5 **(a)** Distinguish between electromotive force and potential difference.

……

……

……

……

…….. [2]

(b) The circuit in Fig 5.1 consists of one battery with an e.m.f. of 12.0 V connected to a resistance wire of uniform resistivity and uniform cross-sectional area.

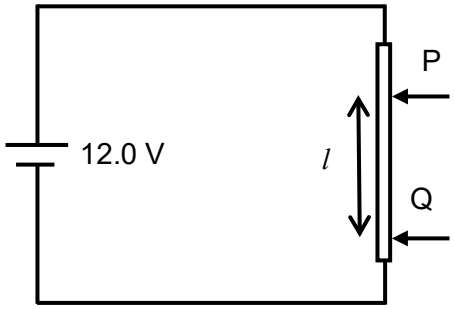

Fig 5.1

Explain why the potential difference between two points P and Q on the resistance wire is proportional to the distance between P and Q.

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……

……

……

…….. [2]

(c)

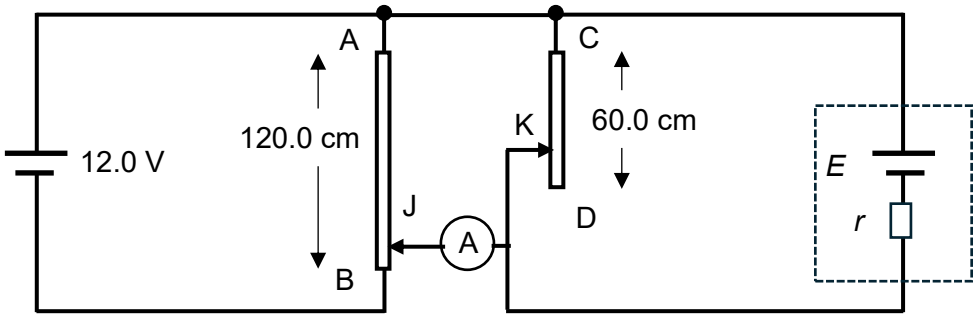

Fig 5.2

Fig 5.2 shows a circuit consisting of two parts.

The part on the left consists of a battery having an e.m.f. of 12.0 V, with negligible internal resistance, connected to a uniform resistance wire of length 120.0 cm.

The part on the right consists of a battery having an unknown e.m.f. *E,* with internal resistance *r*, connected to another uniform resistance wire of different resistivity and cross-sectional area, 60.0 cm in length.

The two jockeys J and K, which are connected to each other through an ideal ammeter, are free to move along the resistance wires AB and CD respectively.

The ammeter shows zero reading when the distance AJ is 54.0 cm and CK is 60.0 cm, and also when AJ is 45.0 cm and CK is 20.0 cm.

(i) Show that the potential difference (p.d.) across CK is 5.4 V when the length CK is 60.0 cm.

[2]

(ii) Given that the p.d. across CK is 4.5 V when the length CK is 20.0 cm, and the resistance of the resistance wire CD is 4.5 Ω.

Determine E and r.

E = ... V

r = ... Ω

[4]

[Total: 10]