

- 5 (a) Define the capacitance of a parallel plate capacitor.

.....  
 .....  
 ..... [2]

- (b) Two capacitors, of capacitances  $C_1$  and  $C_2$ , are connected in parallel to a power supply of electromotive force (e.m.f.)  $E$ , as shown in Fig. 5.1.

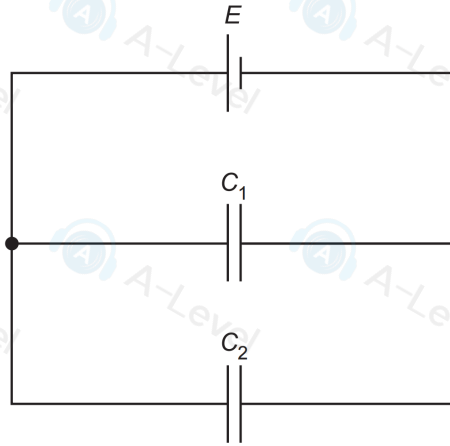


Fig. 5.1

Show that the combined capacitance  $C_T$  of the two capacitors is given by

$$C_T = C_1 + C_2.$$

Explain your reasoning. You may draw on Fig. 5.1 if you wish.

[3]

- (c) Two capacitors of capacitances  $22\mu\text{F}$  and  $47\mu\text{F}$ , and a resistor of resistance  $2.7\text{M}\Omega$ , are connected into the circuit of Fig. 5.2.

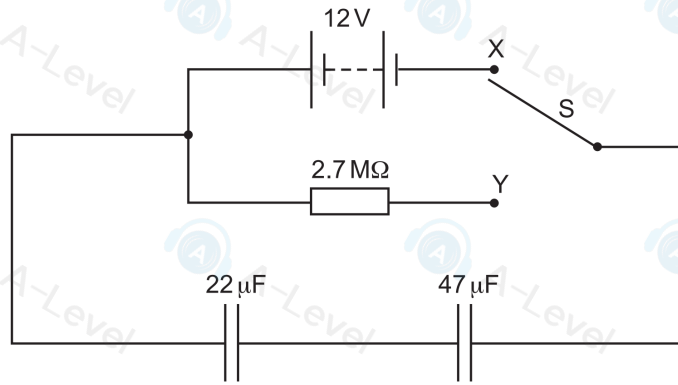


Fig. 5.2

The battery has an e.m.f. of 12V.

- (i) Show that the combined capacitance of the two capacitors is  $15\mu\text{F}$ .

[1]

- (ii) The two-way switch S is initially at position X, so that the capacitors are fully charged.

Use the information in (c)(i) to calculate the total energy stored in the two capacitors.

total energy = ..... J [2]

- (iii) The two-way switch is now moved to position Y.

Determine the time taken for the potential difference (p.d.) across the  $22\mu\text{F}$  capacitor to become 6.0V.

time = ..... s [3]

[Total: 11]

[Turn over

- 5 The variation with potential difference  $V$  of the charge  $Q$  on one of the plates of a capacitor is shown in Fig. 5.1.

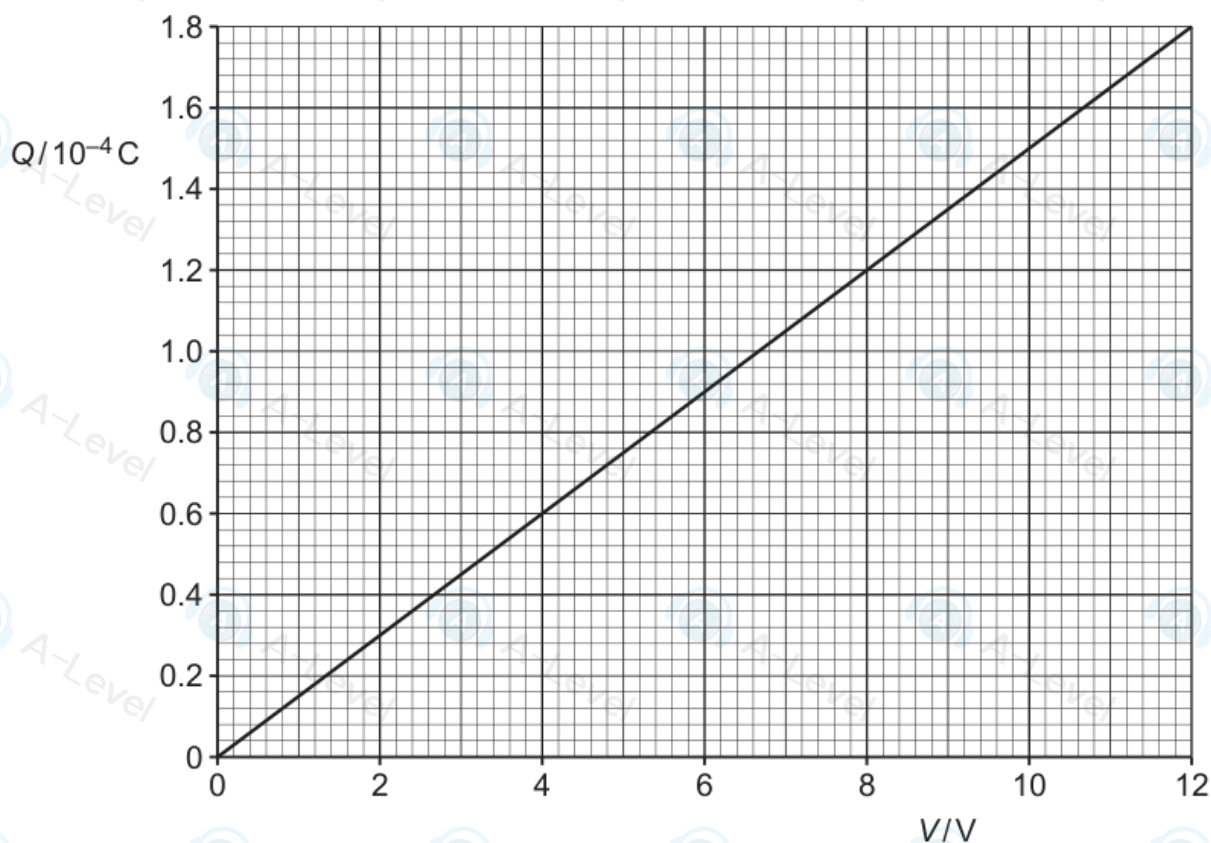


Fig. 5.1

The capacitor is connected to an 8.0V power supply and two resistors R and S as shown in Fig. 5.2.

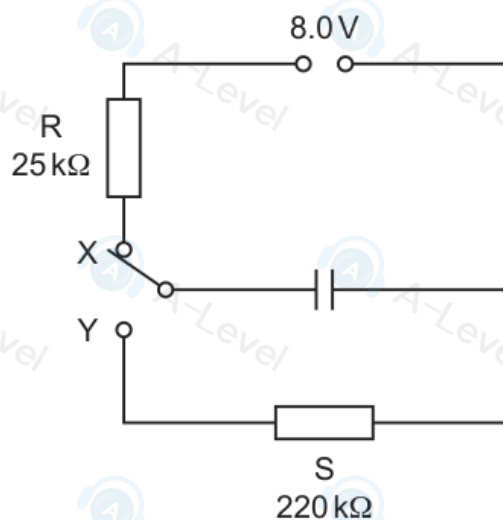


Fig. 5.2

The resistance of R is  $25\text{ k}\Omega$  and the resistance of S is  $220\text{ k}\Omega$ .

The switch can be in either position X or position Y.

- (a) The switch is in position X so that the capacitor is fully charged.