

Q1. 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;

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(1)

(ii) the outside walls;

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(1)

(iii) the glass in the windows;

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(1)

(iv) gaps around the front and back doors.

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(1)

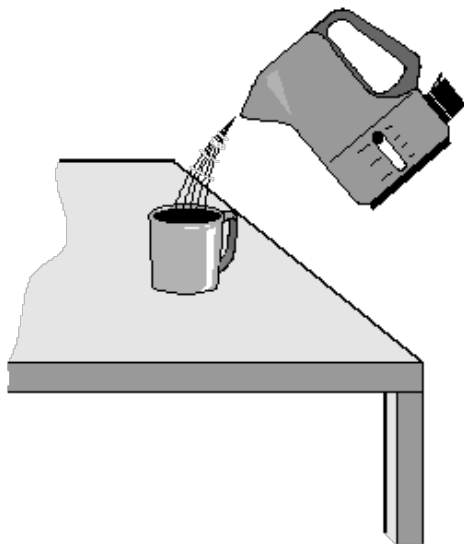
(b) A house is more difficult to keep warm in cold weather. What other type of weather makes it difficult to keep a house warm?

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(1)

(Total 5 marks)

Q2. (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
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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.

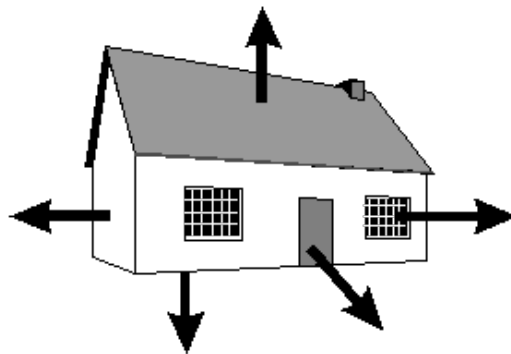
coal	gas	oil	wood
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Which **one** of these types of fuel is renewable?

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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	convection	electric	evaporation	insulator
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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 The curtains will also stop currents pulling cold air into the room through small gaps in the window.

(3)

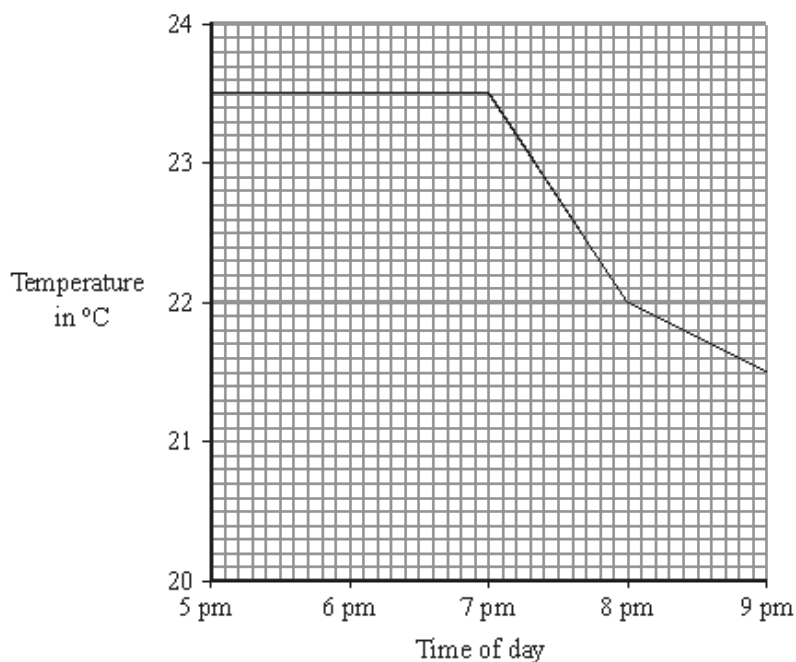
- (ii) Write down **one** other way of reducing heat loss from a house.

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(1)

(Total 7 marks)

- Q3.** (a) The graph shows the temperature inside a flat between 5 pm and 9 pm. The central heating was on at 5 pm.



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

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(1)

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

What time do you think the curtains were closed?

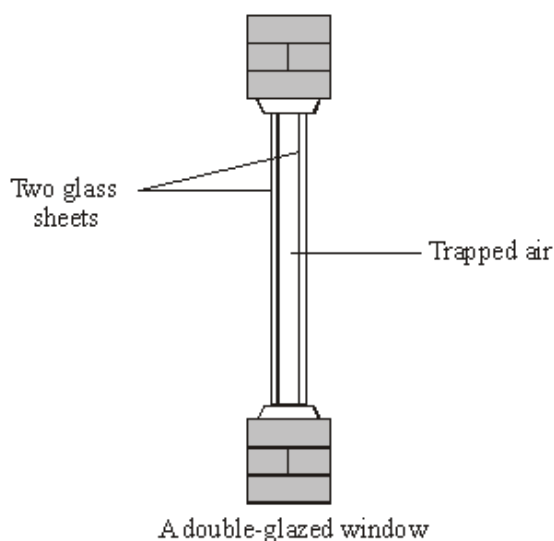
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Give a reason for your answer.

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(2)

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



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 wall insulation	£600	£150	

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

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(1)

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

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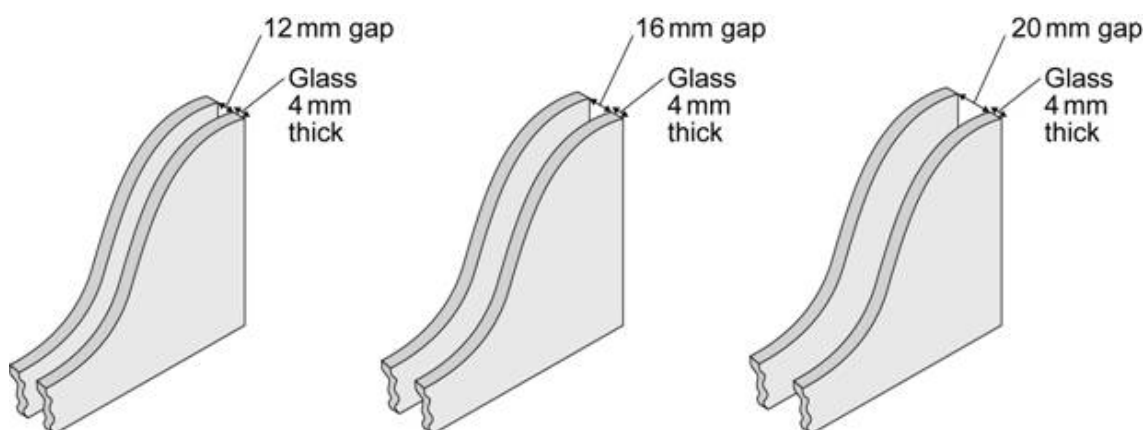
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(2)

(Total 9 marks)

Q4. The diagrams show the cross-section of three double glazed windows.



The gap between the two sheets of glass can be filled with either air or a mixture of air and argon.

The U-values for different types of double glazed windows, using different types of glass **X** and **Y**, are given in the table.

	Type of window	12 mm gap	16 mm gap	20 mm gap
1	Glass type X with air	2.9	2.7	2.8
2	Glass type X with air and argon	2.7	2.6	2.6
3	Glass type Y with air	1.9	1.8	1.8
4	Glass type Y with air and argon	1.6	1.5	1.5

- (a) Which type of window, **1**, **2**, **3** or **4** is the least energy efficient?

.....

(1)

- (b) Which two windows should be compared to decide if adding argon to the gap improves the energy efficiency of the window?

.....

(1)

- (c) A householder is going to buy new windows. The sales assistant recommends that the householder buys windows with a 20 mm gap. These windows are much more expensive than those with a 16 mm gap.

It is **not** worth the householder paying the extra cost to buy 20 mm windows rather than 16 mm windows.

Explain this in terms of energy efficiency.

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.....

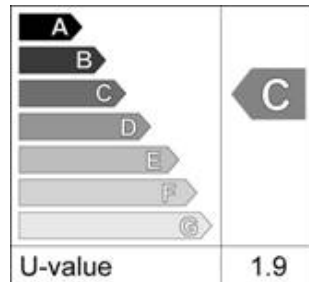
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(2)

- (d) Windows are given an energy rating, from **A** down to **G**. The diagram shows the energy label from one type of double glazed window.



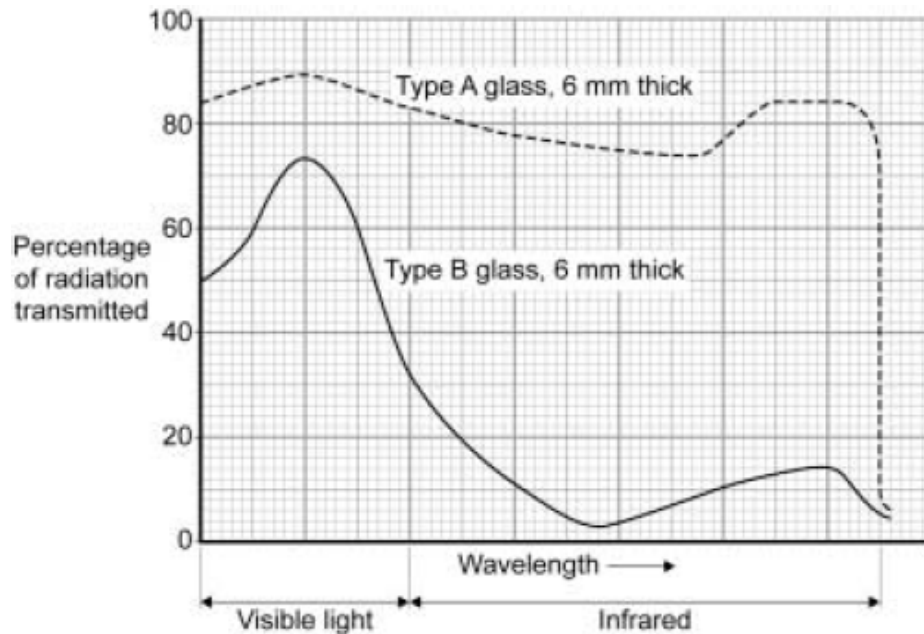
All new double glazed windows must have an energy rating of **C** or above. Windows having a **C rating** have a U-value of 1.9.

Which windows given in the table would the householder be **unable** to buy?

.....

(1)

- (e) Glass transmits infrared radiation and visible light. The amount transmitted depends on the type and thickness of the glass. The data from tests on two different types of glass is displayed in the graph below.



A homeowner has a glass conservatory built on the back of the house. The homeowner tells the builder that the inside of the conservatory should stay as cool as possible throughout the summer.

Explain why the builder uses 'Type B' glass for the conservatory.

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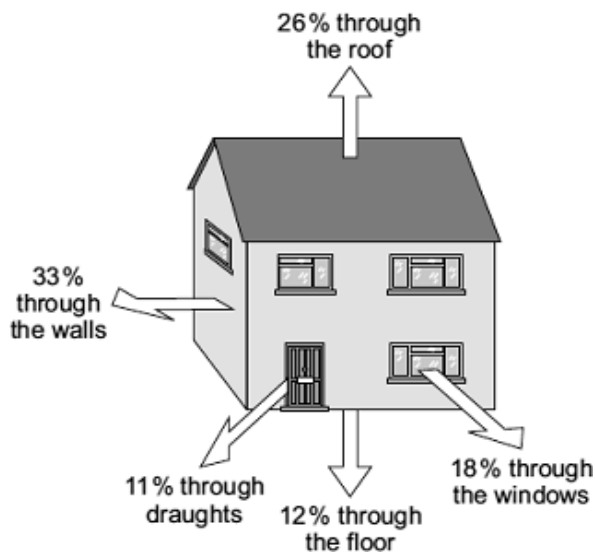
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(2)
(Total 7 marks)

Q5. The diagram shows where heat is lost from a house that is **not** insulated.



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

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(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?

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(1)

- (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.

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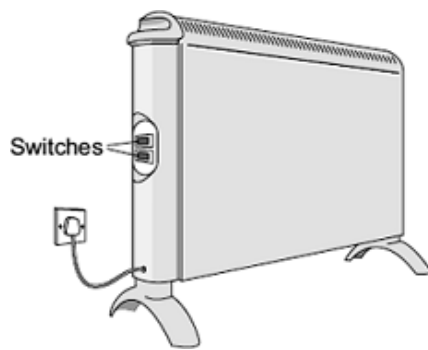
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(2)
(Total 5 marks)

- Q6.** (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)
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Show clearly how you work out your answer.

.....
.....

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
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Show clearly how you work out your answer.

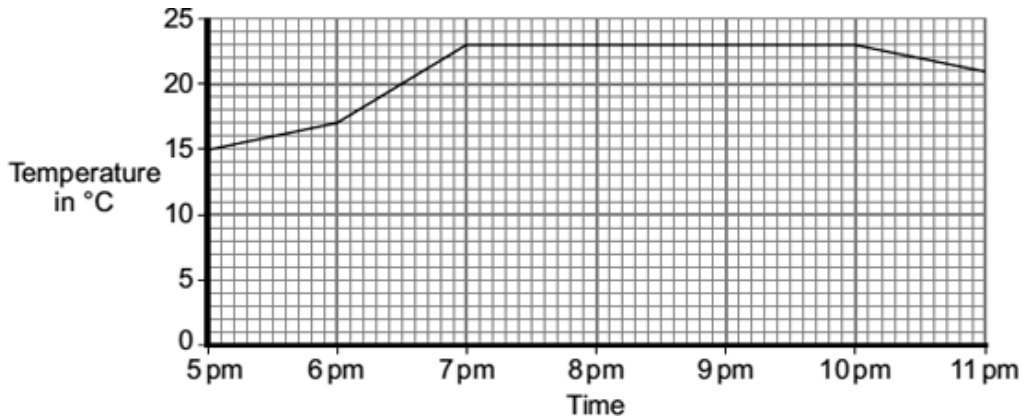
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Total cost = pence

(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)

- (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.

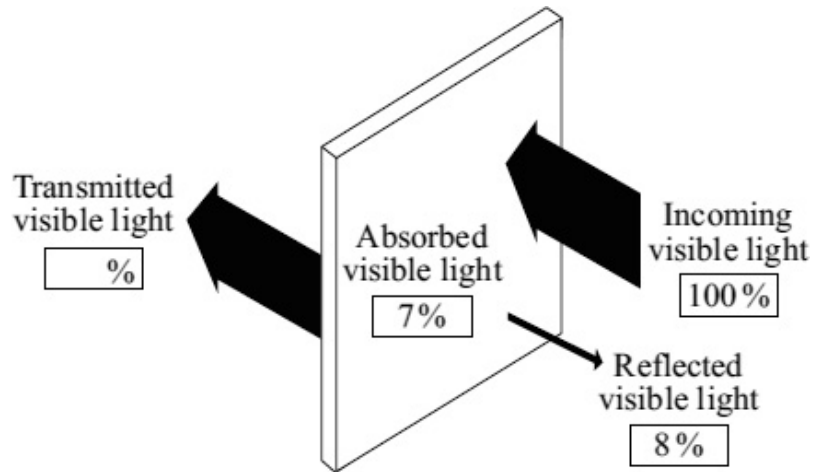
☐

(1)

(Total 8 marks)

Q7. Glass reflects, absorbs and transmits both infra red radiation and visible light.

- (a) The diagram shows the percentages of visible light that are reflected and absorbed by one type of glass.

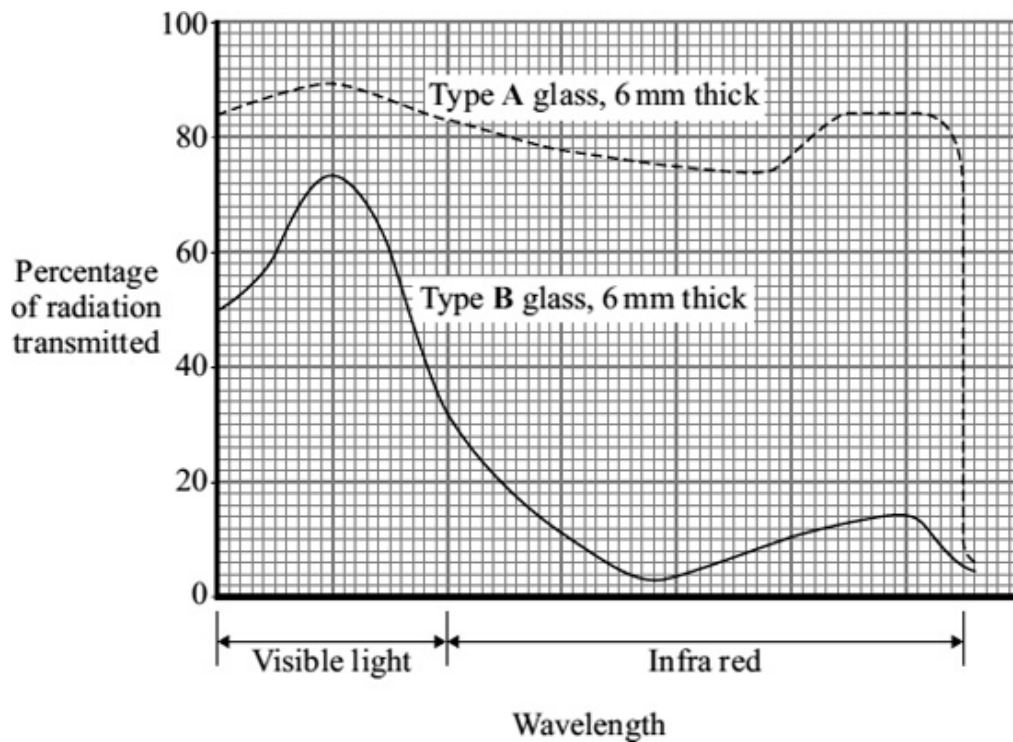


What percentage of visible light is transmitted by this type of glass?

..... %

(1)

- (b) The amounts of infra red radiation and visible light transmitted by glass depend on the type and thickness of glass. The data obtained from tests on two different types of glass is displayed in the graph below.



- (i) To be able to compare the two types of glass, it was important to control one variable.

What variable was controlled in the tests?

.....

(1)

- (ii) A homeowner has a glass conservatory built on the back of the house. The homeowner tells the builder that the inside of the conservatory should stay as cool as possible throughout the summer.

Explain why the builder uses 'type B' glass for the conservatory.

.....

(2)

- (c) Infra red and visible light can be used to send signals along an optical fibre.

Which **one** of the following diagrams, **X**, **Y** or **Z**, shows the path taken by a signal as it travels along an optical fibre?

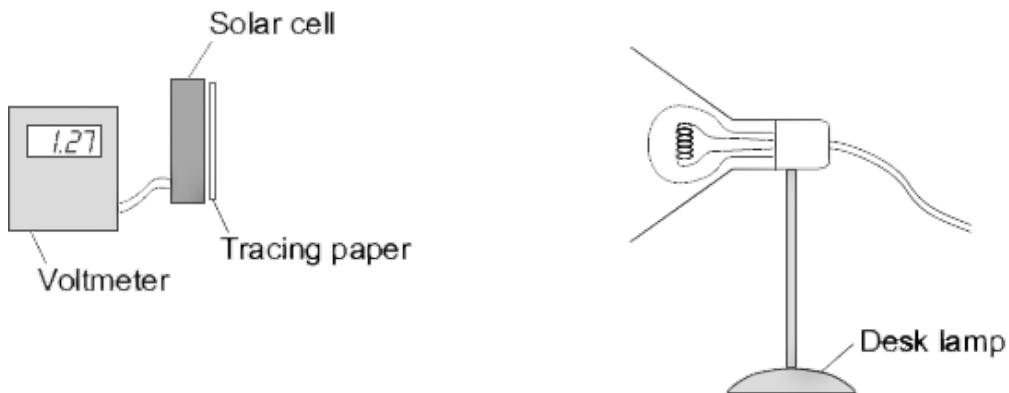
Draw a ring around the correct diagram.



(1)
(Total 5 marks)

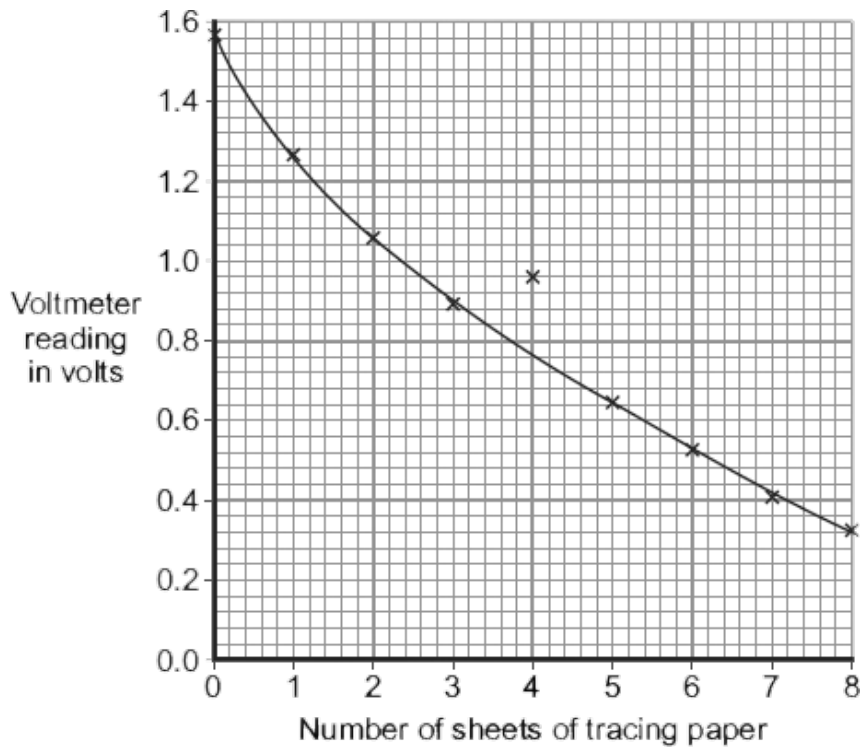
- Q8.** A student has read that a solar cell with a dirty surface will not work as well as a solar cell with a clean surface.

To test the effect of a dirty surface on a solar cell, the student set up the following equipment.



The student put the desk lamp a fixed distance from the solar cell. To represent the effect of a dirty surface, the student covered the surface of the solar cell with pieces of tracing paper. Each time the student added a piece of paper, she measured the output voltage of the solar cell.

(a) The results taken by the student have been used to draw the graph below.



(i) One of the results seems to be anomalous.

Draw a ring around the anomalous data point on the graph.

(1)

(ii) The larger the number of sheets of tracing paper used, the lower the intensity of the light reaching the solar cell.

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

A decrease in the intensity of the light reaching the solar cell causes

a decrease in
no change to
an increase in

(1)

the output voltage from the solar cell.

- (b) People can buy panels of solar cells to generate electricity for their homes. Any surplus electricity can be sold to the electricity supply company.

- (i) Give **one** environmental advantage of generating electricity using solar cells rather than generating electricity in a coal-burning power station.

.....
.....

(1)

- (ii) A homeowner pays £7600 to have solar panels fitted on the roof of their house. The homeowner expects to save £950 each year from reduced energy bills and from selling the electricity.

Assuming these figures to be correct, calculate the pay-back time for the solar panels.

Show clearly how you work out your answer.

.....
.....
.....

Pay-back time = years

(2)

- (iii) Draw a ring around the correct answer in the box to complete the sentence.

Allowing the surface of the solar panels to become very dirty will

decrease
not change
increase

the pay-back time.

(1)

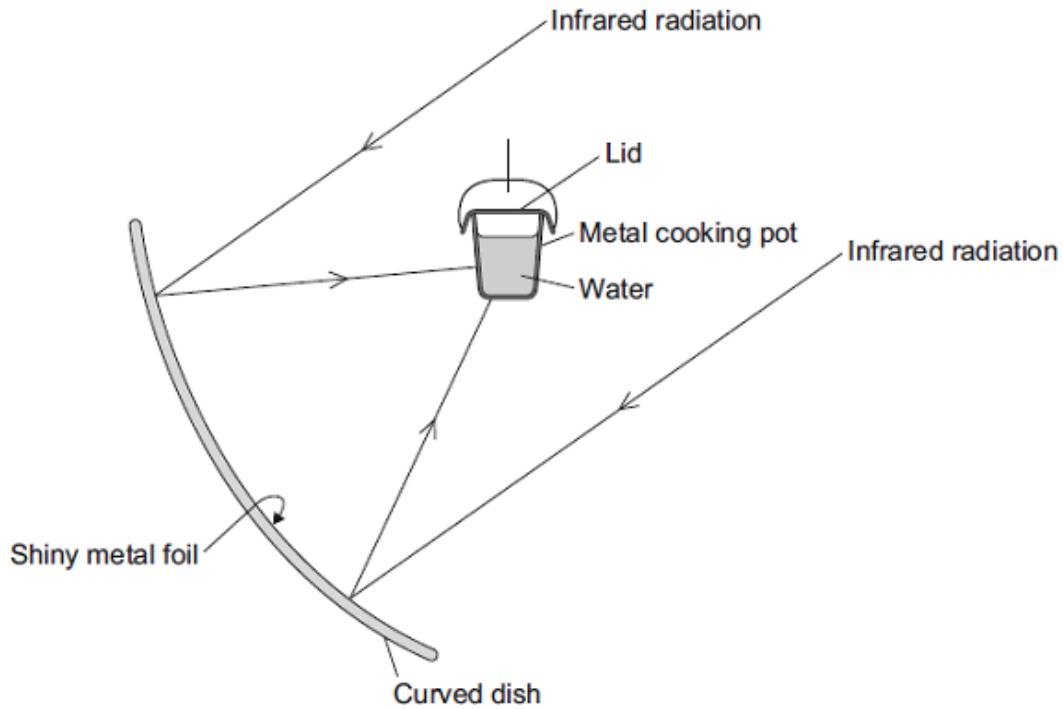
- (iv) Explain your answer to part (b)(iii).

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.....
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.....

(2)

(Total 8 marks)

- Q9.** 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?

.....

(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.

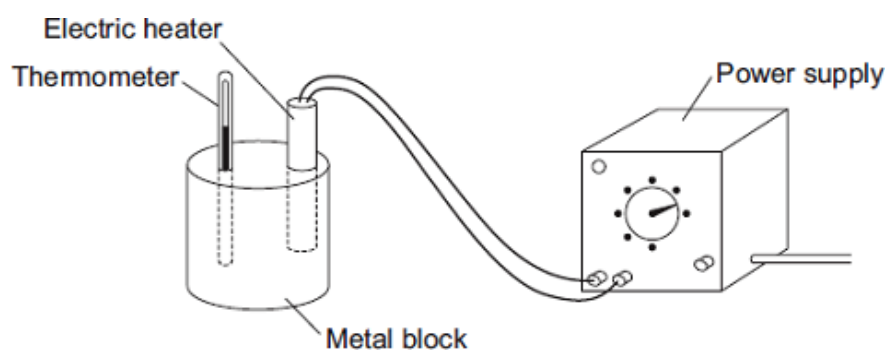
Use the correct equation from the Physics Equations Sheet.

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Energy = J

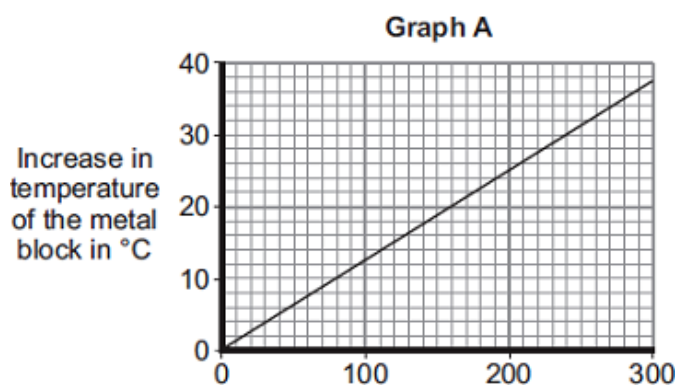
(2)
 (Total 6 marks)

- Q10.** (a) A student used the apparatus drawn below to investigate the heating effect of an electric heater.



- (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.



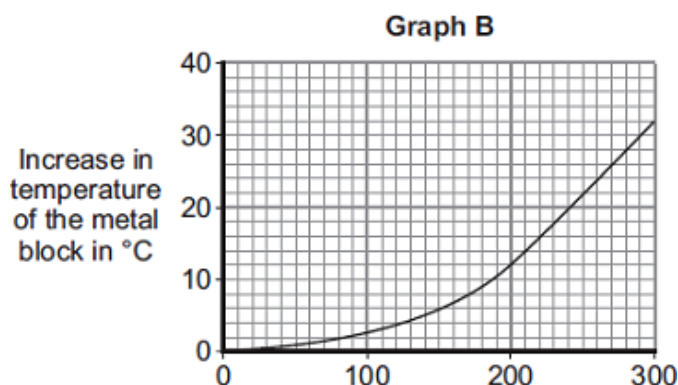
Describe the pattern shown in **Graph A**.

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(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**.



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.

Use the correct equation from the Physics Equations Sheet.

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.....

.....

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

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

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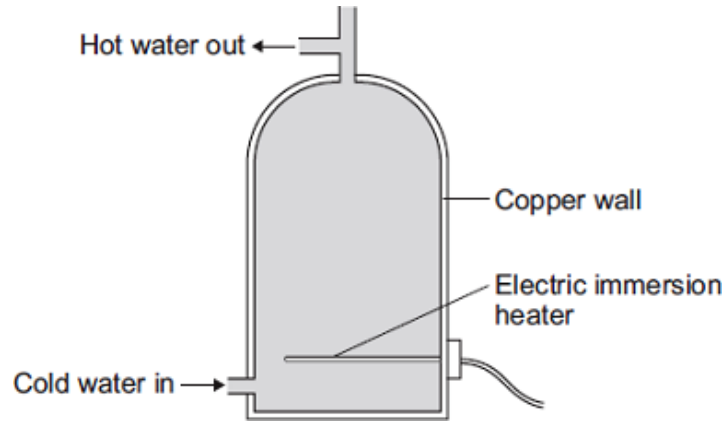
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(2)

- (c) A homeowner uses an electric immersion heater to heat the water in his hot water tank. The hot water tank has no insulation.



- (i) Draw a ring around the correct answer to complete each sentence.

Energy is transferred through the water by

conduction.
convection.
evaporation.

Energy is transferred through the copper wall of the hot water tank by

conduction.
convection.
evaporation.

(2)

- (ii) To keep the water in the tank hot for longer, the homeowner fits an insulating jacket around the tank. The insulating jacket costs £12 to buy.

The homeowner expects to save £16 each year from reduced energy bills.

Calculate the pay-back time for the insulating jacket.

.....
.....

Pay-back time = years

(2)

(Total 11 marks)

