

7 Fig. 7.1 shows a circuit containing a capacitor of capacitance C and a resistor of resistance R .

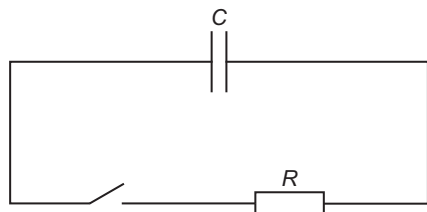


Fig. 7.1

Initially, the switch is open and the potential difference (p.d.) across the capacitor is 12 V.

The switch is closed at time $t = 0$ and the capacitor discharges through the resistor.

Fig. 7.2 shows the variation of the charge Q on the capacitor with the p.d. V_C across the capacitor as the capacitor discharges. Fig. 7.3 shows the variation of the current I in the resistor with the p.d. V_R across the resistor as the capacitor discharges.

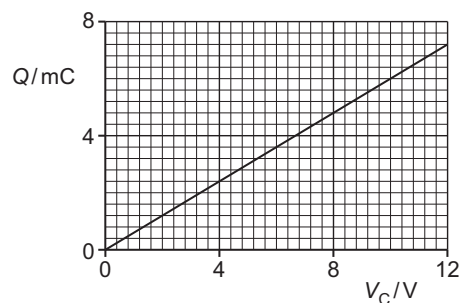


Fig. 7.2

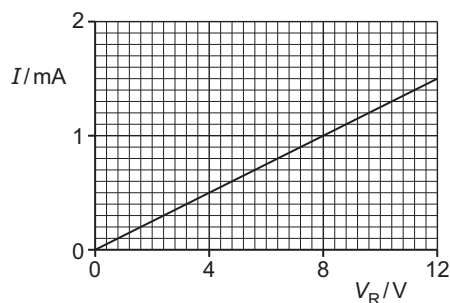


Fig. 7.3

(a) State the relationship between V_C and V_R .

..... [1]

(b) Determine:

(i) the capacitance C , in μF

$C = \dots\dots\dots \mu\text{F}$ [2]

(ii) the resistance R , in $\text{k}\Omega$

$R = \dots\dots\dots \text{k}\Omega$ [2]

(iii) the time constant τ of the circuit.

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

(c) Use Fig. 7.2, Fig. 7.3 and your answer in (a) to explain why the variation of Q with t is exponential in nature.

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 [3]

[Total: 10]