6 **(a)** A wire has length 100 cm and diameter 0.38 mm. The metal of the wire has resistivity $4.5 \times 10^{-7}\,\Omega\,m$.

Show that the resistance of the wire is $4.0\,\Omega$.

[3]

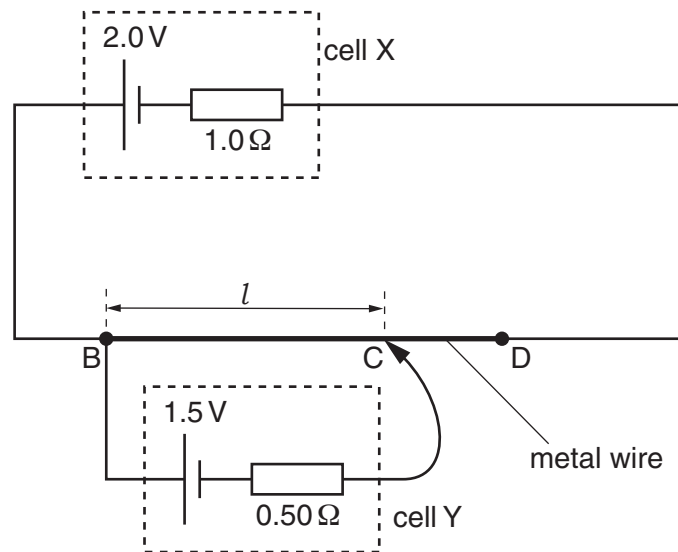**(b)** The ends B and D of the wire in **(a)** are connected to a cell X, as shown in Fig. 6.1.

Fig. 6.1

The cell X has electromotive force (e.m.f.) 2.0 V and internal resistance $1.0\,\Omega$.

A cell Y of e.m.f. 1.5 V and internal resistance $0.50\,\Omega$ is connected to the wire at points B and C, as shown in Fig. 6.1.

The point C is distance l from point B. The current in cell Y is zero.

Calculate

(i) the current in cell X,

current = ... A [2]

(ii) the potential difference (p.d.) across the wire BD,

p.d. = ... V [1]

(iii) the distance l.

l = ... cm [2]

(c) The connection at C is moved so that l is increased. Explain why the e.m.f. of cell Y is less than its terminal p.d.

....

....

....[2]