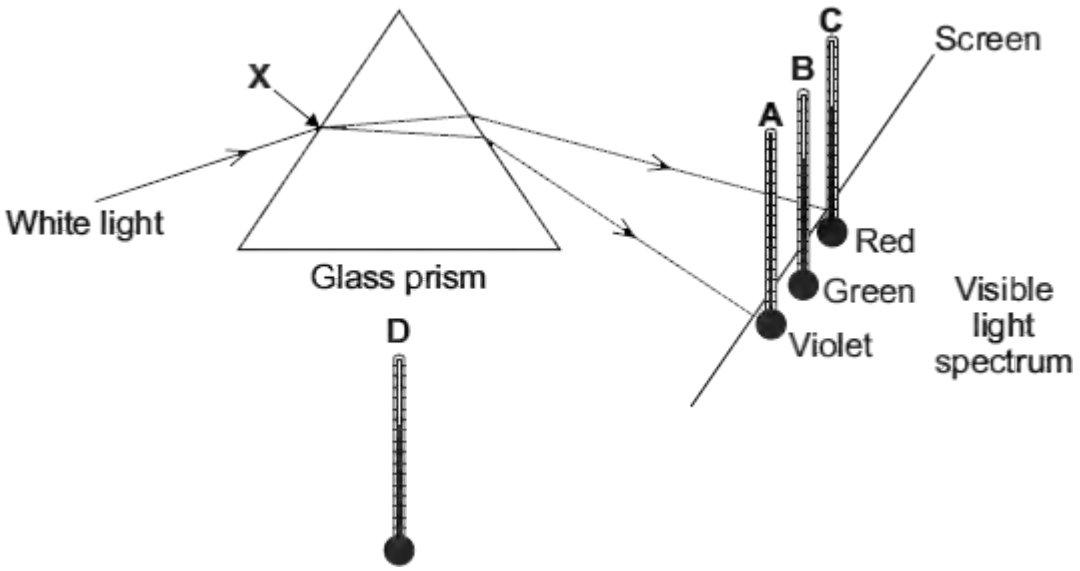
Q1. The diagram shows the apparatus that a student used to investigate the heating effect of different wavelengths of light.



(a) (i) The student put thermometer **D** outside of the light spectrum.

Suggest why.

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(1)

(ii) The table gives the position and reading of each thermometer 10 minutes after the investigation started.

Thermometer	Position of thermometer	Temperature in °C
A	in violet light	21
B	in green light	22
C	in red light	24
D	outside the spectrum	20

What should the student conclude from the data in the table?

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(2)

(b) A similar investigation completed in 1800 by the scientist Sir William Herschel led to the discovery of infrared radiation.

Suggest how the student could show that the spectrum produced by the glass prism has an infrared region.

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(2)

(c) A person emits infrared radiation at a frequency of 3.2×10^{13} Hz.

Calculate the wavelength of the infrared radiation that a person emits.

Take the speed of infrared radiation to be 3.0×10^{8} m/s.

Show clearly how you work out your answer.

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Wavelength = ... m

(2)

(d) A thermal imaging camera detects infrared radiation. Electronic circuits inside the camera produce a visible image of the object emitting the infrared radiation.

At night, police officers use thermal imaging cameras to track criminals running away from crime scenes.

Thermal imaging cameras work better at night than during the day.

Explain why.

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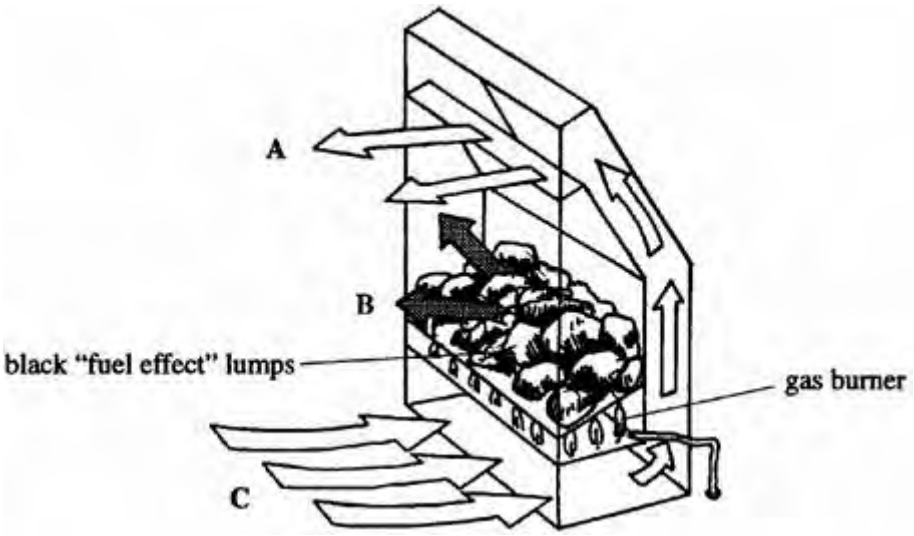
(2)
(Total 9 marks)

Q2. The diagram comes from a leaflet about a "coal effect" gas fire.
It shows how air circulates through the fire.



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

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(4)

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

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

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(1)

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

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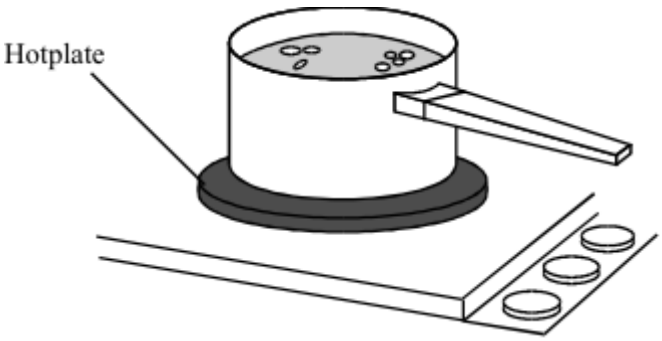
(1)

(Total 6 marks)

Q3. The drawing shows water being heated in a metal saucepan.



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

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(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

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(3)

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

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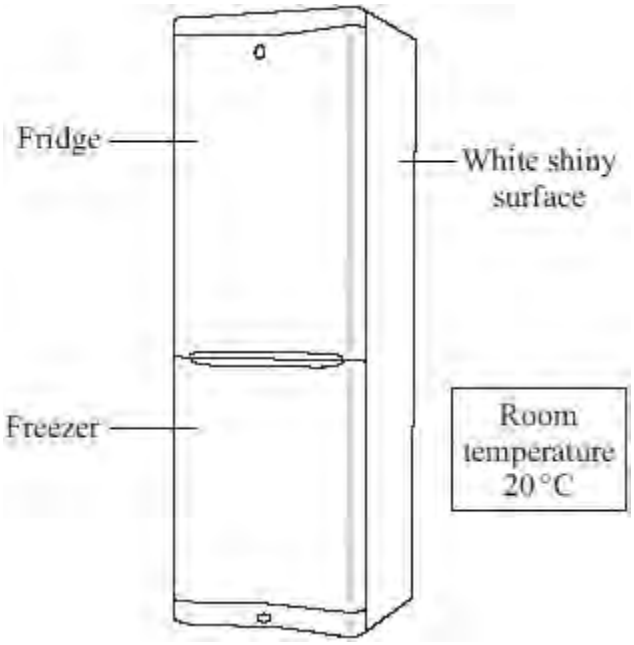
(1)
(Total 6 marks)

Q4. 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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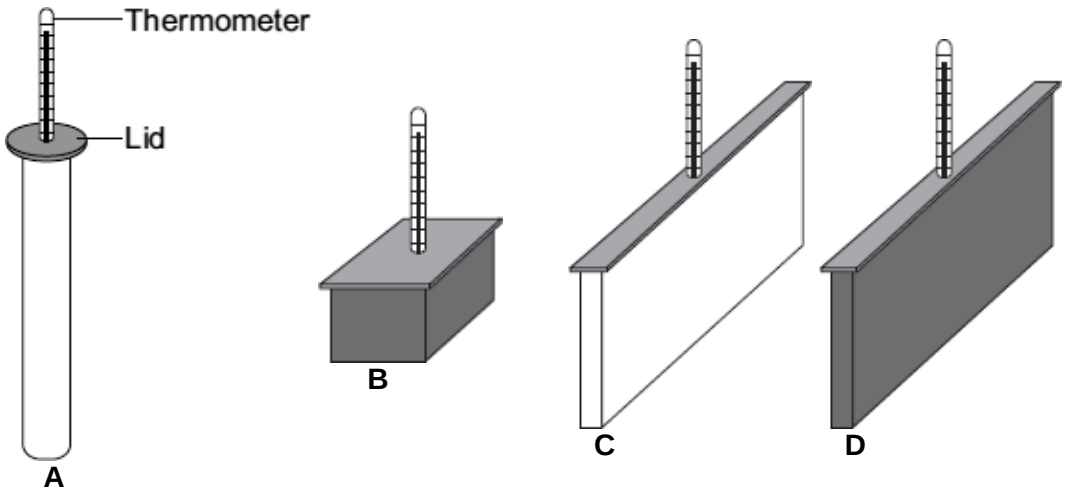
(2)
(Total 4 marks)

Q5. A student investigated the effect of shape and colour on heat transfer.

The student used metal containers with the same volume but with different shapes and outside colour. The containers were each filled with water at 100 °C.
After 20 minutes the temperature of the water inside each container was measured.



The results from the investigation are given in the table.

Container	Colour	Temperature after 20 minutes in °C	Temperature fall in °C
A	White	86	14
B	Black	86	14
C	White	73	27
D	Black	60	40

(i) The student uses the results in the table to see if shape has affected heat transfer.

Which containers should the student compare to do this?

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Give a reason for your answer.

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(1)

(ii) Explain why the temperature of the water in both containers **A** and **B** fell by the same amount.

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(2)

(iii) A central heating system has several radiators joined together. The hot water goes from the boiler, through each radiator in turn and then back to the boiler for reheating.

Give **one** reason, other than appearance, why it might **not** be a good idea to paint radiators black.

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(1)
(Total 4 marks)