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Student number

Name _____

Date _____

Attempt/Time taken _____

GCSE
PHYSICS

Topic Paper: 3.1 & 3.2 Change of state, internal energy and energy transfers Part 1

Time allowed: 45 minutes

Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.

39 Marks

Q1. 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.

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(3)

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

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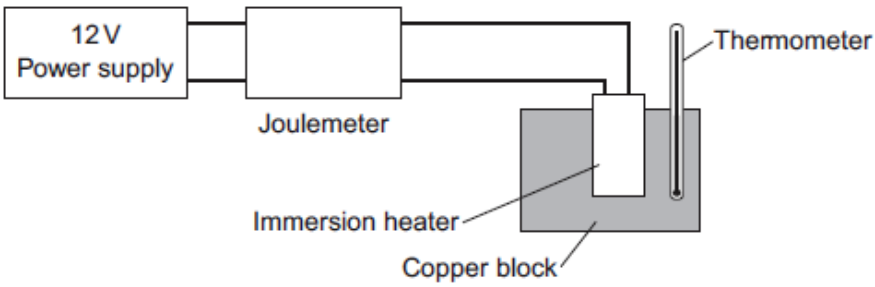
(2)

(Total 5 marks)

Q2. 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.

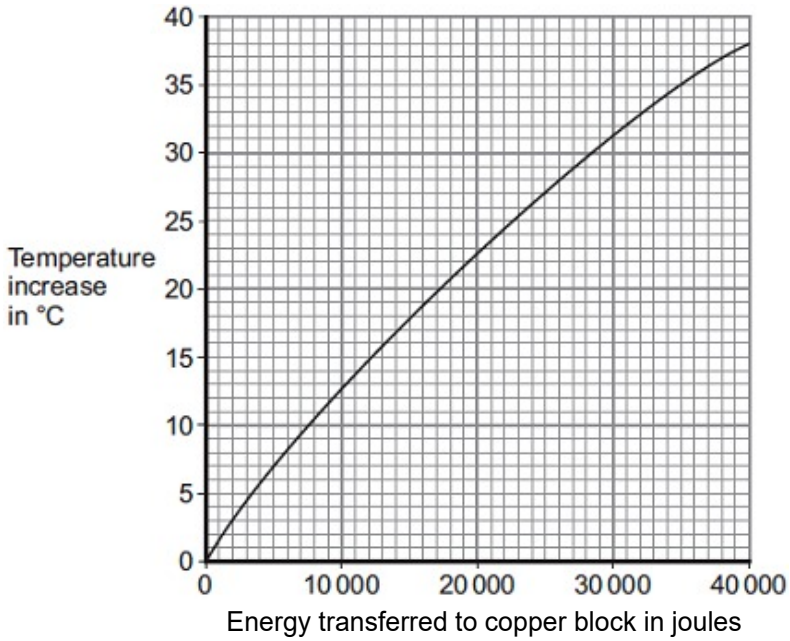
The energy transferred by the heater to the block was measured using the joulemeter.

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.

Use the correct equation from the Physics Equations Sheet.

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Specific heat capacity = ...

(3)

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

Suggest **one** reason why.

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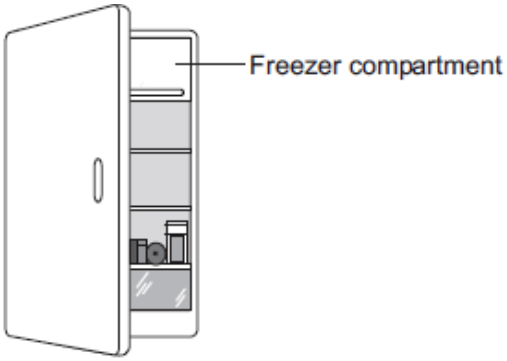
(1)

(Total 6 marks)

Q3. (a) The figure below shows a fridge with a freezer compartment.

The temperature of the air inside the freezer compartment is –5 °C.



The air inside the fridge forms a convection current when the fridge door is closed.

Explain why.

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(4)

(b) The table below shows information about four fridges.

Fridge	Volume in litres	Energy used in one year in kWh
A	250	300
B	375	480
C	500	630
D	750	750

A householder concludes that the energy used in one year is directly proportional to the volume of the fridge.

Explain why her conclusion is **not** correct.

Use data from the table in your answer.

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(2)

(c) New fridges are more efficient than fridges made twenty years ago.

Give **one** advantage and **one** disadvantage of replacing an old fridge with a new fridge.

Ignore the cost of buying a new fridge.

Advantage .....

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Disadvantage .....

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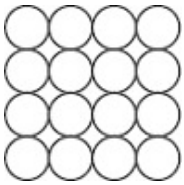
(2)
(Total 8 marks)

Q4. 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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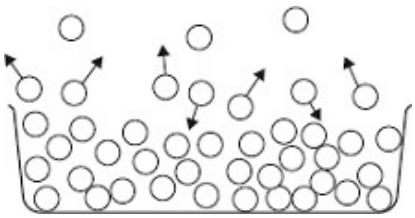
(4)

(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?

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(1)

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

Use kinetic theory to explain why.

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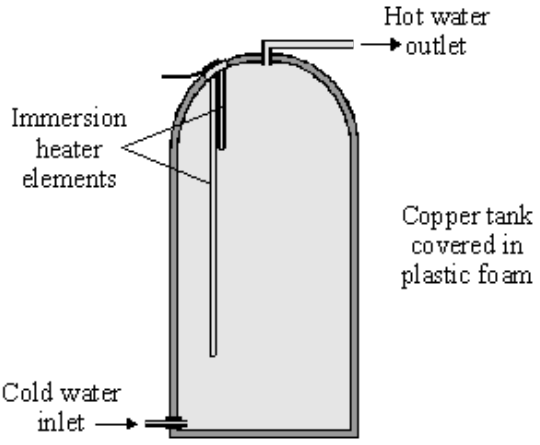
(3)
(Total 8 marks)

Q5. The diagram shows a type of electric immersion heater in a hot water tank. These hot water tanks are normally found in airing cupboards.



Information on the immersion heater states:

230 V
10 A

(a) Immersion heaters for hot water tanks often have a switch on them labelled *bath* or *sink.* The *bath* position of the switch has **both** parts of the immersion heater elements in the circuit. The *sink* position has only the short heater element in the circuit.

(i) Explain why the hot water outlet is at the top of the tank, and the cold water inlet is at the bottom of the tank.

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(2)

(ii) Explain how the *sink* position for the immersion heater is able to save energy.

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(2)

(b) The copper tank is surrounded by plastic foam to minimise energy loss.

Explain why a pale, shiny surface to the foam also helps to minimise energy loss.

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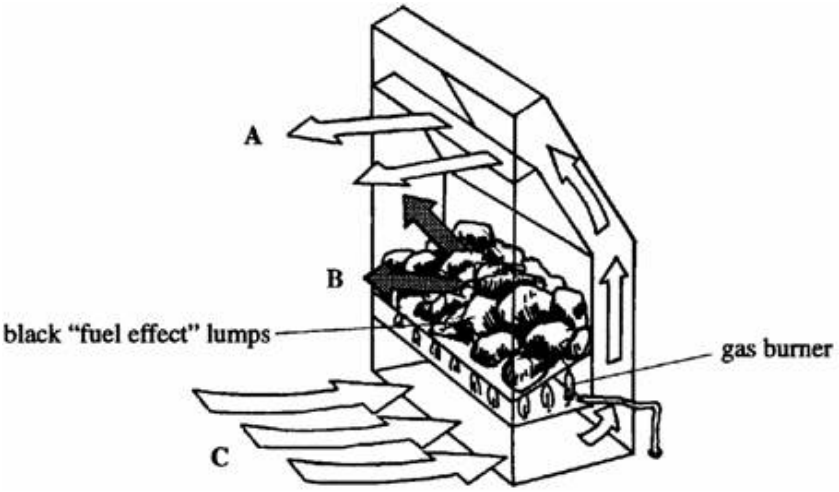
(2)
(Total 6 marks)

Q6. The diagram comes from a leaflet about a "coal effect" gas fire.
It shows how air circulates through the fire.



(a) Explain in detail why the air travels from **C** to **A**.

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(4)

(b) The black “fuel effect” lumps become very hot.

(i) Name the process by which the lumps transfer thermal energy to the room as shown at **B**.

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(1)

(ii) Suggest **one** feature of the black “fuel effect” lumps which make them efficient at transferring energy.

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(1)

(Total 6 marks)