AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.3.2.1 INTERNAL ENERGY (PACK 2)

SCORE	PERCENTAGE
/121	%

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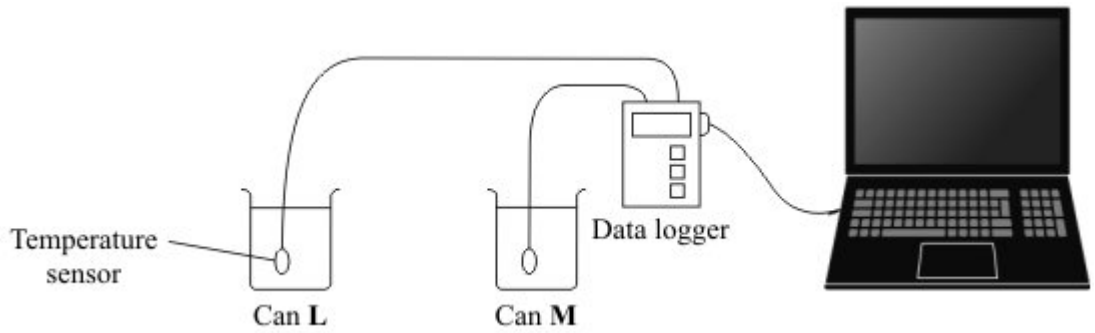
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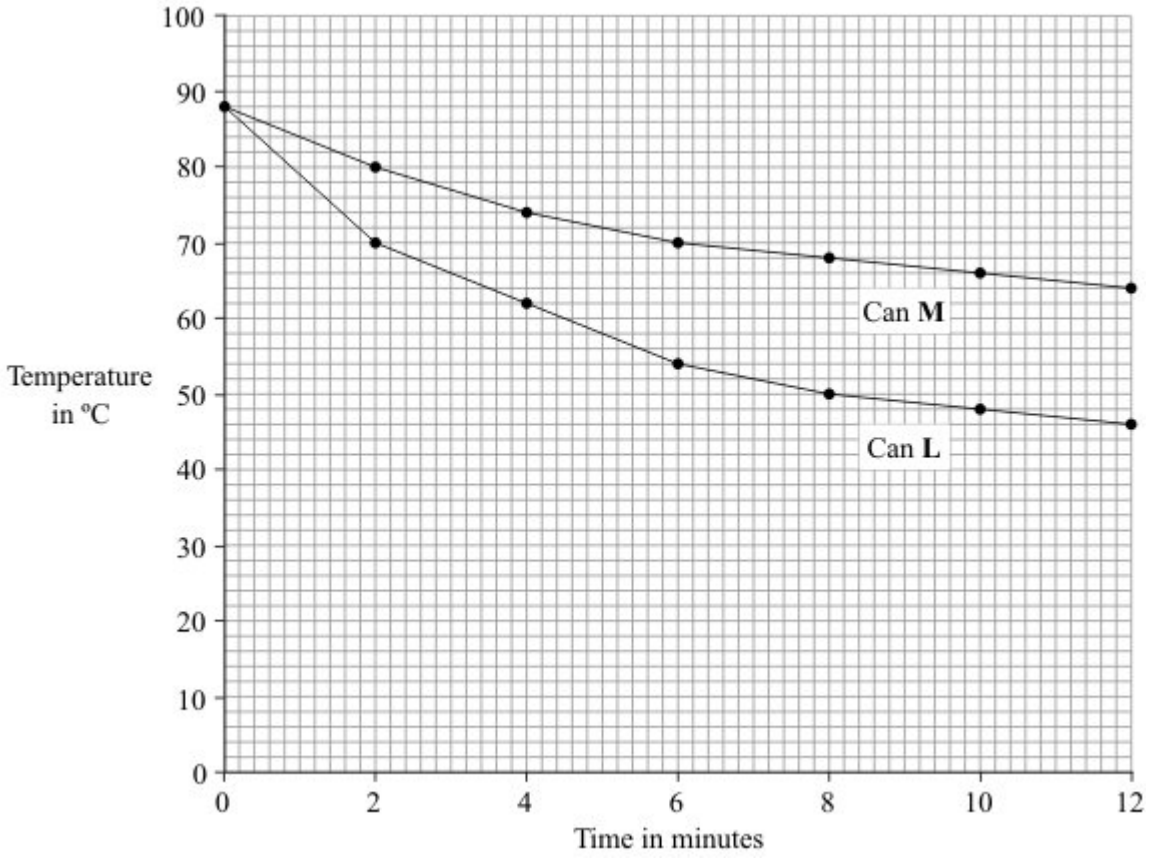
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Q1.

A student was asked to investigate the heat loss from two metal cans, L and M. The cans were identical except for the outside colour.



The student filled the two cans with equal volumes of hot water. He then placed the temperature sensors in the water and started the data logger. The computer used the data to draw the graph below.



(a) Which **one** of the following is a categoric variable?

Put a tick (✓) in the box next to your answer.

the outside colour of the cans ☐

the starting temperature of the hot water ☐

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the time ☐

the volume of hot water ☐

(1)

(b) For can **L**, state the temperature drop of the water:

(i) in the **first** two-minute interval

_____

(1)

(ii) in the **second** two-minute interval.

_____

(1)

(c) In both cans the water cooled faster at the start of the investigation than at the end of the investigation. Why?

_____

_____

(1)

(d) One can was black on the outside and the other can was white on the outside.

What colour was can **L**? _____

Explain the reason for your answer.

_____

_____

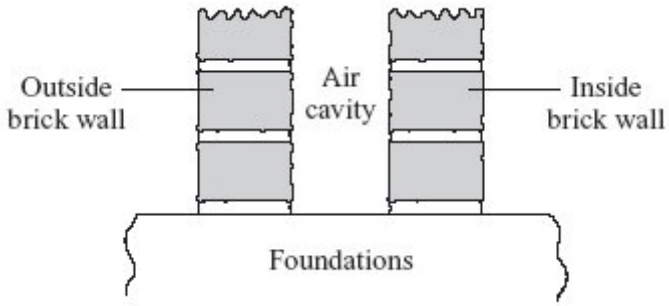
_____

(3)

(Total 7 marks)

Q2.

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



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

_____

_____

_____

_____

(2)

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

Method of insulation	Installation costin £	Yearly saving on 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

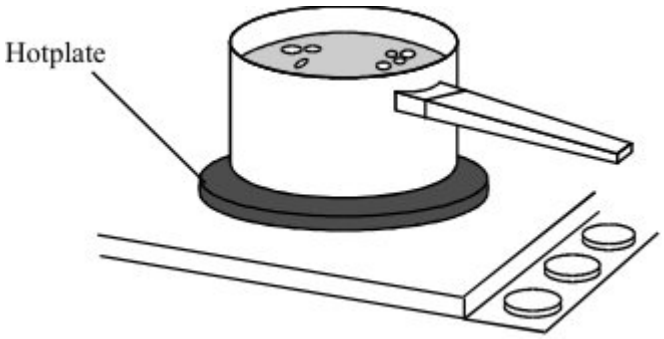
(1)

(Total 4 marks)

Q3.

The drawing shows water being heated in a metal saucepan.

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(a) Explain, in terms of the particles in the metal, how heat energy is transferred through the base of the saucepan.

_____

_____

_____

_____

(2)

(b) Energy is transferred through the water by convection currents. Explain what happens to cause a convection current in the water. The answer has been started for you.

As heat energy is transferred through the saucepan, the water particles at the bottom

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(c) Some energy is transferred from the hotplate to the air by *thermal radiation*. What is meant by *thermal radiation*?

_____

_____

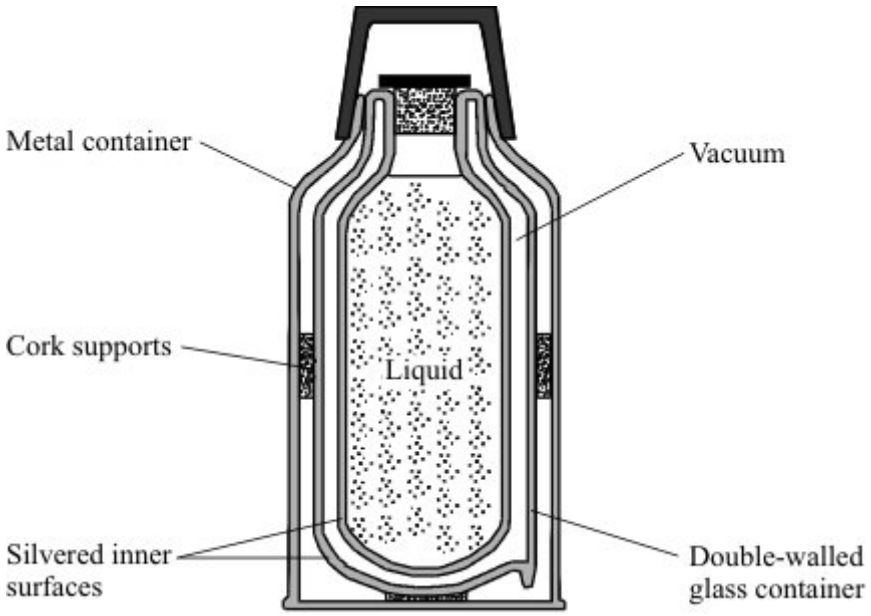
(1)

(Total 6 marks)

Q4.

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The vacuum flask shown has five features labelled, each one designed to reduce heat transfer.



(a) (i) Which labelled feature of the vacuum flask reduces heat transfer by both conduction and convection?

_____

(1)

(ii) Explain how this feature reduces heat transfer by **both** conduction and convection.

_____

_____

_____

_____

_____

(2)

(b) (i) Which labelled feature of the vacuum flask reduces beat transfer by radiation?

_____

(1)

(ii) Explain how this feature reduces heat transfer by radiation.

_____

_____

_____

_____

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_____

_____

(2)

(Total 6 marks)

Q5.

Many people use a sleeping bag when they sleep in a tent. Sleeping bags, designed to keep a person warm, have a fibre filling.



(i) Complete the sentence by choosing the correct words from the box.

conduction	convection	radiation

The fibre is designed to reduce heat transfer by _____ and

_____

(ii) Explain why the fibre is good at reducing heat loss from a person sleeping in the bag.

_____

_____

_____

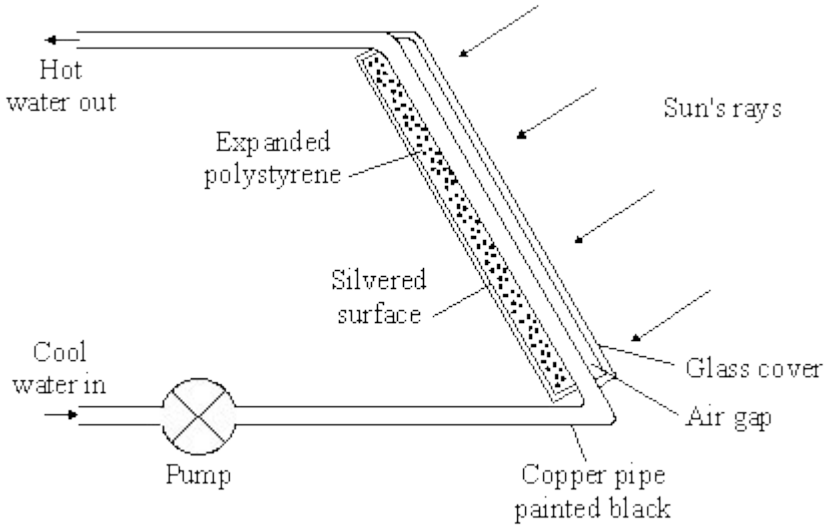
_____

(Total 3 marks)

Q6.

The diagram shows part of a solar water heater. Water circulating through the solar panel is heated by the Sun.

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(i) Complete the following sentence.

Heat energy is transferred from the Sun to the solar panel by

_____ .

(1)

(ii) The pipe inside the solar panel is black. Why?

_____

_____

(1)

(iii) There is a layer of expanded polystyrene behind the black pipe. Why?

_____

_____

(1)

(iv) A silvered surface is used at the back of the solar panel. Explain why.

_____

_____

_____

_____

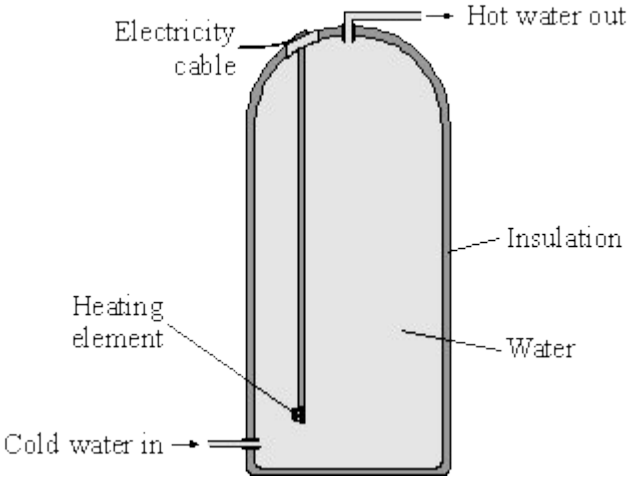
(2)

(Total 5 marks)

Q7.

(a) The diagram shows an immersion heater used to heat water inside a tank. Heat is transferred through the water by convection.

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(i) Draw arrows on the diagram to show the movement of the water in the tank when the heating element is switched on.

(2)

(ii) Explain how a convection current is set up in the water. The explanation has been started for you.

When the heating element is switched on, the hot water nearest the element rises

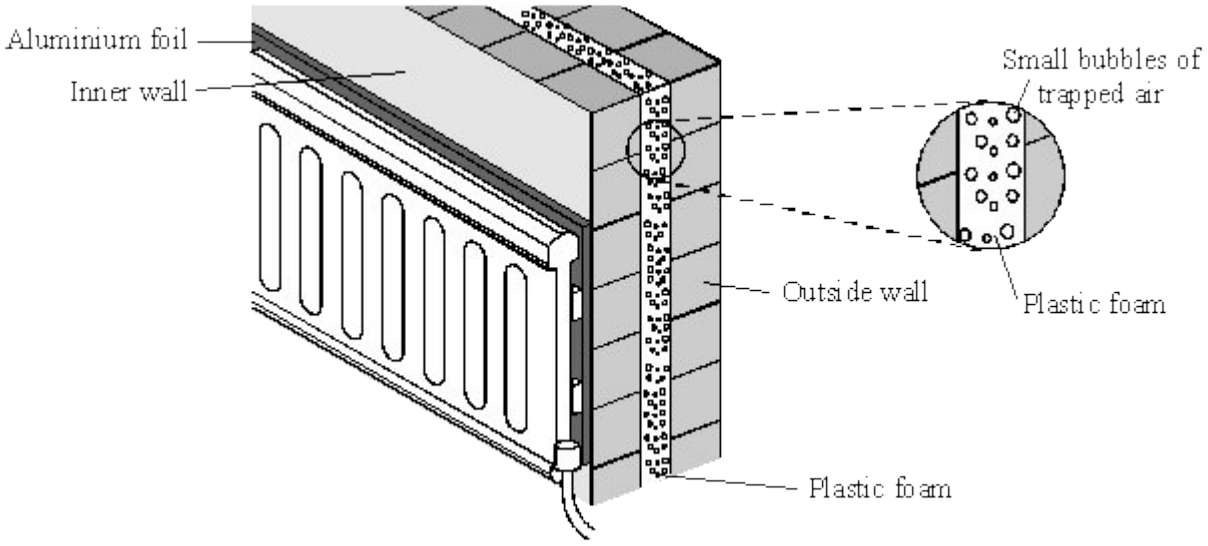
because _____

_____

_____

(2)

(b) The diagram shows **two** ways to reduce heat loss through the walls of a house.



(i) How is the aluminium foil able to reduce heat loss?

_____

_____

(1)

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(ii) The plastic foam is good at reducing heat loss through the walls. Explain why.

_____

_____

_____

_____

_____

(3)

(c) Evaporation is an important heat transfer process. When sweat evaporates, it takes heat energy from your body. As humidity increases, you are more likely to feel hot and uncomfortable. Explain why.

_____

_____

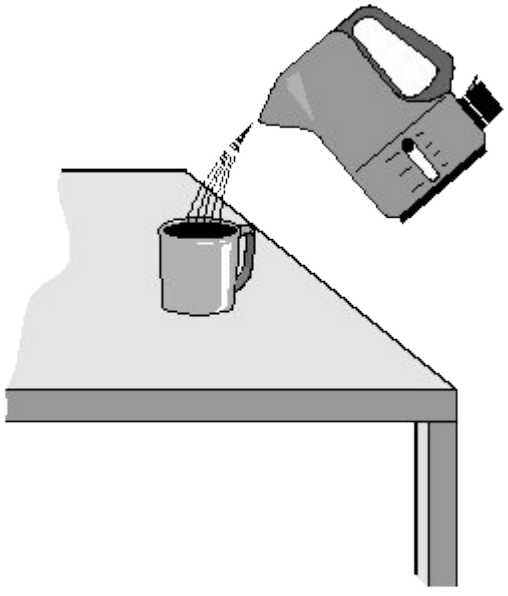
_____

(2)

(Total 10 marks)

Q8.

(a) The diagram shows hot water being poured into a mug.



(i) Complete the sentence by choosing the correct words from the box. Each word may be used once or not at all.

air	mug	table	water

Heat energy is being transferred from the _____ to

the _____ .

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(1)

(ii) When will this transfer of heat energy stop?

_____

_____

(1)

(b) In the box are the names of four types of fuel used to heat homes.

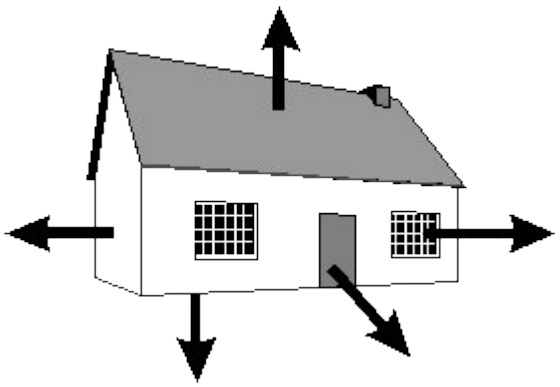
coal	gas	oil	wood

Which **one** of these types of fuel is renewable?

_____

(1)

(c) The diagram shows where heat energy is lost from a house.



(i) Complete the sentences by choosing the correct words from the box. Each word may be used once or not at all.

conduction	conductor	electric	evaporation	insulator

The amount of heat energy lost through the windows by

_____ can be reduced by using thick

curtains. The curtains trap a layer of air and air is a good

_____ .

(2)

(ii) Write down **one** other way of reducing heat loss from a house.

_____

_____

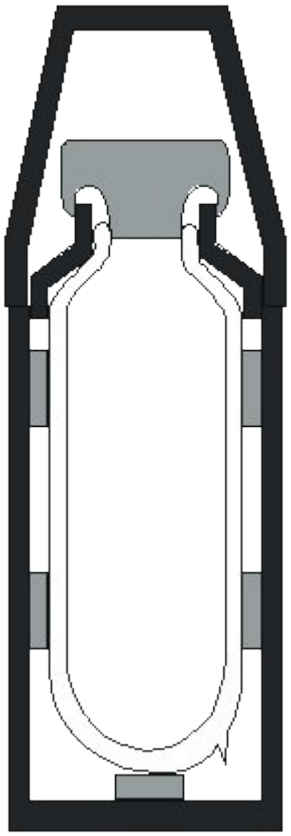
(1)

(Total 6 marks)

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Q9.

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)

Q10.

(a) When an electric kettle is switched on it will take a few minutes to boil the water. Once switched off it will gradually cool down.

(i) When the kettle is switched on the water heats. Explain how all of the water is heated.

_____

_____

(ii) The kettle is now switched off and begins to cool.

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(1) Describe how heat energy is transferred **through** the walls of the kettle.

_____

_____

_____

(2) Describe how the heat energy is transferred **from** the walls of the kettle.

_____

_____

_____

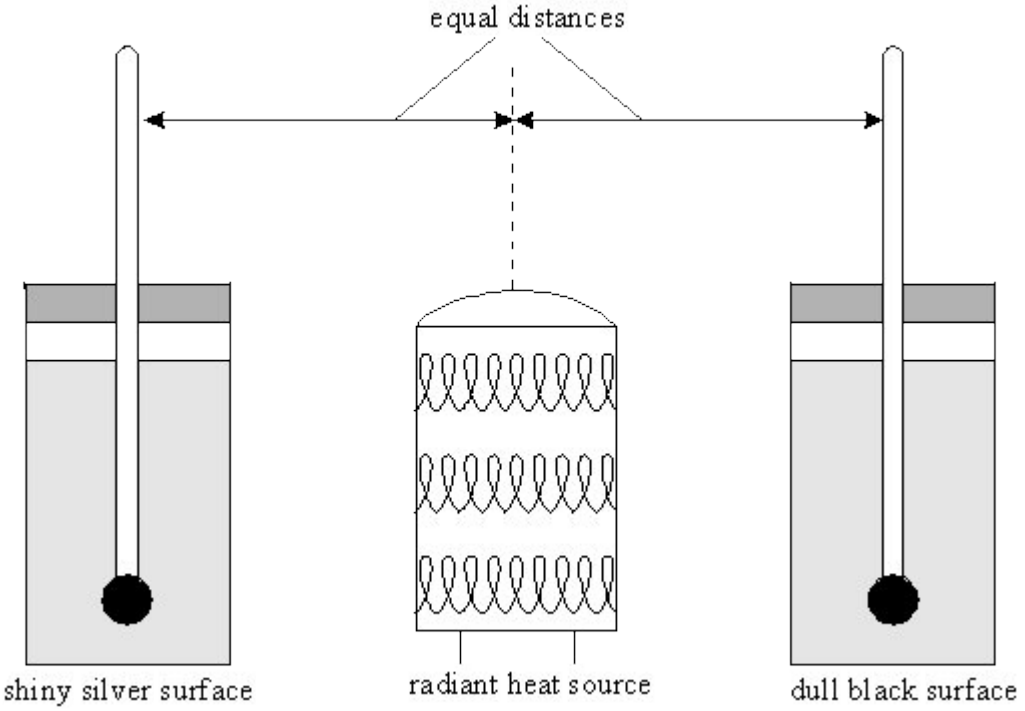
(iii) Describe how heat losses from the surface of a metal kettle may be kept small.

_____

_____

(4)

(b) A shiny metal can and a dull black can are filled with the same amounts of cold water.
A radiant heater is placed exactly half way between the cans as shown in the diagram below.



Two thermometers are used to measure the temperature of the water in each can every minute.

(i) Suggest how the temperature of the water in the dull can would be different from the temperature of the water in the shiny can after ten minutes.

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_____

_____

(ii) Explain your answer to part (i).

_____

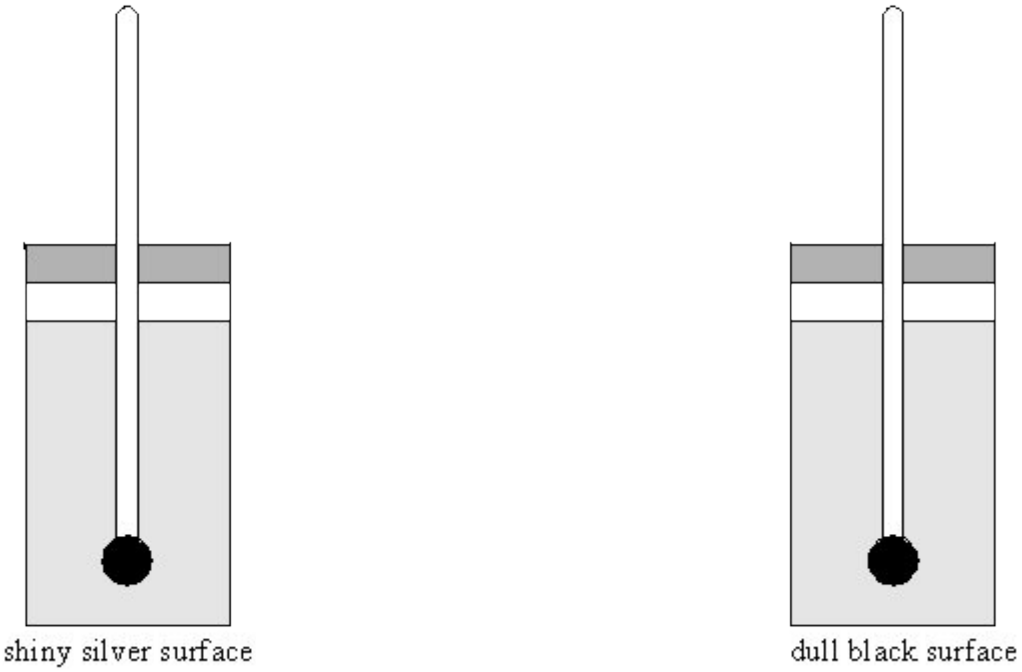
_____

_____

_____

(3)

(c) The radiant heater was removed and both the cans were filled with the same amount of boiling water, as shown in the diagram below.



The temperature was recorded every minute for ten minutes.

(i) Suggest how the temperature of the water in the dull can would be different from the temperature of the water in the shiny can after ten minutes.

_____

_____

(ii) Explain your answer to part (i).

_____

_____

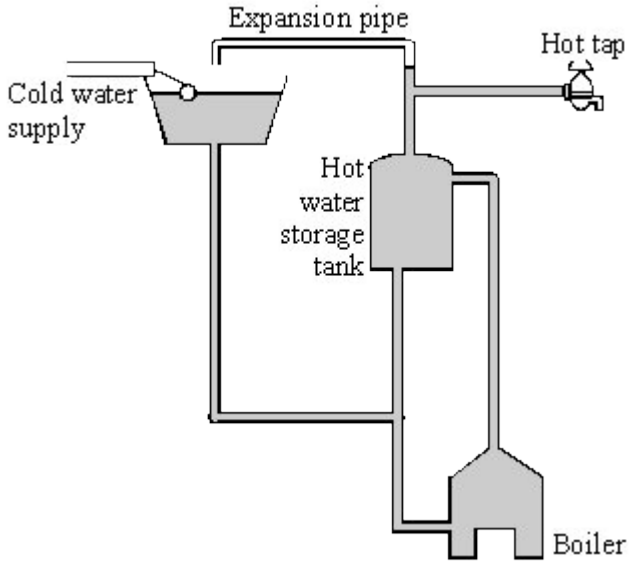
(3)

(Total 10 marks)

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Q11.

(a) The diagram shows a hot water system.



(i) Explain why the boiler is below the hot water tank.

_____

_____

_____

(ii) Why is heat energy transferred from hot water in the tank to the surrounding air?

_____

_____

(iii) Name the process by which energy is transferred through the sides of the tank.

_____

(iv) How may heat loss from the hot water tank be reduced?

_____

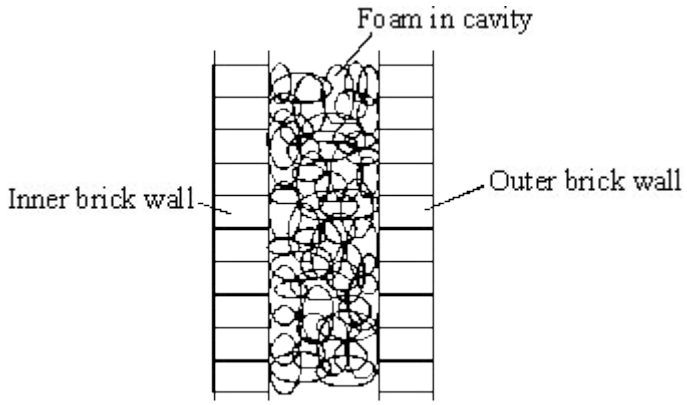
_____

_____

(6)

(b) One way of reducing heat loss from a house is by cavity wall insulation. Foam is pumped between the inner and outer brick walls as shown in the diagram.

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How is heat loss from a house reduced by:

(i) having a cavity wall?

_____

_____

_____

_____

(ii) filling the cavity with foam?

_____

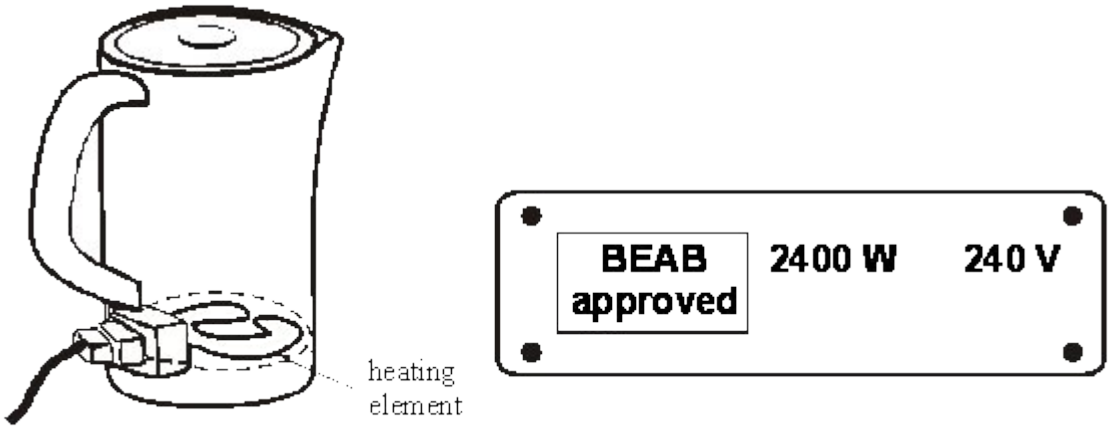
_____

(3)

(Total 9 marks)

Q12.

The diagram below shows an electric kettle and the label on the bottom of the kettle.



The water at the bottom of the kettle will heat up first.
This is because the heating element is near the bottom of the kettle.
Convection currents will then cause the rest of the water in the kettle to be heated.

(i) What are convection currents?

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_____

(1)

(ii) Explain how convection currents are produced.
(Your answer should refer to **density** and **temperature**.)

_____

_____

_____

_____

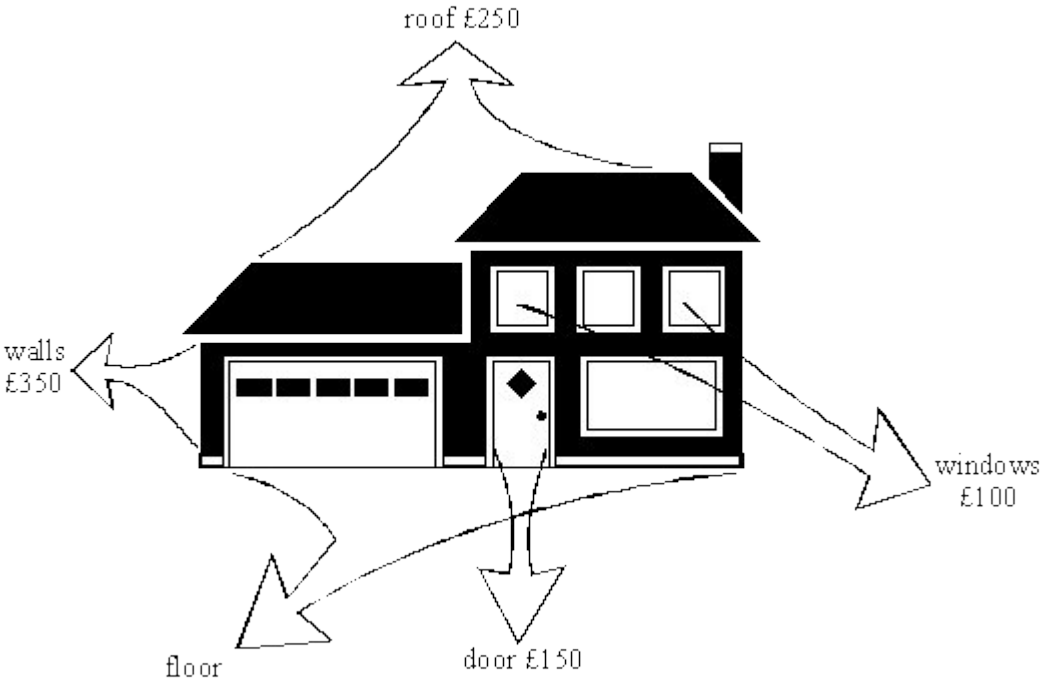
_____

(4)

(Total 5 marks)

Q13.

The diagram below shows a house which has **not** been insulated. The cost of the energy lost from different parts of the house during one year is shown on the diagram.



(a) The total cost of the energy lost during one year is £1000.

(i) What is the cost of the energy lost through the floor?

_____

(2)

(ii) Suggest one way of reducing this loss.

_____

(1)

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(b) The table below shows how some parts of the house may be insulated to reduce energy losses. The cost of each method of insulation is also given.

WHERE LOST	COST OF ENERGY LOST PER YEAR (£)	METOD OF INSULATION	COST OF INSULATION (£)
roof	250	fibre-glass in loft	300
walls	350	foam filled cavity	800
windows	100	double glazing	4500
doors	150	draught proofing	5

(i) Which method of insulation would you install first? Explain why.

_____

_____

_____

_____

(3)

(ii) Which method of insulation would you install last? Explain why.

_____

_____

_____

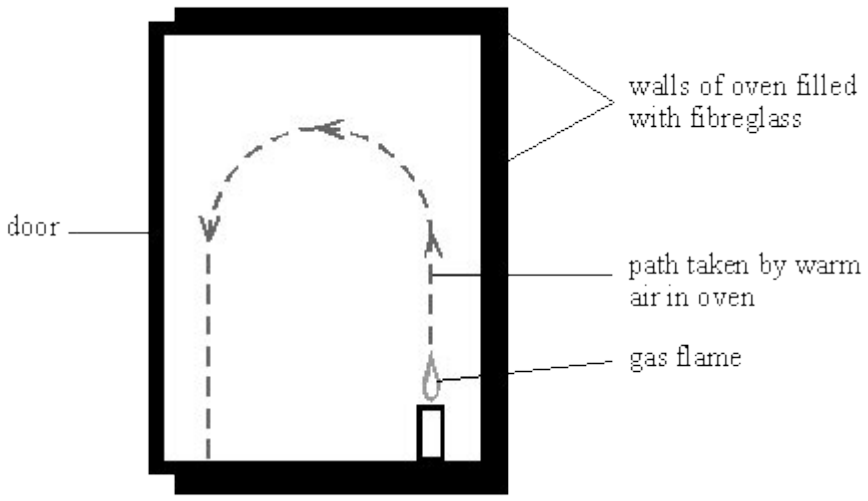
_____

(3)

(Total 9 marks)

Q14.

The diagram shows a section through a gas oven.



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Use words from the list to complete the sentences.

conduction convection insulation radiation resistance

The outside of the door gets hot because energy is transferred through

the door by _____

Energy is transferred from the gas flame to the rest of the oven by the movement of air.

This type of energy transfer is called _____

The walls of the oven are packed with fibreglass to reduce energy transfer. Energy

transfer is reduced because fibreglass provides good _____

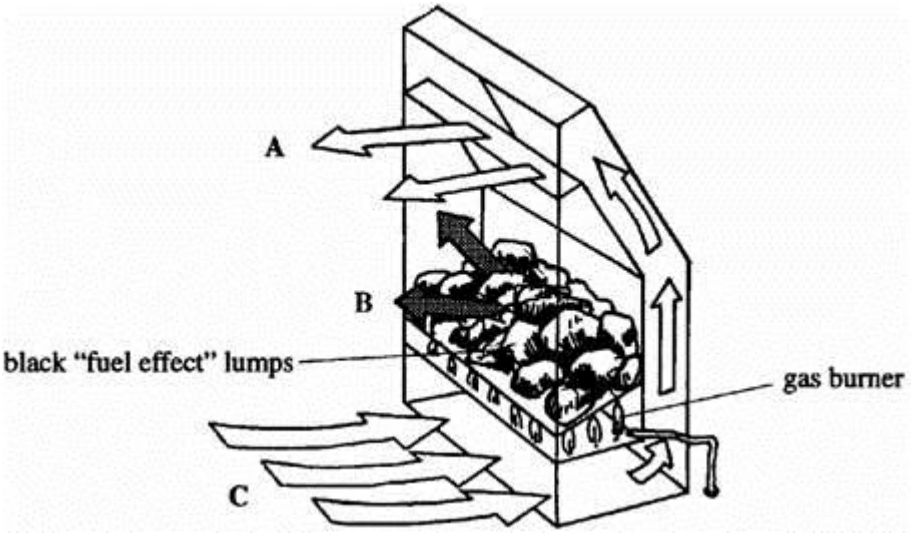
The outside of the cooker is white and shiny.

This reduces energy transfer by _____

(Total 4 marks)

Q15.

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**.

_____

_____

_____

_____

_____

_____

(4)

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(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**.

_____

(1)

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

_____

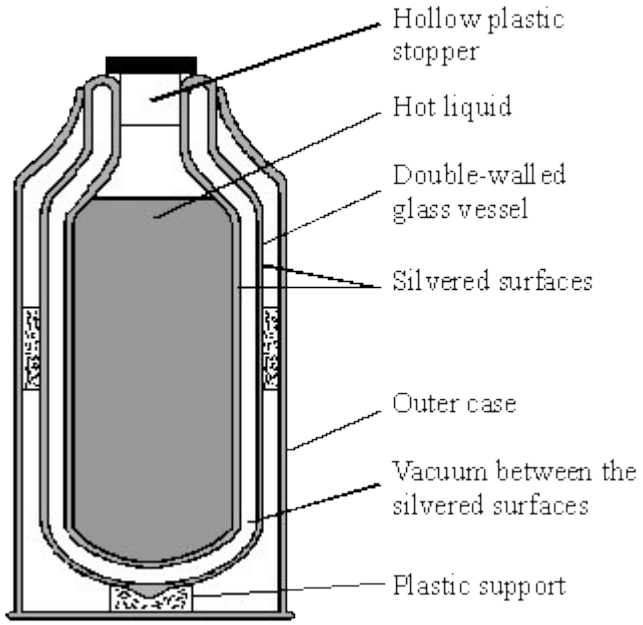
_____

(1)

(Total 6 marks)

Q16.

The drawing shows a section of a vacuum flask.



(a) Heat is slowly “lost” from the hot liquid in the closed flask. It may be transferred by:

conduction	convention	evaporation	radiation

Choose from the words above to complete the following sentences. You may use a word once, more than once or not at all.

(i) The vacuum between the glass walls reduces

_____ and _____

(2)

(ii) The silvered surfaces of the glass walls reduce

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_____

(1)

(iii) The stopper in the opening of the flask reduces

_____ and _____

(2)

(iv) Heat is transferred by the air molecules, away from the vacuum flask, by

_____

(1)

(v) The plastic of the plastic stopper is preferred to metal because it cuts down

_____

(1)

(b) Mark **X** on the diagram of the vacuum flask where the liquid in the flask is hottest.

(1)

(c) Explain, in terms of particles, how heat is conducted through a glass wall of the vacuum flask.

_____

_____

_____

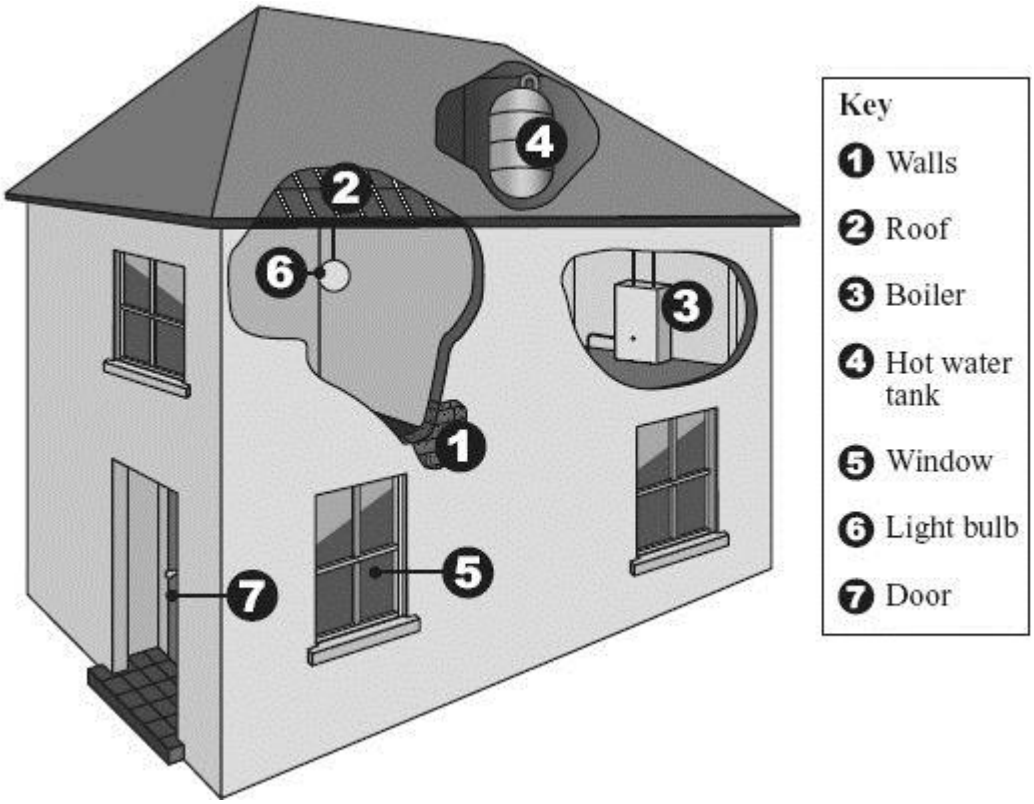
(2)

(Total 10 marks)

Q17.

The drawing shows parts of a house where it is possible to reduce the amount of energy lost.

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(a) Give **one** way in which the amount of energy lost can be reduced from each of the following parts of the house.

1, **2** and **4** _____

5 _____

7 _____

(3)

(b) Energy consumption can be reduced by using a more efficient boiler or more efficient light bulbs.

What is meant by a *more efficient* light bulb?

_____

_____

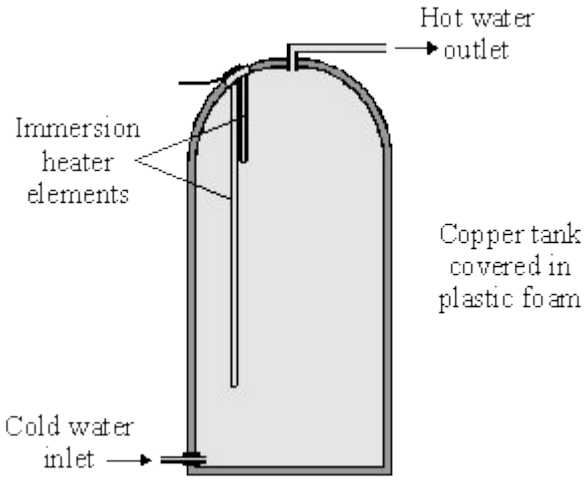
(1)

(Total 4 marks)

Q18.

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

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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.

_____

_____

_____

(2)

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

_____

_____

_____

(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.

_____

_____

_____

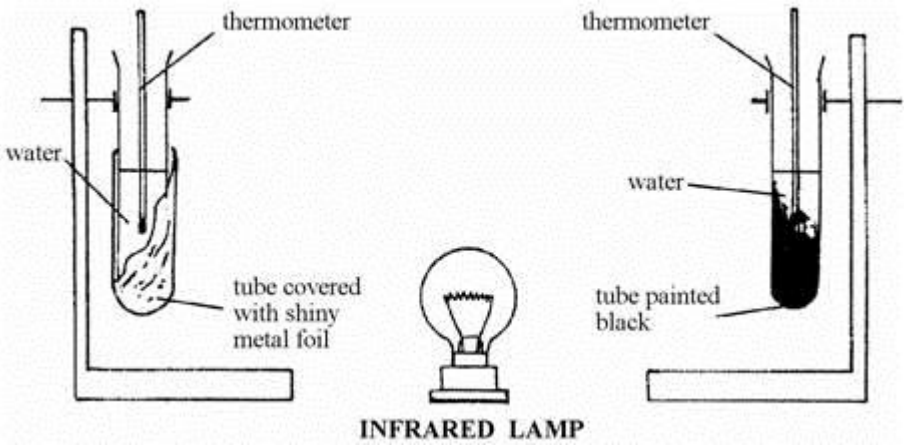
(2)

(Total 6 marks)

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Q19.

The diagram shows an experiment to find out what happens to infrared waves when they strike different surfaces.



(a) The water in the black tube gets hotter than the water in the shiny tube.
Choose words from the list to complete the sentences below.

absorbs **conducts** **convects** **radiates** **reflects**

The infrared lamp _____ energy to the tubes of water.

The black surface _____ most of the energy that reaches it.

The shiny surface _____ most of the energy that reaches it.

(3)

(b) Put the sentences A- E below into the correct boxes on the flow diagram so that they tell you how to do the experiment

(You may use just the letters if you want to.)

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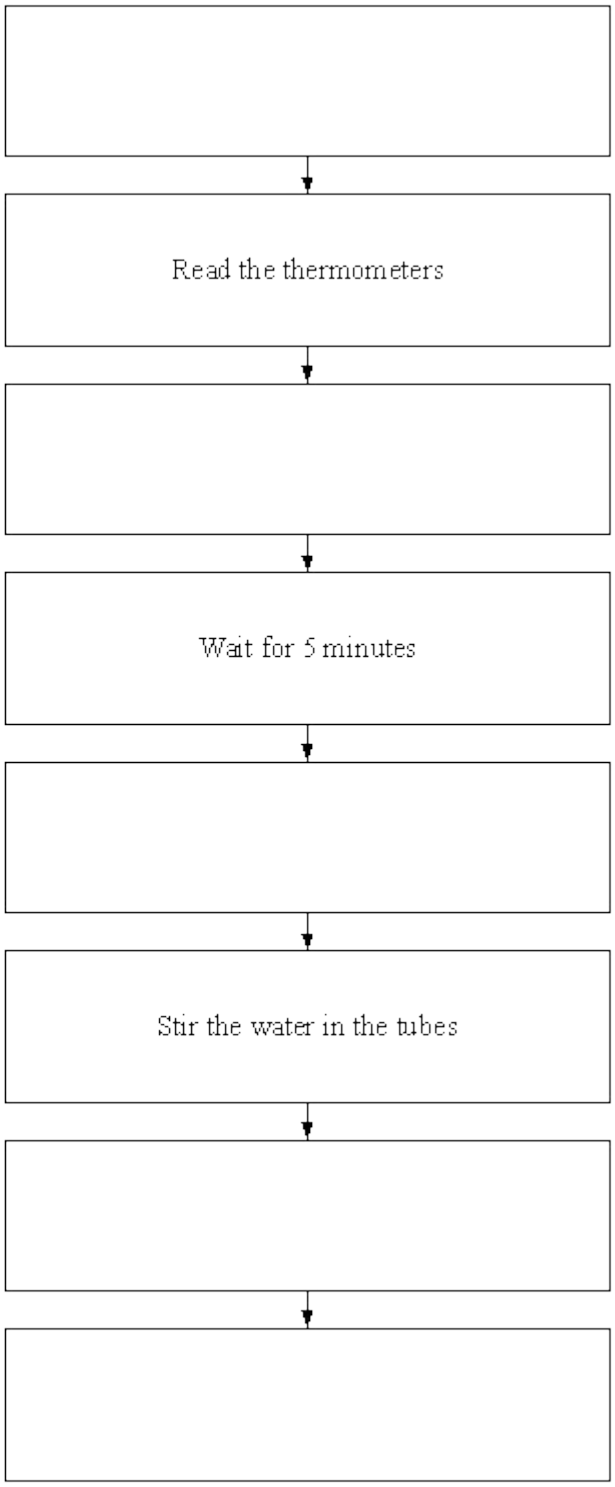
A Switch off the lamp

B Switch on the lamp

C Make sure the lamp is the same distance from both tubes

D Read the thermometers

E Wait for the temperature to stop rising



(5)

(Total 8 marks)

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