

- 5 (a) State Kirchhoff's second law.

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 .....  
 ..... [2]

- (b) A battery has electromotive force (e.m.f.)  $4.0\text{ V}$  and internal resistance  $0.35\ \Omega$ . The battery is connected to a uniform resistance wire XY and a fixed resistor of resistance  $R$ , as shown in Fig. 5.1.

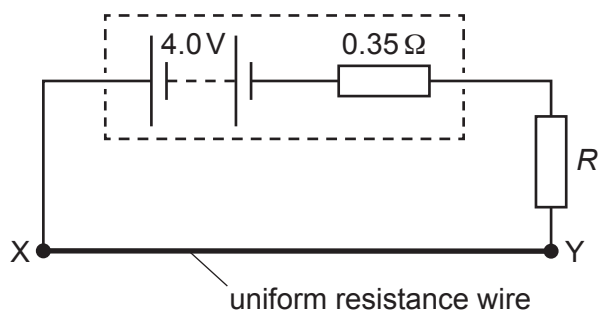


Fig. 5.1

Wire XY has resistance  $0.90\ \Omega$ . The potential difference across wire XY is  $1.8\text{ V}$ .

Calculate:

- (i) the current in wire XY

current = ..... A [1]

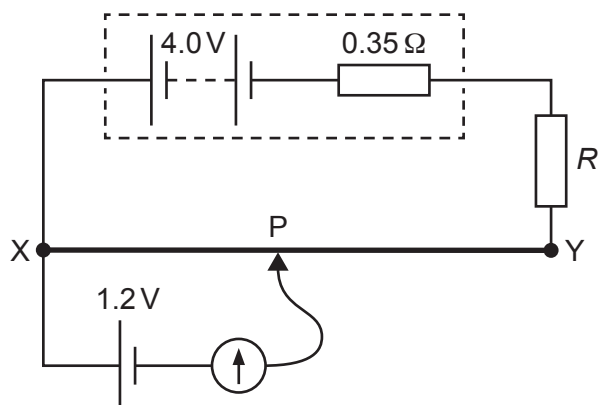
- (ii) the number of free electrons that pass a point in the battery in a time of  $45\text{ s}$

number = ..... [2]

- (iii) resistance  $R$ .

$R =$  .....  $\Omega$  [2]

- (c) A cell of e.m.f.  $1.2\text{ V}$  is connected to the circuit in (b), as shown in Fig. 5.2.



**Fig. 5.2**

The connection  $P$  is moved along the wire  $XY$ . The galvanometer reading is zero when distance  $XP$  is  $0.30\text{ m}$ .

- (i) Calculate the total length  $L$  of wire  $XY$ .

$L = \dots\dots\dots\text{ m}$  [2]

- (ii) The fixed resistor is replaced by a different fixed resistor of resistance greater than  $R$ .

State and explain the change, if any, that must be made to the position of  $P$  on wire  $XY$  so that the galvanometer reading is zero.

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 .....  
 ..... [2]

[Total: 11]