

**A Level Physics A**  
**H556/01** Modelling physics

**Question Set 8**

1 A plastic kettle is filled with 0.60 kg of water at a temperature of 20 °C.  
A 2.2 kW electric heater is used to heat the water for a time of 4.0 minutes.

(a) Calculate the total energy supplied by the heater during the time of 4.0 minutes.

$$\begin{aligned} \text{Energy} &= \text{power} \times \text{time} \\ &= 2200 \times 4 \times 60 \\ &= 5.28 \times 10^5 \text{ J} \end{aligned} \quad \text{energy} = \dots\dots\dots 5.3 \times 10^5 \text{ J} \quad [2]$$

(b) The specific heat capacity of water is 4200 J kg<sup>-1</sup> K<sup>-1</sup> and the specific latent heat of vaporisation of water is 2.3 × 10<sup>6</sup> J kg<sup>-1</sup>. The boiling point of water is 100 °C.

Calculate the mass of water **remaining** in the kettle after 4.0 minutes.  
Assume that all the thermal energy from the heater is transferred to the water.

Water will heat to 100 °C, then begin to vaporize.

E to heat to 100 → mass of water remaining = ..... 0.46 ..... kg [4]

$$\begin{aligned} E &= mc\Delta\theta \\ &= 0.6 \times 4200 \times 80 \\ &= 201600 \end{aligned}$$

Remaining E goes to vaporization  
 Remaining E = 5.28 × 10<sup>5</sup> - 2.016 × 10<sup>5</sup>  
 = 326400 J

$$\begin{aligned} E &= mL \text{ so } m = \frac{E}{L} \\ m &= \frac{326400}{2.3 \times 10^6} = 0.1419 \text{ kg} \end{aligned}$$

**Total Marks for Question Set 8: 6**

$$\begin{aligned} \text{Mass remaining} &= 0.6 - 0.1419 \\ &= 0.4581 \text{ kg} \end{aligned}$$

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