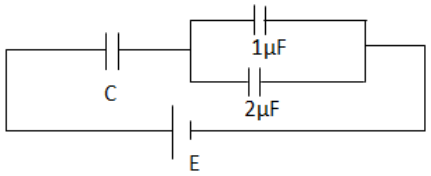
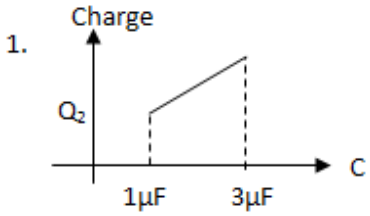
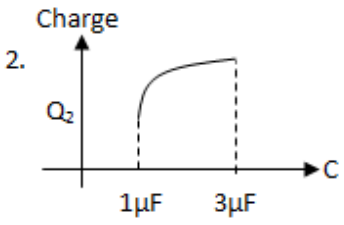
16. In the given circuit, charge Q_2 on the 2 μF capacitor changes as C is varied from 1μF to 3μF. Q_2 as a function of 'C' is given properly by : (figures are drawn schematically and are not to scale)



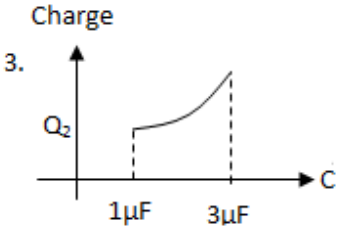
1.



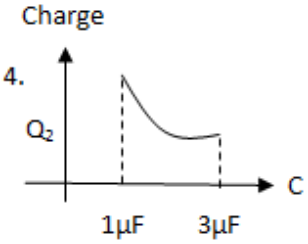
2.



3.

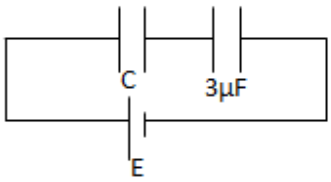


4.



Answer:

In the given circuit 1μF and 2μF are parallel hence equivalent capacitance= 2+1=3μF



Now C and 3μF are in series therefore equivalent capacitance=$\frac{3C}{3+C}$ therefore Charge $Q = \left(\frac{3C}{3+C}\right)E$ Hence potential difference across the combination 1μF and 2μF =$\frac{Q}{3} = \frac{CE}{3+C}$.

Now the charge of 2μF capacitor (say q)

$q = \frac{2CE}{3+C}$

$To\ find\ this\ in\ standard\ equation$:

$$\frac{q}{2E} = \frac{C}{3+C}$$

$$or\ \frac{q}{2E} = \frac{3+C-3}{3+C}$$

$$or\ \frac{q}{2E} = 1 - \frac{3}{3+C}$$

$$or\ q - 2E = \frac{-6E}{3+C}$$

$$or(q-2E)(C+3) = -6E$$

This is comparable with standard equation $(y-\alpha)(x+\beta) < 0$ which is hyperbola

Correct option (2)