AQA GCSE PHYSICS (HIGHER) · 8463

# PHYSICS



EXAM QUESTION PACK

## 4.3.2.2 TEMPERATURE CHANGES IN A SYSTEM AND SPECIFIC HEAT CAPACITY (PACK 1)

| SCORE | PERCENTAGE |
| --- | --- |
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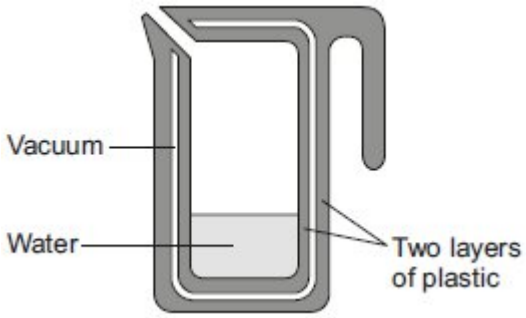
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## Q1.

A new design for a kettle is made from two layers of plastic separated by a vacuum. After the water in the kettle has boiled, the water stays hot for at least 2 hours.

The new kettle is shown below.




(a) The energy transferred from the water in the kettle to the surroundings in 2 hours is 46 200 J.

The mass of water in the kettle is 0.50 kg.

The specific heat capacity of water is 4200 J/kg °C.

The initial temperature of the water is 100 °C.

Calculate the temperature of the water in the kettle after 2 hours.

_____

_____

_____

_____

Temperature after 2 hours = _____ °C

**(3)**

(b) Calculate the average power output from the water in the kettle to the surroundings in 2 hours.

_____

_____

_____

_____

Average power output = _____ W

**(2)**

**(Total 5 marks)**

## Q2.



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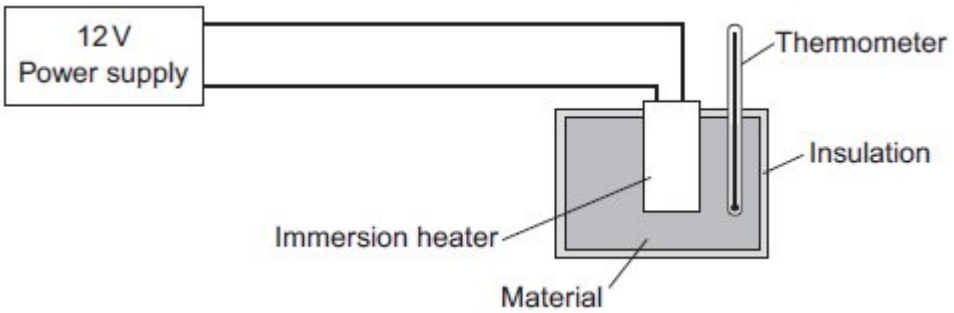
A student used the apparatus in **Figure 1** to compare the energy needed to heat blocks of different materials.

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.

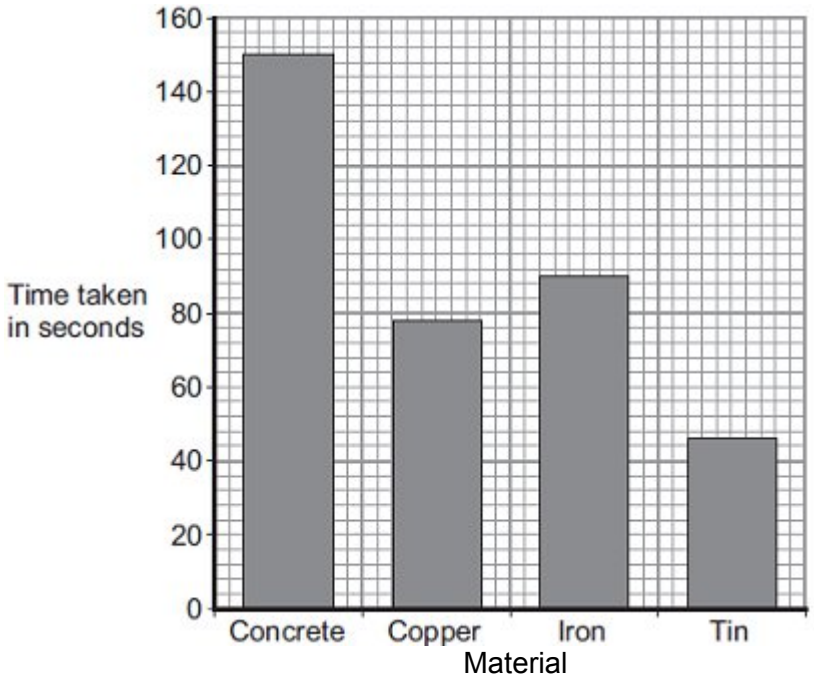
1. _____

2. _____

**(2)**

**Figure 2** shows the student's results.

**Figure 2**




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



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_____

_____

**(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.

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

_____

_____

_____

Energy transferred = _____ J

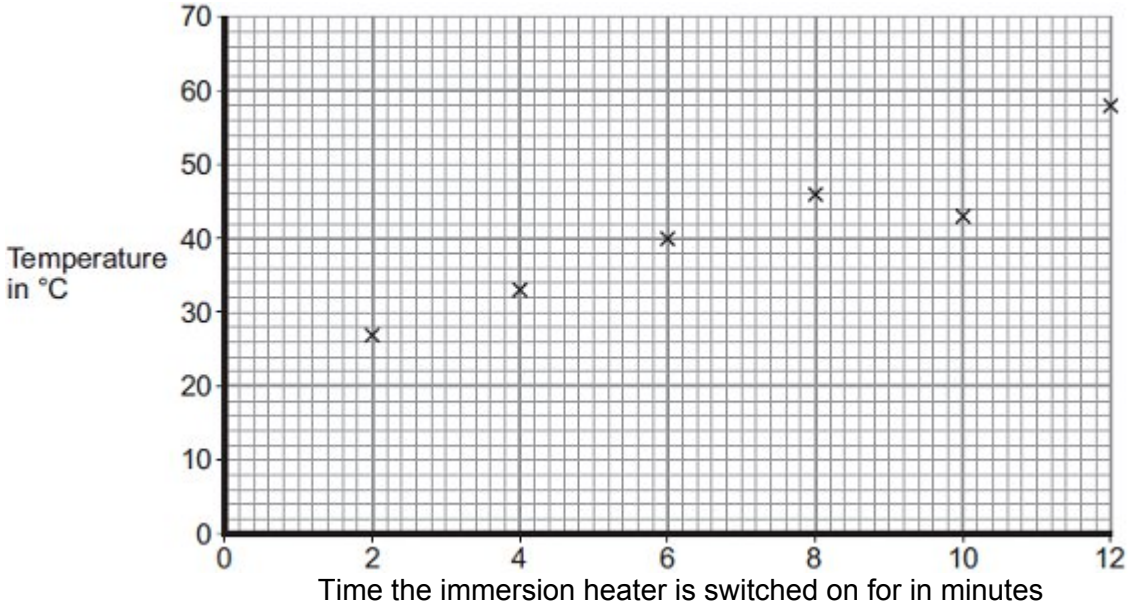
**(2)**

(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**






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(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

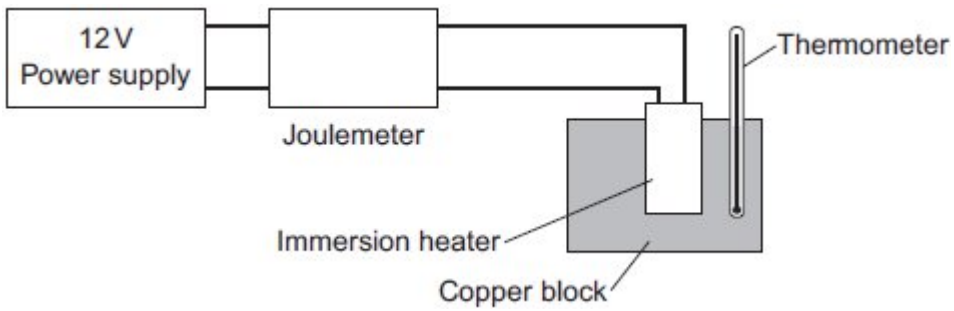
**(1)**

**(Total 11 marks)**

## Q3.

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.

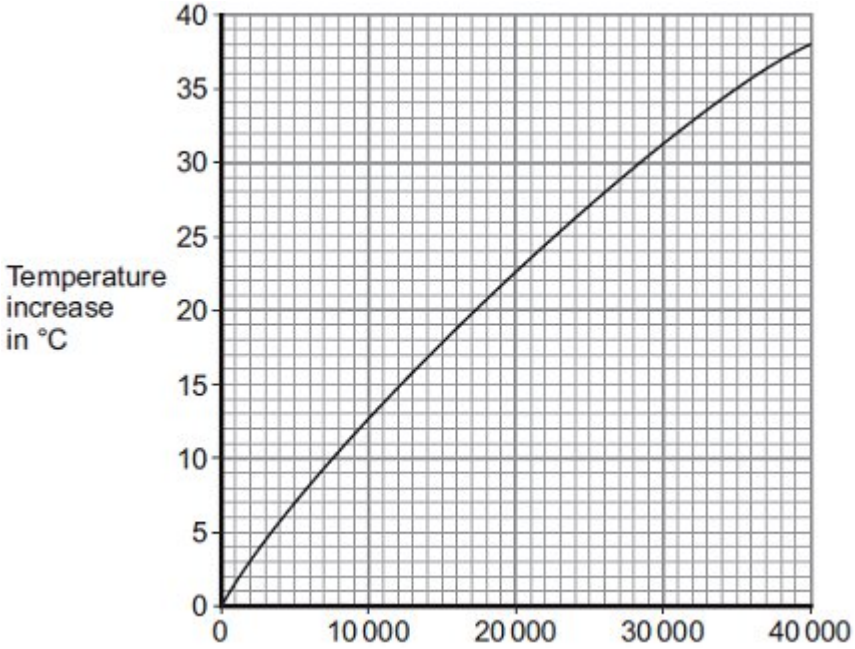
The temperature increase was calculated.

**Figure 2** shows the student's results.

**Figure 2**



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(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.

_____

_____

_____

_____



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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.

_____

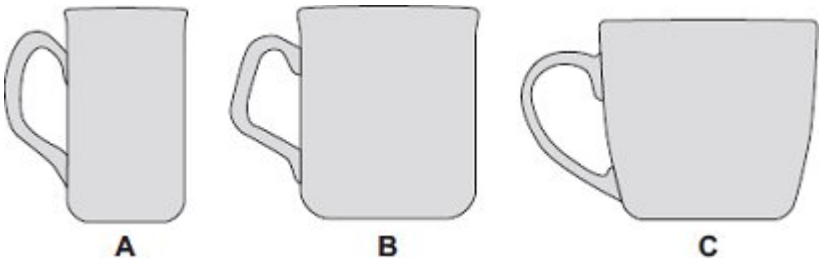
_____

**(1)**

**(Total 6 marks)**

## Q4.

The diagram shows three cups **A**, **B** and **C**.




Energy is transferred from hot water in the cups to the surroundings.

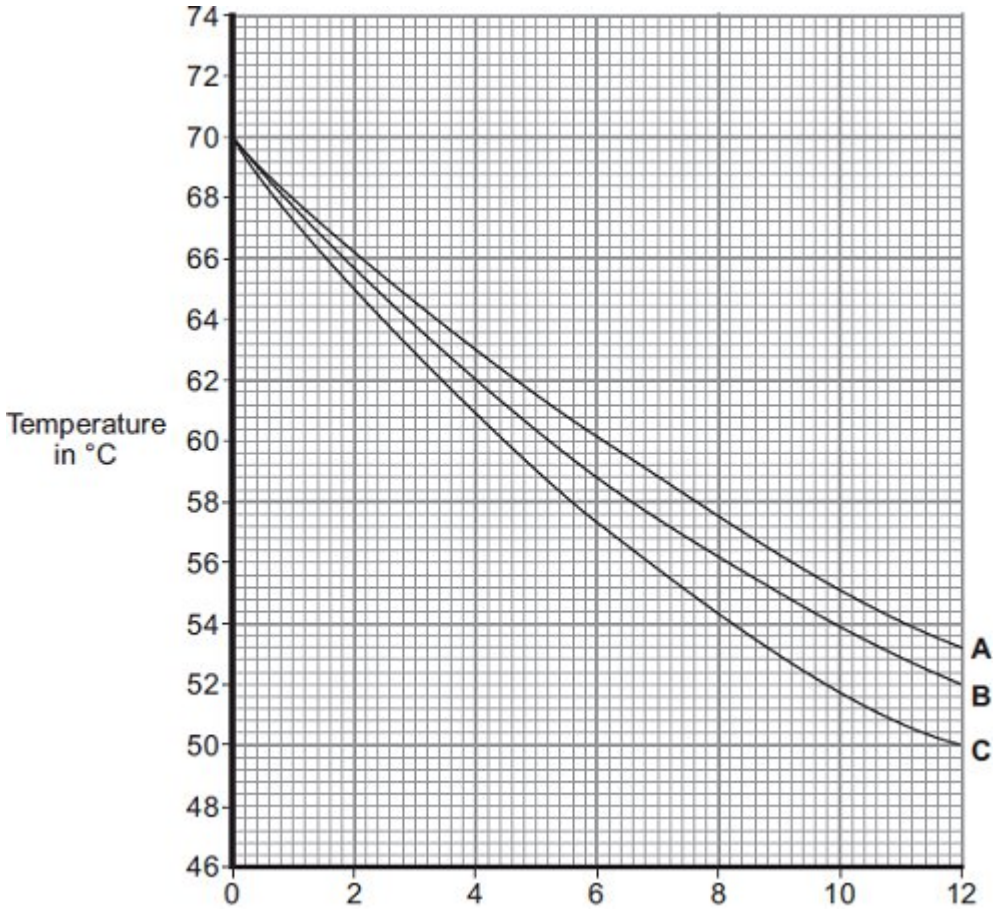
(a) Some students investigated how the rate of cooling of water in a cup depends on the surface area of the water in contact with the air.

They used cups **A**, **B** and **C**. They poured the same volume of hot water into each cup and recorded the temperature of the water at regular time intervals.

The results are shown on the graph.



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(i) What was the starting temperature of the water for each cup?

Starting temperature = _____ °C

**(1)**

(ii) Calculate the temperature fall of the water in cup **B** in the first 9 minutes.

_____

Temperature fall = _____ °C

**(2)**

(iii) Which cup, **A**, **B** or **C**, has the greatest rate of cooling? ☐

Using the graph, give a reason for your answer.

_____

_____

**(2)**

(iv) The investigation was repeated using the bowl shown in the diagram.

The same starting temperature and volume of water were used.



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Draw on the graph in part **(b)** another line to show the expected result.

**(1)**

(v) After 4 hours, the temperature of the water in each of the cups and the bowl was 20°C.

Suggest why the temperature does **not** fall below 20°C.

_____

**(1)**

(b) (i) The mass of water in each cup is 200 g.

Calculate the energy, in joules, transferred from the water in a cup when the temperature of the water falls by 8°C.

Specific heat capacity of water = 4200 J / kg°C.

_____

_____

_____

Energy transferred = _____ J

**(3)**

(ii) Explain, in terms of particles, how evaporation causes the cooling of water.

_____

_____

_____

_____

_____

_____

_____

_____

**(4)**

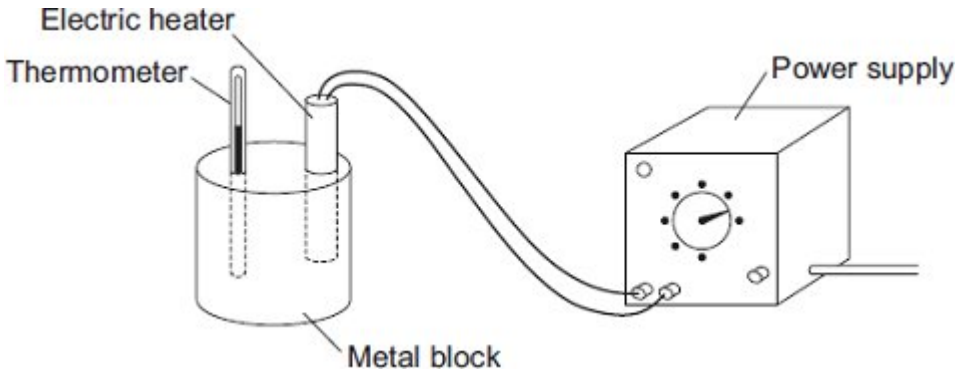
**(Total 14 marks)**

## Q5.

(a) A student used the apparatus drawn below to investigate the heating effect of an electric heater.

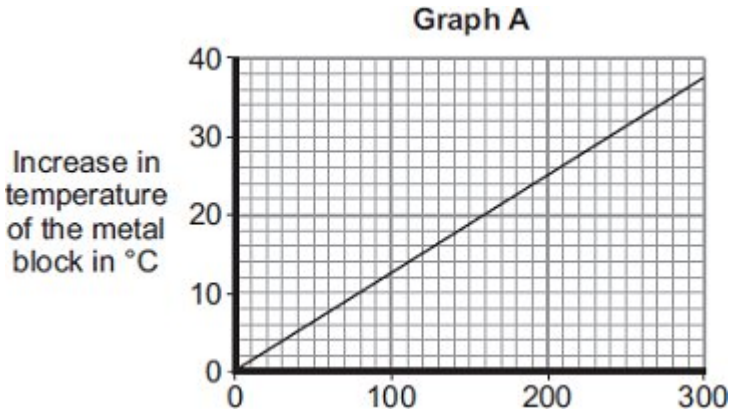


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(i) Before starting the experiment, the student drew **Graph A**.

**Graph A** shows how the student expected the temperature of the metal block to change after the heater was switched on.




Describe the pattern shown in **Graph A**.

_____

_____

_____

_____

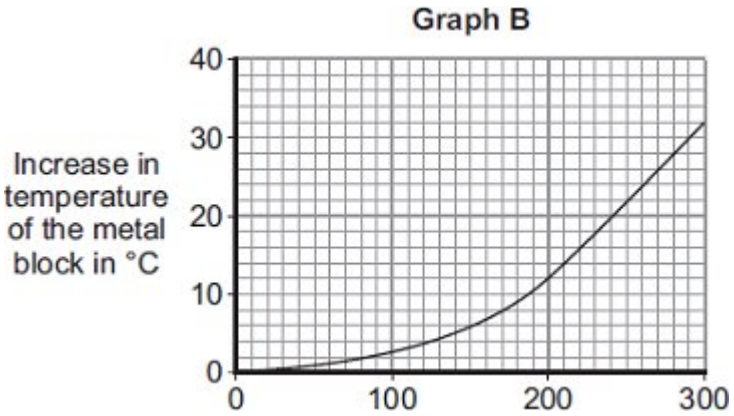
**(2)**

(ii) The student measured the room temperature. He then switched the heater on and measured the temperature of the metal block every 50 seconds.

The student calculated the increase in temperature of the metal block and plotted **Graph B**.



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After 300 seconds, **Graph B** shows the increase in temperature of the metal block is lower than the increase in temperature expected from **Graph A**.

Suggest **one** reason why.

_____

_____

**(1)**

(iii) The power of the electric heater is 50 watts.

Calculate the energy transferred to the heater from the electricity supply in 300 seconds.

_____

_____

_____

Energy transferred = _____ J

**(2)**

(b) The student uses the same heater to heat blocks of different metals. Each time the heater is switched on for 300 seconds.

Each block of metal has the same mass but a different specific heat capacity.

| Metal | Specific heat capacity in J/kg°C |
|---|---|
| Aluminium | 900 |
| Iron | 450 |
| Lead | 130 |

Which **one** of the metals will heat up the most?

Draw a ring around the correct answer.

**aluminium** **iron** **lead**



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Give, in terms of the amount of energy needed to heat the metal blocks, a reason for your answer.

_____

_____

_____

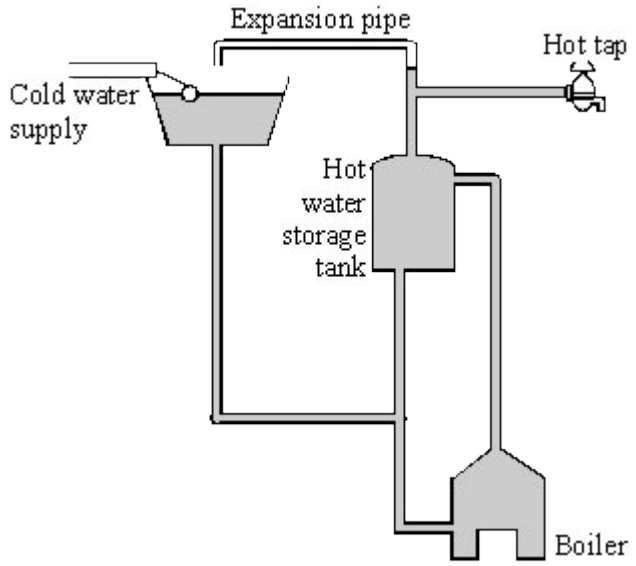
_____

**(2)**

**(Total 7 marks)**

## Q6.

(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?

_____



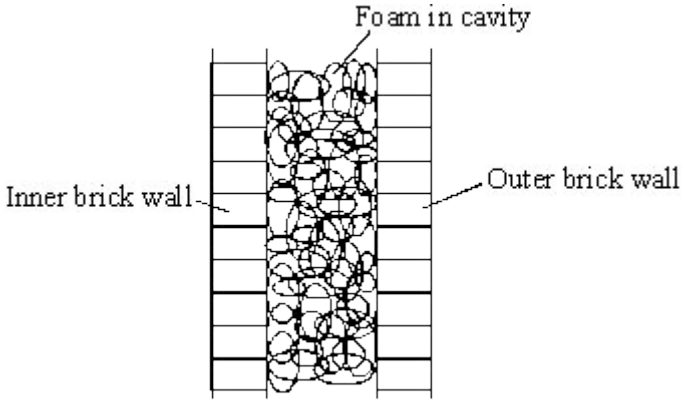
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_____

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**(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.




How is heat loss from a house reduced by:

(i) having a cavity wall?

_____

_____

_____

_____

(ii) filling the cavity with foam?

_____

_____

**(3)**

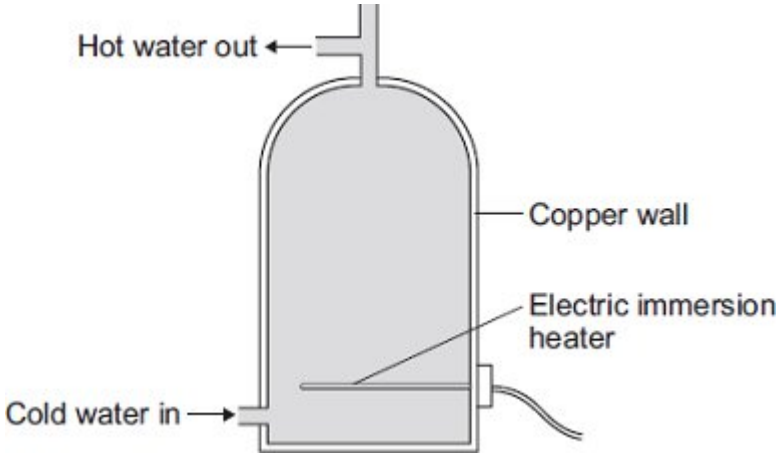
**(Total 9 marks)**

## Q7.

An electric immersion heater is used to heat the water in a domestic hot water tank. When the immersion heater is switched on the water at the bottom of the tank gets hot.



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(a) Complete the following sentence.

The main way the energy is transferred through the copper wall of the water tank is

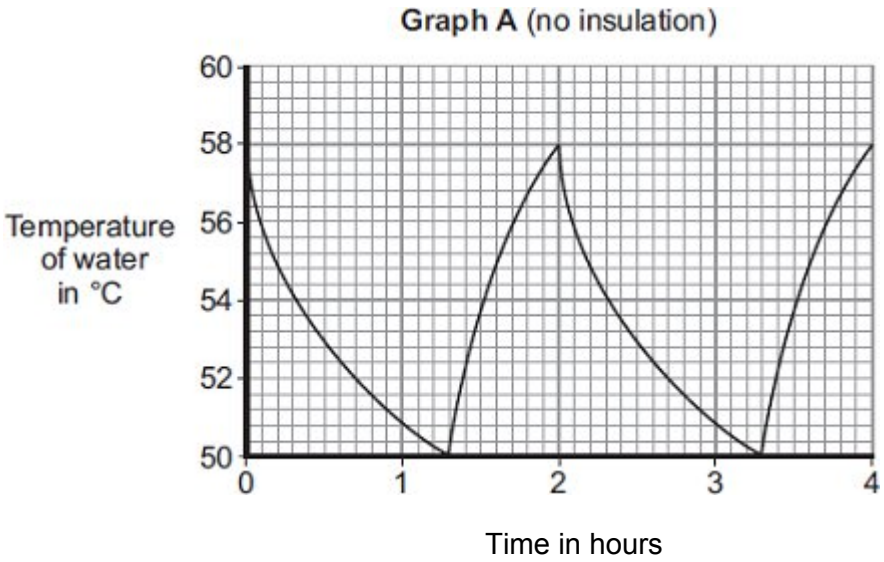
by the process of _____ .

**(1)**

(b) The immersion heater has a thermostat to control the water temperature.

When the temperature of the water inside the tank reaches 58°C the thermostat switches the heater off. The thermostat switches the heater back on when the temperature of the water falls to 50°C.

**Graph A** shows how the temperature of the water inside a hot water tank changes with time. The tank is **not** insulated.




(i) The temperature of the water falls at the fastest rate just after the heater switches off.

Explain why.

_____

_____

_____



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_____

**(2)**

(ii) To heat the water in the tank from 50°C to 58°C the immersion heater transfers 4032 kJ of energy to the water.

Calculate the mass of water in the tank.

Specific heat capacity of water = 4200 J/kg°C

_____

_____

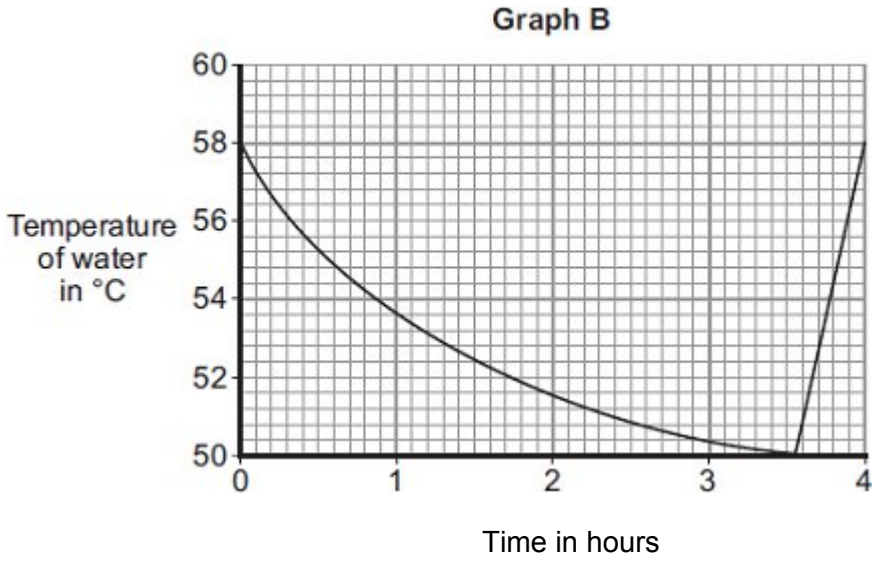
_____

Mass = _____ kg

**(3)**

(iii) An insulating jacket is fitted to the hot water tank.

**Graph B** shows how the temperature of the water inside the insulated hot water tank changes with time.




An insulating jacket only costs £12.

By comparing **Graph A** with **Graph B**, explain why fitting an insulating jacket to a hot water tank saves money.

_____

_____

_____

_____

_____

_____

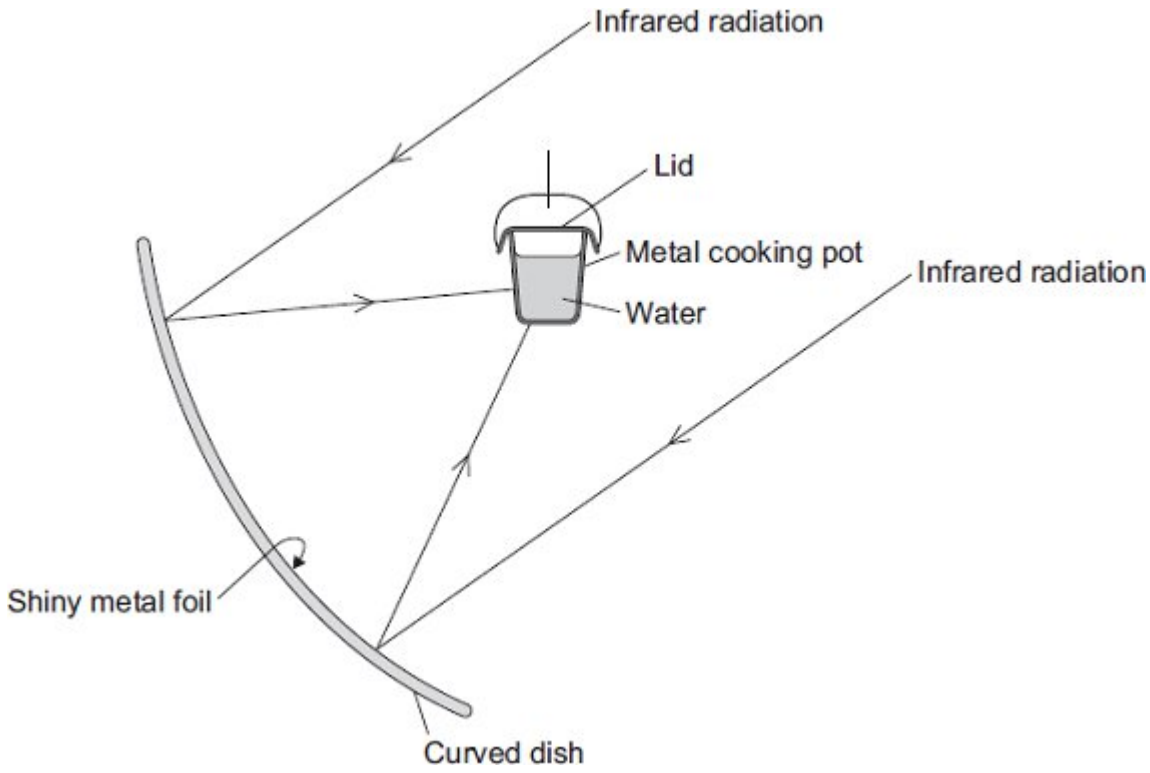


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**(3)**
**(Total 9 marks)**

## Q8.

The diagram shows the design of a solar cooker. The cooker heats water using infrared radiation from the Sun.




(a) Why is the inside of the large curved dish covered with shiny metal foil?

_____

_____

**(1)**

(b) Which would be the best colour to paint the outside of the metal cooking pot?

Draw a ring around the correct answer.

**black** **silver** **white**

Give a reason for your answer.

_____

_____

_____

**(2)**

(c) Why does the cooking pot have a lid?

_____



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_____

**(1)**

(d) Calculate how much energy is needed to increase the temperature of 2 kg of water by 80 °C.

The specific heat capacity of water = 4200 J/kg °C.

_____

_____

_____

Energy = _____ J

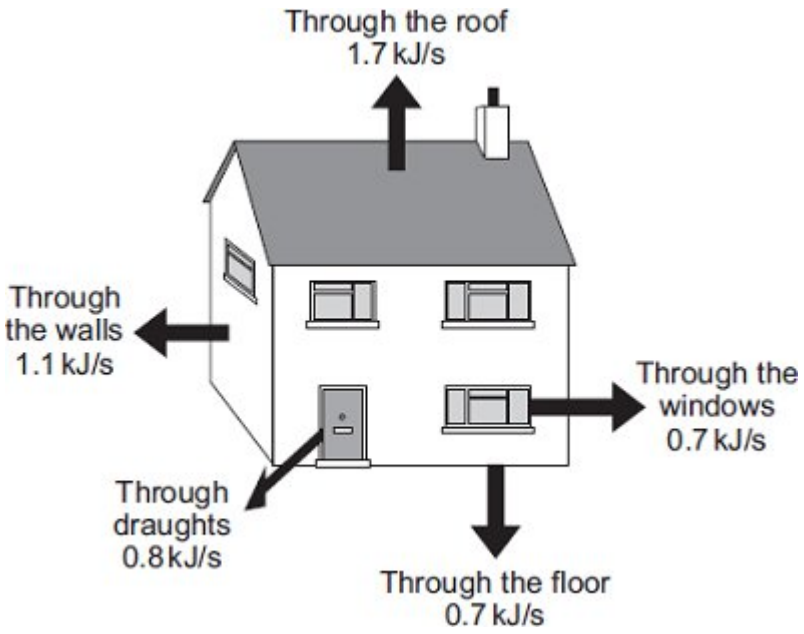
**(2)**

**(Total 6 marks)**

## Q9.

**Diagram 1** shows the energy transferred per second from a badly insulated house on a cold day in winter.

**Diagram 1**




(a) (i) When the inside of the house is at a constant temperature, the energy transferred from the heating system to the inside of the house equals the energy transferred from the house to the outside.

Calculate, in kilowatts, the power of the heating system used to keep the inside of the house in **Diagram 1** at a constant temperature.

1 kilowatt (kW) = 1 kilojoule per second (kJ/s)

_____

Power of the heating system = _____ kW

**(1)**



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(ii) In the winter, the heating system is switched on for a total of 7 hours each day.

Calculate, in kilowatt-hours, the energy transferred each day from the heating system to the inside of the house.

_____

_____

Energy transferred each day = _____ kWh

**(2)**

(iii) Energy costs 15 p per kilowatt-hour.

Calculate the cost of heating the house for one day.

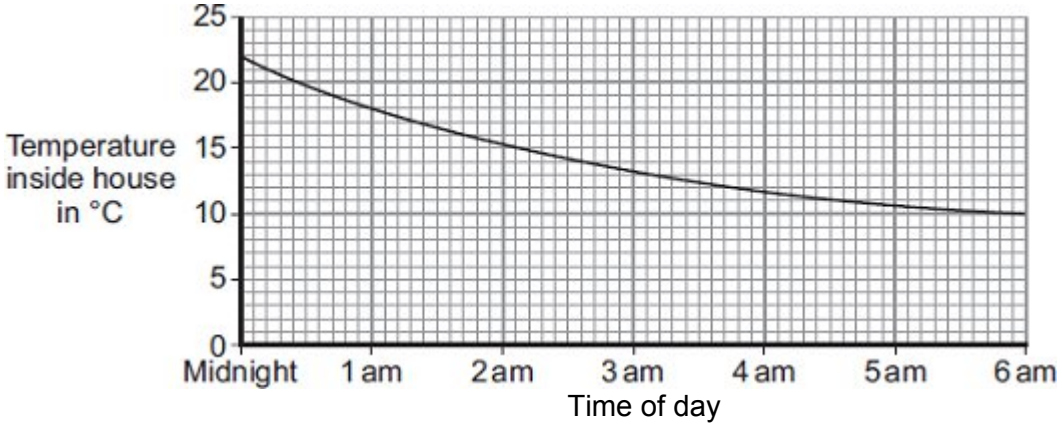
_____

Cost = _____

**(1)**

(iv) The heating system is switched off at midnight.

The graph shows how the temperature inside the house changes after the heating system has been switched off.




Draw a ring around the correct answer in the box to complete the sentence.

Between midnight and 6 am the rate of energy transfer from

the house

| |
|---|
| decreases. |
| decreases then stays constant. |
| increases. |

Give the reason for your answer.

_____

_____

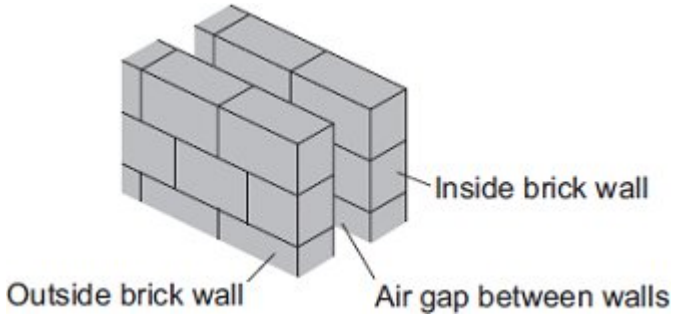
**(2)**



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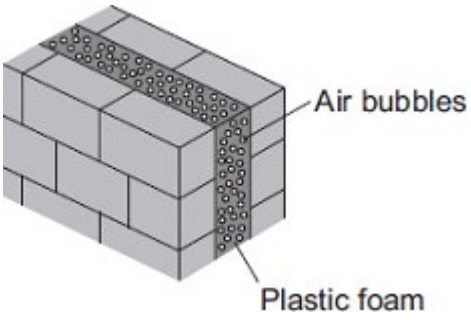
(b) **Diagram 2** shows how the walls of the house are constructed.
**Diagram 3** shows how the insulation of the house could be improved by filling the air gap between the two brick walls with plastic foam.

**Diagram 2**




U-value of the wall = 0.7

**Diagram 3**




U-value of the wall = 0.3

The plastic foam reduces energy transfer by convection.

Explain why.

_____

_____

_____

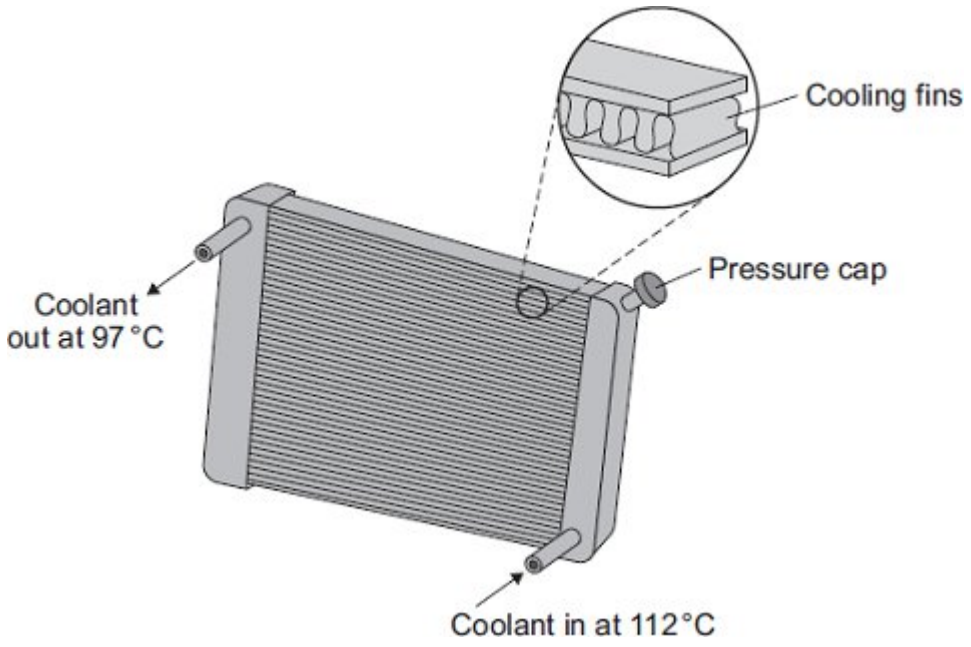
_____

**(2)**

**(Total 8 marks)**

## Q10.

The diagram shows a car radiator. The radiator is part of the engine cooling system.






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Liquid coolant, heated by the car engine, enters the radiator. As the coolant passes through the radiator, the radiator transfers energy to the surroundings and the temperature of the coolant falls.

(a) Why is the radiator painted black?

_____

_____

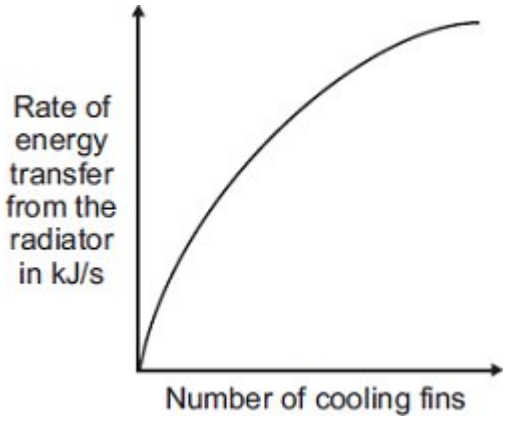
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_____

**(2)**

(b) Different radiators have different numbers of cooling fins along the length of the radiator.

The sketch graph shows how the number of cooling fins affects the rate of energy transfer from the radiator.




The number of cooling fins affects the rate of energy transfer from the radiator.

Explain how.

_____

_____

_____

_____

**(2)**

(c) When the car engine is working normally, 2 kg of coolant passes through the radiator each second. The temperature of the coolant falls from 112 °C to 97 °C.

Calculate the energy transferred each second from the coolant.

Specific heat capacity of the coolant = 3800 J/kg °C.

_____

_____



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_____

_____

Energy transferred each second = _____ J

**(3)**

(d) On cold days, some of the energy transferred from a hot car engine is used to warm the air inside the car. This is a useful energy transfer.

What effect, if any, does this energy transfer have on the overall efficiency of the car engine?

Draw a ring around the correct answer.

| **decreases the efficiency** | **does not change the efficiency** | **increases the efficiency** |
|---|---|---|

Give a reason for your answer.

_____

_____

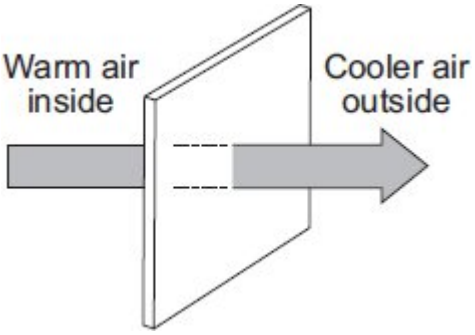
_____

**(2)**

**(Total 9 marks)**

## Q11.

The diagram shows the direction of heat transfer through a single-glazed window.




(a) (i) Name the process by which heat is transferred **through** the glass.

_____

**(1)**

(ii) Explain how heat is transferred **through** the glass.

_____

_____

_____

_____

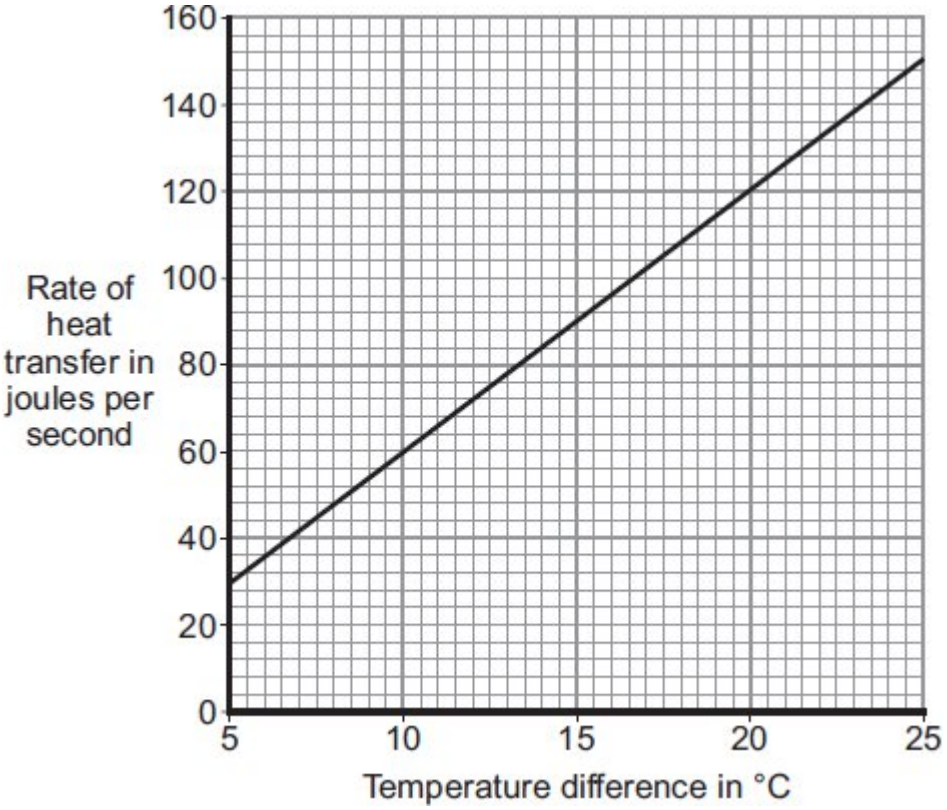


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**(2)**

(b) The rate of heat transfer through a window depends on the difference between the inside and outside temperatures.

The graph shows the rate of heat transfer through a 1 $m^2$ single-glazed window for a range of temperature differences.




(i) What is the range of temperature differences shown in the graph?

From _____ to _____

**(1)**

(ii) A student looks at the graph and concludes:

'Doubling the temperature difference doubles the rate of heat transfer.'

Use data from the graph to justify the student's conclusion.

_____

_____

_____

_____

**(2)**

(iii) A house has single-glazed windows. The total area of the windows in the house is 15 $m^2$.

On one particular day, the difference between the inside and outside temperatures is 20 °C.



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Use the graph to calculate the total rate of heat transfer through all of the windows on this particular day.

Show clearly how you work out your answer.

_____

_____

_____

_____

Rate of heat transfer = _____ J/s

**(2)**

(c) A homeowner plans to replace the single-glazed windows in his home with double-glazed windows. He knows that double-glazed windows will reduce his annual energy bills.

The table gives information about the double glazing to be installed by the homeowner.

| Cost to buy and install | Estimated yearly savings on energy bills | Estimated lifetime of the double-glazed windows |
|---|---|---|
| £5280 | £160 | 30 years |

Explain, in terms of energy savings, why replacing the single-glazed windows with these double-glazed windows is not cost effective.

To gain full marks you must complete a calculation.

_____

_____

_____

_____

**(2)**

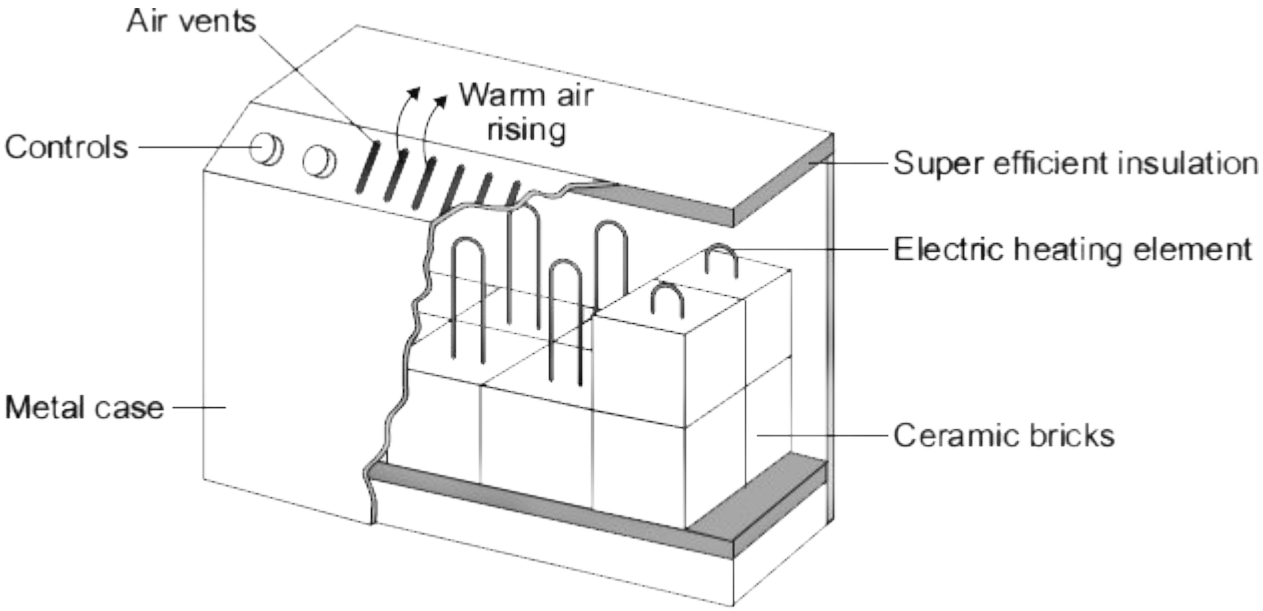
**(Total 10 marks)**

## Q12.

The diagram shows how one type of electric storage heater is constructed. The heater has ceramic bricks inside. The electric elements heat the ceramic bricks during the night. Later, during the daytime, the ceramic bricks transfer the stored energy to the room.



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(a) (i) Complete the following sentences using words from the box.

| | | |
|---|---|---|
| **conduction** | **convection** | **evaporation** |

Energy is transferred through the metal casing by _____

The warm air rising from the heater transfers energy to the

room by _____

**(2)**

(ii) The inside of the metal case is insulated.

Which **one** of the following gives the reason why?

Tick (✓) **one** box.

To transfer energy from the ceramic bricks to the room faster ☐

To stop energy from the room transferring into the heater ☐

To keep the ceramic bricks hot for a longer time ☐

**(1)**

(b) In winter, the electricity supply to a 2.6 kW storage heater is switched on for seven hours each day.

(i) Calculate the energy transferred, in kilowatt-hours, from the electricity supply to the heater in seven hours.

Show clearly how you work out your answer.



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_____

_____

Energy transferred = _____ kWh

**(2)**

(ii) The electricity supply to the heater is always switched on between midnight and 7 am. Between these hours, electricity costs 5 p per kilowatt-hour.

Calculate how much it costs to have the heater switched on between midnight and 7 am.

_____

_____

Cost = _____ p

**(1)**

(c) Between 7 am and 8 am, after the electricity supply is switched off, the temperature of the ceramic bricks falls by 25 °C.

Calculate the energy transferred from the ceramic bricks between 7 am and 8 am.

Total mass of ceramic bricks = 120 kg.
Specific heat capacity of the ceramic bricks = 750 J/kg °C.

Show clearly how you work out your answer.

_____

_____

_____

_____

Energy transferred = _____ J

**(2)**

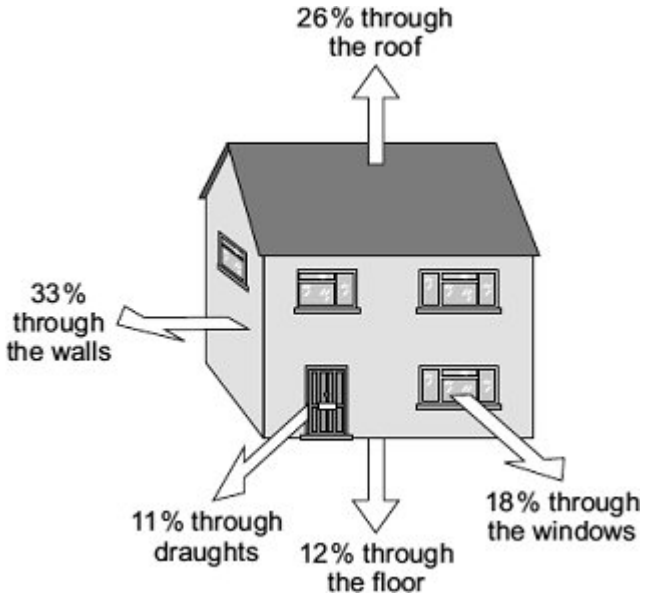
**(Total 8 marks)**

## Q13.

The diagram shows where heat is lost from a house that is **not** insulated.



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(a) (i) Through which part of the house is most heat lost?

_____

**(1)**

(ii) How can the heat loss through the windows be reduced?

_____

_____

**(1)**

(b) A homeowner wants to reduce her energy bills and make her home more energy efficient. The table shows five ways this could be done. The table also shows how much money each way would save the homeowner each year.

| | **Cost** | **Money saved each year** |
|---|---|---|
| Installing loft insulation | £175 | £60 |
| Fitting draught-proofing | £45 | £20 |
| Installing cavity wall insulation | £300 | £80 |
| Adding a hot water tank jacket | £15 | £20 |
| Using energy efficient light bulbs | £60 | £30 |

(i) Which **one** of the five ways of reducing energy bills would reduce the yearly energy bill the most?

_____

**(1)**



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(ii) This year the homeowner has only got £60 to spend to improve the energy efficiency of her home.

Use the information in the table to explain what the homeowner should spend this money on.

_____

_____

_____

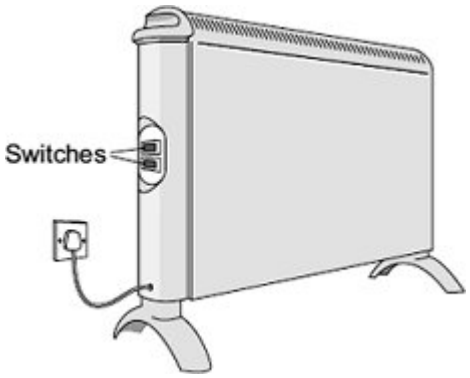
_____

**(2)**

**(Total 5 marks)**

## Q14.

(a) The diagram shows two switches on a room heater. The heater has three power settings. The power produced by two of the settings is given in the table.




| Setting | Power in kW |
|---|---|
| Low | 0.5 |
| Medium | 1.5 |
| High | |

(i) When both switches are on, the heater works at the high power setting.

What is the power of the heater when it is switched to the **high** power setting?

_____

Power = _____ kW

**(1)**

(ii) The heater is used on the **medium** power setting. It is switched on for three hours.

Use the equation in the box to work out the energy transferred from the mains to the heater in three hours.

| energy transferred (kilowatt-hour, kWh) | = | power (kilowatt, kW) | × | time (hour, h) |
|---|---|---|---|---|

Show clearly how you work out your answer.



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_____

_____

Energy transferred = _____ kWh

**(2)**

(iii) Electricity costs 12 pence per kilowatt-hour.

Use the equation in the box to calculate how much the heater costs to use on **medium** power for three hours.

| total cost = number of kilowatt-hours × cost per kilowatt-hour |
|---|

Show clearly how you work out your answer.

_____

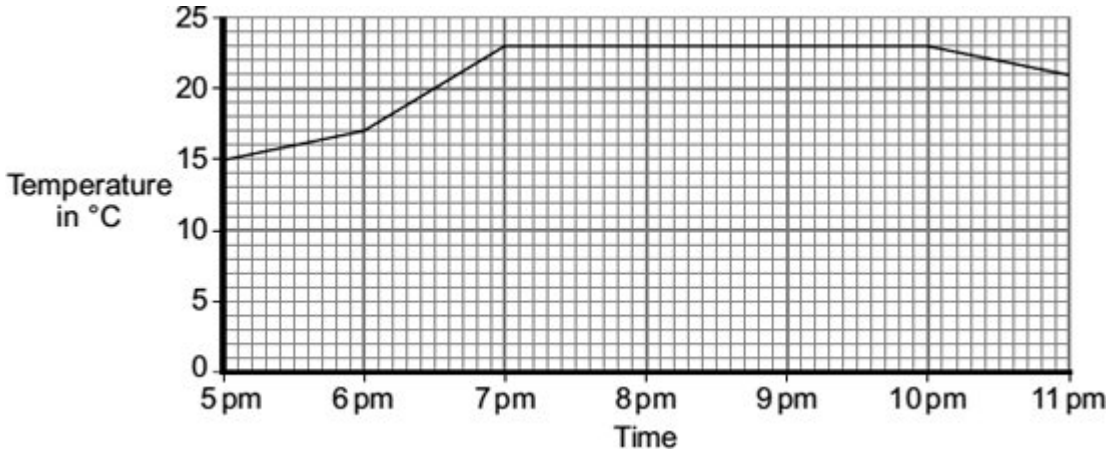
_____

Total cost = _____ pence

**(2)**

(b) The heater is used to warm a room.

The graph shows how the temperature of the room changes from the moment the heater is switched on.




The heater was first used on the medium setting.

(i) At what time was the heater setting changed to the **high** setting?

_____

Give a reason for your answer.

_____

_____

_____

**(2)**



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(ii) From 7 pm until 10 pm, the temperature of the room is **not** changing.

Which **one** of the following statements gives the reason why the temperature of the room is **not** changing?

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

The room is losing energy slower than the heater supplies energy. ☐

The room is losing energy as fast as the heater supplies energy. ☐

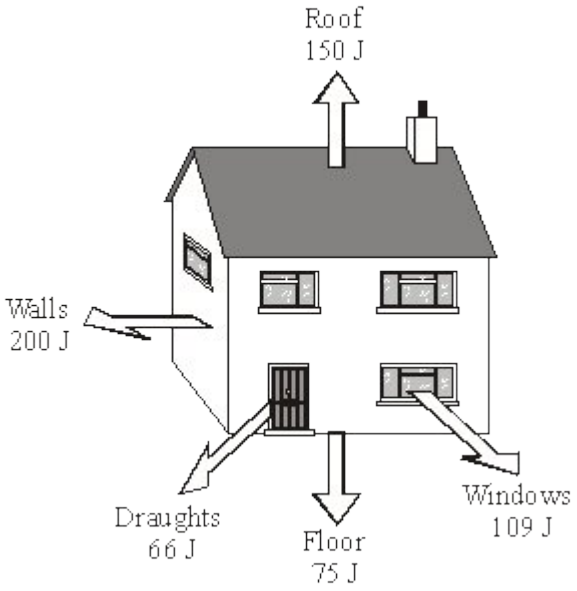
The room is losing energy faster than the heater supplies energy. ☐

**(1)**

**(Total 8 marks)**

## Q15.

(a) The diagram shows how much heat is lost each second from different parts of an uninsulated house.




(i) Each year, the house costs £760 to heat.

How much money is being wasted because of heat lost through the roof?

Show clearly how you work out your answer.

_____

_____

**(2)**

(ii) Insulating the loft would cut the heat lost through the roof by 50 %.



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The loft insulation has a payback time of $1\frac{1}{2}$ years.

How much did the loft insulation cost to buy?

_____

Cost of loft insulation = £ _____

**(1)**

(b) What happens to the wasted energy?

_____

_____

**(1)**

**(Total 4 marks)**

## Q16.

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.

_____

_____

_____

_____

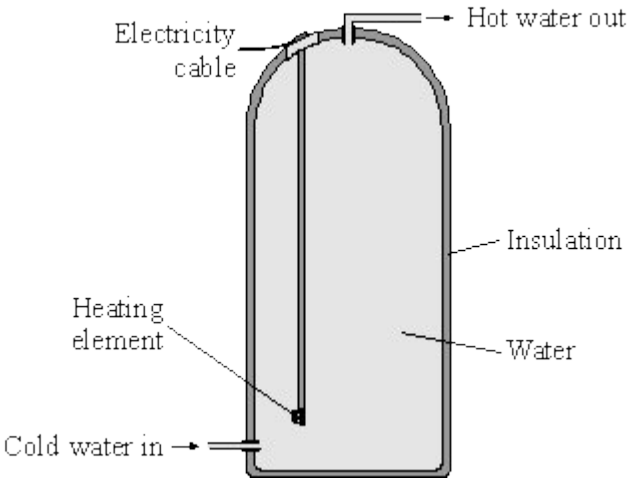


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**(2)**
**(Total 5 marks)**

## Q17.

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




(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* _____

_____

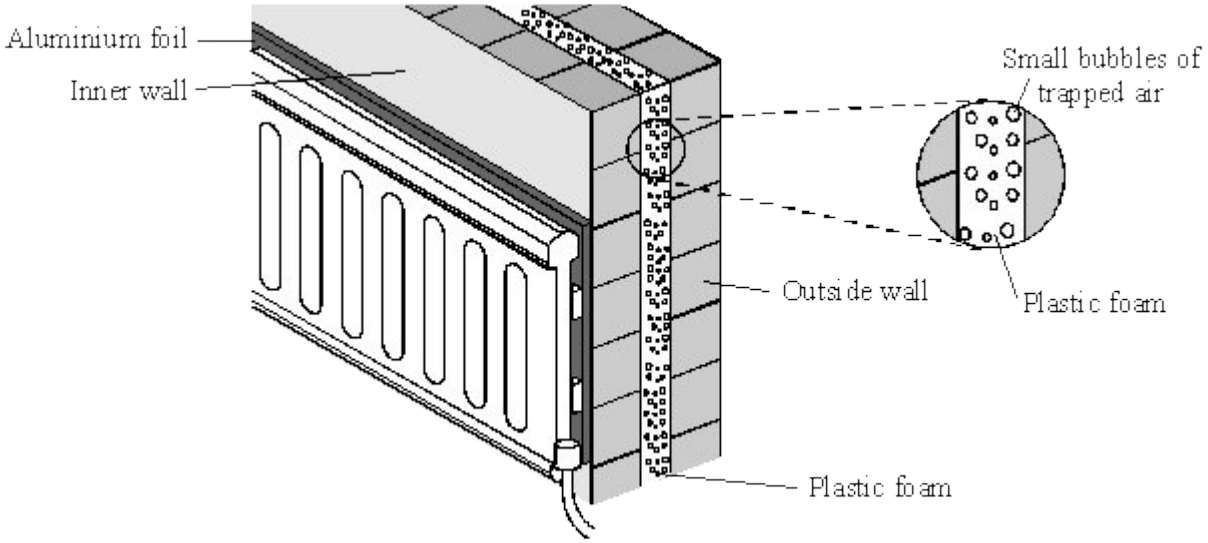
_____

**(2)**

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



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

_____

_____

**(1)**

(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)**

## Q18.

(a) The table gives information about some ways of reducing the energy consumption in a house.

| Method of reducing energy consumption | Installation cost in £ | Annual saving on energy bills in £ |
|---|---|---|



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| | | |
|---|---|---|
| Fit a new hot water boiler | 1800 | 200 |
| Fit a solar water heater | 2400 | 100 |
| Fit under floor heating | 600 | 50 |
| Fit thermostatic radiator valves | 75 | 20 |

Which way of reducing energy consumption is most cost effective over a 10-year period?

To obtain full marks you must support your answer with calculations.

_____

_____

_____

_____

_____

_____

**(3)**

(b) Explain why using an energy-efficient light bulb instead of an ordinary light bulb reduces the amount of carbon dioxide emitted into the atmosphere.

_____

_____

_____

_____

**(2)**

**(Total 5 marks)**

## Q19.

People do a number of things to reduce the energy loss from their homes.

(a) Describe **one** thing they may do to cut down the energy loss through:

(i) the roof;

_____

**(1)**

(ii) the outside walls;

_____

**(1)**

(iii) the glass in the windows;



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_____

**(1)**

(iv) gaps around the front and back doors.

_____

**(1)**

(b) A house is more difficult to keep warm in cold weather. What other type of weather makes it difficult to keep a house warm?

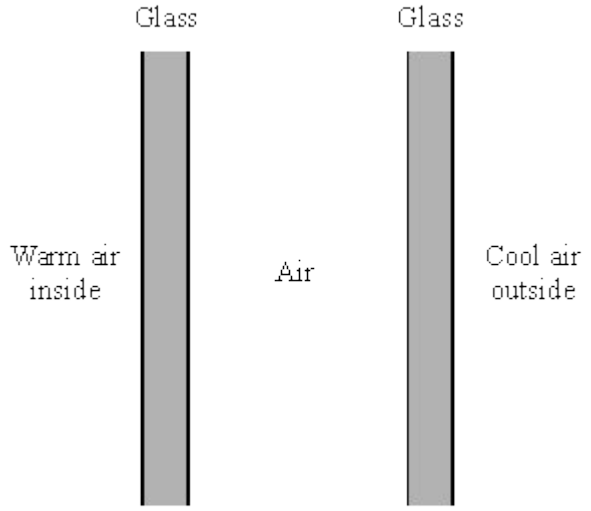
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**(1)**

**(Total 5 marks)**

## Q20.

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.



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_____

**(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.

_____

_____

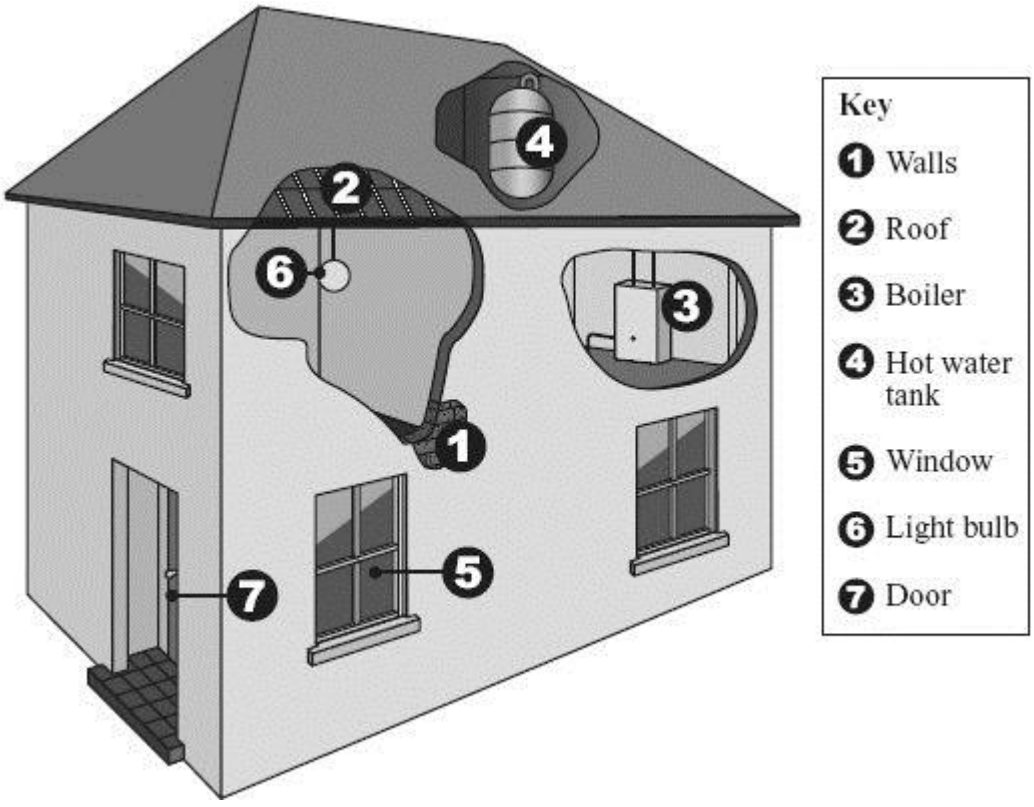
_____

**(2)**

**(Total 8 marks)**

## Q21.

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?

_____

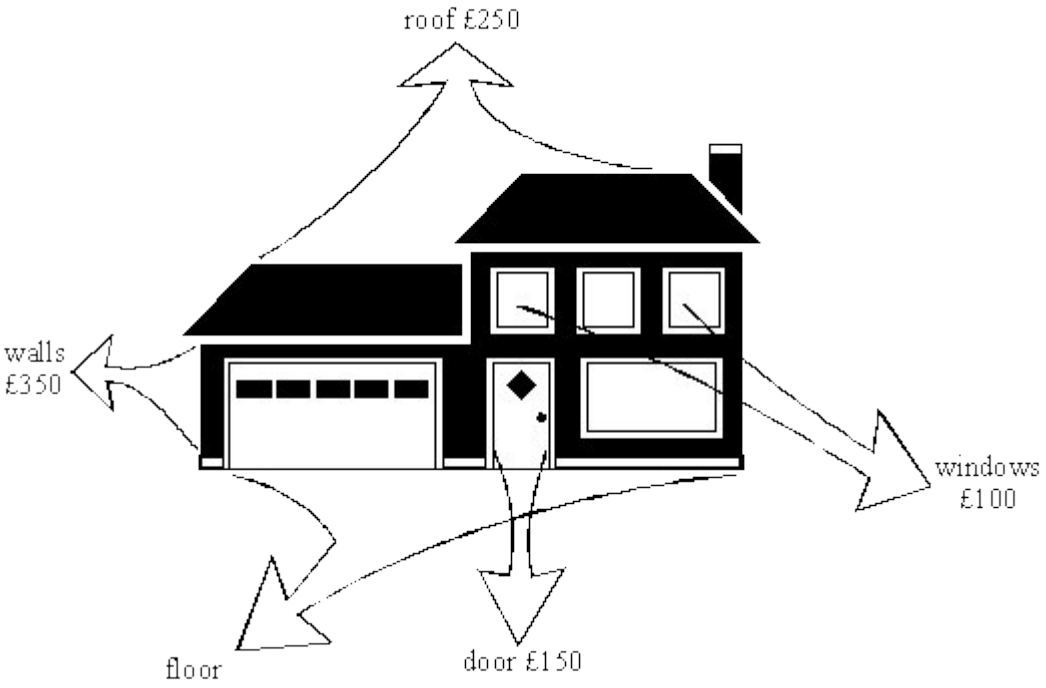
_____

**(1)**

**(Total 4 marks)**

## Q22.

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.

_____



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**(1)**

(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)**

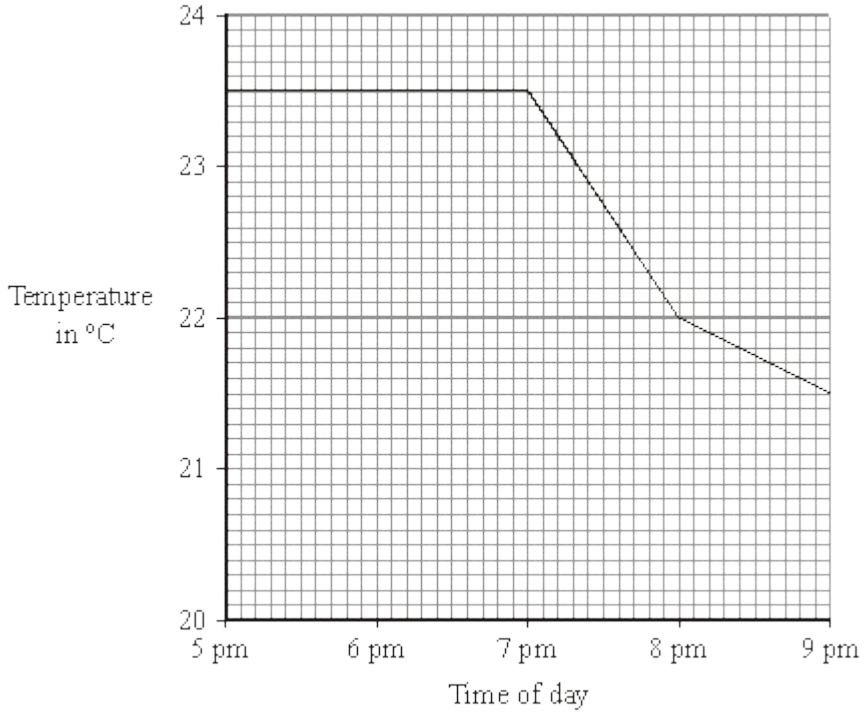
**(Total 9 marks)**

## Q23.

(a) The graph shows the temperature inside a flat between 5 pm and 9 pm. The central heating was on at 5 pm.



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(i) What time did the central heating switch off?

_____

**(1)**

(ii) Closing the curtains reduces heat loss from the flat.

What time do you think the curtains were closed?

_____

Give a reason for your answer.

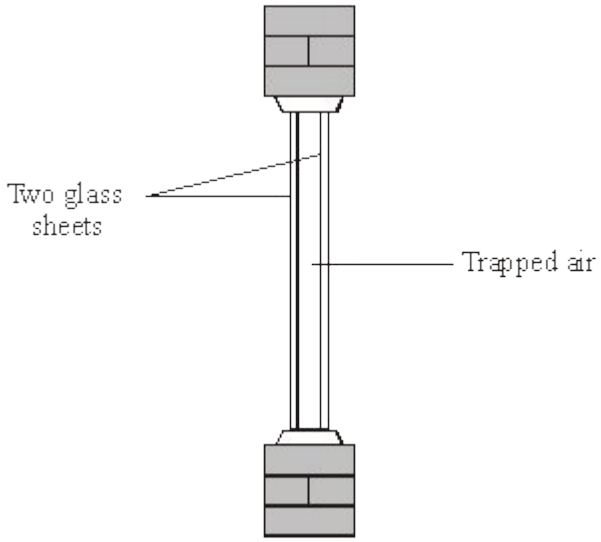
_____

**(2)**

(b) Less heat is lost through double-glazed windows than through single-glazed windows.



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A double-glazed window

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

| conduction | conductor | convection | evaporation | insulator | radiation |
|---|---|---|---|---|---|

Air is a good _____ . When trapped between two sheets of glass it reduces heat loss by _____ and _____

**(3)**

(c) The table gives information about three types of house insulation.

| Type of insulation | Cost to install | Money save each year on heating bills | Payback time |
|---|---|---|---|
| Double glazing | £4000 | £200 | 20 years |
| Loft insulation | £300 | £100 | 3 years |
| Cavity wallinsulation | £600 | £150 | |

(i) Use the information in the table to calculate the payback time for cavity wall insulation.

_____

**(1)**

(ii) Explain why people often install loft insulation before installing double glazing or cavity wall insulation.

_____

_____

_____



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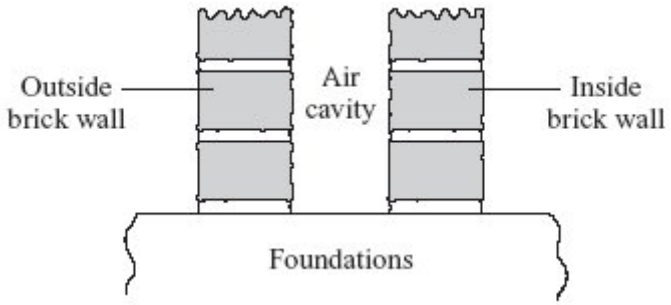
_____

**(2)**

**(Total 9 marks)**

## Q24.

(a) 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)**

(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.



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_____

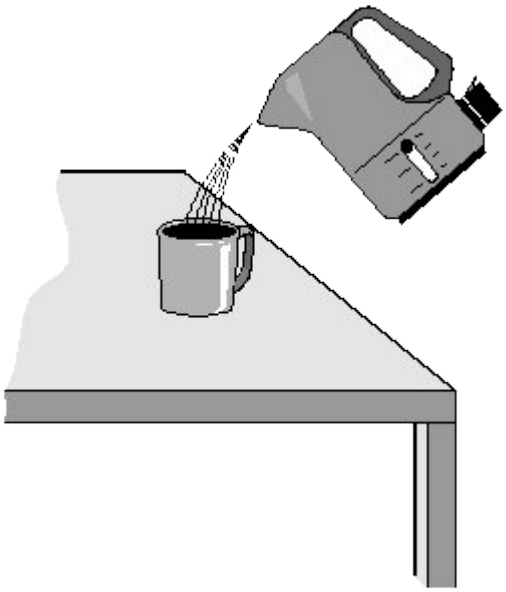
Pay-back time = _____ years

**(1)**

**(Total 4 marks)**

## Q25.

(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 _____ .

**(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?

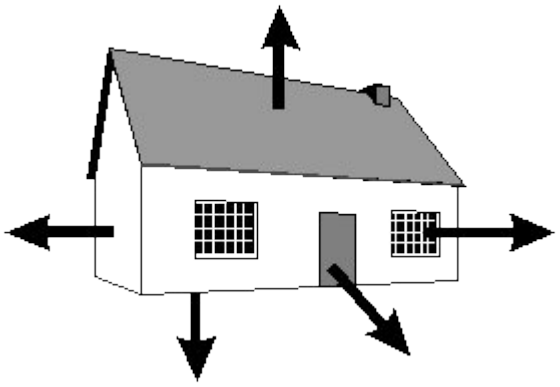
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**(1)**

(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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