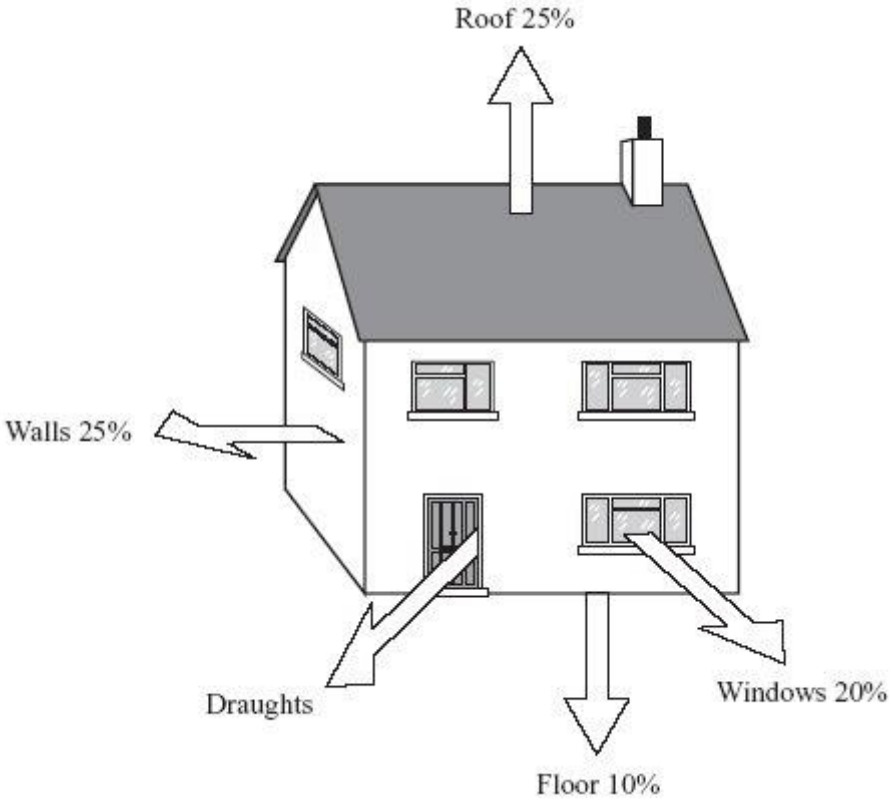
.....

Density = ... Unit .....

(3)

(Total 7 marks)

Q2. (a) The diagram shows the ways in which heat energy can be transferred from an old house.



(i) Calculate the percentage of energy transferred by draughts.

% energy transferred by draughts = ...

(1)

(ii) Complete the following sentence using **one** of the words from the box.

conduction	**convection**	**radiation**

Draughts transfer heat energy by .....

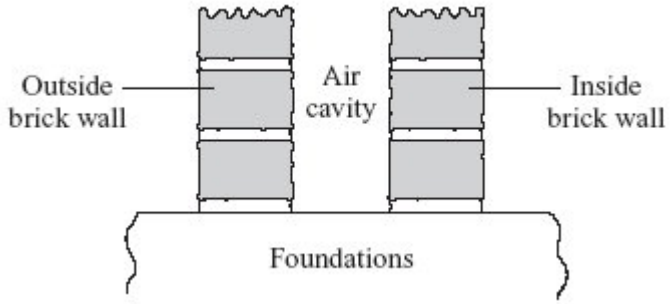
(1)

(iii) State **one** way of reducing the heat transfer by draughts.

.....

(1)

(b) The diagram shows a section through the walls of a house built in 1930.



Explain how the air cavity between the two walls reduces the heat transfer from the house.

.....

.....

.....

.....

(2)

(c) The table shows the installation costs and yearly savings on energy bills for different methods of insulating a house.

Method of	**Installation costin**	**Yearly saving on**

insulation	£	energy bills in £
Double glazing	4000	65
Loft insulation	240	60
Cavity wall insulation	600	80

(i) Give **one** reason why loft insulation is often fitted to an old house before double glazing or cavity wall insulation.

.....

.....

(1)

(ii) The time it takes for the saving on energy bills to equal the cost of installing the insulation is called the pay-back time.

Calculate the pay-back time for loft insulation.

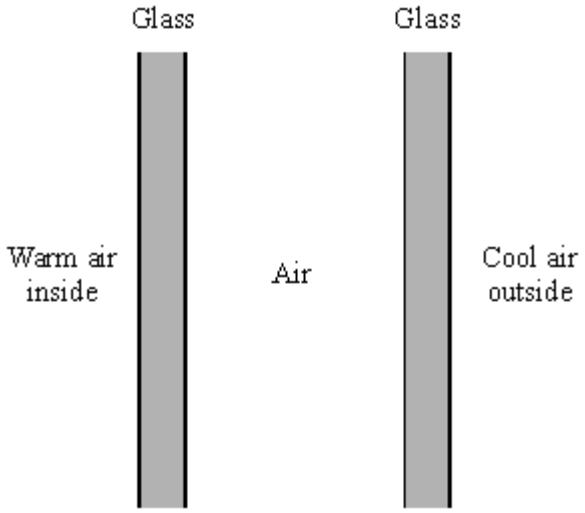
.....

Pay-back time = ... years

(1)

(Total 7 marks)

Q3. The diagram shows a side view of a double-glazed window.



(a) Use each of the terms in the box to explain how heat is lost from inside a house through the window.

conduction	**convection**	**radiation**

.....

.....

.....

.....

.....

.....

(3)

(b) Besides heat, state **one other** form of energy that passes through double-glazed windows.

.....

(1)

(c) Explain why plastic foam cavity wall insulation cuts down energy transfer between warm inner walls and cooler outer walls.

.....

.....

.....

.....

(2)

(d) When it rains the walls and windows of a house get wet.

Explain how the drying process can increase the cooling of the house.

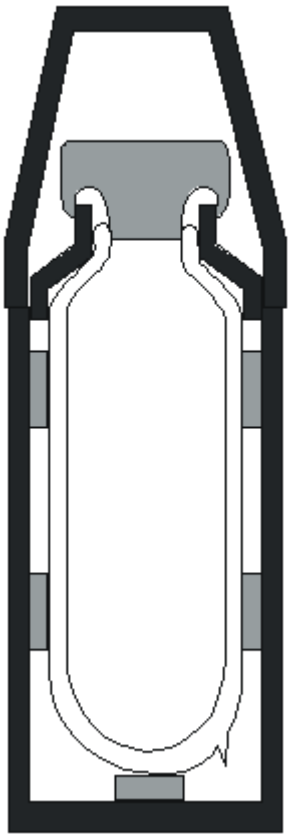
.....

.....

.....

(2)
(Total 8 marks)

Q4. The diagram below shows a vacuum flask.



(a) Give **two** features of the flask which reduce heat loss by conduction.

1. .....

2. .....

(2)

(b) Give **one** feature of the flask which reduces heat loss by radiation.

.....

(1)

(Total 3 marks)

Q5. According to kinetic theory, all matter is made up of small particles. The particles are constantly moving.

Diagram 1 shows how the particles may be arranged in a solid.

Diagram 1

(a) One kilogram of a gas has a much larger volume than one kilogram of a solid.

Use kinetic theory to explain why.

.....

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.....

.....

.....

.....

.....

.....

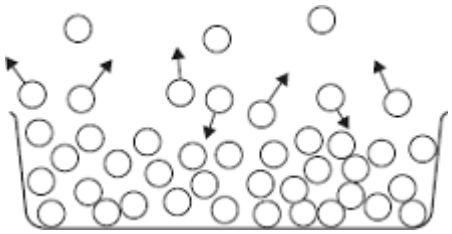
.....

.....

(4)

(b) **Diagram 2** shows the particles in a liquid. The liquid is evaporating.

Diagram 2



(i) How can you tell from **Diagram 2** that the liquid is evaporating?

.....

.....

(1)

(ii) The temperature of the liquid in the container decreases as the liquid evaporates.

Use kinetic theory to explain why.

.....

.....

.....

.....

.....

.....

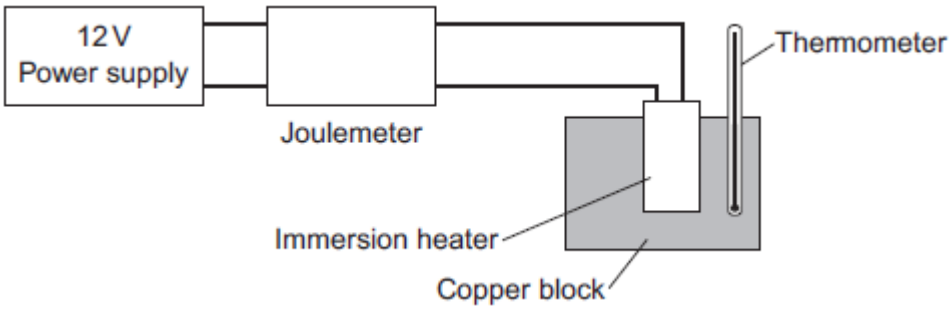
.....

.....

(3)
(Total 8 marks)

Q6. A student used the apparatus in **Figure 1** to obtain the data needed to calculate the specific heat capacity of copper.

Figure 1



The initial temperature of the copper block was measured.

The power supply was switched on.

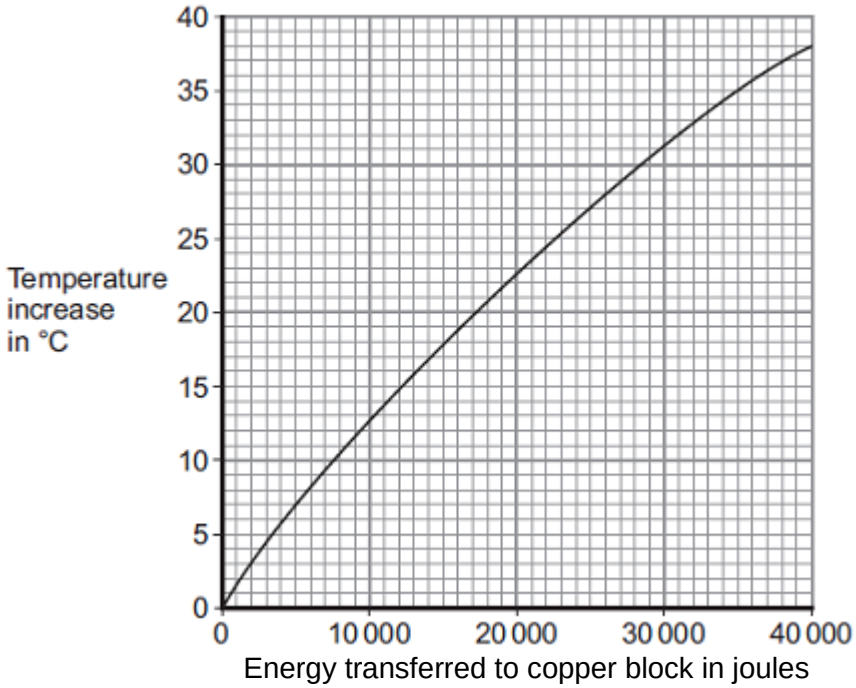
The energy transferred by the heater to the block was measured using the joulemeter.

The temperature of the block was recorded every minute.

The temperature increase was calculated.

Figure 2 shows the student's results.

Figure 2



(a) Energy is transferred through the copper block.

What is the name of the process by which the energy is transferred?

Tick (✓) **one** box.

Conduction ☐

Convection ☐

Radiation ☐

(1)

(b) Use **Figure 2** to determine how much energy was needed to increase the temperature of the copper block by 35 °C.

..... joules

(1)

(c) The copper block has a mass of 2 kg.

Use your answer to part (b) to calculate the value given by this experiment for the specific heat capacity of copper. Give the unit.

.....

.....

.....

.....

Specific heat capacity = ...

(3)

(d) This experiment does **not** give the correct value for the specific heat of copper.

Suggest **one** reason why.

.....

.....

(1)

(Total 6 marks)

M1.(a) range of speeds

1

moving in different directions

accept random motion

1

(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 / m^3

1

[7]

M2. (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

[7]

M3. (a) (heat) is conducted through the glass

the answers must be within the context of the question

1

(heat) passes through glass and air by radiation

both glass and air required

1

(heat) crosses the air gap by convection

mention of conduction through air is neutral

1

(b) any **one** from

light

accept sunlight

gamma rays

X-rays

radio

*accept sound **or** ir **or** microwaves **or** electromagnet waves*

1

(c) any **two** from

cuts down convection currents

accept stops air moving

air pockets trap air (from moving)

accept has air pockets
*do not accept stops heat moving **or** traps heat*

foam is a poor conductor

air in the foam is a good insulator

accept air is a good insulator in air pockets for both marks

2

(d) evaporation (of the water)

do not accept rain is cold

1

takes energy from the house

*accept takes heat away **or** higher energy molecules leave first*

1

[8]

M4. (a) plastic/glass walls; vacuum; insulating top

any two for 1 mark each

2

(b) silvering/shiny on either wall

for 1 mark

1

[3]

M5.(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 escapingparticles 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]

M6.(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]