

- 6 (a) Two capacitors X and Y are connected in series to a power supply of voltage V , as shown in Fig. 6.1.

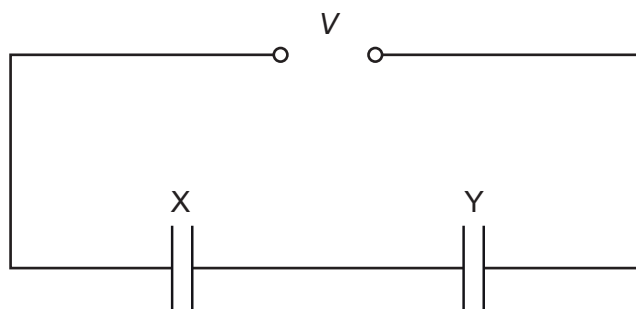


Fig. 6.1

The capacitance of X is C_X and the capacitance of Y is C_Y .

Derive an expression, in terms of C_X and C_Y , for the combined capacitance C_T of the capacitors in this circuit.
Explain your reasoning.

[3]

- (b) Two capacitors P and Q are connected in parallel to a power supply of voltage V .
The capacitance of P is $200\mu\text{F}$. The capacitance C_Q of Q can be varied between 0 and $400\mu\text{F}$.
When $C_Q = 0$, the total energy stored in the capacitors is 2.5 mJ .
- (i) Show that the supply voltage V is 5.0 V .

[2]



- (ii) Calculate the total energy, in mJ, stored in the capacitors when C_Q has its maximum value.

total energy = mJ [3]

- (iii) On Fig. 6.2, sketch the variation of the total energy E stored in the capacitors with C_Q , as C_Q varies from 0 to 400 μF .

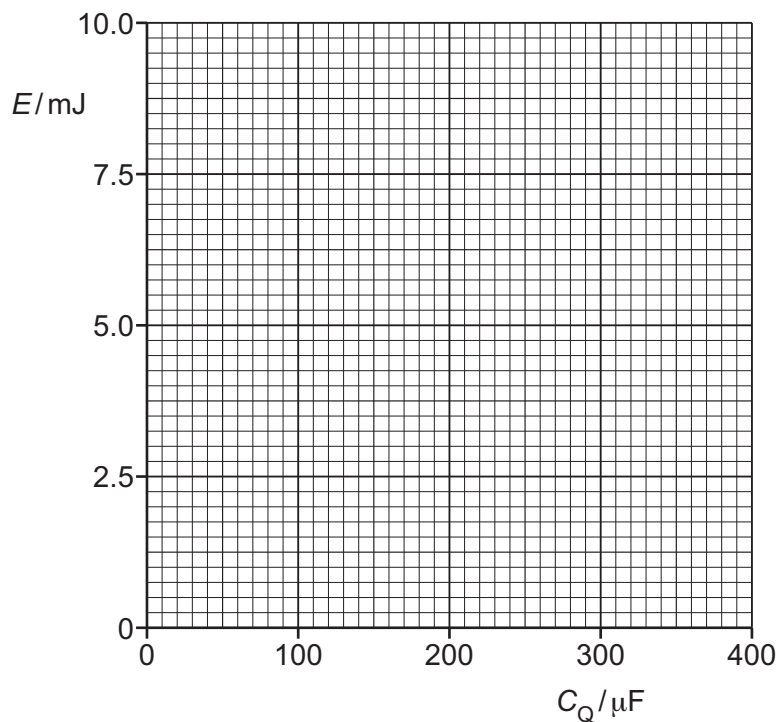


Fig. 6.2