1 A solar panel is mounted on the roof of a house. Fig. 4.1 shows a section through part of the solar panel.

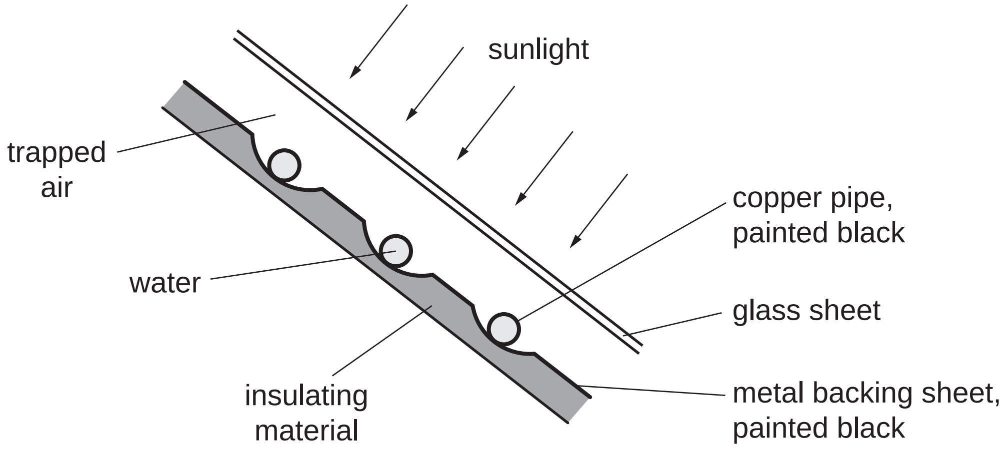

Fig. 4.1

A pump makes water flow through the copper pipes. The water is heated by passing through the solar panel.

(a) Select and explain **three** features of the solar panel that maximise the final temperature of the water.

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.... [4]

(b) During one day, 250 kg of water is pumped through the solar panel. The temperature of this water rises from 16 °C to 38 °C.

The water absorbs 25 % of the energy incident on the solar panel. The specific heat capacity of water is 4200 J / (kg °C).

Calculate the energy incident on the solar panel during that day.

energy = ... [4]

(c) The solar panel in Fig. 4.1 is designed to heat water.

A person is deciding whether to install solar panels on her house.

List and explain **three** pieces of information she needs to consider in order to make her decision.

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.... [4]

(d) The Sun releases energy as a result of nuclear fusion.

State the meaning of *nuclear fusion*.

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.... [2]

[Total: 14]

2 Fig. 4.1 shows a cross-section of a double-walled glass vacuum flask, containing a hot liquid. The surfaces of the two glass walls of the flask have shiny silvered coatings.

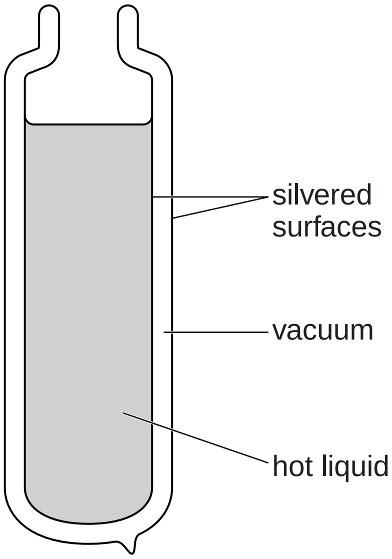

Fig. 4.1

(a) Explain

(i) why the rate of loss of thermal energy through the walls of the flask **by conduction** is very low,

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....

....

(ii) why the rate of loss of thermal energy through the walls of the flask **by radiation** is very low.

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[3]

(b) Suggest, with reasons, what must be added to the flask shown in Fig. 4.1 in order to keep the liquid hot.

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.... [3]

[Total: 6]

3 One side of a copper sheet is highly polished and the other side is painted matt black.

The copper sheet is very hot and placed in a vertical position, as shown as in Fig. 5.1.

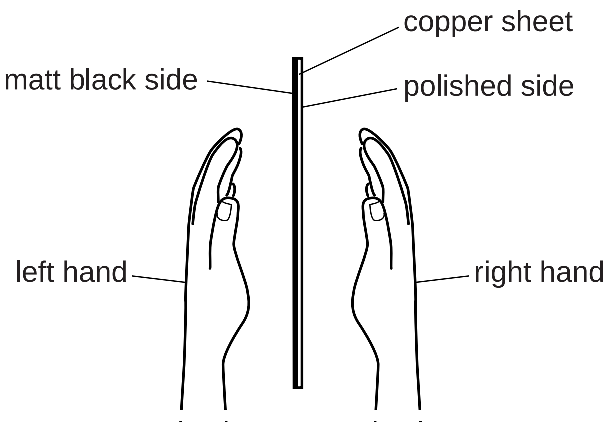

Fig. 5.1

A student places her hands at equal distances from the sheet, as shown in Fig. 5.1.

(a) Explain

(i) why her hands are not heated by **convection**,

....

.... [1]

(ii) why her hands are not heated by **conduction**.

....

.... [1]

(b) State and explain which hand gets hotter.

....

....

.... [2]

(c) It is suggested that one side of the copper sheet cools to a lower temperature than the other side.

Explain why this does not happen.

....

....

.... [2]

[Total: 6]

4 Fig. 5.1 shows two identical metal cans, open at the top, used in an experiment on thermal energy. The outside of can A is polished and the outside of can B is painted black.

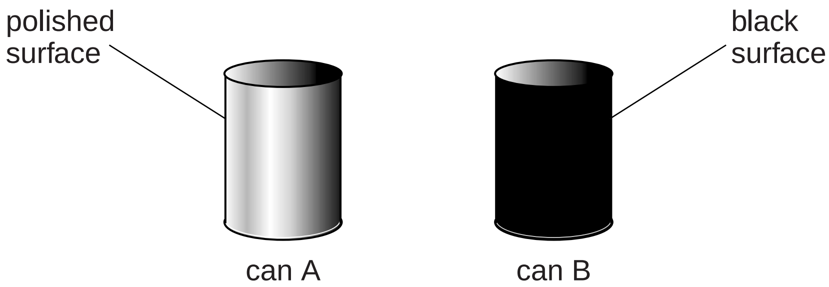

Fig. 5.1

(a) The cans are heated to the same temperature. Predict and explain the relative rates of loss of thermal energy by infra-red radiation from the two cans.

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.... [2]

(b) **(i)** A student is provided with the two cans, a supply of hot water and two thermometers.

Describe the experiment he should carry out to test your answer to **(a)**.

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.... [4]

(ii) Another student is given the same equipment but finds two polystyrene tiles. Fig. 5.2 shows the tiles alongside the cans.

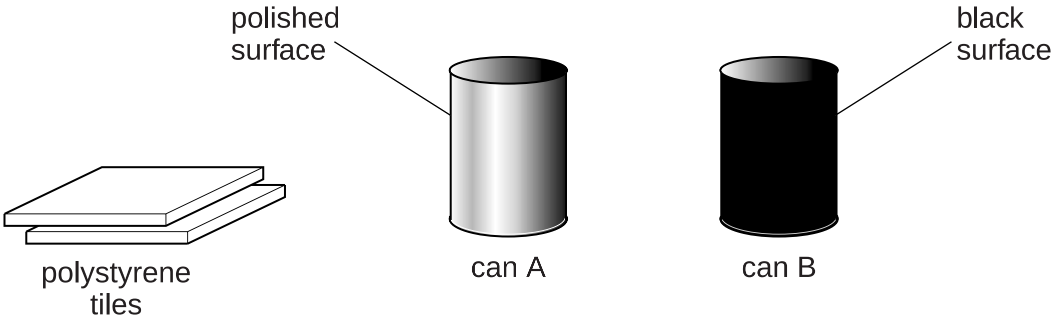

Fig. 5.2

State how she could use the tiles to improve the experiment, and explain why this is effective.

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.... [2]

(c) The two cans are now filled with cold water and placed equal distances from a strong source of infra-red radiation.

State and explain which can of water heats up more quickly.

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....

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.... [2]

[Total: 10]

5 .

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(a) .

. 1.1.

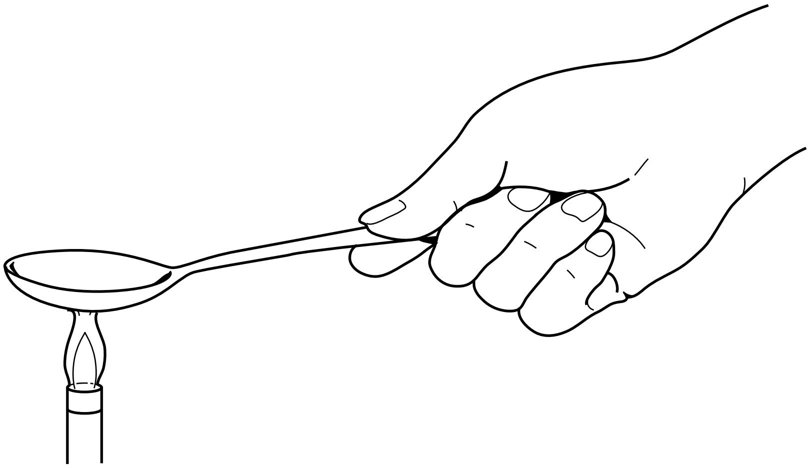

Fig. 1.1

(i) k .

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.... 1

(ii) .

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....

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(b)

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6 **(a)**

(i) ....

(ii) . ...
1

(b) . 10.1 1.2 kΩ .
.

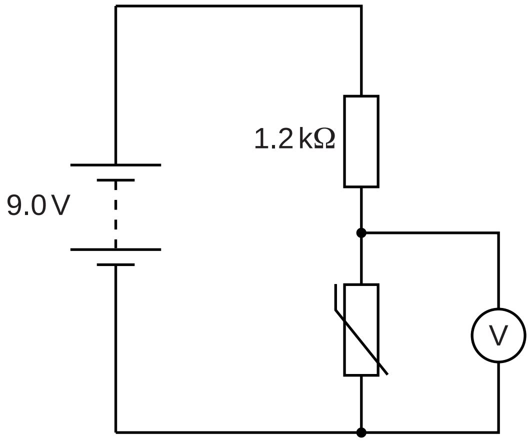

Fig. 10.1

. kΩ.

....

(c) . 10.2 .

.

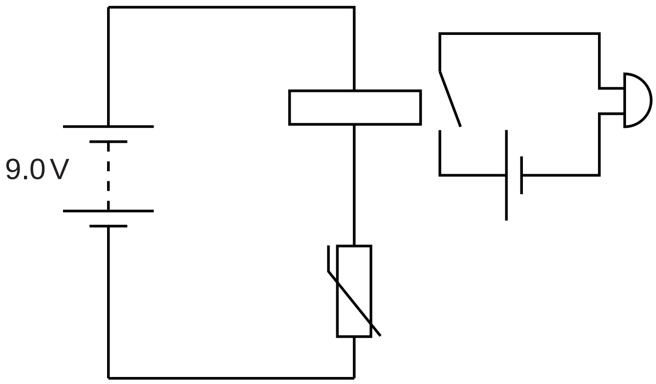

Fig. 10.2

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