

- 5 A capacitor of capacitance $470 \mu\text{F}$ is connected to a battery of electromotive force (e.m.f.) 24 V in the circuit of Fig. 5.1.

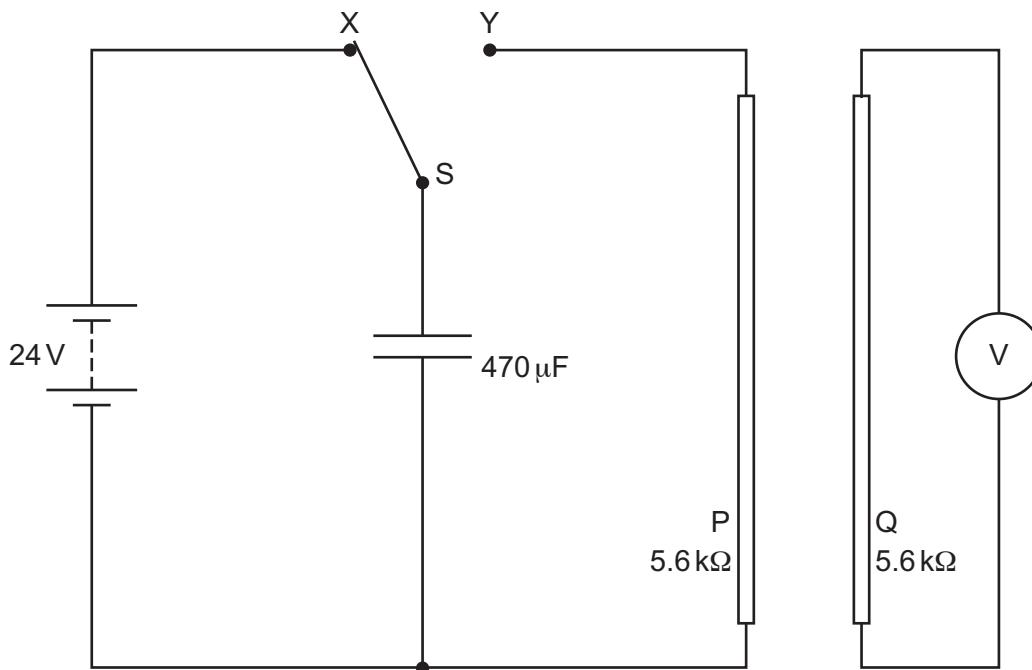


Fig. 5.1

The two-way switch S is initially at position X.

P and Q are identical long straight wires, each with a resistance of $5.6 \text{ k}\Omega$. These wires are placed near to, and parallel to, each other. Wire Q is connected to a voltmeter.

At time $t = 0$, switch S is moved to position Y so that the capacitor discharges through wire P.

(a) (i) Calculate the charge Q_0 on the capacitor at time $t = 0$.

$$Q_0 = \dots \text{ C} [2]$$

(ii) Calculate the current I_0 in wire P at time $t = 0$.

$$I_0 = \dots \text{ A} [1]$$

- (iii) Calculate the time constant τ of the discharge circuit.

$$\tau = \dots \text{ s} [2]$$

- (iv) On Fig. 5.2, sketch a line to show the variation with t of the current I in wire P as the capacitor discharges.



Fig. 5.2

[2]

- (b) (i) Explain why there is an induced e.m.f. across wire Q during the discharge of the capacitor.

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..... [3]

- (ii) On Fig. 5.3, sketch a line to suggest the variation with t of the voltmeter reading V .



Fig. 5.3

[1]