

# Thermal Properties and Temperature

## Question Paper 8

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Thermal Physics
Sub-Topic	Thermal Properties and Temperature
Paper Type	(Extended) Theory Paper
Booklet	Question Paper 8

**Time Allowed:** 63 minutes

**Score:** /52

**Percentage:** /100

- 1 Some water is heated electrically in a glass beaker in an experiment to find the specific heat capacity of water. The temperature of the water is taken at regular intervals.

The temperature-time graph for this heating is shown in Fig. 4.1.

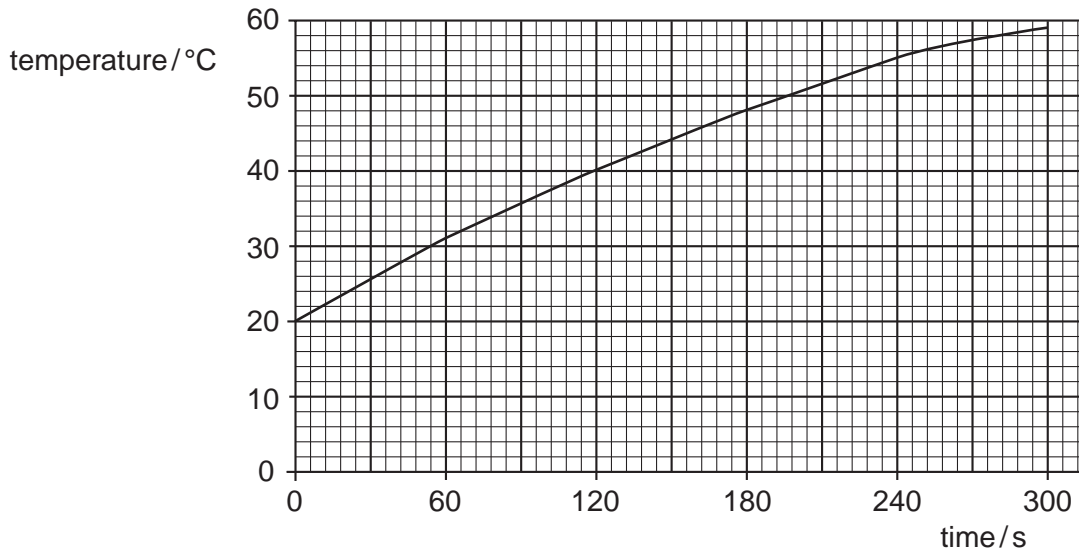


Fig. 4.1

(a) (i) Use the graph to find

1. the temperature rise in the first 120 s,

.....

2. the temperature rise in the second 120 s interval.

.....

(ii) Explain why these values are different.

.....

.....

[2]

- (b) The experiment is repeated in an insulated beaker. This time, the temperature of the water increases from 20°C to 60°C in 210s. The beaker contains 75g of water. The power of the heater is 60W. Calculate the specific heat capacity of water.

specific heat capacity = .....[4]

- (c) In order to measure the temperature during the heating, a thermocouple is used. Draw a labelled diagram of a thermocouple connected to measure temperature.

[2]

[ Total : 8]

- 2 Fig. 4.1 shows apparatus that a student uses to make an estimate of the specific heat capacity of iron.

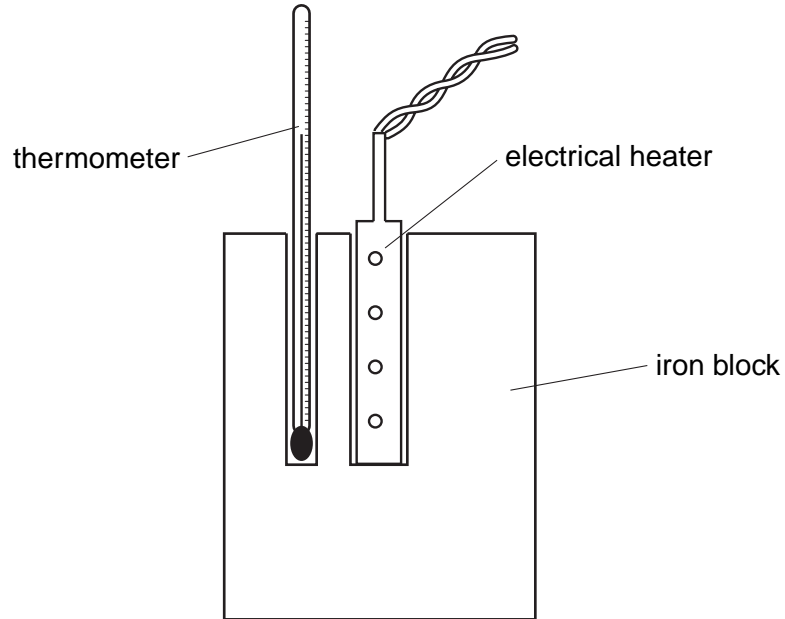


Fig. 4.1

- (a) The power of the heater is known. State the four readings the student must take to find the specific heat capacity of iron.

1. ....
2. ....
3. ....
4. .... [3]

- (b) Write down an equation, in words or in symbols, that could be used to work out the specific heat capacity of iron from the readings in (a).

(c) (i) Explain why the value obtained with this apparatus is higher than the actual value.

.....

..... [1]

(ii) State one addition to the apparatus that would help to improve the accuracy of the value obtained.

.....

..... [1]

[ Total : 7]

3 Fig. 4.1 shows apparatus that could be used to measure the specific latent heat of ice.

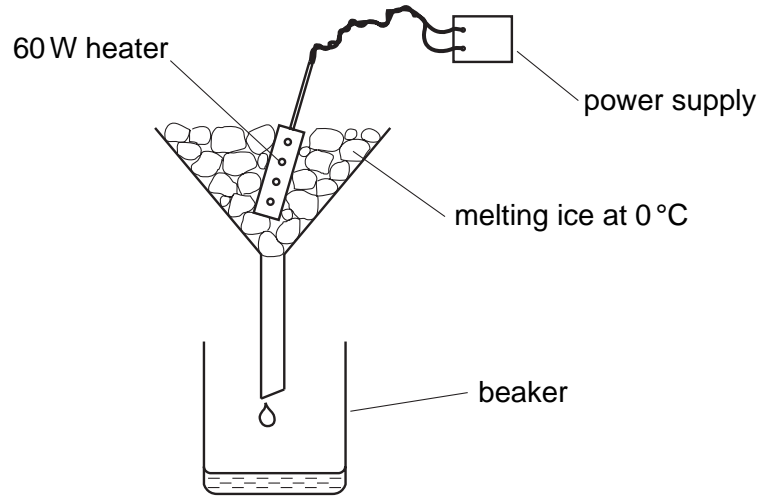


Fig. 4.1

(a) Describe how you would use the apparatus. You may assume that ice at 0°C and a stopwatch are available. State all the readings that would be needed at each stage.

.....  
.....  
.....  
.....  
..... [4]

(b) In an experiment, 120 g of ice at 0°C is to be melted. The specific latent heat of ice is 340 J/g. Assume that all the energy from the heater will be used to melt the ice.

Calculate the expected time for which the 60 W heater is switched on.

expected time = ..... [2]

(c) When the experiment is carried out, the ice melts in slightly less time than the expected time.

(i) State one reason why this happens.

.....  
..... [1]

(ii) Suggest one modification to the experiment that would reduce the difference between the experimental time and the expected time.

.....  
..... [1]

[Total : 8 ]

- 4 (a) Fig. 4.1 shows a simple type of thermocouple that has been calibrated to measure temperature.

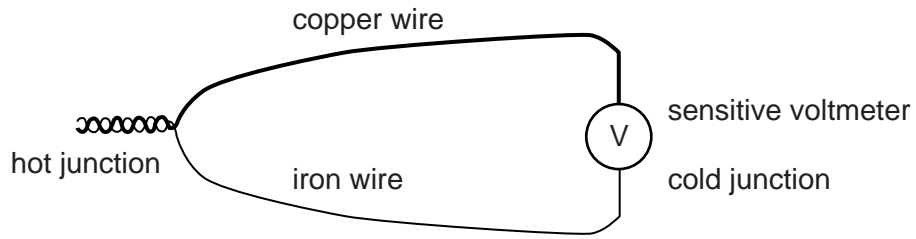


Fig. 4.1

- (i) Describe how the thermocouple could be used to measure the temperature of a beaker of hot water.

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

- (ii) State two situations where a thermocouple would be a good choice of thermometer to measure temperature.

1. ....  
.....  
2. ....  
.....

[4]



- (b) A mercury-in-glass thermometer is placed in an insulated beaker of water at 60 °C. The water is heated at a constant rate. The temperature of the water is measured and recorded on the graph shown in Fig. 4.2.

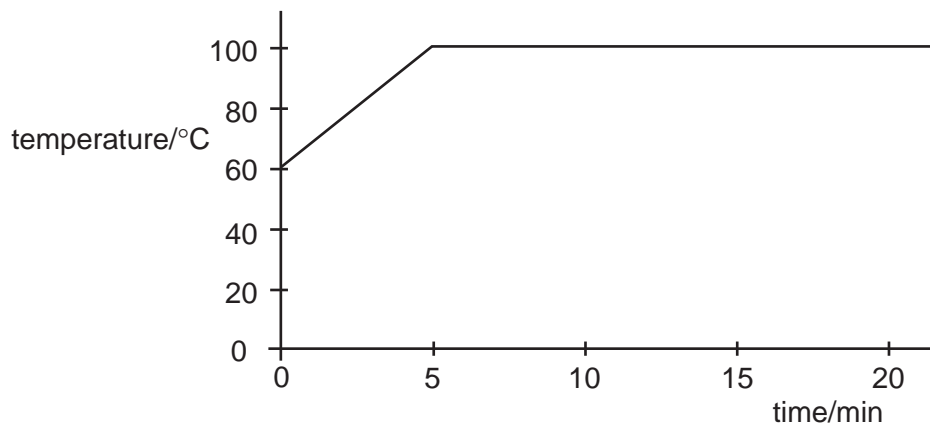


Fig. 4.2

State the effect of the heat supplied

- (i) during the period 0 to 5 minutes,

.....  
.....

- (ii) during the period 10 to 15 minutes.

.....  
.....

[2]

[ Total : 6 ]

- 5 Fig. 5.1 shows a thermocouple set up to measure the temperature at a point on a solar panel.

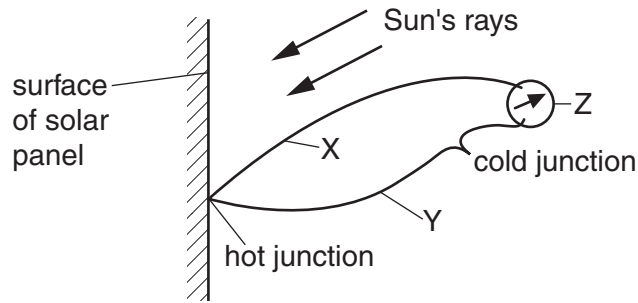


Fig. 5.1

- (a) X is a copper wire.

- (i) Suggest a material for Y.

.....

- (ii) Name the component Z.

.....

[2]

- (b) Explain how a thermocouple is used to measure temperature.

.....

.....

.....[3]

- (c) Experiment shows that the temperature of the surface depends upon the type of surface used.

Describe the nature of the surface that will cause the temperature to rise most.

.....

.....[1]

- 6 (a) Equal volumes of nitrogen, water and copper at 20 °C are heated to 50 °C.
- (i) Which one of the three will have a much greater expansion than the other two?

.....

- (ii) Explain your answer in terms of the way the molecules are arranged in the three substances.

.....

.....

.....

[3]

- (b) Fig. 5.1 shows a thermometer with a range of -10 °C to 50 °C.



Fig. 5.1

Explain what is meant by

- (i) the *sensitivity* of a thermometer,

.....

.....

- (ii) the *linearity* of a thermometer.

.....

.....

[2]

7 A thermocouple is used to measure the temperature of the inner wall of a pottery kiln.

(a) In the space below, draw a labelled diagram of a thermocouple that could be used for this purpose. [2]

(b) Describe

(i) how you would read the temperature of the wall from the thermocouple,

.....  
.....

(ii) how the thermocouple works.

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

[2]

(c) State two conditions in which a thermocouple is very suitable for temperature measurement.

.....  
.....[2]

- 8 (a) In an experiment to find the specific latent heat of water, the following readings were taken.

$m_1$	mass of water at 100 °C, before boiling starts	120 g
$m_2$	mass of water at 100 °C, after boiling finishes	80 g
$V$	voltage across the heater	12 V
$I$	current through the heater	2.0 A
$t$	time that the heater was supplying energy	3750 s

- (i) Using the symbols above, write down the equation that must be used to find the value of the specific latent heat  $L$  of water.

- (ii) Use the equation to calculate the specific latent heat of water from the readings above.

specific latent heat = .....  
[4]

- (b) Explain, in terms of the energy of molecules, why the specific latent heat of water has a high value.

.....  
.....  
.....[2]