6 **(a)** Two cylindrical resistors M and N of the same material are connected parallel in Fig. 6.1. The mass of M is twice the mass of N and the radius of M is half the radius of N.

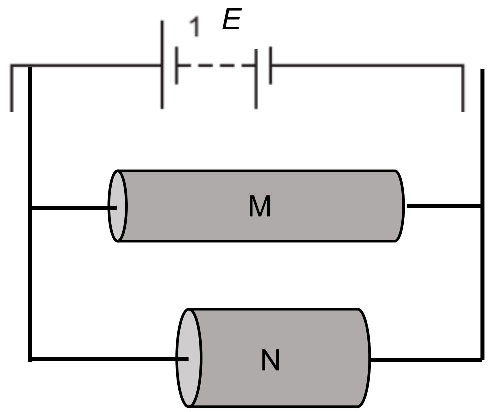

Fig. 6.1 (not to scale)

Determine the ratio

(i) $\dfrac{\text{resistance of M}}{\text{resistance of N}}$,

ratio = ... [2]

(ii) $\dfrac{\text{average drift speed of electrons in M}}{\text{average drift speed of electrons in N}}$.

ratio = ... [2]

(b) A cell of electromotive force (e.m.f.) 1.5 V and internal resistance 1.0 Ω is connected to a resistor X and resistor Y as shown in Fig. 6.2.

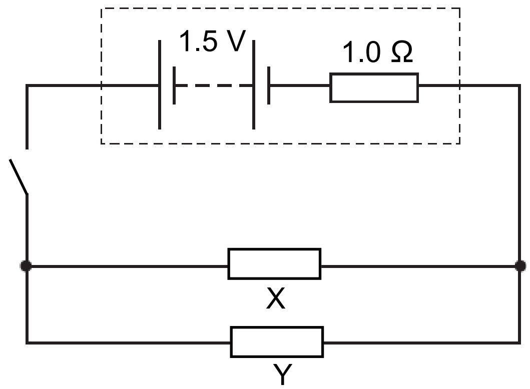

Fig. 6.2

Resistor X has resistance 2.0 Ω while resistor Y has a resistance of 6.0 Ω.

(i) Show that the current in the cell is 0.60 A when the switch is closed.

[2]

(ii) Determine the energy dissipated in the cell when the switch is closed for 8.0 minutes.

energy dissipated = ... J [1]

(iii) Resistor Y is replaced with a component Z with similar resistance value. When the temperature increases, the resistance of component Z decreases. State and explain the change to the power dissipated in the cell when temperature increases.

....

....

....

....

....

....[1]

(iv) The I-V characteristic of X and Z are given in Fig. 6.3.

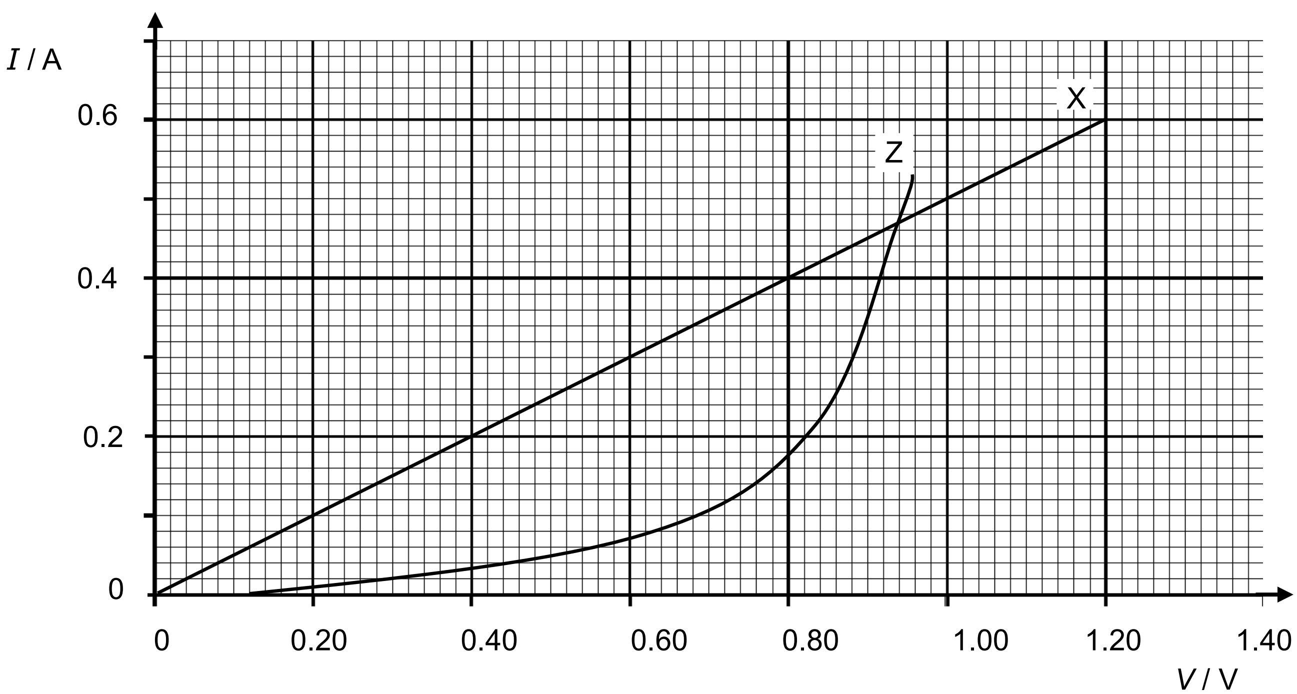

Fig. 6.3

The circuit is now reconnected such that resistor X and component Z are in series with the same cell. Using the Fig. 6.3, or otherwise, determine the potential difference across component Z.

potential difference = ... V [2]

[Total: 10]