



# **A Level Physics A**

**H556/02** Exploring physics

## **Question Set 8**

- 1(a) A capacitor of capacitance  $7.2 \text{ pF}$  consists of two parallel metal plates separated by an insulator of thickness  $1.2 \text{ mm}$ . The area of overlap between the plates is  $4.0 \times 10^{-4} \text{ m}^2$ . Calculate the permittivity of the insulator between the capacitor plates.

$$C = \frac{\epsilon A}{d} \rightarrow \epsilon = \frac{dC}{A} = \frac{1.2 \times 10^{-3} \times 7.2 \times 10^{-12}}{4 \times 10^{-4}} \text{ permittivity} = \dots\dots\dots 2.2 \times 10^{-11} \text{ F m}^{-1} \text{ [2]}$$

- (b) Fig. 21 shows a circuit.

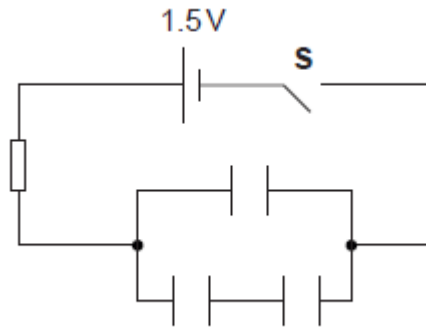


Fig. 21

The capacitance of each capacitor is  $1000 \mu\text{F}$ . The resistance of the resistor is  $10 \text{ k}\Omega$ . The cell has e.m.f.  $1.5 \text{ V}$  and negligible internal resistance.

- (i) Calculate the total capacitance  $C$  in the circuit.

Capacitance of capacitors in series:  $C_s = \left[ \frac{1}{1000} + \frac{1}{1000} \right]^{-1} = 500 \mu\text{F}$

Total  $C = 500 + 1000 = 1500 \mu\text{F}$

$C = \dots\dots\dots 1500 \dots\dots\dots \mu\text{F} \text{ [2]}$

- (ii) The switch  $S$  is closed at time  $t = 0$ . There is zero potential difference across the capacitors at  $t = 0$ .

Calculate the potential difference  $V$  across the resistor at time  $t = 12 \text{ s}$ .

$V = V_0 e^{-t/RC}$  }  $V = \dots\dots\dots 0.67 \dots\dots\dots \text{V [2]}$

$V = 1.5 \times e^{-\frac{12}{(10 \times 10^3 \times 1500 \times 10^{-6})}}$  }

$V = 0.674$

**Total Marks for Question Set 8: 6**

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