4 A cell P, a fixed resistor *R* and a uniform resistance wire AB are connected in a circuit as shown in Fig. 4.1.

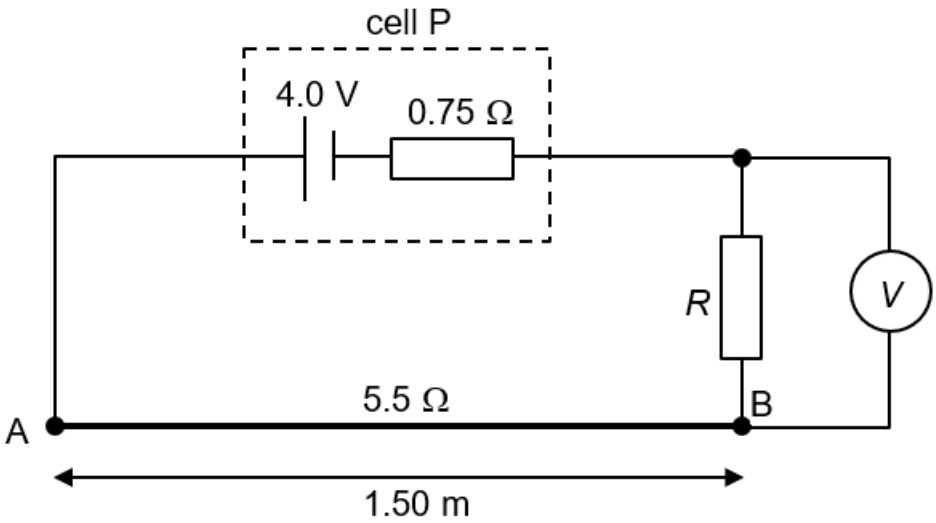

Fig. 4.1

Cell P has e.m.f. 4.0 V and internal resistance 0.75 Ω. Wire AB has length 1.50 m and resistance 5.5 Ω. The voltmeter reads 1.3 V.

(a) Show that the potential difference across AB is 2.4 V.

[2]

(b) A cell Q and a sensitive ammeter are connected to the circuit in Fig. 4.1, as shown in Fig. 4.2.

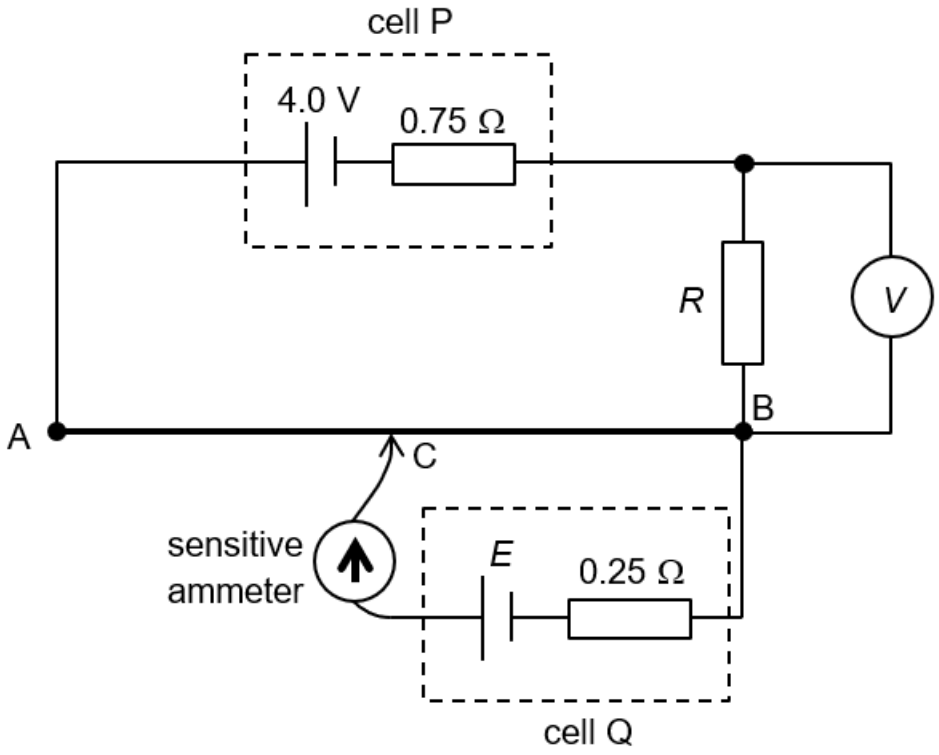

Fig. 4.2

Cell Q has e.m.f. E and internal resistance 0.25 Ω. The ammeter reads zero when the length of AC is 0.56 m.

(i) Determine E.

E = ... V [2]

(ii) There is a reading on the ammeter when the connection C is shifted closer to A. State and explain the direction of the current across cell Q.

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..... [2]

(c) The resistance wire AB is detached from the circuit and wound in a circular manner such that there are 2 semi-circular turns above and 3 semi-circular below XY as shown in Fig. 4.3.

X and Y are two metallic fasteners with negligible resistance. They are used to secure the wire so that the distance between X and Y is the diameter of the coil.

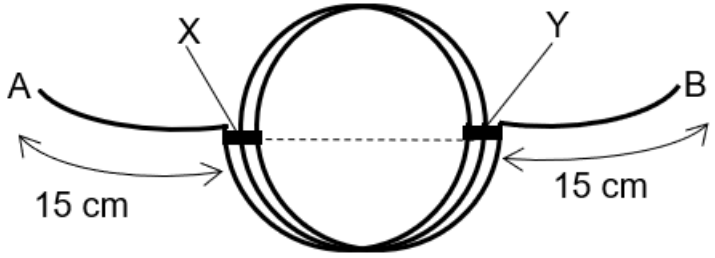

Fig. 4.3

(i) Show that the resistance of wire AB when coiled in this manner is 1.3 Ω.

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[2]

(ii) An e.m.f. source is again connected across AB. State and explain whether the drift velocity of electrons is greater in section AX or section XY.

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..... [2]

[Total: 10]