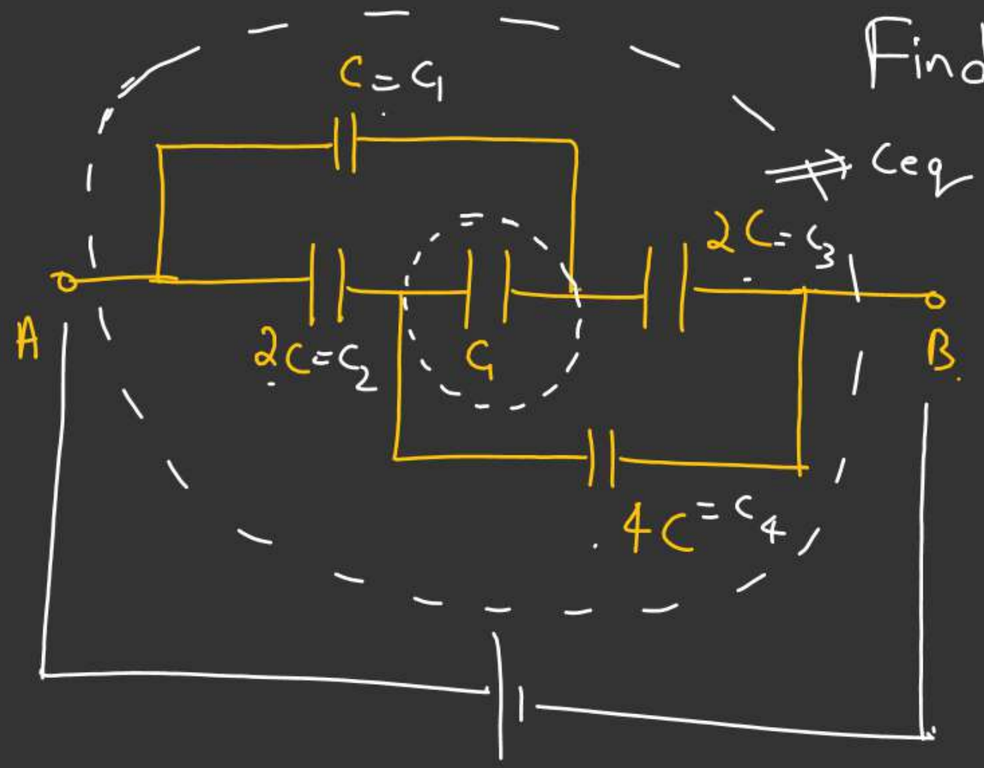
Nishant Jindal

Capacitor

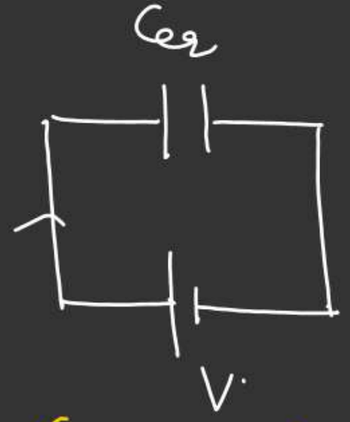
Capacitive Ckt

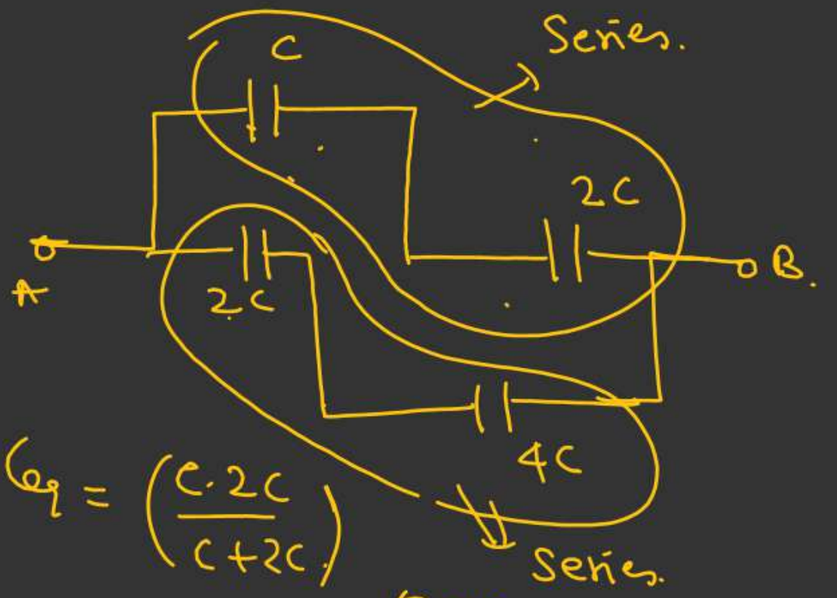
Balance wheat - Stone bridge.

$\left[\frac{C_1}{C_2} = \frac{C_3}{C_4}\right] = \frac{1}{2}$



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





$C_{eq} = \left(\frac{C \cdot 2C}{C+2C}\right) + \frac{(2C)(4C)}{(2C+4C)}$

$C_{eq} = \frac{2C^2}{3C} + \frac{8C^2}{6C}$

$= \frac{2}{3}C + \frac{4C}{3} = \frac{6C}{3} = 2C$

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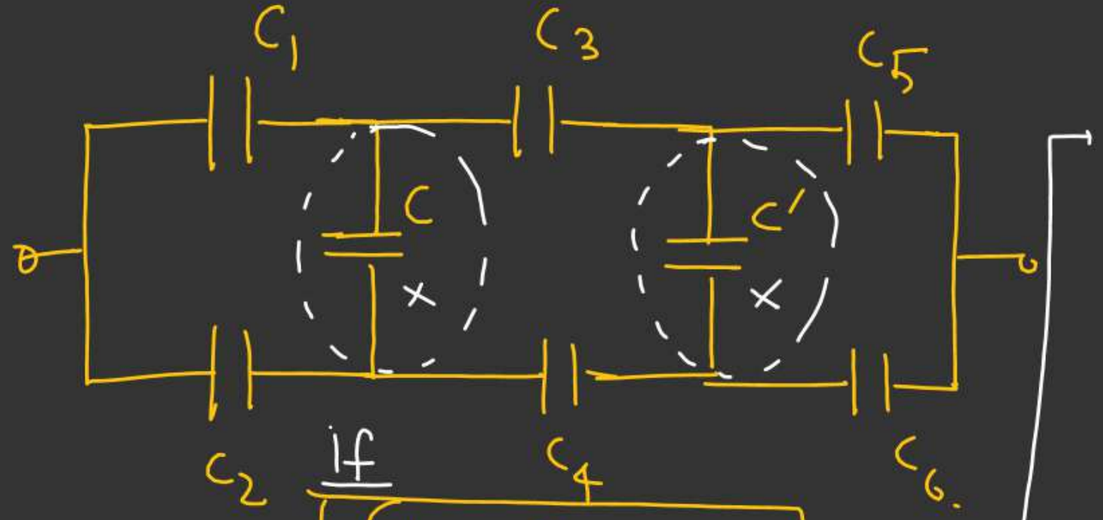
Extended Wheat-Stone bridge.

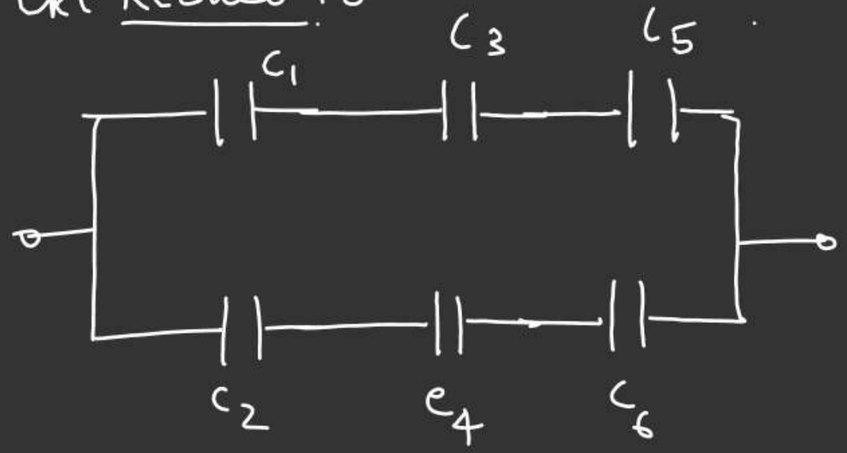
Case-1 :- Horizontal Extended-wheat stone bridge



if

$$\frac{C_1}{C_2} = \frac{C_3}{C_4} = \frac{C_5}{C_6}.$$

Ckt Reduced to



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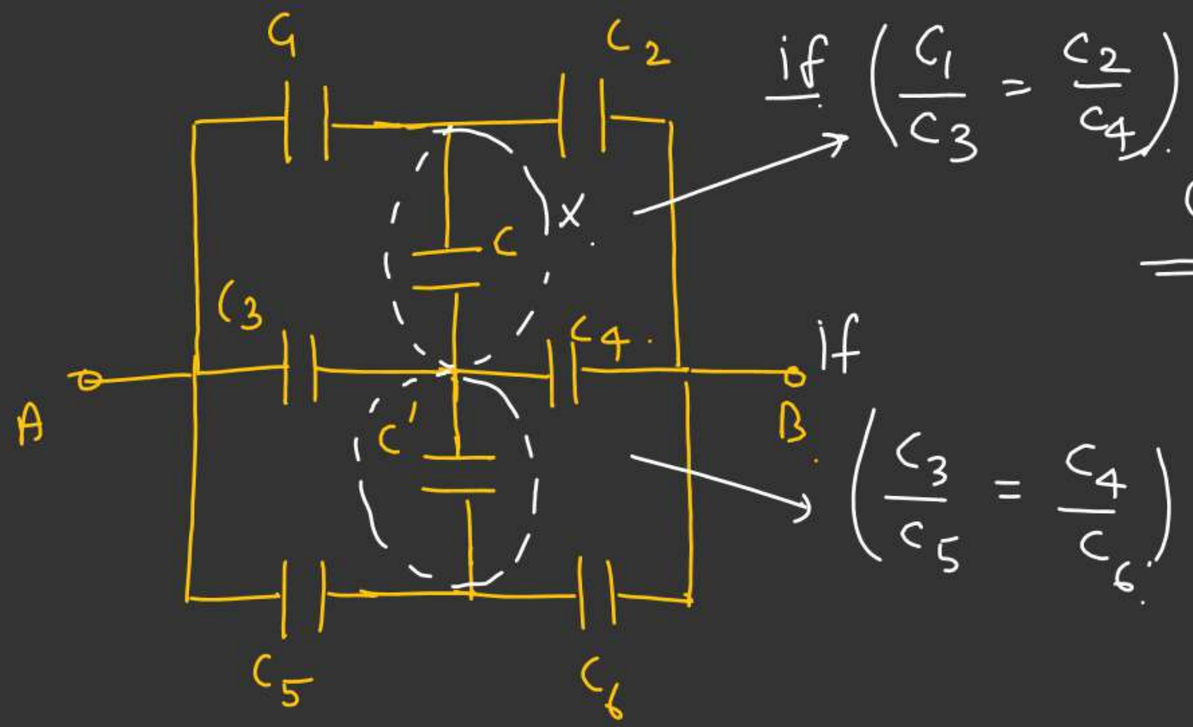
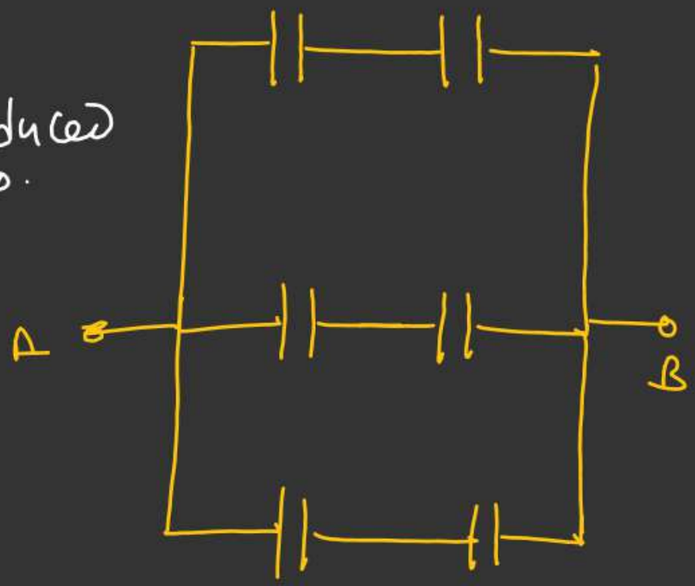
Case-2 Vertical Extended Wheatstone bridge:-



if $\left(\frac{C_1}{C_3} = \frac{C_2}{C_4}\right) \Rightarrow$

Ckt Reduced to.



If $\left(\frac{C_3}{C_5} = \frac{C_4}{C_6}\right)$

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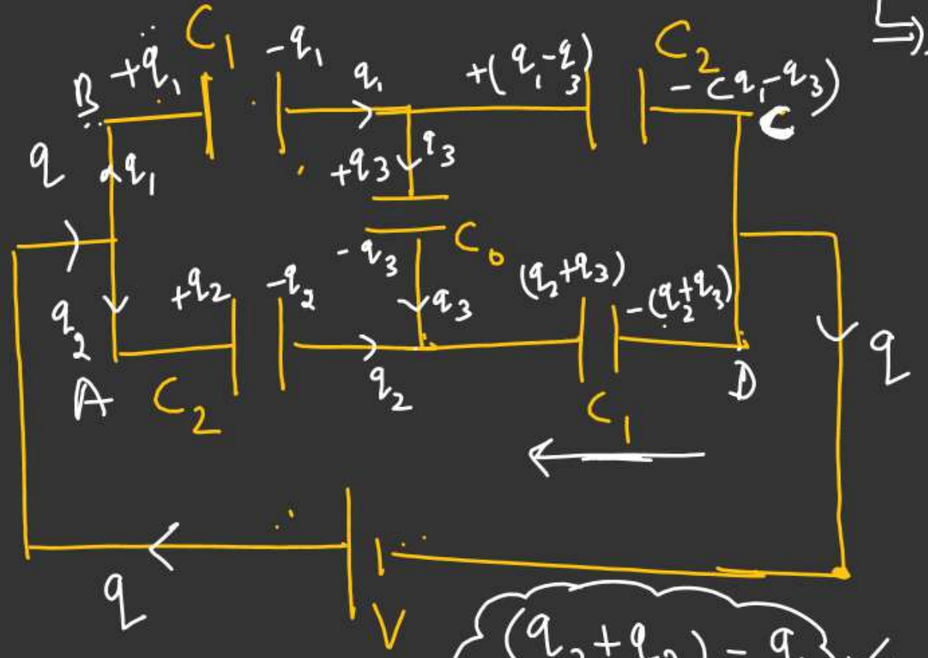
Capacitors with diagonal Symmetry :→



↳ Note :- [Capacitors having diagonal Symmetry have Same Charge.]

K.V.L in the loop ABCDA :-

$$-\frac{q_1}{C_1} - \frac{(q_1-q_3)}{C_2} + \left(\frac{q_2+q_3}{C_1}\right) + \frac{q_2}{C_2} = 0$$

$$-\frac{q_1}{C_1} - \frac{q_1}{C_2} + \frac{q_3}{C_2} + \frac{q_2}{C_2} + \frac{q_2+q_3}{C_1} = 0$$

$$q_1\left(\frac{1}{C_1}+\frac{1}{C_2}\right) = (q_2+q_3)\left(\frac{1}{C_1}+\frac{1}{C_2}\right)$$

$$q_1 = q_2+q_3$$

$(q_2+q_3) = q_1$

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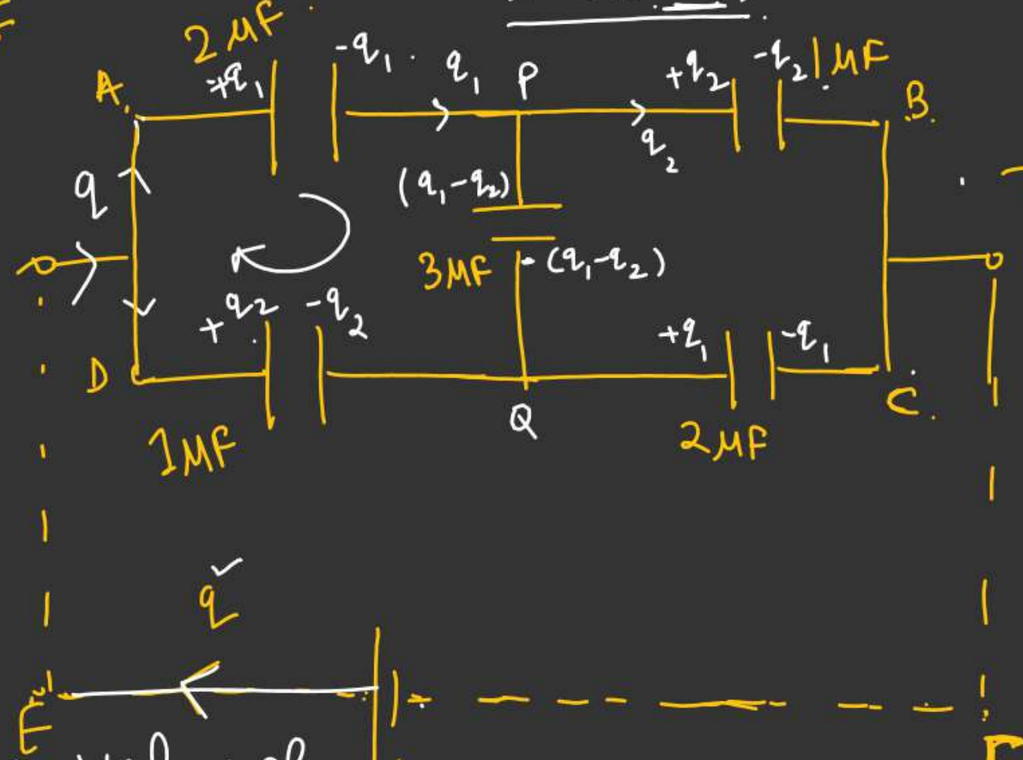
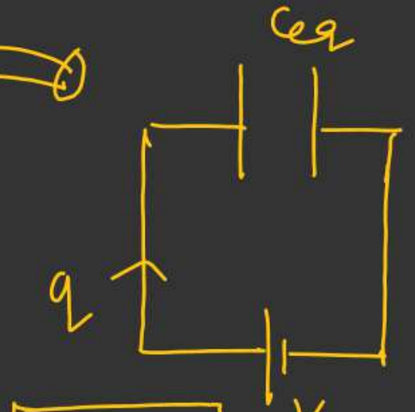
#



$q = (q_1 + q_2)$ — ①

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



$q = C_{eq} \cdot V$ ✓

K.V.L in the ABFEA :-

$$-\frac{q_1}{2} - \frac{q_2}{1} + V = 0$$

$$V = \frac{q_2}{1} + \frac{q_1}{2} \quad \text{— ②}$$

K.V.L in close loop APQDA

$$-\frac{q_1}{2} - \frac{(q_1 - q_2)}{3} + \frac{q_2}{1} = 0$$

$$-\frac{q_1}{2} - \frac{q_1}{3} + \frac{q_2}{3} + q_2 = 0$$

$$\frac{4q_2}{3} = \frac{3q_1 + 2q_1}{6} = \frac{5q_1}{6}$$

$$q_1 = \frac{6}{5} \times \frac{4q_2}{3} = \left(\frac{8q_2}{5}\right) \checkmark$$

Put the value of q_1 & C_2 in ①

$$V = \frac{5q}{13} + \frac{1}{2}\left(\frac{8q}{13}\right)$$

$$V = \left(\frac{5}{13}q + \frac{4q}{13}\right) = \frac{9q}{13}$$

$$q = \frac{8q_2}{5} + q_2$$

$$q = \frac{13}{5} q_2$$

$$q_2 = \left(\frac{5q}{13}\right), \quad q_1 = \frac{8}{5} \times \frac{5q}{13}$$

$$q_1 = 8q/13$$

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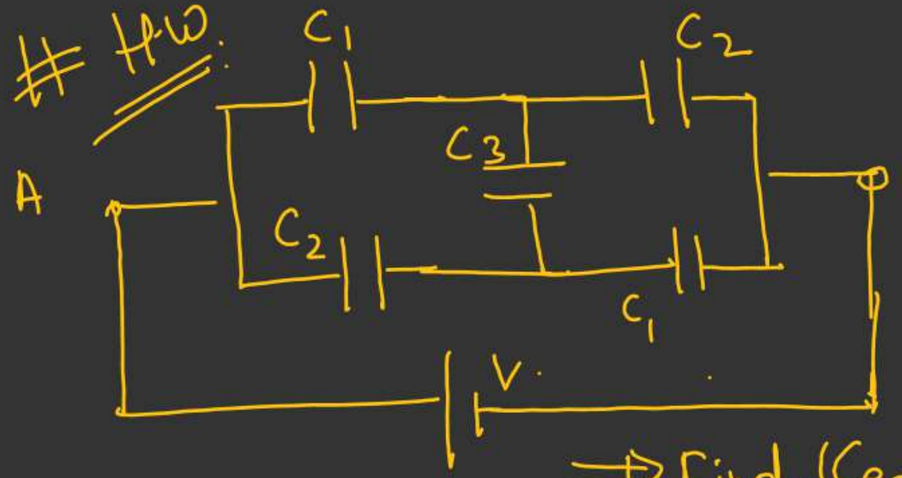
$$V = \frac{9q}{13}$$

$$q = \frac{13}{9} V$$

$$q = C_{eq} \cdot V$$

$$C_{eq} = \frac{13}{9}\ \mu F$$ → (Equivalent Capacitance of the Ckt)

HW:



⇒ Find $(C_{eq})_{A-B} = ??$

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Nodal method

$q = CV$

CAPACITOR

(x-20) Volt | 20V | x

Q.1 In the circuit shown in Fig. determine charge on each capacitor.

Steps :→ ① Assume any node of junction as refrance potential ie 0.

② Write the potential across the Capacitor w.r.t refrance zero potential.

③ Apply (K.C.L) By junction law at C :—

$q_1 + q_2 = q_3$

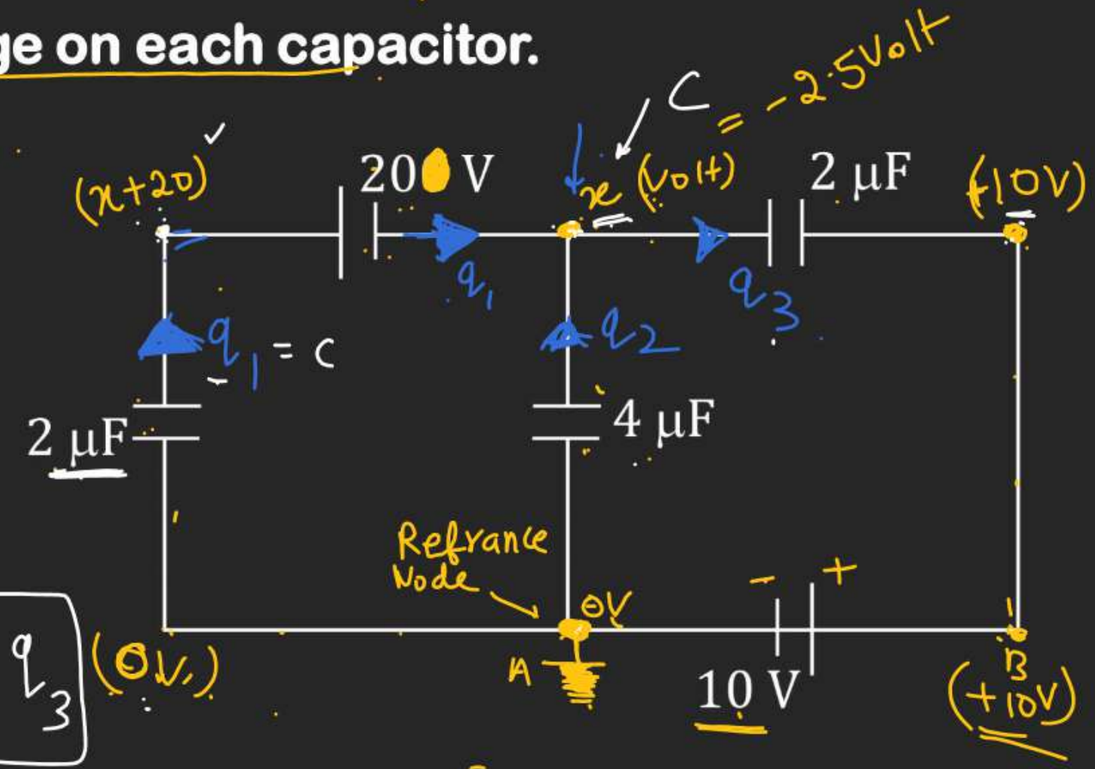
$-8x = 20$

$x = -\frac{20}{8}$

$x = \left(-\frac{5}{2}\right) = -2.5$ Volt

$-2(x+20) - 4x = (x-10)2$

$-2x - 4x - 40 = 2x - 20$



$V_A + 10 = V_B$

$V_B = V_A + 10$

$= 0 + 10$