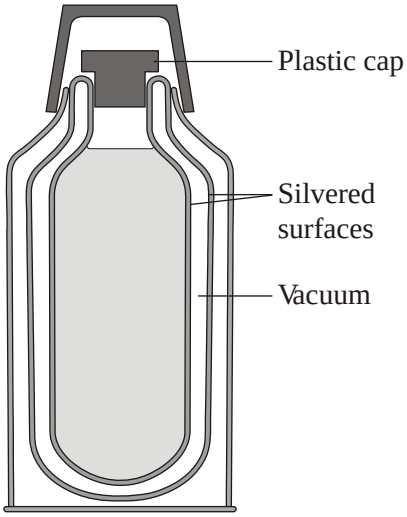
The transfer of energy by heating processes

1. A vacuum flask is designed to reduce the rate of heat transfer.



(a) (i) Complete the table to show which methods of heat transfer are reduced by each of the features labelled in the diagram.

The first row has been done for you.

Feature	Conduction	Convection	Radiation
vacuum	✓	✓	
silvered surfaces			
plastic cap			

(2)

(ii) Explain why the vacuum between the glass walls of the flask reduces heat transfer by conduction and convection.

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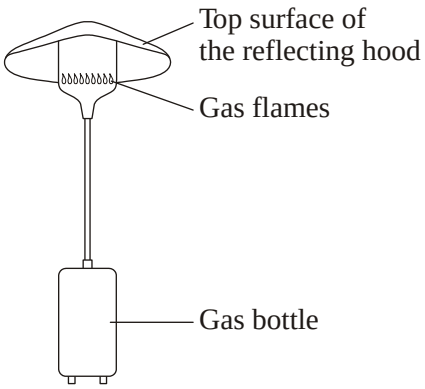
(2)

(b) The diagram shows a gas flame patio heater.



(i) Explain why the top surface of the reflecting hood should be a light, shiny surface rather than a dark, matt surface.

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(2)

(ii) Most of the chemical energy in the gas is transformed into heat. A **small** amount of chemical energy is transformed into light.

Draw and label a Sankey diagram for the patio heater.

(2)

(iii) State why the total energy supplied to the patio heater must always equal the total energy transferred by the patio heater.

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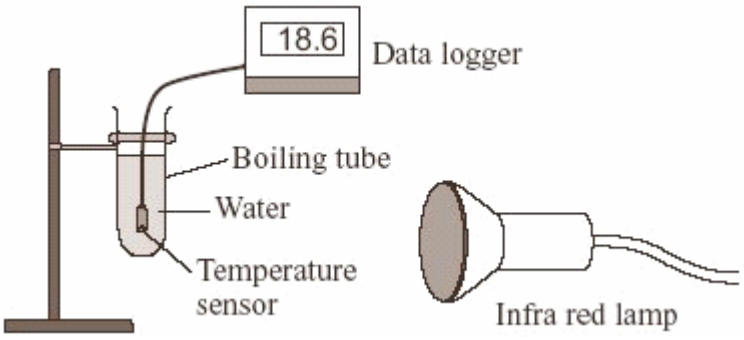
(1)
(Total 9 marks)

2. A student had read about a glacier that had been covered in insulating material. The idea was to slow down the rate at which the glacier melts in the summer.

She investigated this idea using the apparatus shown in the diagram.



(a) These are the steps taken by the student.

- Measure 30 cm^3 of cold water into a boiling tube.
- Place the boiling tube 25 cm from an infra red lamp.
- Record the temperature of the water.
- Switch on the infra red lamp.
- Record the temperature of the water every minute for 5 minutes.
- Repeat with boiling tubes covered in different insulating materials.

(i) Why did she use an infra red lamp?

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(1)

(ii) Name **one** control variable in this investigation.

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(1)

(iii) Give **one** advantage of using a temperature sensor and data logger instead of a glass thermometer to measure temperature.

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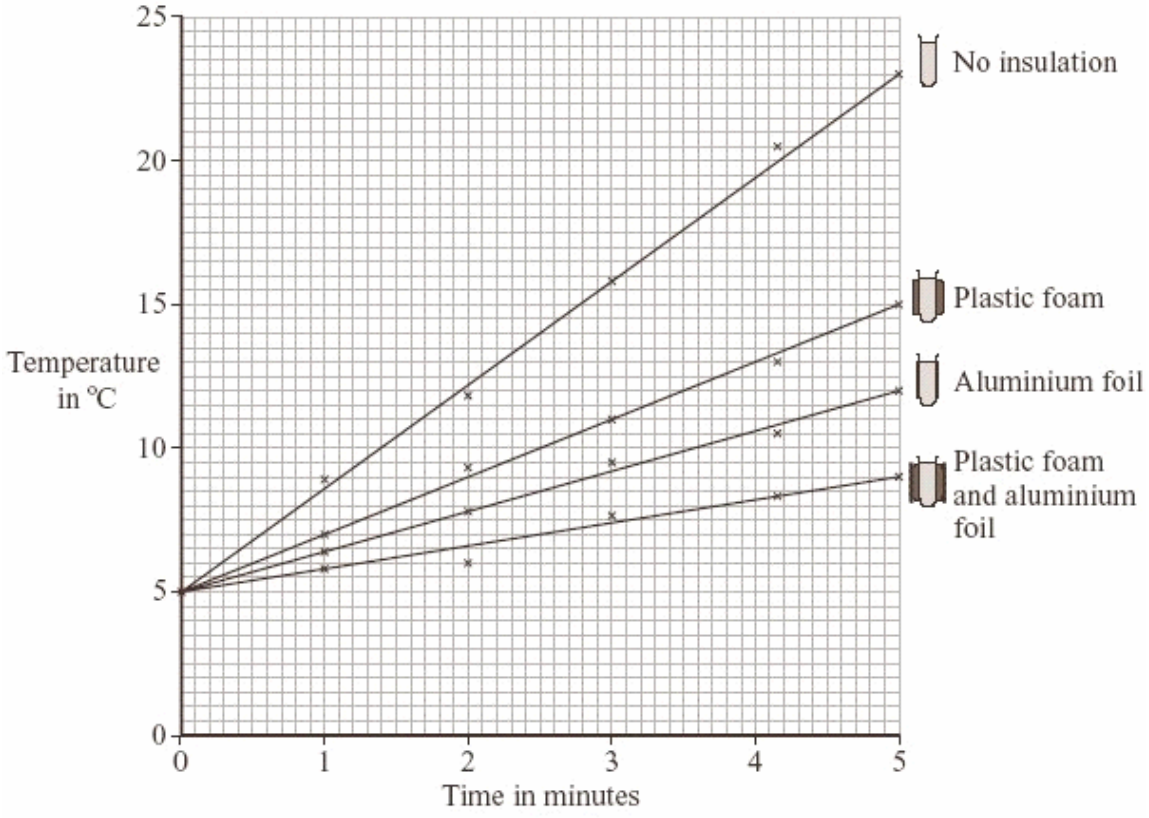
(1)

(b) The results of the investigation are shown in the graph.



(i) Why did the student use a boiling tube with no insulation?

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(1)

(ii) From her results, what should she recommend is used to insulate the glacier?

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(1)

(iii) Explain why the insulation recommended by the student will reduce the heat transfer from the Sun to the glacier.

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(2)

(c) Explain, in terms of particles, how heat is transferred through the glass wall of a boiling tube.

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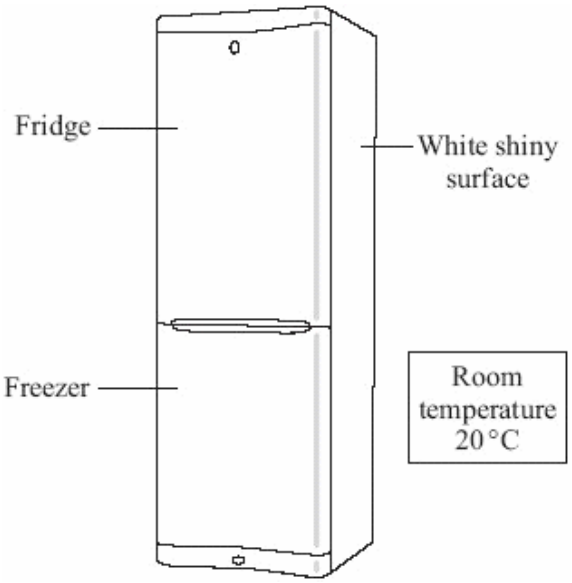
(2)
(Total 9 marks)

3. The diagram shows a fridge-freezer.



(a) By which method is heat transferred through the walls of the fridge-freezer?

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(1)

(b) The inside of the fridge is at 4 °C. The inside of the freezer is at –18 °C.
Into which part of the fridge-freezer will the rate of heat transfer be greater?
Draw a ring around your answer.

the fridge **the freezer**

Give a reason for your answer.

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(1)

(c) The outside surface of the fridge-freezer is white and shiny.
Give **two** reasons why this type of surface is suitable for a fridge-freezer.

1 .....

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2 .....

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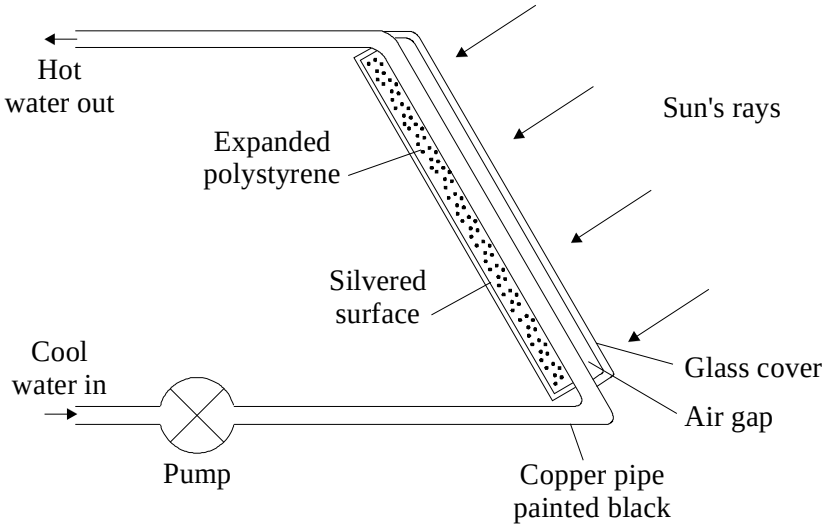
(2)
(Total 4 marks)

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



(i) Complete the following sentence.

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

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(1)

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

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(1)

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

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(1)

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

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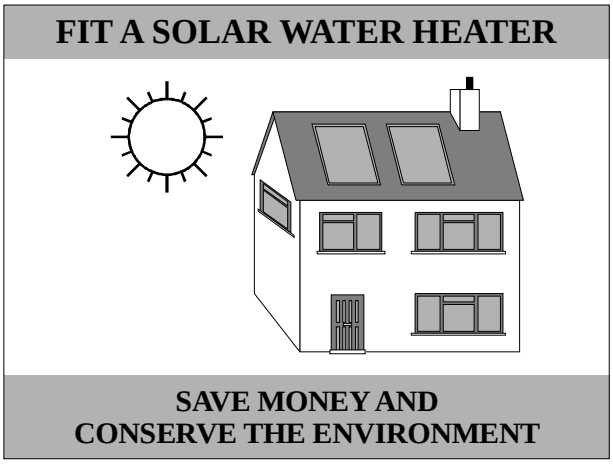
(2)

(b) The picture shows an advertisement for a solar water heater.



Installing the solar water heater may help to conserve the environment. Explain how.

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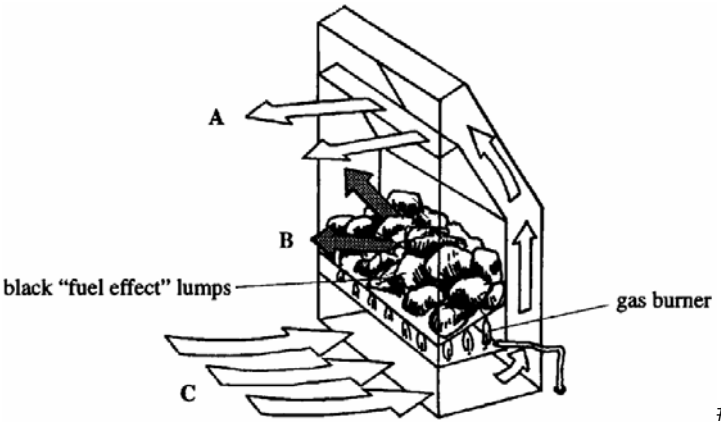
(2)
(Total 7 marks)

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



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(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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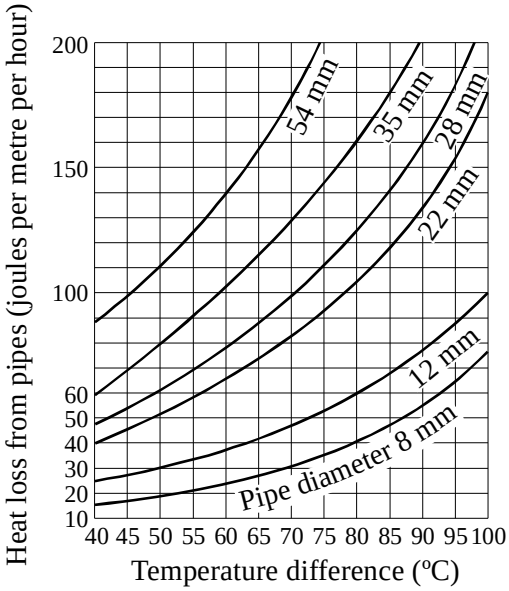
(1)
(Total 6 marks)

6. Many houses are kept warm by water, heated in a boiler, then circulated through the house by copper pipes to radiators.

The graph below gives information about the heat losses from copper pipes in such circumstances.



(a) One factor which affects the total amount of heat loss from the pipes, is the temperature difference between the pipes and the surrounding air.

What are the other **three** factors indicated on the graph?

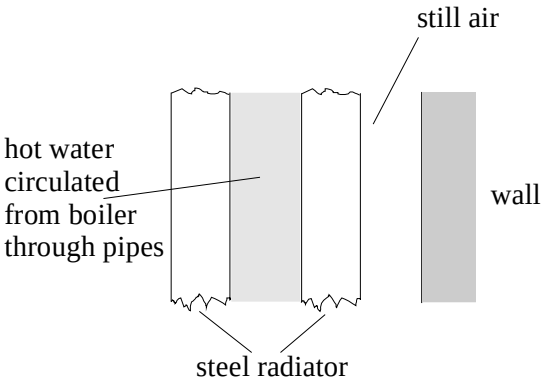
1. .....

2. .....

3. .....

(3)

(b)



Describe, as fully as you can, how heat from inside the boiler reaches the wall behind a radiator.

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(4)
(Total 7 marks)