5 A battery of electromotive force (e.m.f.) 12 V and negligible internal resistance is connected to a network of two lamps and two resistors, as shown in Fig. 5.1.

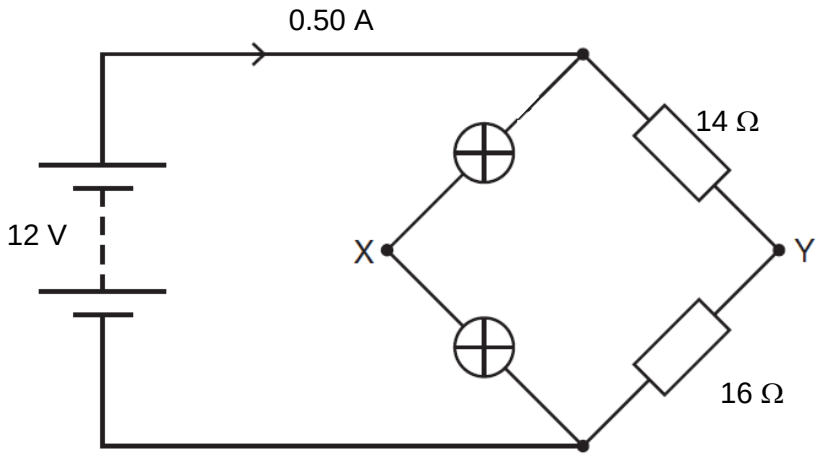

Fig. 5.1

The two lamps in the circuit have equal resistances. The two resistors have resistances 14 Ω and 16 Ω. The lamps are connected at junction X and the resistors are connected at junction Y. The current in the battery is 0.50 A.

(a) The two filament lamps are observed to take a few seconds to achieve their full brightness. Explain why this is so.

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……[2]

(b) Calculate the potential difference across the 16 Ω resistor.

potential difference = ……V [2]

(c) **(i)** Determine the potential difference between points X and Y.

potential difference = ……V [1]

(ii) State whether point X or point Y is at a higher potential.

……..[1]

(d) Show that the current in the lamps is 0.10 A.

[1]

(e) Calculate the ratio

$$\frac{\text{total power dissipated by the lamps}}{\text{total power produced by battery}}$$

ratio = ……[2]

(f) The 14 Ω is replaced by another resistor of higher resistance.

State and explain the effect, if any, of this change on the ratio in **(e)**.

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……...

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……

……..…… [2]

[Total: 11]