

- 6 (a) (i) State Kirchhoff's first law.

.....  
 .....[1]

- (ii) Kirchhoff's first law is linked to the conservation of a certain quantity. State this quantity.

.....[1]

- (b) A battery of electromotive force (e.m.f.)  $8.0\text{ V}$  and internal resistance  $2.0\ \Omega$  is connected to a resistor X and a wire Y, as shown in Fig. 6.1.

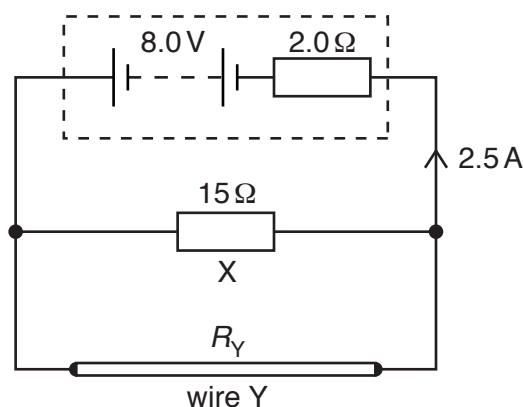


Fig. 6.1

The resistance of X is  $15\ \Omega$ . The resistance of Y is  $R_Y$ . The current in the battery is  $2.5\text{ A}$ .

- (i) Calculate

1. the thermal energy dissipated in the battery in a time of 5.0 minutes,

energy = ..... J [2]

2. the terminal potential difference of the battery.

terminal potential difference = ..... V [1]

(ii) Determine the resistance  $R_Y$

$R_Y = \dots\dots\dots \Omega$  [3]

(iii) A new wire Z has the same length but less resistance than wire Y.

1. State two possible differences between wire Z and wire Y that would separately cause wire Z to have less resistance than wire Y.

first difference: .....

.....

second difference: .....

.....

[2]

2. Wire Y is replaced in the circuit by wire Z. By considering the current in the battery, state and explain the effect of changing the wires on the total power produced by the battery.

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.....[2]

[Total: 12]