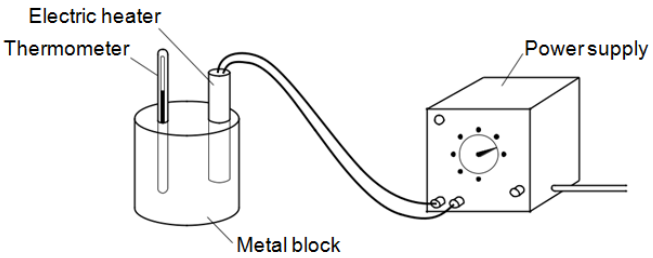
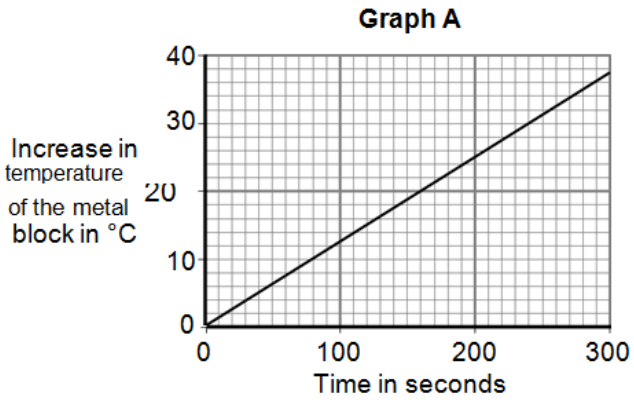
Specific Heat Capacity

Q:1 (a) A student used the apparatus drawn below to investigate the heating effect of an electric heater.



(a) (i) Before starting the experiment, the student drew Graph A.

Graph A shows how the student expected the temperature of the metal block to change after the heater was switched on.



Describe the pattern shown in Graph A.

_____

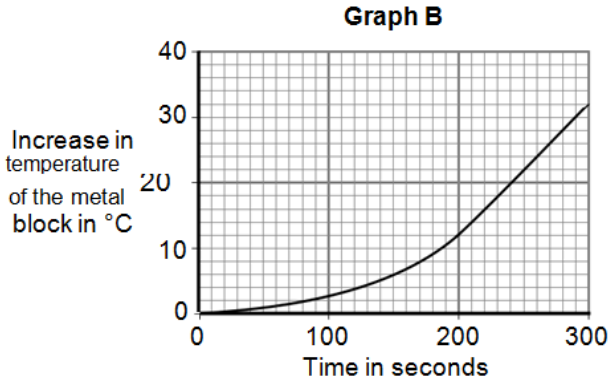
_____

_____

(2 marks)

(a) (ii) The student measured the room temperature. He then switched the heater on and measured the temperature of the metal block every 50 seconds.

The student calculated the increase in temperature of the metal block and plotted Graph B.



After 300 seconds, Graph B shows the increase in temperature of the metal block is lower than the increase in temperature expected from Graph A.

Suggest one reason why.

_____

_____

(1 mark)

(a) (iii) The power of the electric heater is 50 watts.

Calculate the energy transferred to the heater from the electricity supply in 300 seconds.

Use the correct equation from the Physics Equations Sheet.

Energy transferred = _____ J

(2 marks)

(b) The student uses the same heater to heat blocks of different metals. Each time the heater is switched on for 300 seconds.

Each block of metal has the same mass but a different specific heat capacity.

Metal	Specific heat capacity in J/kg°C
Aluminium	900
Iron	450
Lead	130

Which one of the metals will heat up the most? Draw a ring around the correct answer.

aluminium iron lead

Give, in terms of the amount of energy needed to heat the metal blocks, a reason for your answer.

(2 marks)

Q:2 The metal case of the stove gets hot when the fire is lit.

Here is some information about the stove.

Mass of metal case	100 kg
Starting temperature of metal case	20 °C
Final temperature of metal case	70 °C
Specific heat capacity of metal case	510 J/kg °C

Calculate the energy required to raise the temperature of the metal case to 70 °C.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer and give the unit.

_____

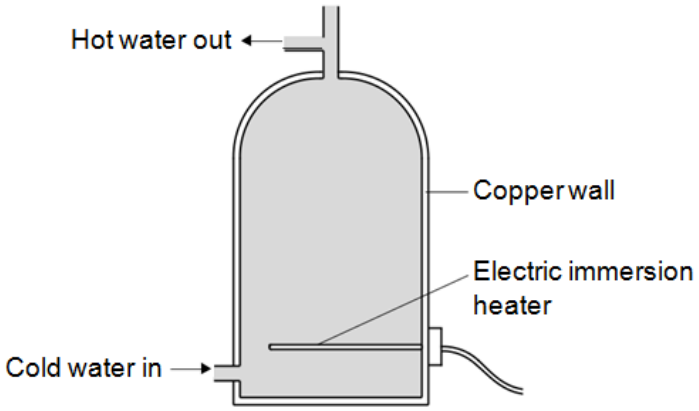
_____

_____

Energy required = _____

(3 marks)

Q:3 An electric immersion heater is used to heat the water in a domestic hot water tank. When the immersion heater is switched on the water at the bottom of the tank gets hot.

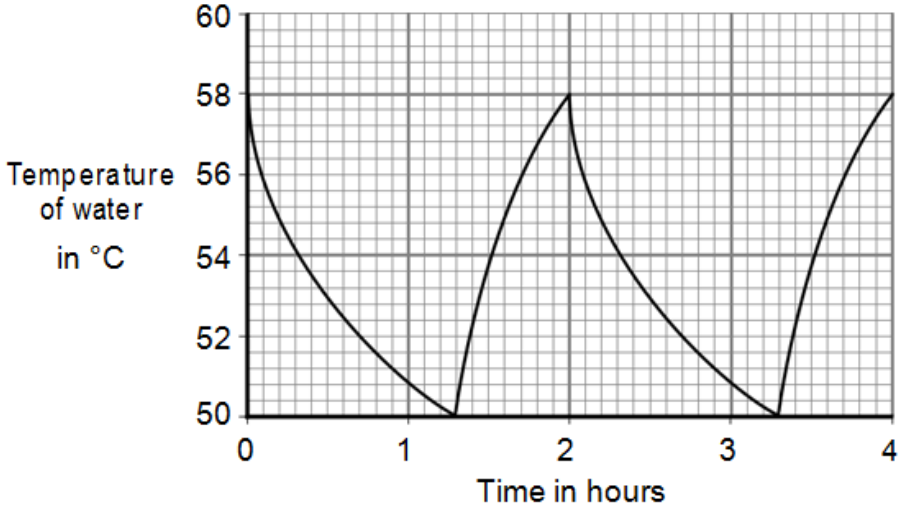


The immersion heater has a thermostat to control the water temperature.

When the temperature of the water inside the tank reaches 58°C the thermostat switches the heater off. The thermostat switches the heater back on when the temperature of the water falls to 50°C.

Graph A shows how the temperature of the water inside a hot water tank changes with time. The tank is not insulated.

Graph A (no insulation)



(a) The temperature of the water falls at the fastest rate just after the heater switches off.

Explain why.

_____

_____

_____

(2 marks)

(b) To heat the water in the tank from 50°C to 58°C the immersion heater transfers 4032 kJ of energy to the water.

Calculate the mass of water in the tank.

Specific heat capacity of water = 4200 J/kg°C

Use the correct equation from the Physics Equations Sheet.

_____

_____

_____

_____

Mass = _____ kg

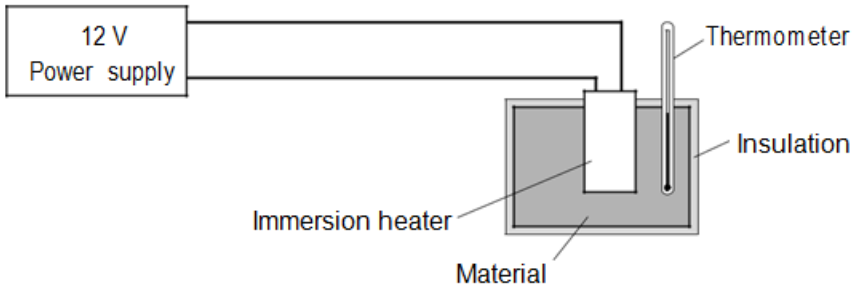
(3 marks)

Q:4 A student used the apparatus in Figure 5 to compare the energy needed to heat blocks of different materials.

Each block had the same mass.

Each block had holes for the thermometer and the immersion heater. Each block had a starting temperature of 20 °C.

Figure 5



The student measured the time taken to increase the temperature of each material by 5 °C.

(a) (i) State two variables the student controlled.

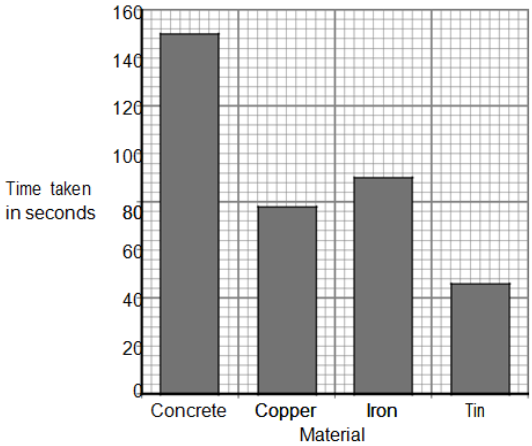
1 _____

2 _____

[2 marks]

Figure 6 shows the student's results.

Figure 6



(a) (ii) Why was a bar chart drawn rather than a line graph?

_____

_____

[1 mark]

(a) (iii) Which material was supplied with the most energy?

_____

Give the reason for your answer.

_____

_____

[2 marks]

(a) (iv) The iron block had a mass of 2 kg.

Calculate the energy transferred by the heater to increase the temperature of the iron block by 5 °C.

Use the correct equation from the Physics Equations Sheet.

The specific heat capacity of iron is 450 J/kg °C.

_____

_____

Energy transferred = ... J

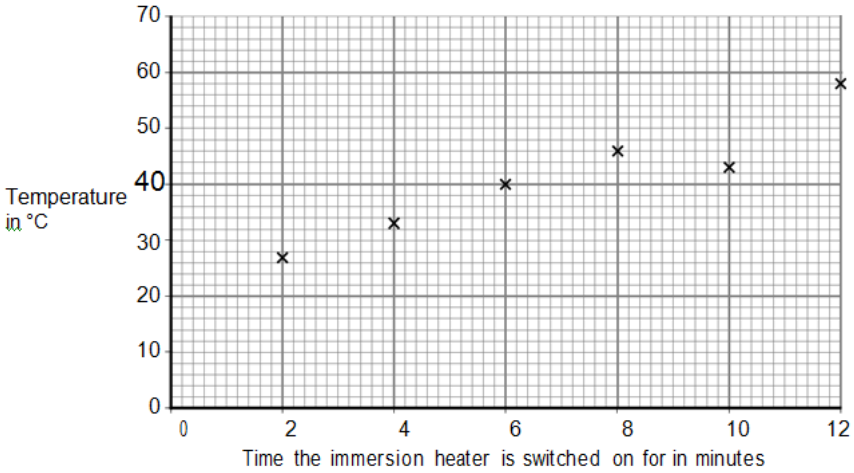
[2 marks]

(b) The student used the same apparatus to heat a 1 kg block of aluminium.

He recorded the temperature of the block as it was heated from room temperature.

The results are shown in Figure 7.

Figure 7



(b) (i) One of the student's results is anomalous.

Draw a ring around the anomalous result.

[1 mark]

(b) (ii) Draw the line of best fit for the points plotted in Figure 7.

[1 mark]

(b) (iii) What was the temperature of the room?

Temperature = _____ . °C

[1 mark]

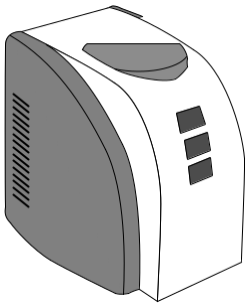
(b) (iv) What was the interval of the time values used by the student?

Interval = _____minutes

[1 mark]

Q:5 A 'can-chiller' is used to make a can of drink colder. Figure 7 shows a can-chiller.

Figure 7



(a) The initial temperature of the liquid in the can was 25.0 °C.

The can-chiller decreased the temperature of the liquid to 20.0 °C.

The amount of energy transferred from the liquid was 6930 J.

The mass of liquid in the can was 0.330 kg.

Calculate the specific heat capacity of the liquid. Give the unit.

Use the correct equation from the Physics Equations Sheet.

_____

_____

_____

_____

Specific heat capacity = _____ unit_____

[4 marks]

(b) Complete the following sentence.

The specific heat capacity of a substance is the amount of energy required to change

the _____ of one kilogram of the substance by one degree Celsius.

[1 mark]

(c) To calculate the specific heat capacity of a material, the mass of the material needs to be measured.

State the name of a measuring instrument used to measure mass.

_____

[1 mark]

TOTAL MARKS=31