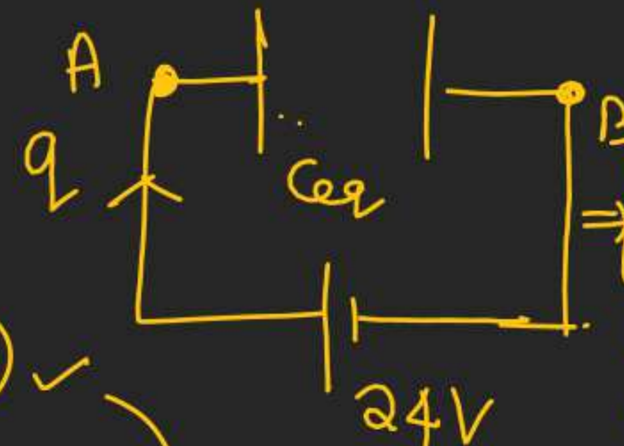
Q.1 Consider the connections shown in figure. (a) Find the capacitance between the points A and B. (b) Find the charges on the three capacitors. (c) Taking the potential at the point B to be zero, find the potential at the point D.

$(C_{eq})_{A-B} = ??$

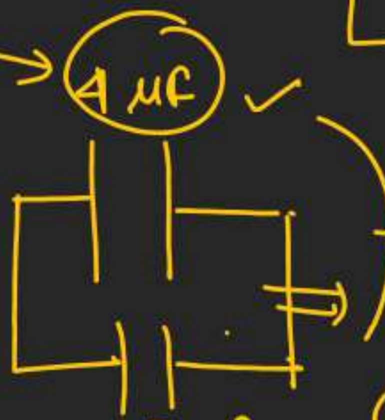
12μF & 6μF → Series.

$\frac{1}{(C_{eq})} = \frac{1}{12} + \frac{1}{6}$

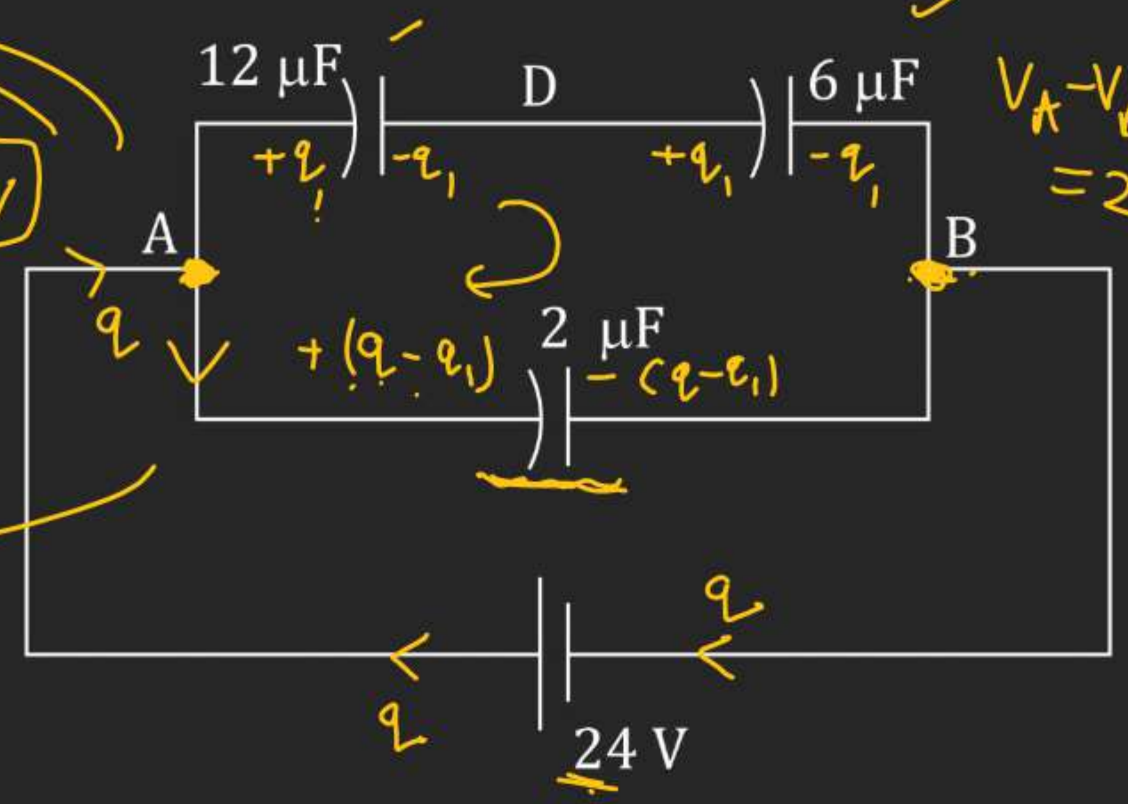
$C_{eq} = \frac{12 \times 6}{12+6} = \frac{72}{18} = 4\mu F$



$q = C_{eq} \cdot V$ → Total Charge



$(C_{eq})_{AB} = (4+2)\mu F = 6\mu F$



$V_A - V_B = 24V$

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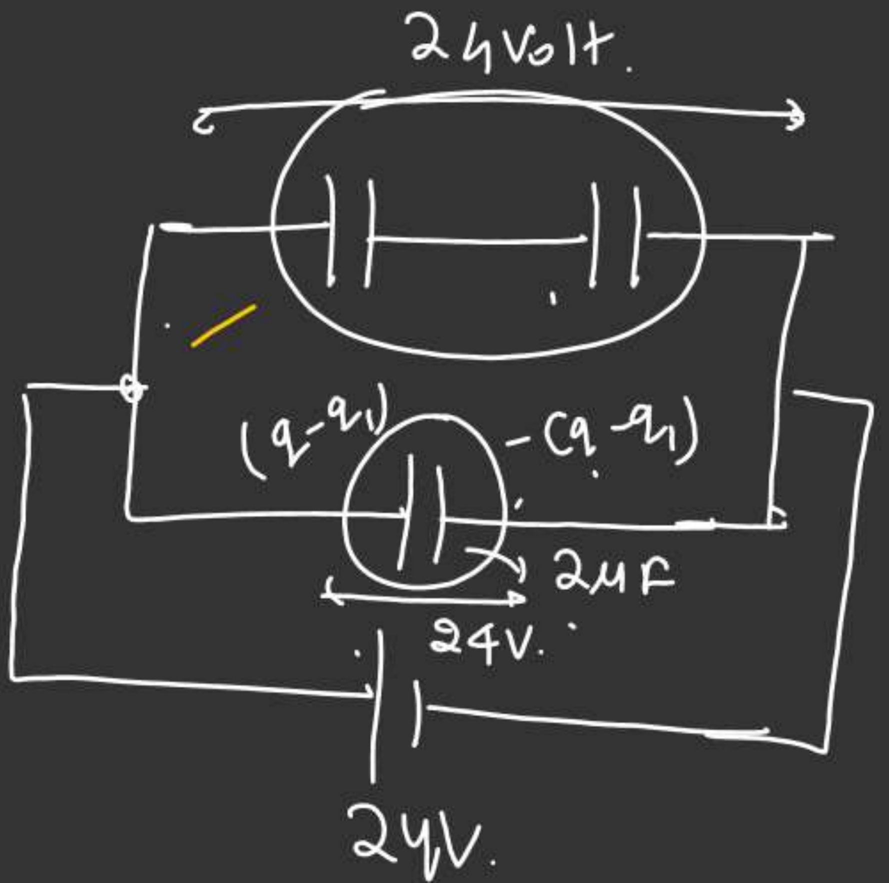
$$q = C_{eq} \cdot V$$
$$= (6 \times 24)\,\mu C$$
$$= \underline{144\,\mu C}$$

$$\frac{q - q_1}{2} = 24\,\text{Volt}$$
$$q - q_1 = 48$$
$$q_1 = (144 - 48)$$
$$= \underline{96\,\mu C}$$



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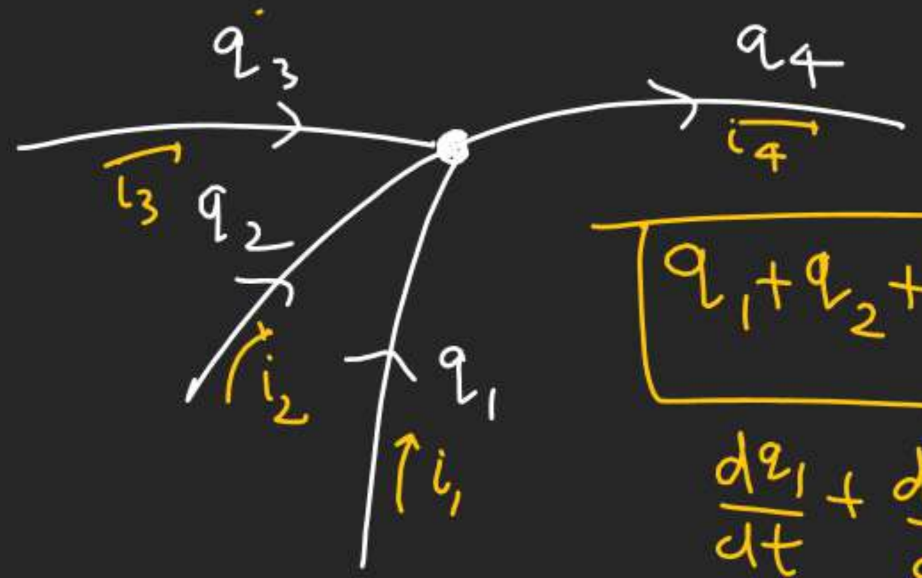
Capacitive Ckt

↳ K.C.L (Krichhoff's Current Law)

↳ "Conservation of Charge"

Sum of incoming Charge is equal to Sum of outgoing Charge across any node or junction



$$\boxed{q_1 + q_2 + q_3 = q_4}$$

$$\frac{dq_1}{dt} + \frac{dq_2}{dt} + \frac{dq_3}{dt} = \frac{dq_4}{dt}$$

$$\rightarrow i_1 + i_2 + i_3 = i_4$$

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Capacitive Ckt ✓

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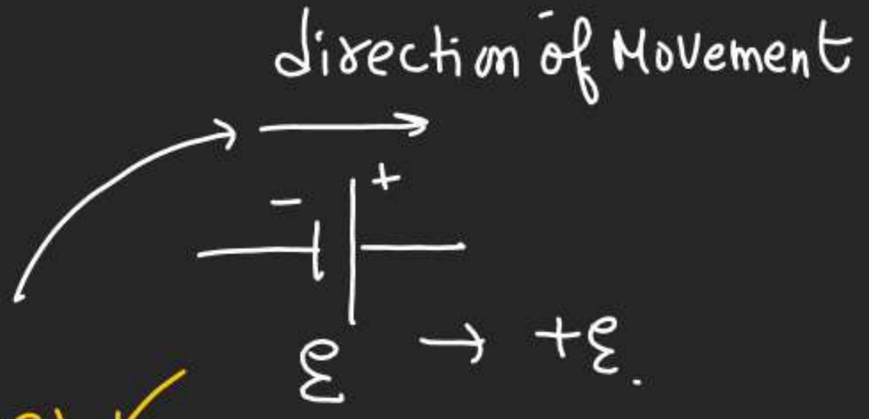
K.V.L :- " Krichhoff's Voltage Law "

↳ [Sum of all the potential drop in a close loop is equal to zero]

Sign-Convention :→

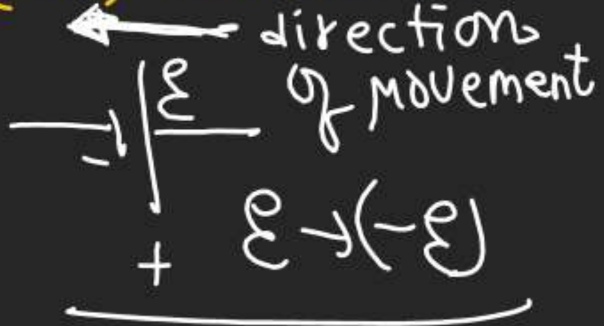
Sign-Convention of battery :→ i) While moving from (-ve) to (+ve) → $(+\varepsilon)$ ✓



ε = (Constant)

$$\boxed{V_B - V_A = \varepsilon}$$

→ (ii) While moving from (+ve) terminal of battery to (-ve) terminal of battery → $(-\varepsilon)$ ✓ →



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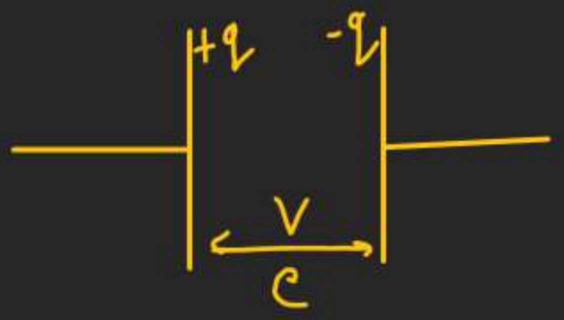
Capacitive Ckt →

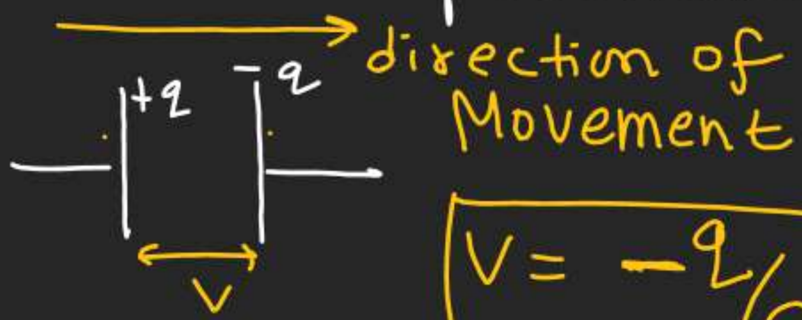
Sign- Convention for Capacitor :-



$q = CV$

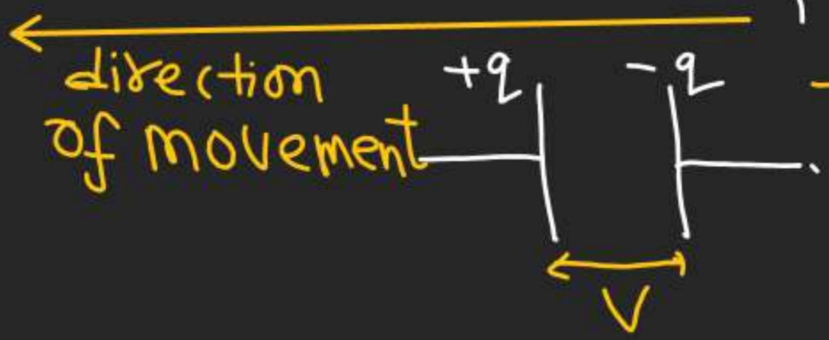
$$\boxed{V = \left(\frac{q}{C}\right)}$$

① While moving from +ve plate of Capacitor to −ve plate we assume potential drop.



$$\boxed{V = -\frac{q}{C}}$$

② While moving from −ve plate of Capacitor to +ve plate. we assume potential rise.



$$\boxed{V = +\left(\frac{q}{C}\right)}$$

Capacitive Ckt

CAPACITOR

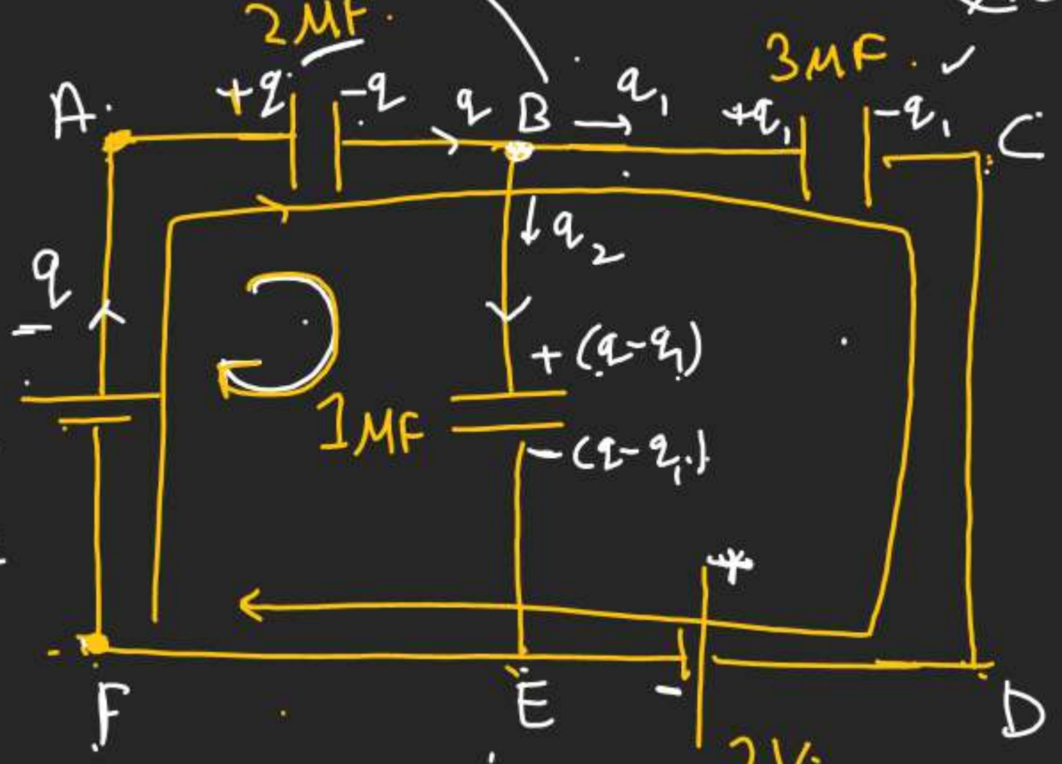
$$q = CV$$

μC, μF

$\mu F \to \times 10^{-6}$, $\mu C \to 10^{-6}$

$q = q_1 + q_2$

$q_2 = (q - q_1)$



→ K.V.L in Close loop ABCDEFA :→

$$+4 - \frac{q}{2} - \frac{q_1}{3} - 2 = 0$$

$$2 = \frac{q}{2} + \frac{q_1}{3}$$

$$12 = 3q + 2q_1 \quad -(1)$$

K.V.L in Closed loop ABEFA

$$-\frac{q}{2} - \frac{(q-q_1)}{1} + 4 = 0$$

$$\frac{q}{2} + \frac{(q-q_1)}{1} = 4$$

$$q + 2(q-q_1) = 8$$

$$3q - 2q_1 = 8 \quad -(2)$$

Adding (1) + (2)

$$6q = 20$$

$$q = \frac{20}{6} = \left(\frac{10}{3}\mu C\right)$$

$2q_1 = 12 - 3q$ From (1)

$$q_1 = \left(6 - \frac{3}{2}q\right) = 6 - \frac{3}{2} \times \frac{10}{3} = 1\,\mu C$$

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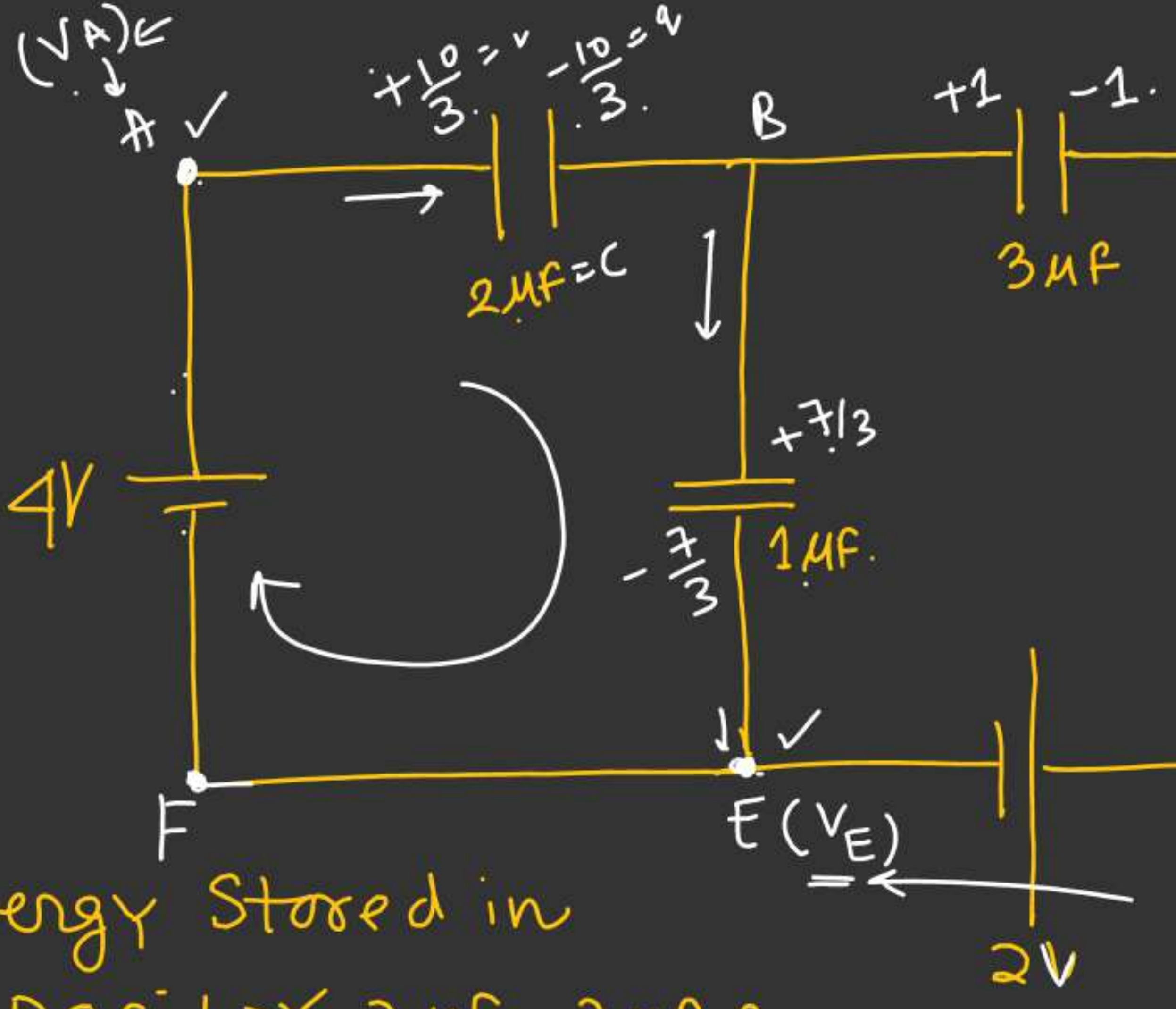


$V_A - V_E = ??$

$V_A - \left(\frac{10}{3\times 2}\right) - \frac{7}{3} = V_E$

$V_A - V_E = \left(\frac{10}{6} + \frac{7}{3}\right)$

$= \frac{10+14}{6} = \frac{24}{6}$

$= +4\,\text{Volt}$

$V_A > V_E$

⇒ Energy Stored in Capacitor 2μF, 3μF & 1μF.

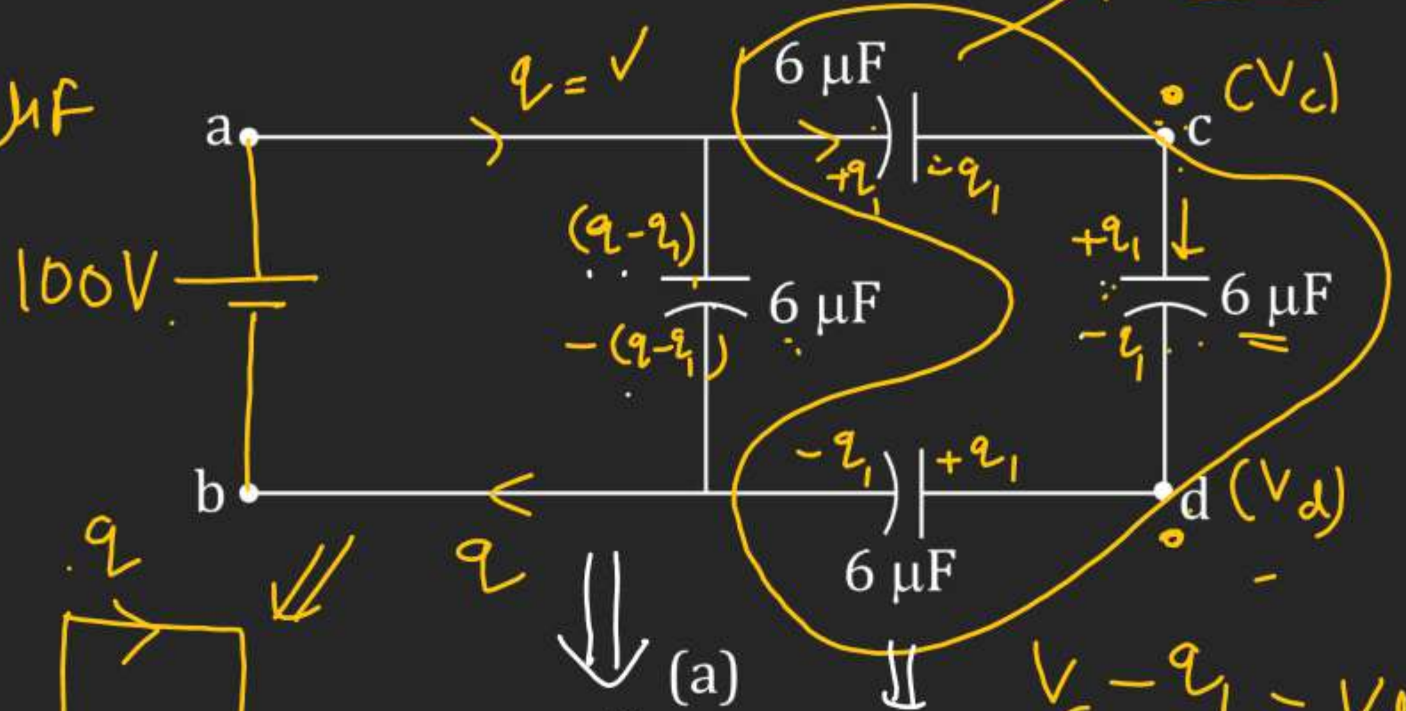
⇒ $U_{2\mu F} = \frac{q^2}{2C} = \frac{(10/3)^2}{2\times 2} = \left(\frac{100}{36}\right)\mu J$

Capacitive Ckt

CAPACITOR

$C, C, C \to \text{Series} = \frac{1}{C_{eq}} = \frac{1}{C} + \frac{1}{C} + \frac{1}{C} \Rightarrow C_{eq} = C/3$

Q.2 If 100 volts of potential difference is applied between a and b in the circuit of figure (~~31-W2a~~), find the potential difference between c and d.



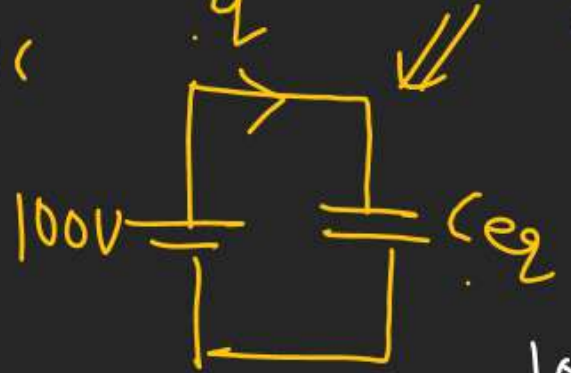
$C_{eq} = (2+6)\mu F$

$= 8\mu F$

$q = C_{eq} V$

$= (8 \times 100)\mu C$

$= 800\mu C$



$\frac{q_1}{2} = 100 \Rightarrow q_1 = 200\mu C$

$V_c - \frac{q_1}{6} = V_d$

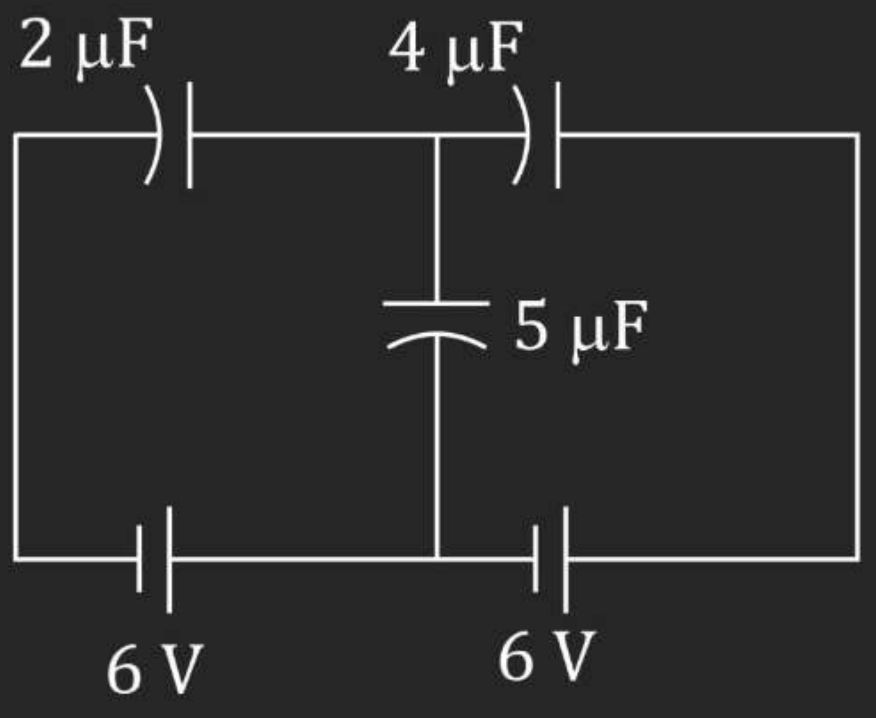
$V_c - V_d = q_1/6$

Nishant Jindal

H.W.

CAPACITOR

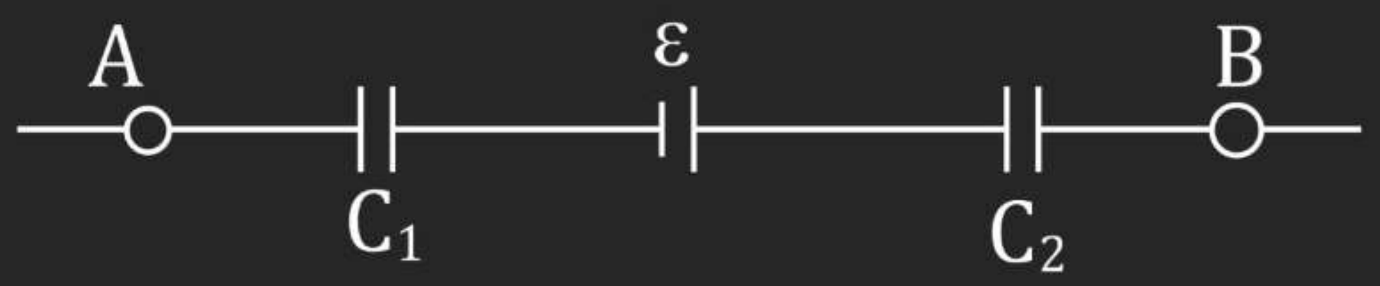
Q.3 Find the charges on the three capacitors shown in figure (a).



(a)

H-W.

Q.6 A circuit has a section AB shown in Fig. The emf of the source equals $\varepsilon = 10\ \mathrm{V}$, the capacitor capacitances are equal to $\mathrm{C}_1 = 1.0\mu\mathrm{F}$ and $\mathrm{C}_2 = 20\mu\mathrm{F}$, and the potential difference $\mathrm{V_A} - \mathrm{V_B} = 5.0\ \mathrm{V}$. Find the voltage across each capacitor.



Capacitive Ckt H.W

CAPACITOR

Q.7 In a circuit shown in Fig. find the potential difference between the left and right plates of each capacitor.