1 A thermometer uses the value of a physical property to indicate the temperature.

(a) A particular thermometer is sensitive, linear and has a wide range.

Draw a straight line from each characteristic of this thermometer to the appropriate feature.

characteristic of thermometer	feature of thermometer
	reacts quickly to change of temperature
sensitive	
	large difference between highest and lowest measurable temperatures
linear	same change of physical property for same change of temperature
	fixed points at 0°C and 100°C
wide range	
	large change of physical property for small change of temperature

[3]

(b) **(i)** In the space below, draw a diagram to show the structure of a thermocouple thermometer.

(ii) Explain why a thermocouple thermometer is particularly well suited to measure

1. high temperatures,

.....

.....

2. very rapidly changing temperatures.

.....

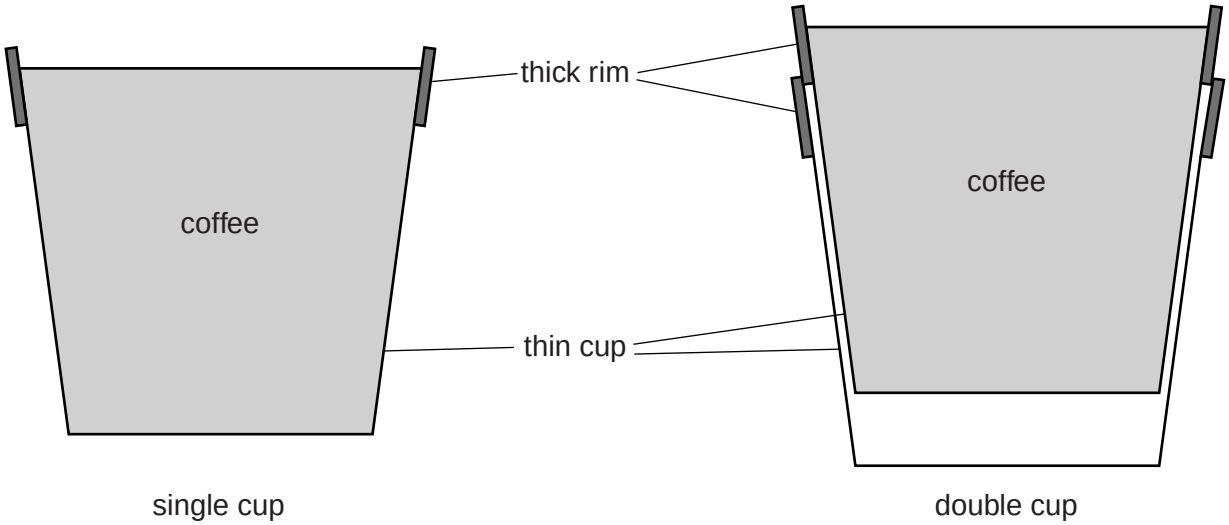
.....

[2]

[Total: 7]

2 Fig. 5.1 shows a thin plastic cup containing hot coffee, which an IGCSE Physics student gets from a machine.

Fig. 5.2 shows how another student, who finds an empty second cup, has placed his identical cup of coffee inside this second cup.



single cup

Fig. 5.1

double cup

Fig. 5.2

(a) Suggest and explain a difference that the students will feel when holding the cups.

.....

.....

.....

..... [2]

(b) The students discuss this experience with their teacher, who makes hot drinks the subject of an experiment.

The same volume of hot water at the same temperature is placed in the single cup and in the double cup.

The temperature of the water in each cup is recorded for 10 minutes.

Fig. 5.3 shows the cooling curve for the water in the single cup.

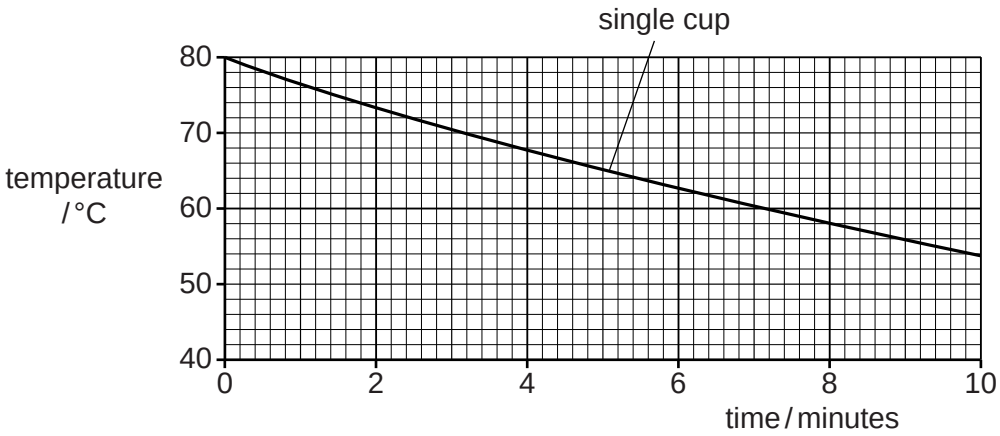


Fig. 5.3

On Fig. 5.3, sketch and label a possible cooling curve for the water in the double cup. [2]

(c) Explain why a cup of coffee cools more slowly when a lid is placed over the cup.

.....

.....

.....

.....

..... [2]

[Total: 6]

3 Solar panels are positioned on the roof of the house shown in Fig. 6.1. They use thermal energy from the Sun to provide hot water in an environmentally friendly way.

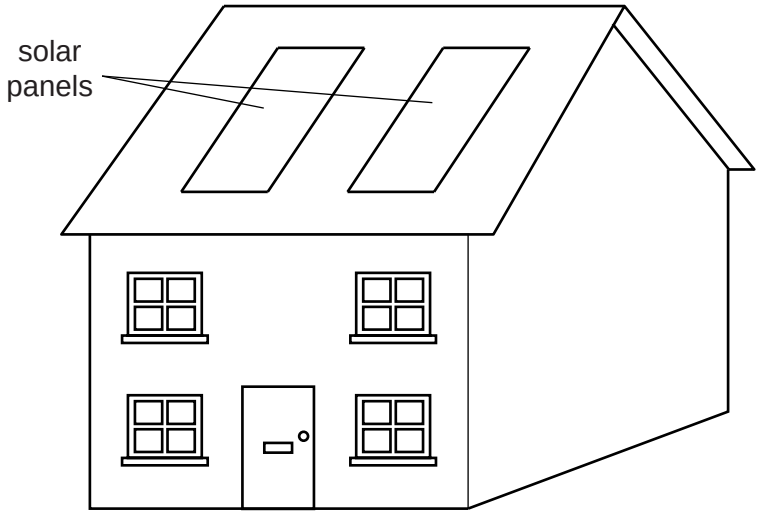


Fig. 6.1

Cold water flows to the panels at 15 °C. During the day, the panels supply 3.8 kg of hot water at 65 °C every hour.

(a) Calculate the average energy that the solar panels deliver to the water in one hour. Specific heat capacity of water = 4200 J / (kg °C).

energy = ... [3]

(b) The solar power incident on the roof during this heating period is 170 W / m^2. The solar panels have a total area of 8.0 m^2.

Calculate the solar energy incident on the panels in one hour.

solar energy = ... [2]

(c) Calculate the efficiency of the solar panels, stating the equation you use.

efficiency = ... [2]

(d) Explain why solar energy is called *renewable* energy.

.....

..... [1]

(e) State one disadvantage of using solar energy.

.....

..... [1]

[Total: 9]

4 A mass of 0.36 kg of a certain substance is in the solid state in a well-insulated container. The substance is heated at the rate of 1.2×10^4 J/minute.

2.0 minutes after starting the heating, the substance is all at the same temperature, and it starts to melt.

11.0 minutes after starting the heating, the substance finishes melting and the temperature starts to rise again.

(a) Calculate the specific latent heat of the substance.

specific latent heat = ...[3]

(b) **(i)** After 11 minutes of heating, when the temperature starts rising again, in which state is the substance?

.....[1]

(ii) Describe what happens to the molecules as thermal energy is supplied to them in this state.

.....

.....

.....

.....[2]

[Total: 6]

5 Use the information in the table when answering this question.

specific heat capacity of ice	2.0 J/(g °C)
specific heat capacity of water	4.2 J/(g °C)
specific latent heat of fusion of ice	330 J/g
specific latent heat of vaporisation of water	2260 J/g

(a) Explain what is meant by the statement: 'the specific latent heat of fusion of ice is 330 J/g'.

.....

.....

.....[1]

(b) A block of ice is taken from a freezer at –25 °C, placed in a metal container, and heated by a source of constant power.

The graph in Fig. 4.1 shows how the temperature of the contents of the container changes with time. At point E on the graph the container is empty.

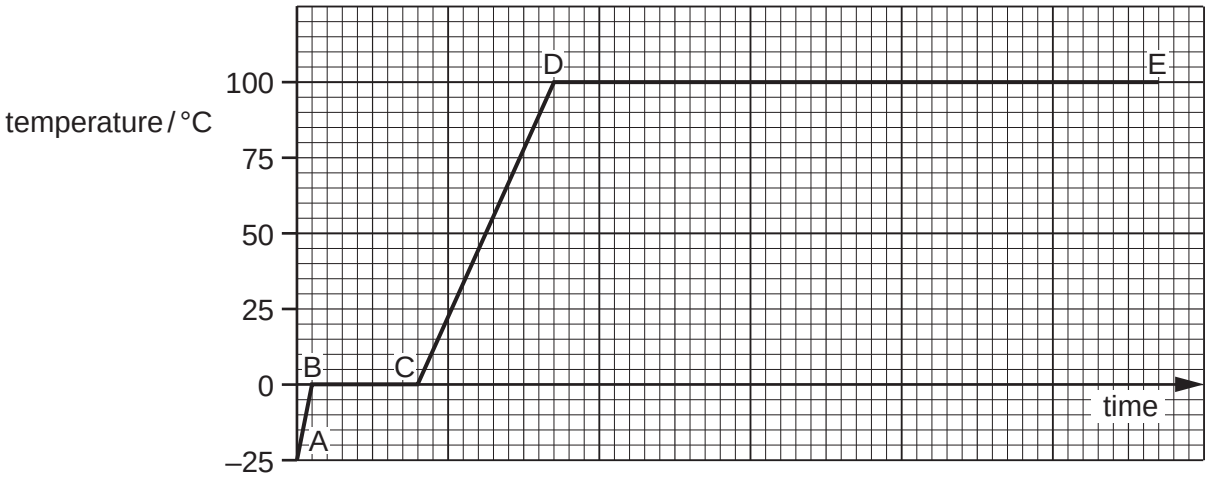


Fig. 4.1

(i) State what is taking place in the regions of the graph from B to C, and from D to E.

B to C .....

.....

D to E .....

.....[2]

(ii) Use the information in the table to explain why the line DE is longer than the line BC.

.....

.....

.....[1]

(iii) Use the information in the table to explain why the graph is steeper from A to B than from C to D.

.....

.....

.....[2]

[Total: 6]

6 **(a)** Equal volumes of a gas held at constant pressure, a liquid and a solid undergo the same temperature rise.

(i) State which of the three, solid, liquid or gas,

1. expands the most, ...

2. expands the least. .....

(ii) Explain why the pressure of the gas must be kept constant for this comparison.

.....

.....[2]

(b) Fig. 5.1 shows an alcohol thermometer.

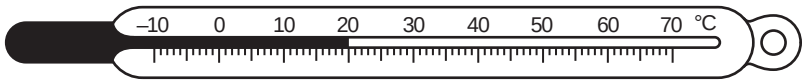


Fig. 5.1

(i) State two properties of alcohol which make it suitable for use in a thermometer.

1. .....

.....

2. .....

.....[2]

(ii) State **two** changes to the design of this thermometer which would make it more sensitive.

1. .....

.....

2. .....

.....[2]

(c) Explain why it is an advantage for the glass surrounding the alcohol in the bulb of the thermometer to be very thin.

.....

.....[1]

[Total: 7]