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.

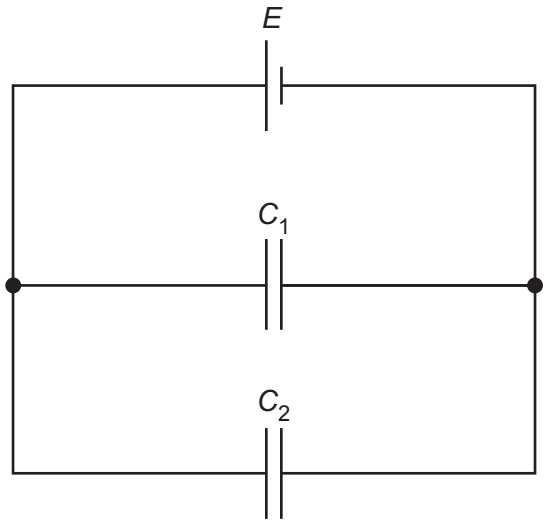

Fig. 5.1

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 μF and 47 μF, and a resistor of resistance 2.7 MΩ, are connected into the circuit of Fig. 5.2.

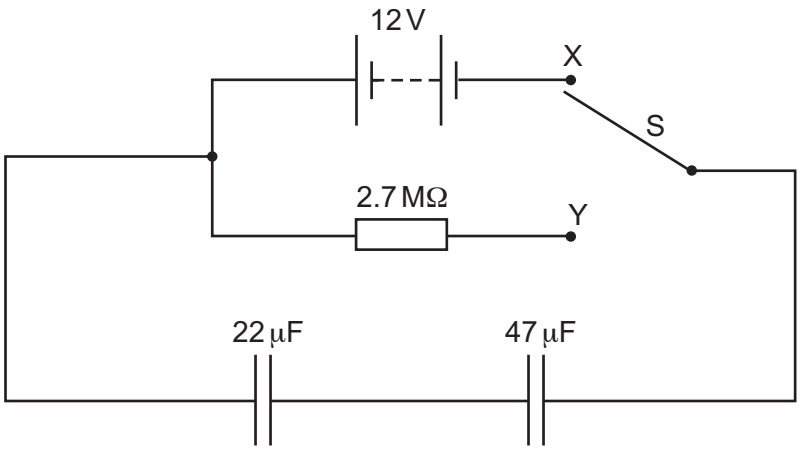

Fig. 5.2

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

(i) Show that the combined capacitance of the two capacitors is 15 μF.

[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 μF capacitor to become 6.0 V.

time = ... s [3]

[Total: 11]