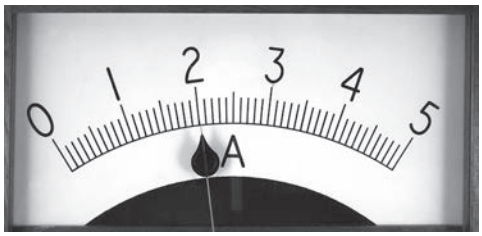
9 A student uses an electric heater to investigate efficiency.

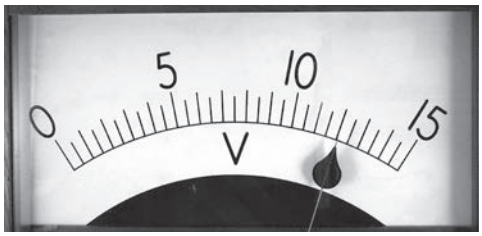
He places the heater in an aluminium block, switches the heater on and measures the temperature of the block each minute for 20 minutes.

(a) The student wants to calculate the electrical energy supplied to the heater.

(i) Complete the table by recording the readings shown on the meters below.

(2)





Current in amps, A	
Voltage in volts, V	

(ii) Show that the energy supplied to the heater in 20 minutes is about 30 000 J.

(3)

(b) The student is told that only 22 000 J are used to raise the temperature of the aluminium block by 25 °C.

(i) State the equation linking efficiency, useful energy output and total energy input.

(1)

(ii) Calculate the efficiency of heating the aluminium block.

(2)

Efficiency = ...

(iii) The efficiency of the **heater** will be **higher** than this value.

Suggest why.

(1)

.....

.....

.....

(iv) State **one** way in which the student could increase the efficiency of heating the aluminium block.

(1)

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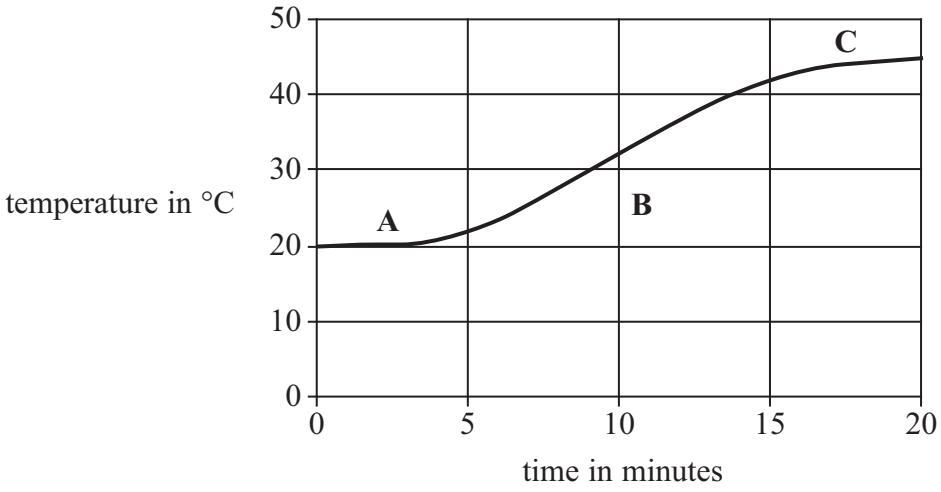
.....

.....

(c) The graph shows how the temperature of the block increases from 20 °C to 45 °C during the investigation.



Use ideas about heat transfer to help you explain the shape of the graph in

(i) section **A**,

(1)

(ii) section **B**,

(2)

(iii) section **C**.

(2)

(Total for Question 9 = 15 marks)