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DPP – 3 (Capacitor)

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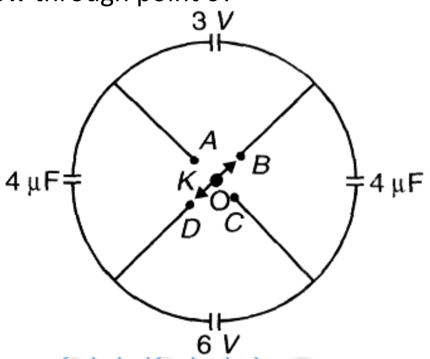
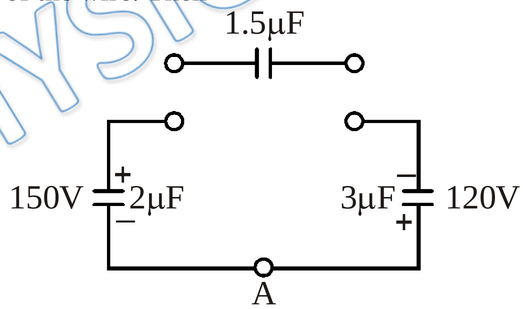
Q 1. In figure, there is a four way key at the middle. If key is thrown from situation BD to AD, then how much charge will flow through point 0?



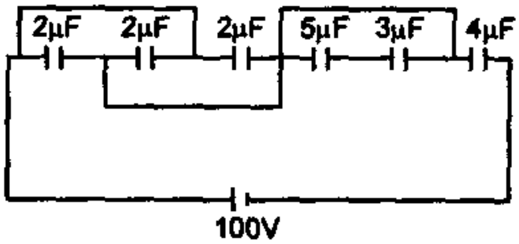
(a) 24 μC
(b) 36 μC
(c) 72 μC
(d)12 μC

Q 2. Two capacitors of 2 μF and 3 μF are charged to 150 volt and 120 volt respectively. The plates of capacitor are connected as shown in the figure. A discharged capacitor of capacity 1.5μF falls to the free ends of the wire. Then



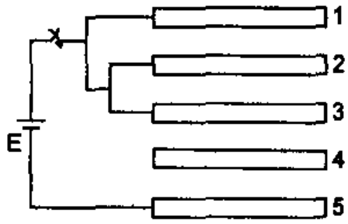
(a) charge on the 1.5 μF capacitor is 180 μC
(b) charge on the 2μF capacitor is 120 μC
(c) positive charge flows through A from right to left.
(d) positive charge flows through A from left to right.

Q 3. In the circuit shown in figure charge stored in the capacitor of capacity 5 μF is:



(a) 60 μC (b) 20 μC (c) 30 μC (d) zero

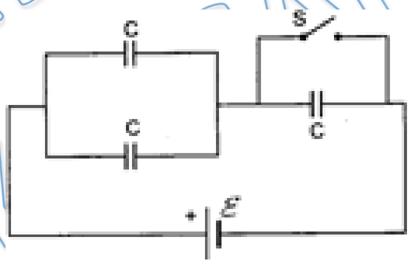
Q 4. Five conducting plates are placed parallel to each other. Separation between them is d and area of each plate is A. Plate number 1, 2 and 3 are connected with each other and at the same time through a cell of emf E. The charge on plate number 1 is:



(a) $\frac{E\varepsilon_0 A}{d}$ (b) $\frac{E\varepsilon_0 A}{2d}$

(c) $\frac{2E\varepsilon_0 A}{d}$ (d) zero

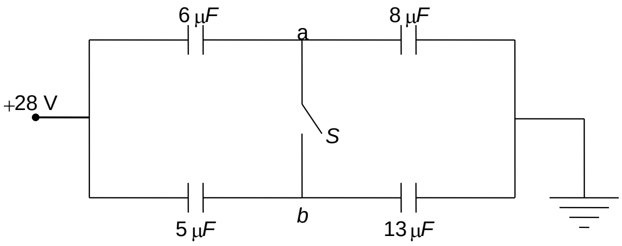
Q 5. In the circuit shown, each capacitor has a capacitance C. The emf of the cell is ξ. If the switch S is closed,



(a) some charge will flow out of the positive terminal of the cell
(b) some charge will enter the positive terminal of the cell
(c) the amount of charge flowing through the cell will be Cξ.
(d) the amount of charge flowing through the cell will be $\frac{4}{3}$Cξ.

COMPREHENSION (Q.6 TO Q.9)

The capacitors in the figure are initially uncharged and are connected as



Q 6. What is the potential difference V_{ab}?

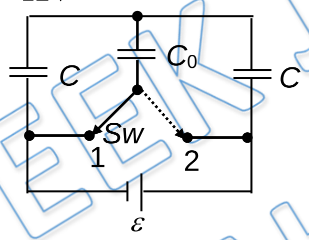
(a) 4.2 V (b) 5.2 V
(c) 6.2 V (d) 7.2 V

Q 7. Now the key S is closed. What is the potential of point a?
(a) 9.2 V (b) 9.4 V
(c) 9.6 V (d) 7.8 V

Q 8. How much charge flowed through the switch when it was closed?
(a) 3.36 μ C (b) 33.6 μ C
(c) 336 μ C (d) 0.336 μ C

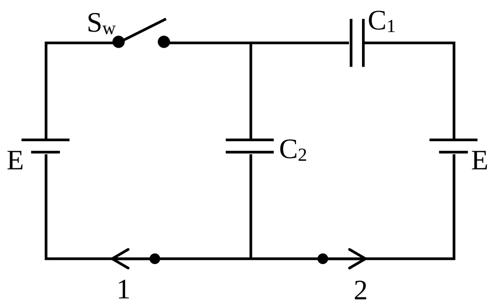
Q 9. The charge on capacitor 5 μF is
(a) 96 μ C (b) 98μ C
(c) 94 μ C (d) 92 μ C

Q 10. What amount of charge (in coulomb) will be supplied by cell shown in figure after the switch Sw is shifted from position 1 to position 2?
Given C = 1F, C_0 = 4F and ε = 12V



Q 11. A capacitor of capacitance $C_0$is charged to a potential V_0 and then isolated. A small uncharged capacitor C is then charged from C_0, discharged and charged again; the process being repeated n times. Due to this, potential of the larger capacitor is decreased to V. Value of C is -
(a) $C_0(V_0/\text{V})^{1/n}$ (b) $C_0\ (V_0/\text{V})^{1/n} - 1)$ (c) $C_0\ \left((V_0/\text{V}) - 1\right)^n$ (d)$C_0[\left(\frac{V}{V_0}\right)^n + 1]$

Q 12. What charges will flow after the shorting of the switch Sw in the circuit illustrated in Fig. through section 1 and 2 in the directions indicated by the arrows ? Given $C_1 = C_2 = 2\ \mu F$ and E = 1 V .

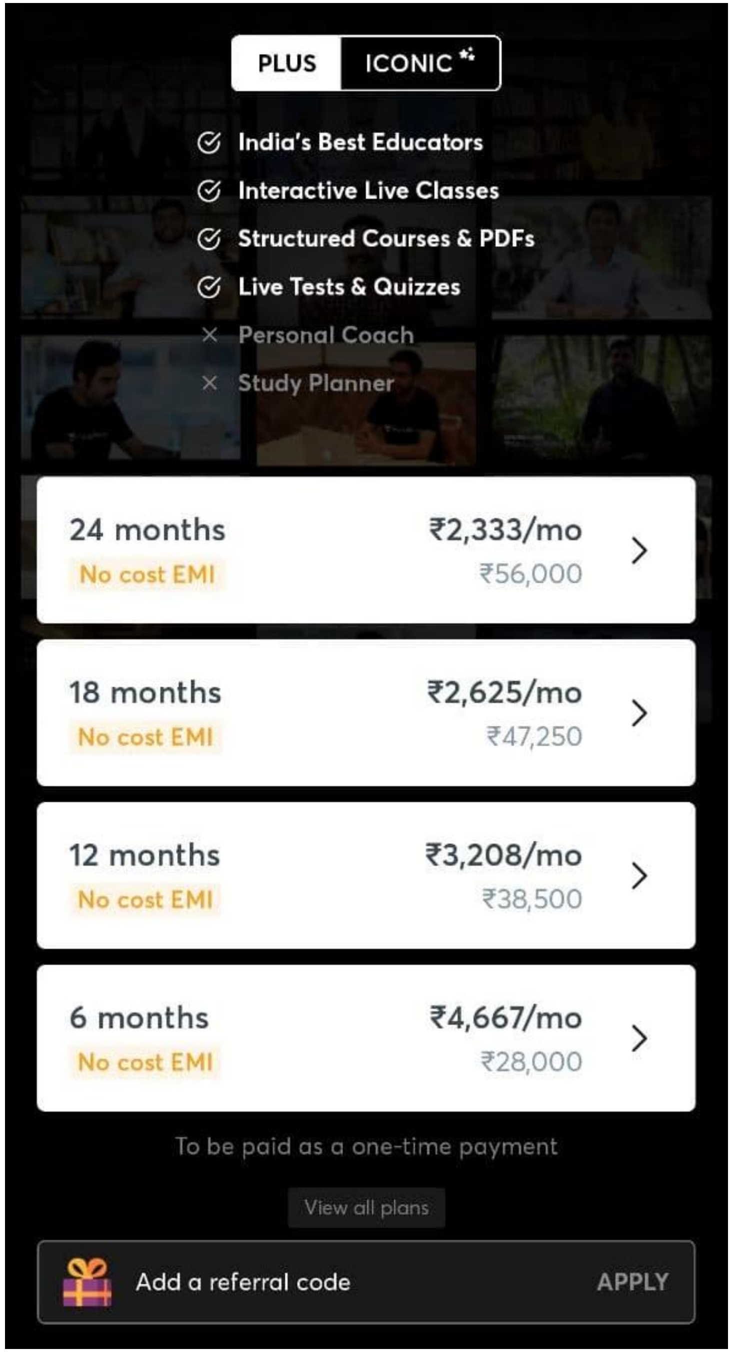


(a) 2μC , 1 μC
(b) 2μC , 2μC
(c) - 2μC, 2μC

(d) 2μC, -1μC

Answer Key

Q.1 c	Q.2 a, b, c	Q.3 d	Q.4 d	Q.5 a, d
Q.6 a	Q.7 c	Q.8 b	Q.9 d	Q.10 8
Q.11 b	Q.12 d			



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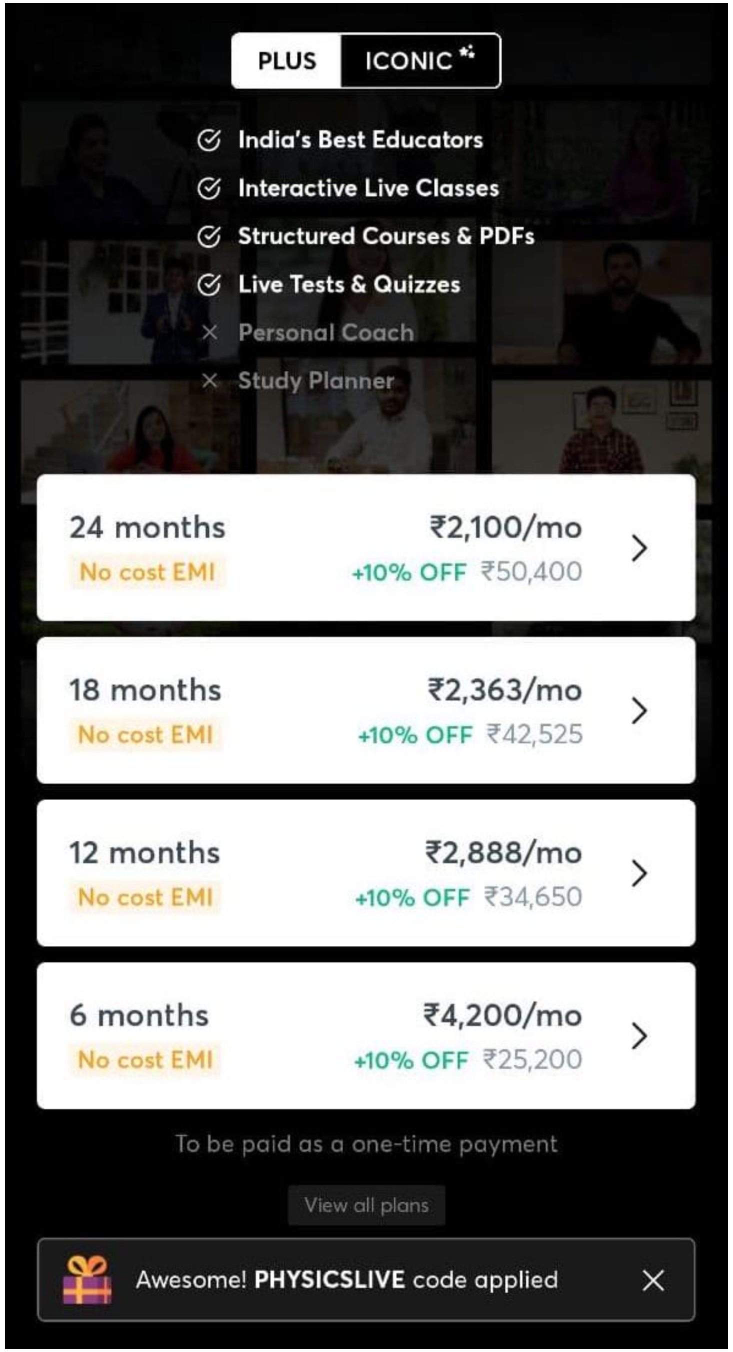

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Written Solution

DPP-3 Capacitor- Kirchhoff's 1st & 2nd Law

By Physicsaholics Team

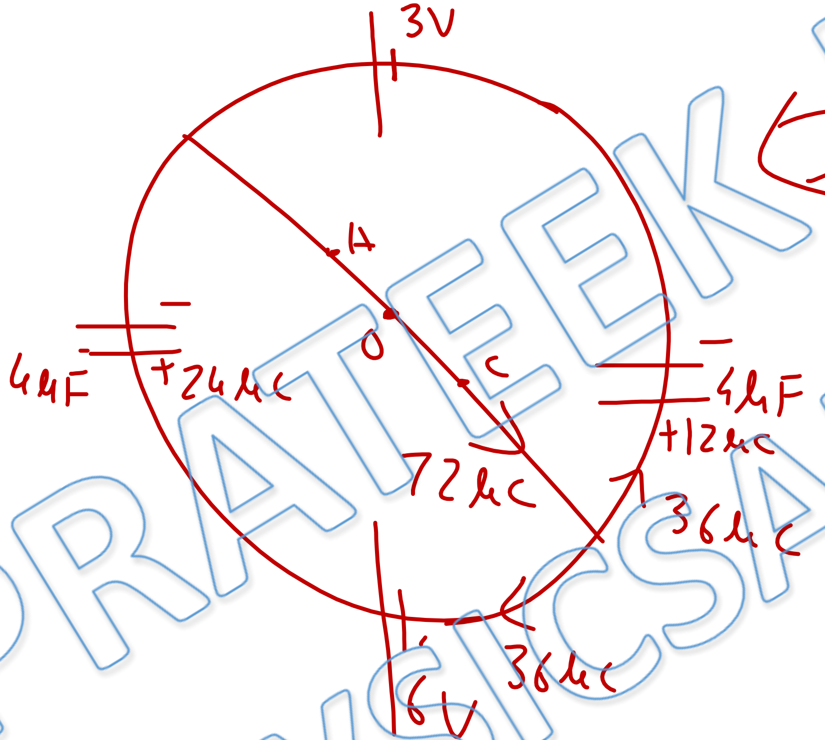
(Q.1) In figure, there is a four way key at the middle. If key is thrown from situation BD to AD, then how much charge will flow through point 0?

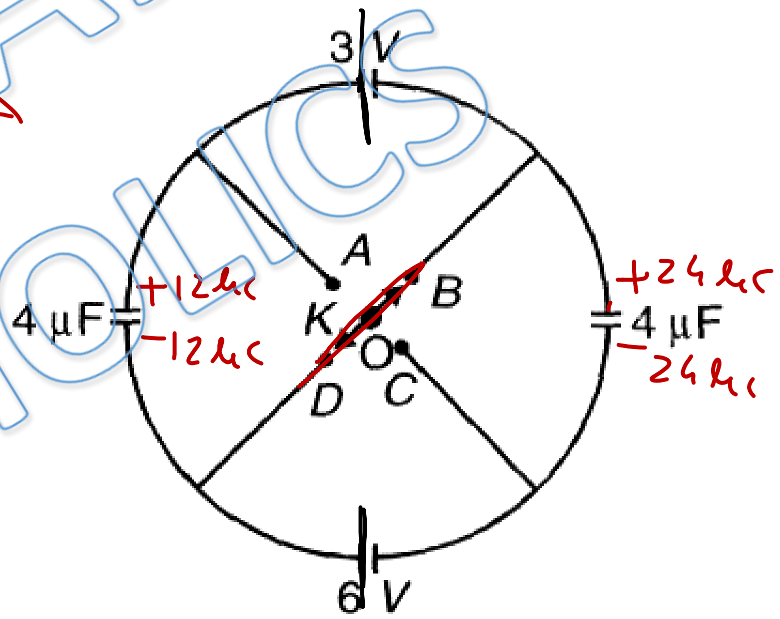
(a) 24 μC

(b) 36 μC

(c) 72 μC

(d)12 μC

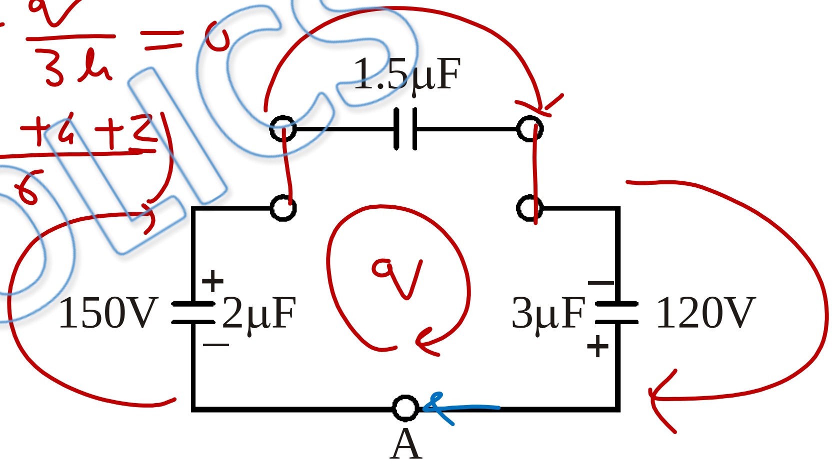




(Q.2) Two capacitors of 2 μF and 3 μF are charged to 150 volt and 120 volt respectively. The plates of capacitor are connected as shown in the figure. A discharged capacitor of capacity 1.5μF falls to the free ends of the wire. Then

$$\Delta V = (+150 + 0 + 120) - \frac{q}{2\mu} - \frac{q}{1.5\mu} - \frac{q}{3\mu} = 0$$

$$270 = \frac{q}{\mu}\left(\frac{1}{2} + \frac{2}{3} + \frac{1}{3}\right) = \frac{q}{\mu}\left(\frac{3+4+2}{6}\right)$$

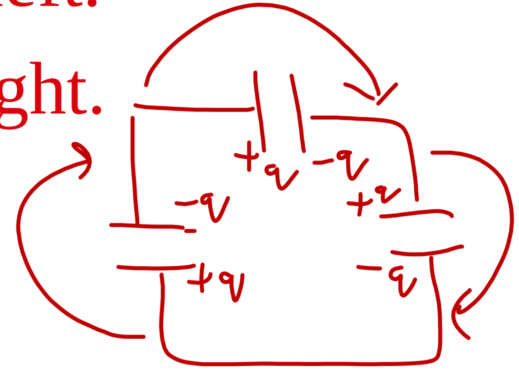


(a) charge on the 1.5 μF capacitor is 180 μC

(b) charge on the 2μF capacitor is 120 μC

(c) positive charge flows through A from right to left.

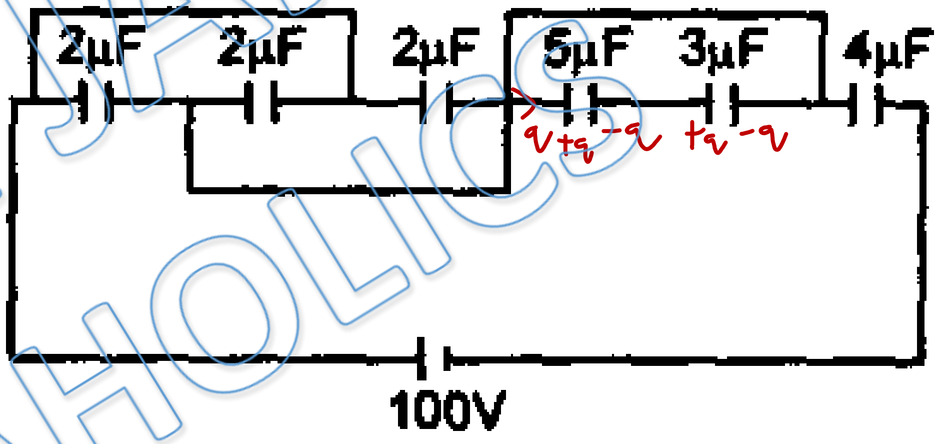
(d) positive charge flows through A from left to right.



$$270 = \frac{9}{6\mu} q = \frac{3}{2\mu} q$$

$$q = \frac{270 \times 2\mu}{3} = 180\,\mu C.$$ Charge on 2μF = 150×2μ − q

(Q.3) In the circuit shown in figure charge stored in the capacitor of capacity 5 μF is:

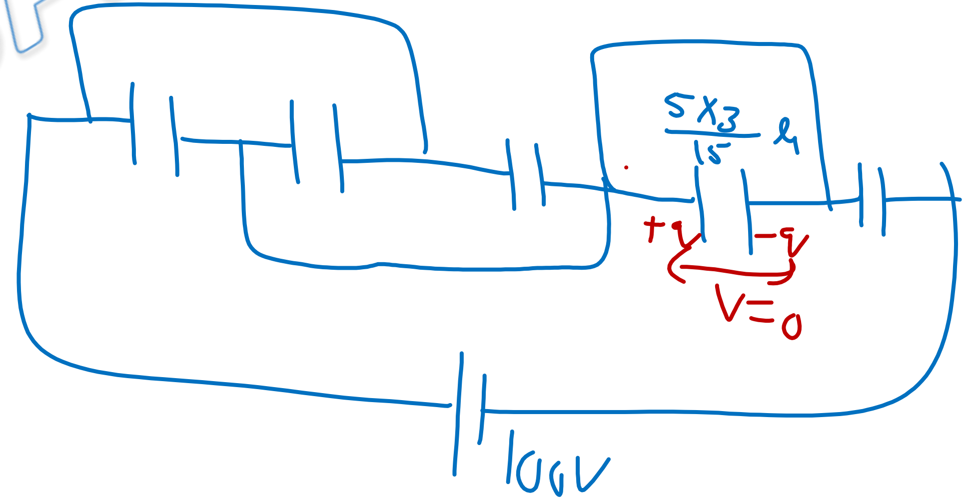


(a) 60 μC

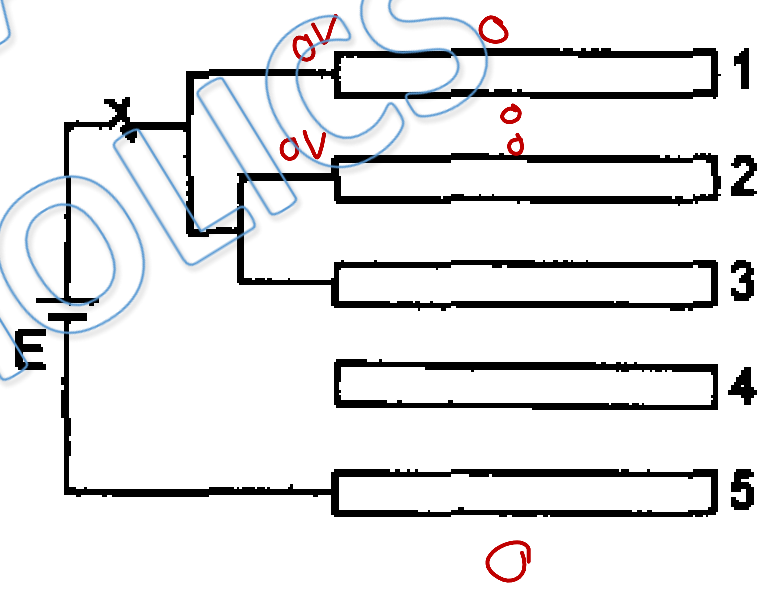
(b) 20 μC

(c) 30 μC

(d) zero



(Q.4) Five conducting plates are placed parallel to each other. Separation between them is d and area of each plate is A. Plate number 1, 2 and 3 are connected with each other and at the same time through a cell of emf E. The charge on plate number 1 is:



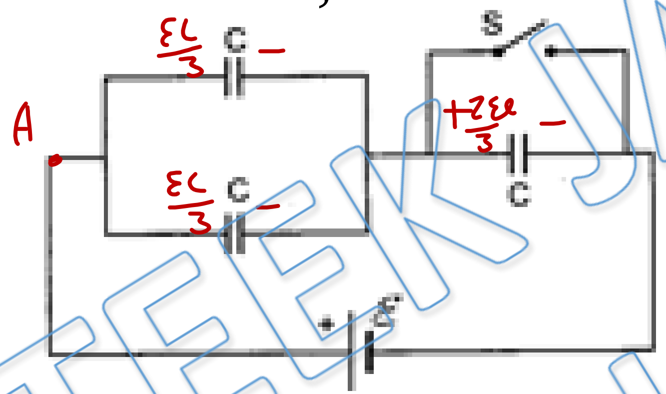
(a) $\frac{E\varepsilon_0 A}{d}$

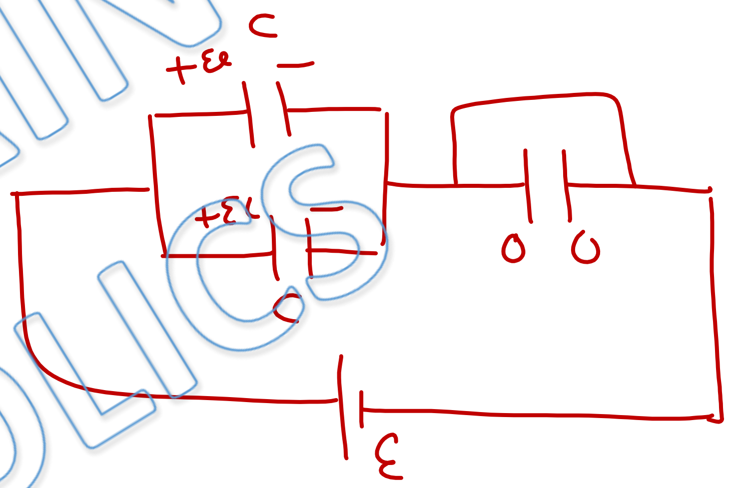
(b) $\frac{E\varepsilon_0 A}{2d}$

(c) $\frac{2E\varepsilon_0 A}{d}$

(d) zero

(Q.5) In the circuit shown, each capacitor has a capacitance C. The emf of the cell is ξ. If the switch S is closed,



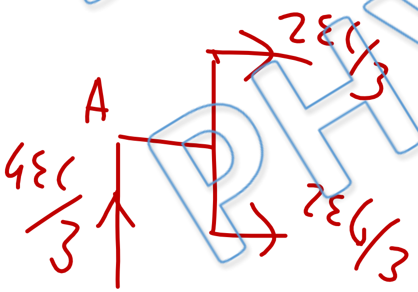


(a) some charge will flow out of the positive terminal of the cell

(b) some charge will enter the positive terminal of the cell

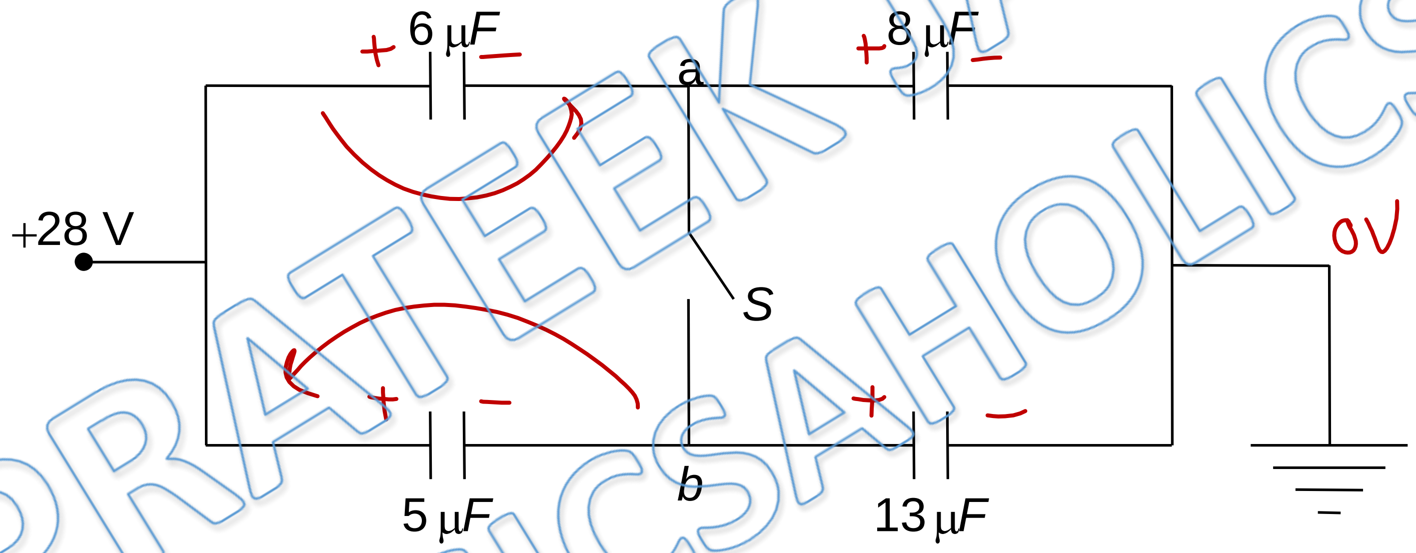
(c) the amount of charge flowing through the cell will be Cξ.

(d) the amount of charge flowing through the cell will be $\frac{4}{3}$Cξ.



LINKED COMPREHENSION TYPE (Q.6 TO Q.9)

The capacitors in the figure are initially uncharged and are connected as shown.



$28 - \frac{182}{9} = \frac{252 - 182}{9} = \frac{170}{9}\,V$

$\frac{28 \times 4}{7}\,V = 16\,V$

$12\,V$

$\frac{13}{18} \times 28 = \frac{182}{9}\,V$

$\frac{170}{9}\,V$

$V_a - V_b = \frac{182}{9} - 16 = \frac{182 - 144}{9} = \frac{38}{9} = 4.2\,V$

(Q.6) What is the potential difference V_{ab}?

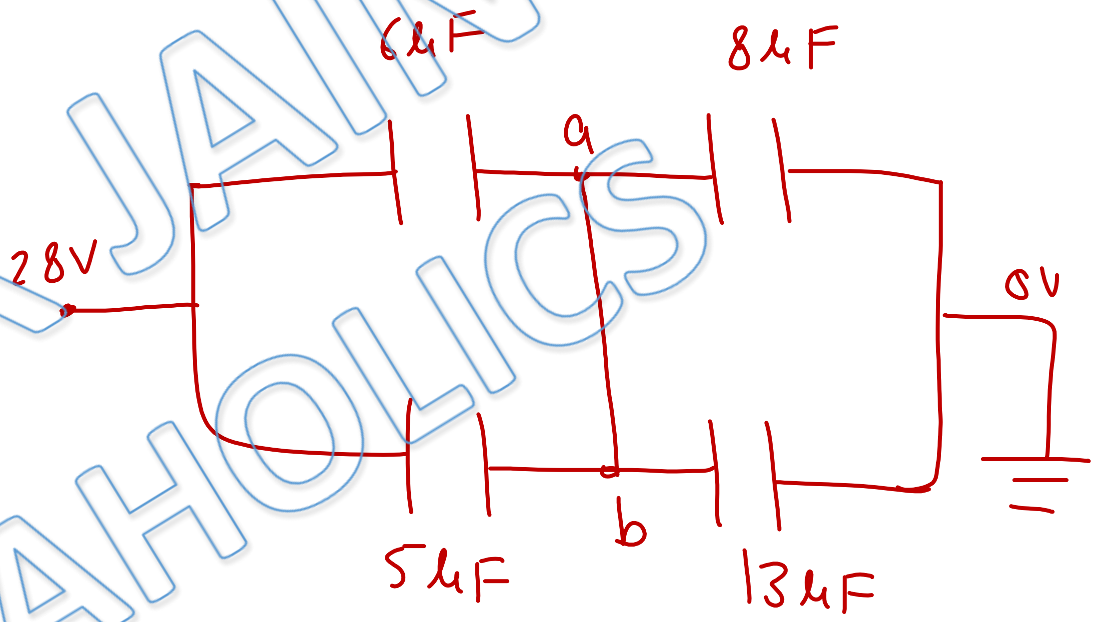
(a) 4.2 V

(b) 5.2 V

(c) 6.2 V

(d) 7.2 V

(Q.7) Now the key *S* is closed. What is the potential of point *a*?

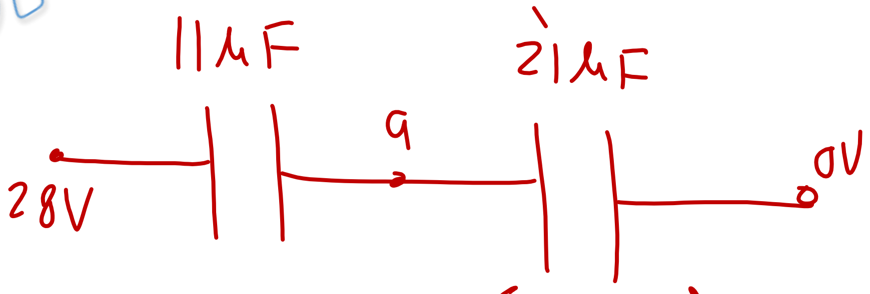


(a) 9.2 V

(b) 9.4 V

(c) 9.6 V ✓

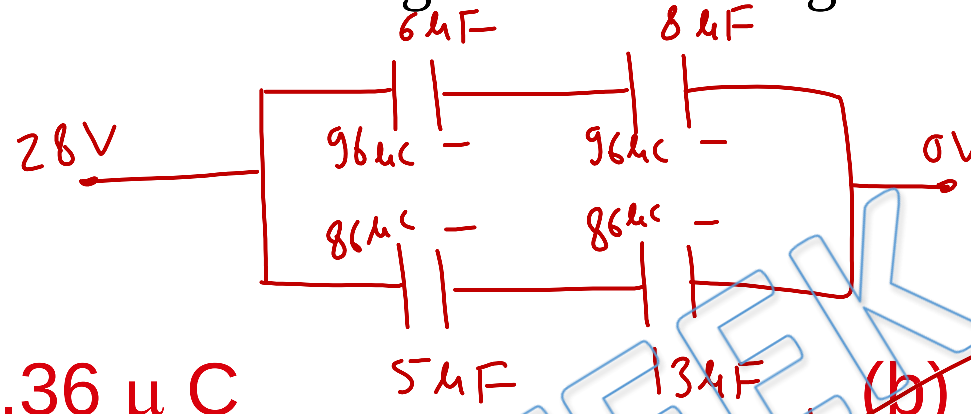
(d) 7.8 V

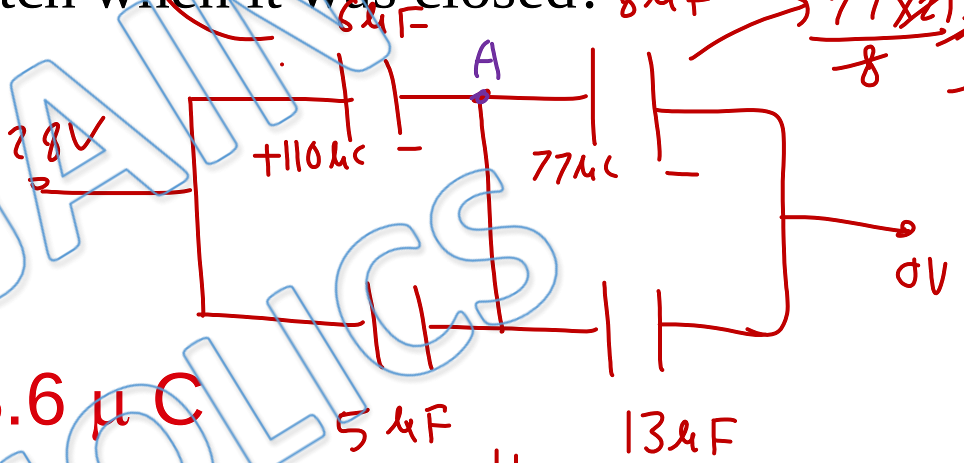


$$V_a = \frac{28 \times 11}{32} \, V$$

$$V_a = \frac{77}{8} = 9.6$$

(Q.8) How much charge flowed through the switch when it was closed?





(a) 3.36 μ C

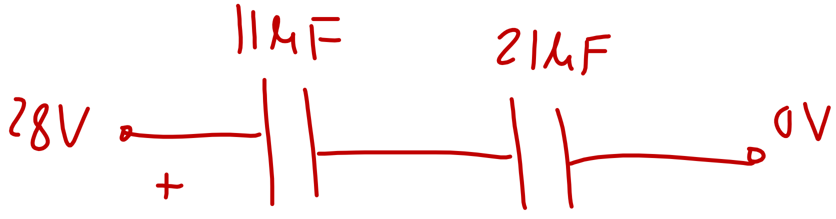
(b) 33.6 μ C

(c) 336 μ C

(d) 0.336 μ C

$$\frac{77\times21}{8}\times\frac{6}{11}=\frac{21\times21}{4}=\frac{441}{4}=110$$

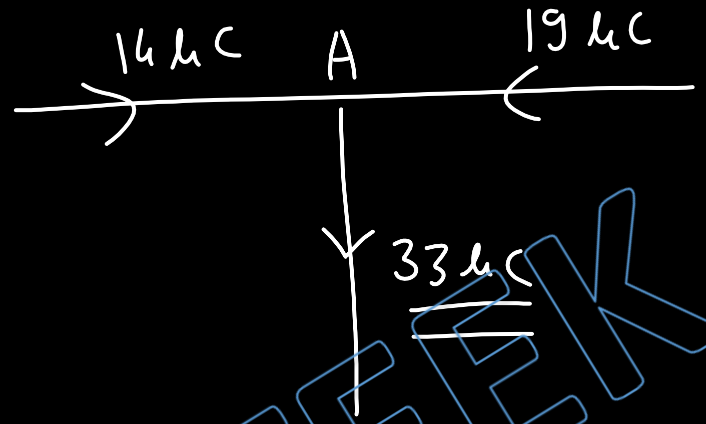
$$\frac{77\times21}{8}\times\frac{8}{21}$$



$$\frac{8\times6}{14}\times28=96\mu C$$

$$\frac{13\times5}{18}\times28=\frac{13\times70}{9}=\frac{780}{9}\mu C=86\mu C$$

$$\frac{11\times21}{32}\times28=\frac{77\times21}{8}=$$



Ans. b

(Q.9) The charge on capacitor 5 μF is

$$\frac{110}{6\mu} = \frac{q_5}{5\mu}$$

(a) 96 μ C

(b) 98μ C

(c) 94 μ C

(d) 92 μ C ✓

$$q_5 = \frac{55}{3} \times 5 = \frac{275}{3} = 91.66\ \mu C.$$

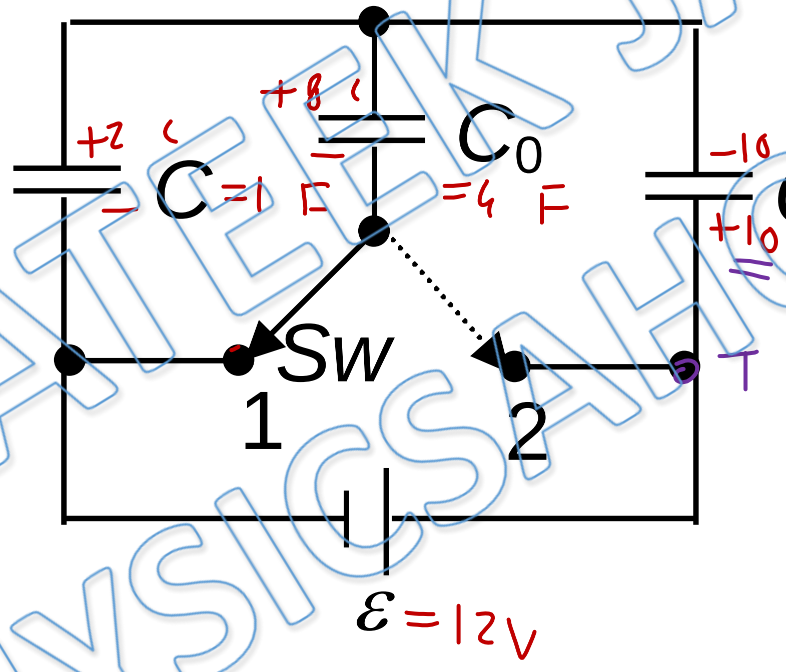
(Q.10) What amount of charge (in coulomb) will be supplied by cell shown in figure after the switch *Sw* is shifted from position 1 to position 2? Given $C = 1\text{F}$, $C_0 = 4\text{F}$ and $\varepsilon = 12\text{V}$

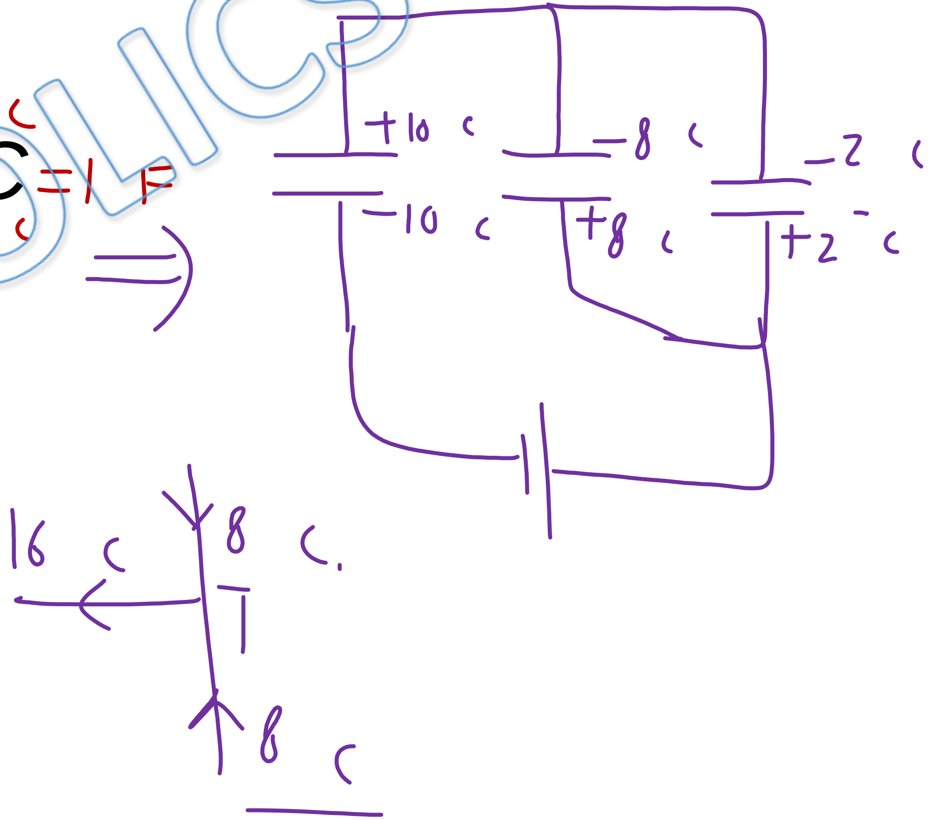
$C_{eff} = \frac{1 \times 5}{6}$ F

$= \frac{5}{6}$ F

$q_{eff} = \frac{5}{6} \times 12$

$= 10$ C





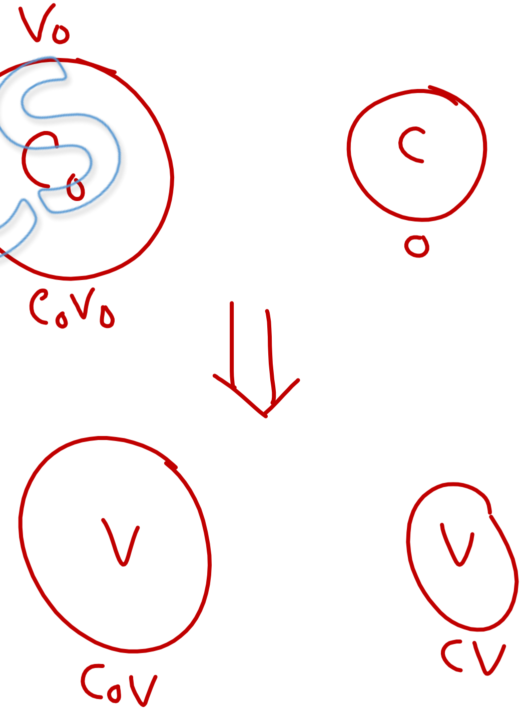
(Q.11) A capacitor of capacitance C_0 is charged to a potential V_0 and then isolated. A small uncharged capacitor C is then charged from C_0, discharged and charged again; the process being repeated n times. Due to this, potential of the larger capacitor is decreased to V. Value of C is -

(a) $C_0(V_0/V)^{1/n}$

(b) $C_0\left((V_0/V)^{1/n} - 1\right)$ ✓

(c) $C_0\left((V_0/V) - 1\right)^n$

(d) $C_0\left[\left(\frac{V}{V_0}\right)^n + 1\right]$



by C0 charged

$C_0V_0 = C_0V + CV$

$\Rightarrow = \frac{C_0V_0}{C_0+C} = \left(\frac{C_0}{C_0+C}\right)V_0$

After repeating process n times

$$V = \left(\frac{c_0}{c_0 + c}\right)^n V_0$$

$$\left(\frac{c_0 + c}{c_0}\right)^n = \frac{V_0}{V}$$

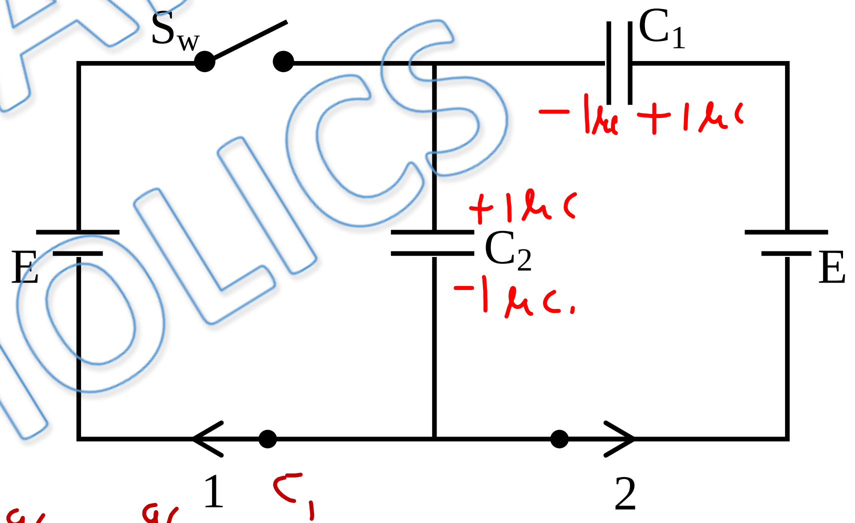
$$1 + \frac{c}{c_0} = \left(\frac{V_0}{V}\right)^{1/n}$$

$$\frac{c}{c_0} = \left(\frac{V_0}{V}\right)^{1/n} - 1$$

$$c = c_0\left[\left(\frac{V_0}{V}\right)^{1/n} - 1\right]$$

Ans. b

(Q.12) What charges will flow after the shorting of the switch Sw in the circuit illustrated in Fig. through section 1 and 2 in the directions indicated by the arrows ? Given $C_1 = C_2 = 2\,\mu F$ and E = 1 V.



$1\mu C + q_2 = 0$

$q_2 = -1\mu C$

$1\mu C + q_1 + q_2 = 2\mu C$

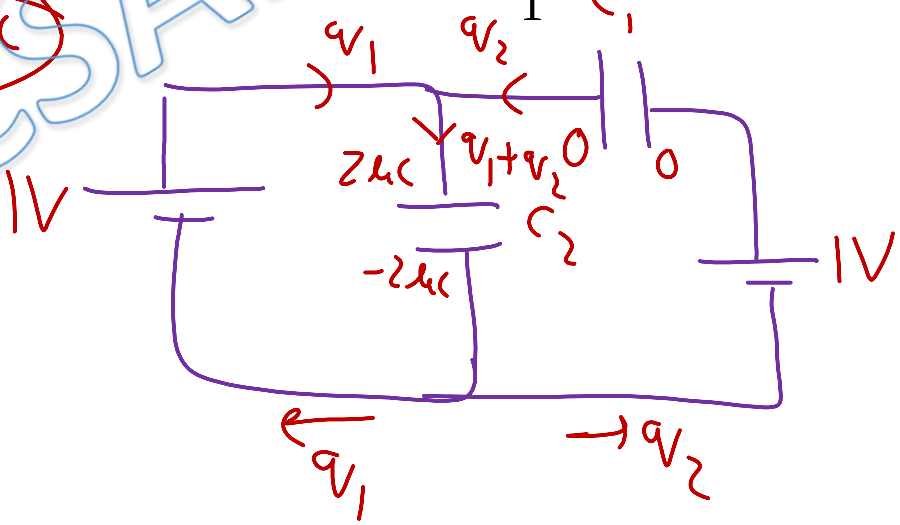
$q_1 = 2\mu C$

(a) 2μC , 1 μC

(b) 2μC , 2μC

(c) - 2μC, 2μC

(d) 2μC, -1μC



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Chalo Niklo