

PRAYAS

JEE 2025

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Lecture - 06

Physics

(Mini Lecture)

Capacitor

By- Saleem Ahmed Sir





Topics *to be covered*

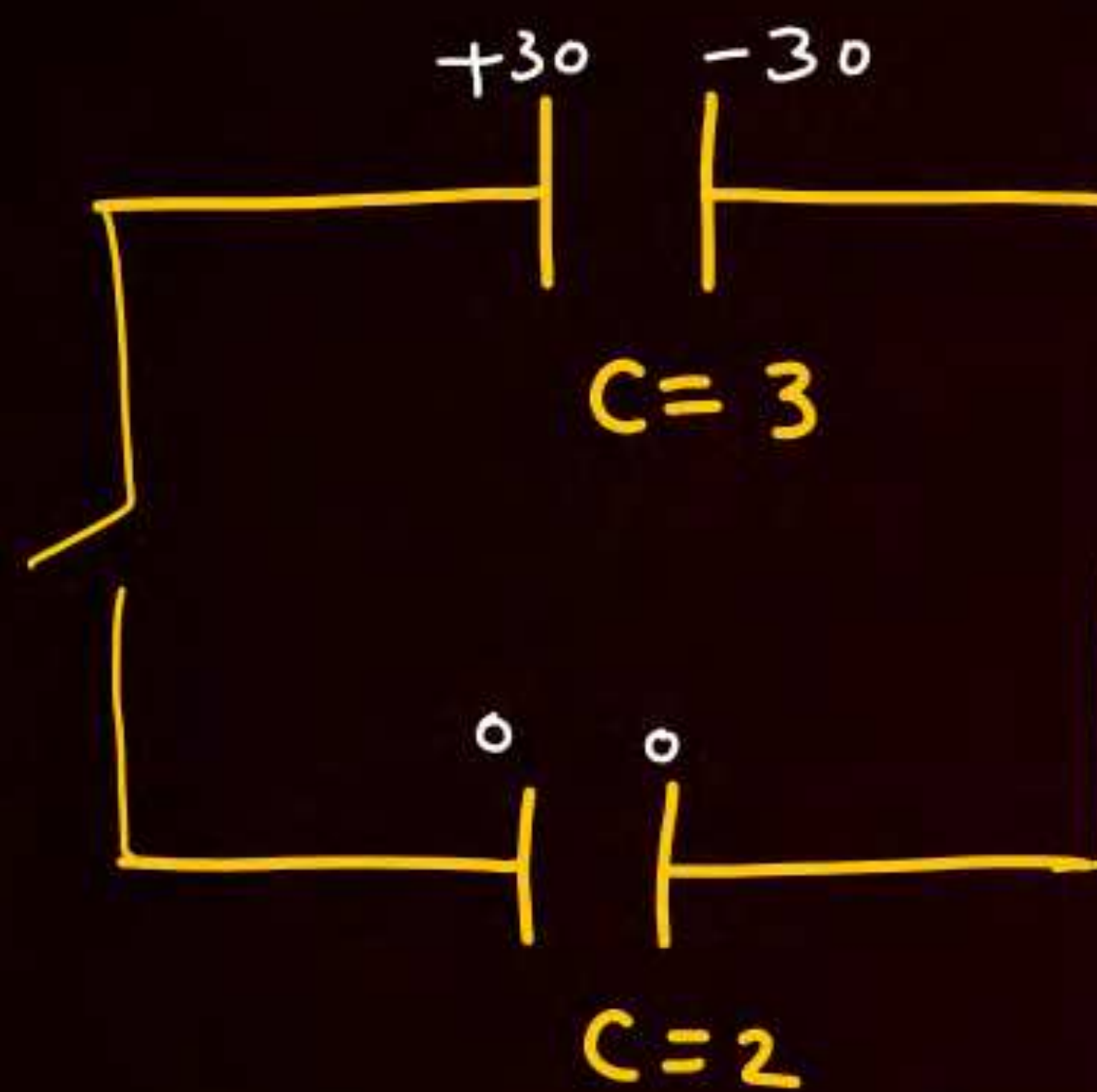
1 Two Capacitor Connection

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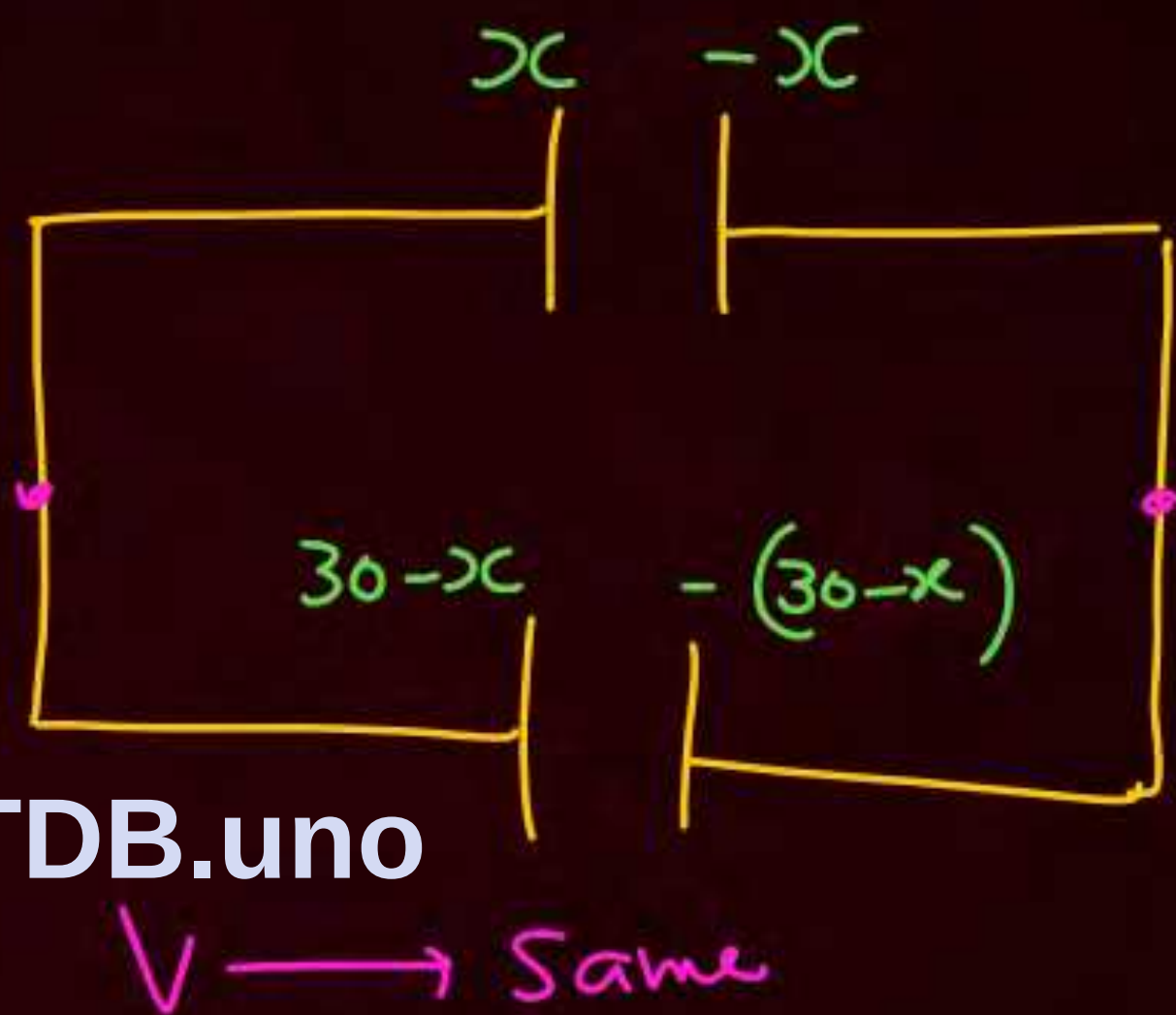
2

3

4



switch close



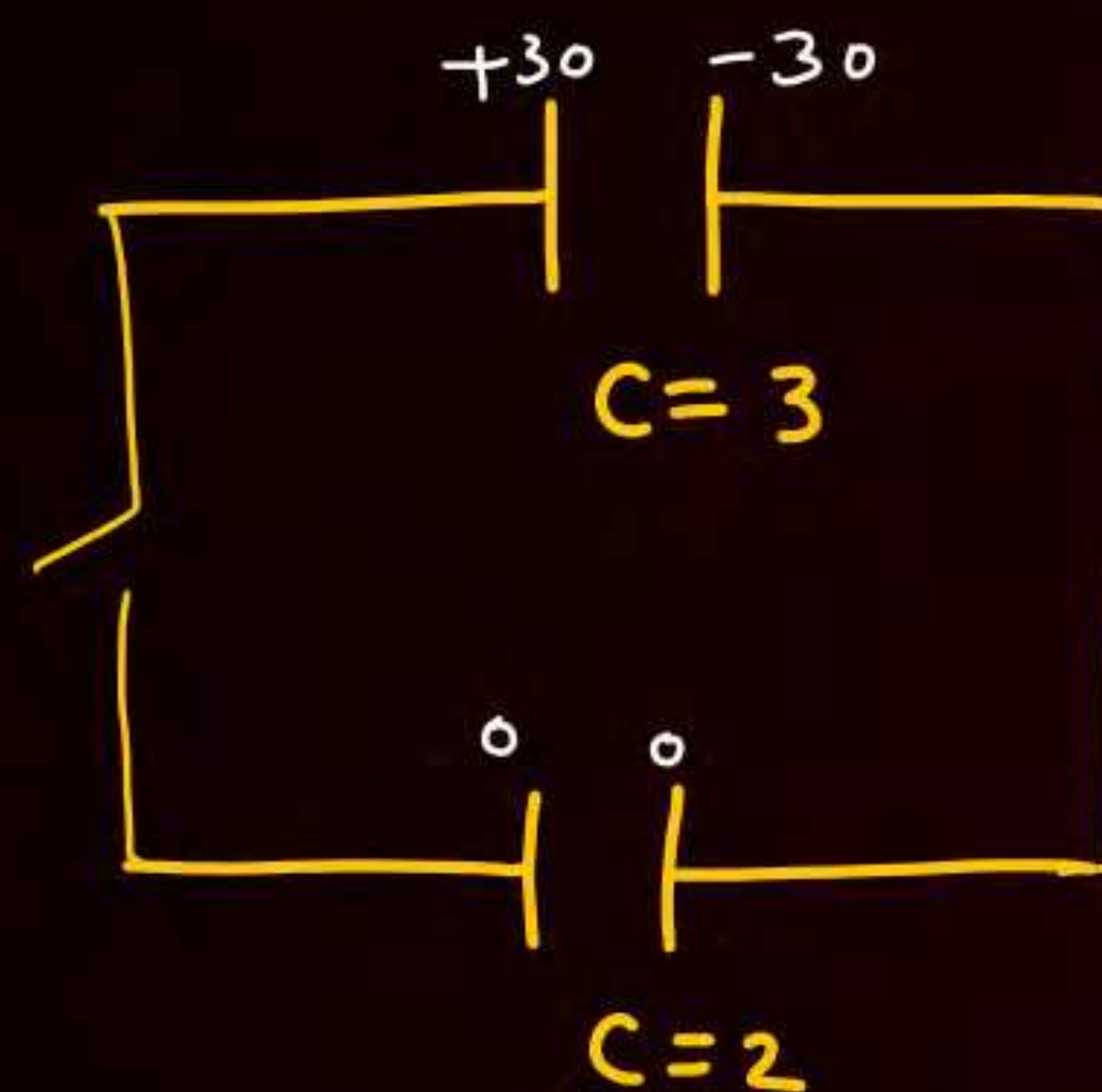
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$V \rightarrow \text{Same}$

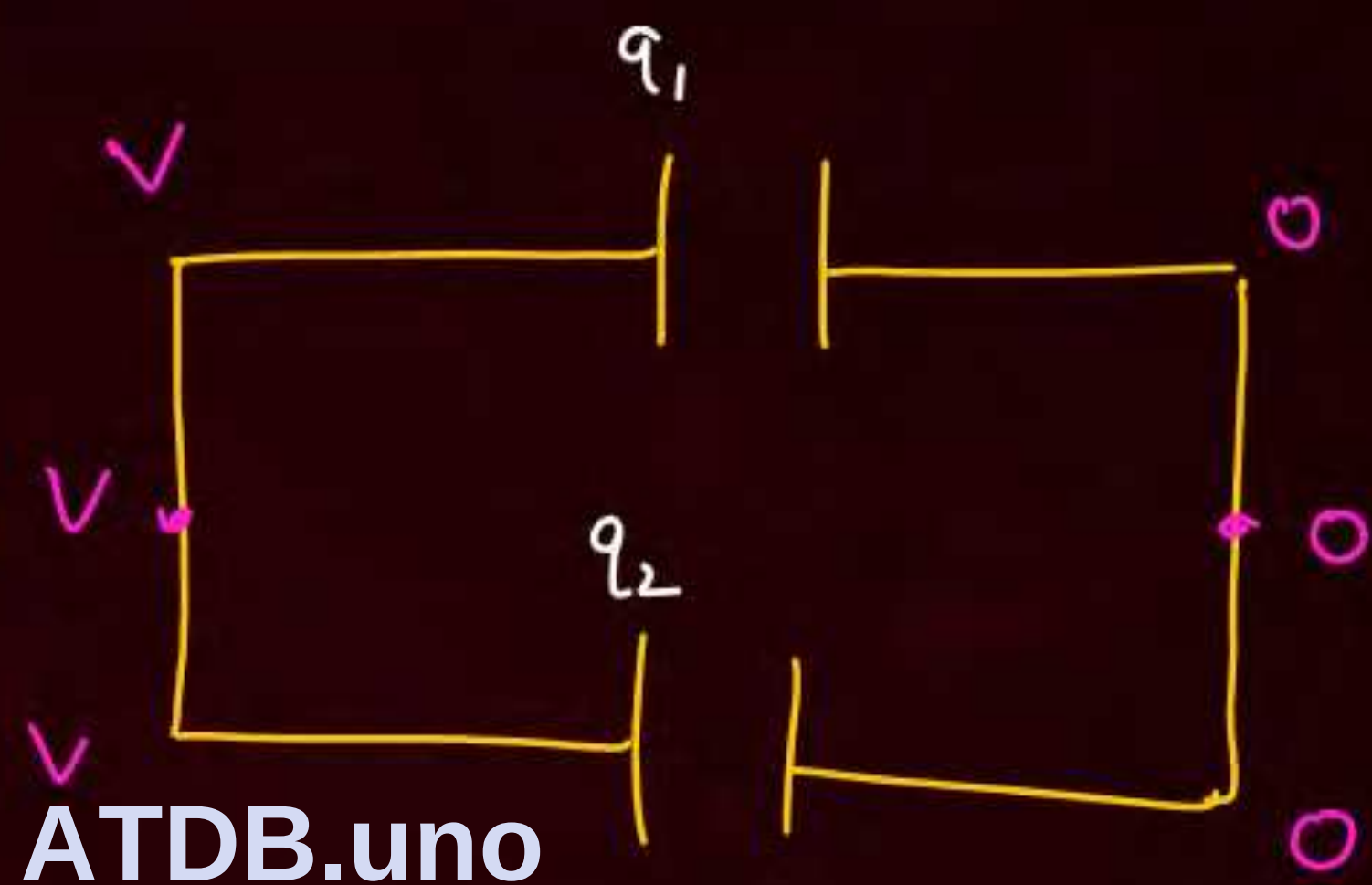
$$V = \frac{x}{3} = \frac{30-x}{2}$$

$$2x = 90 - 3x$$

$$\boxed{x = 18}$$



switch close



$V = V_{\text{common potential}}$

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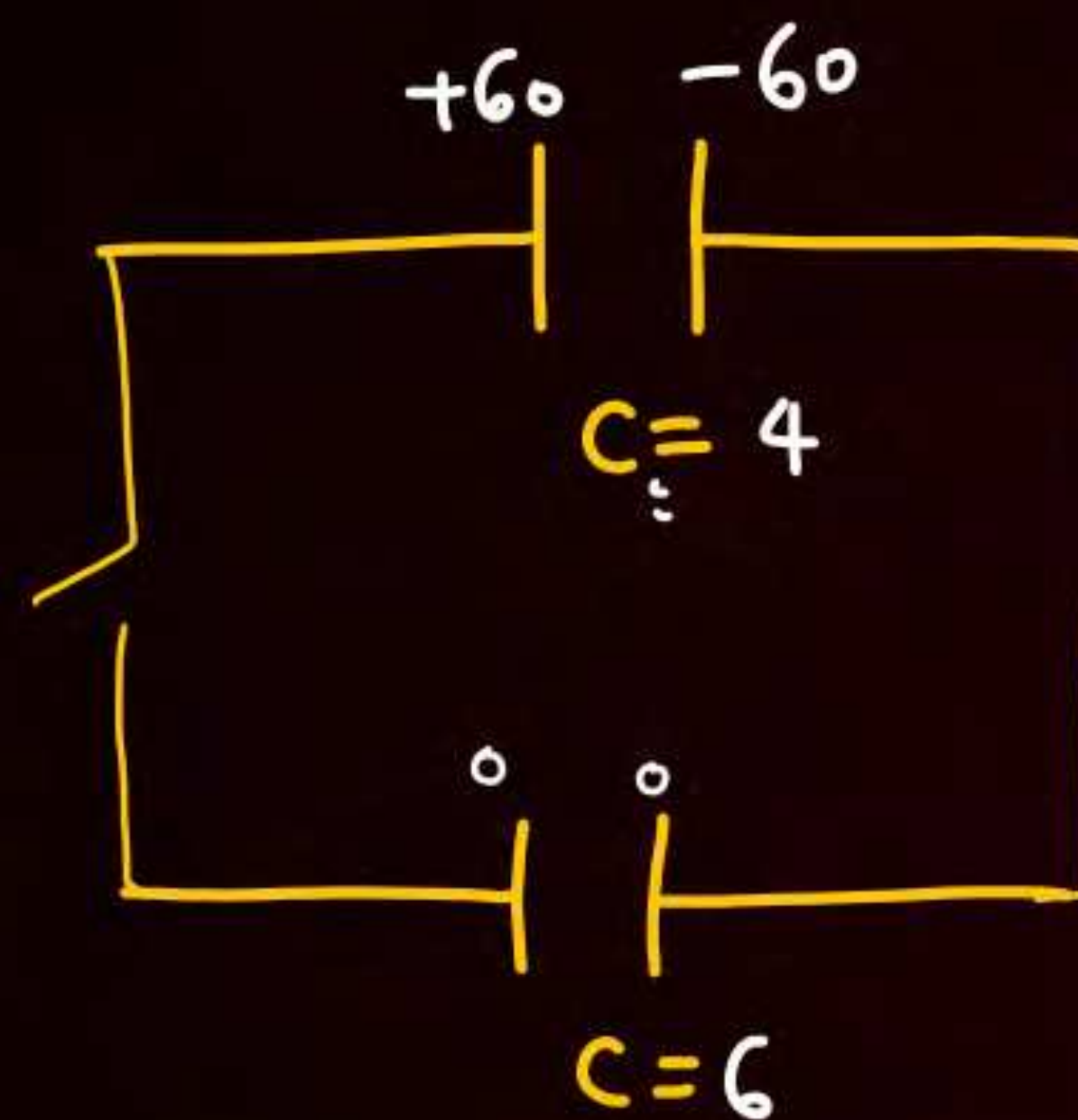
$$q_1 + q_2 = 36$$

$$3V + 2V = 30$$

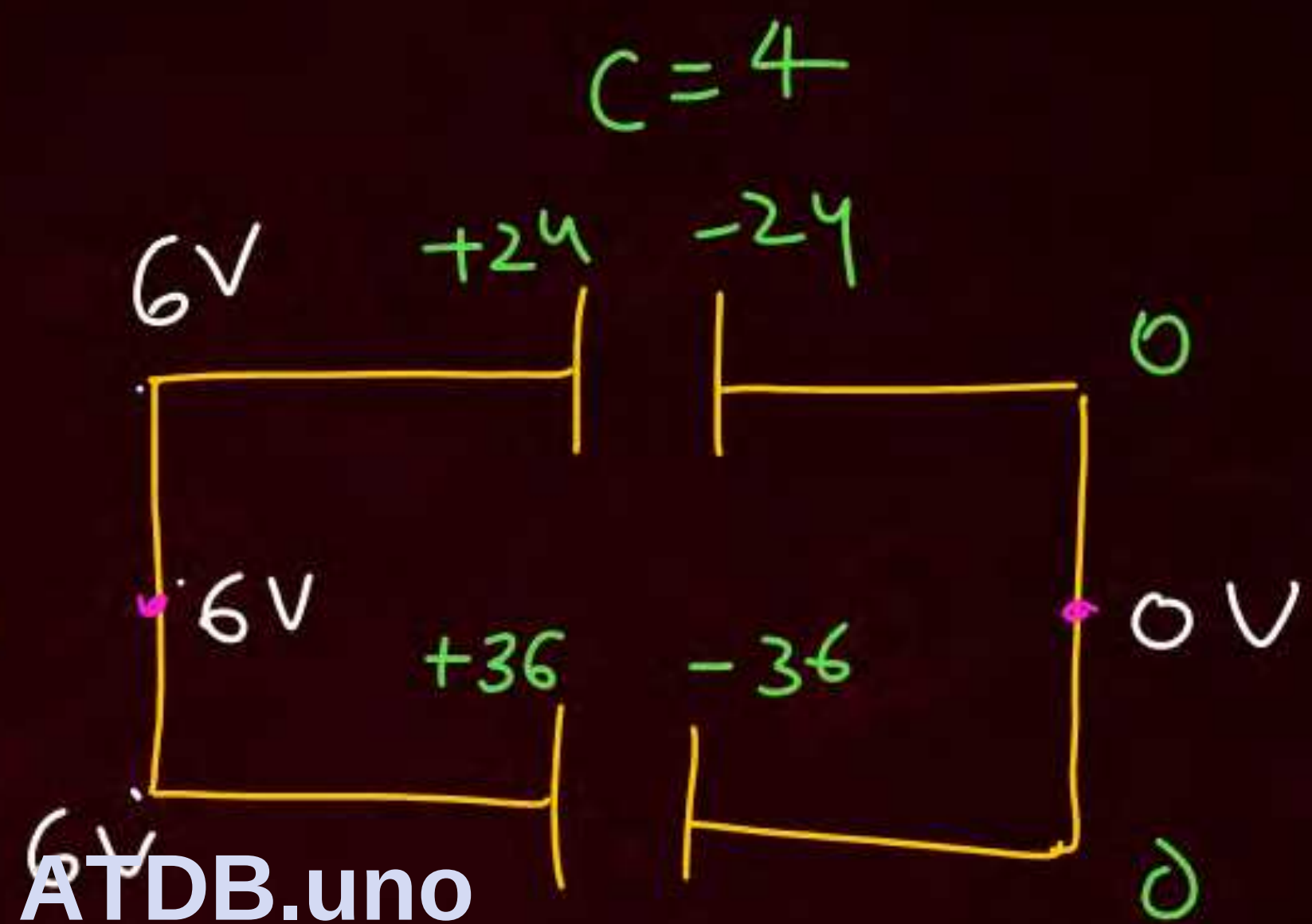
$$V = 6$$

$$q_1 = 3 \times 6 = 18$$

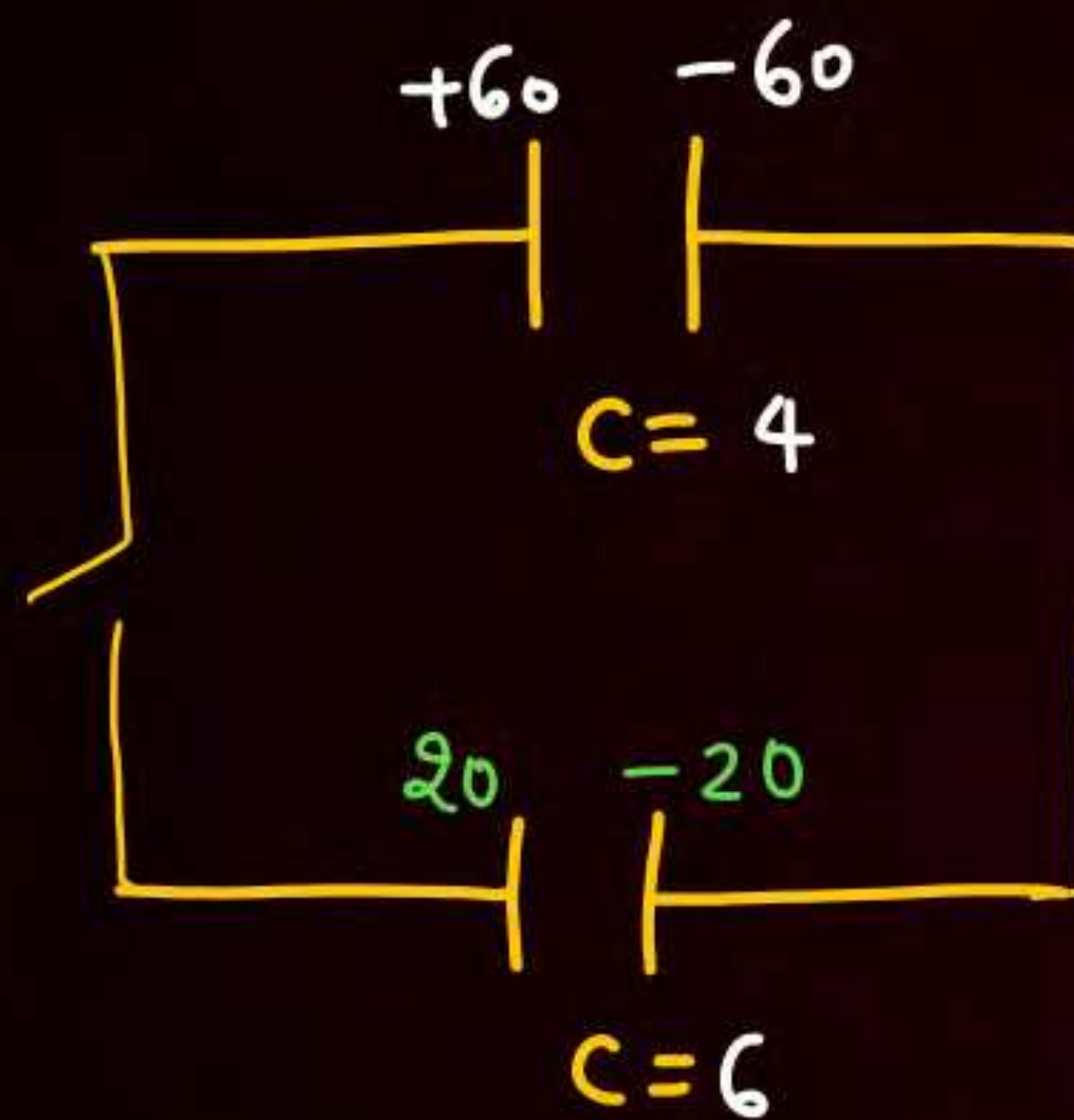
$$q_2 = 2 \times 6 = 12$$



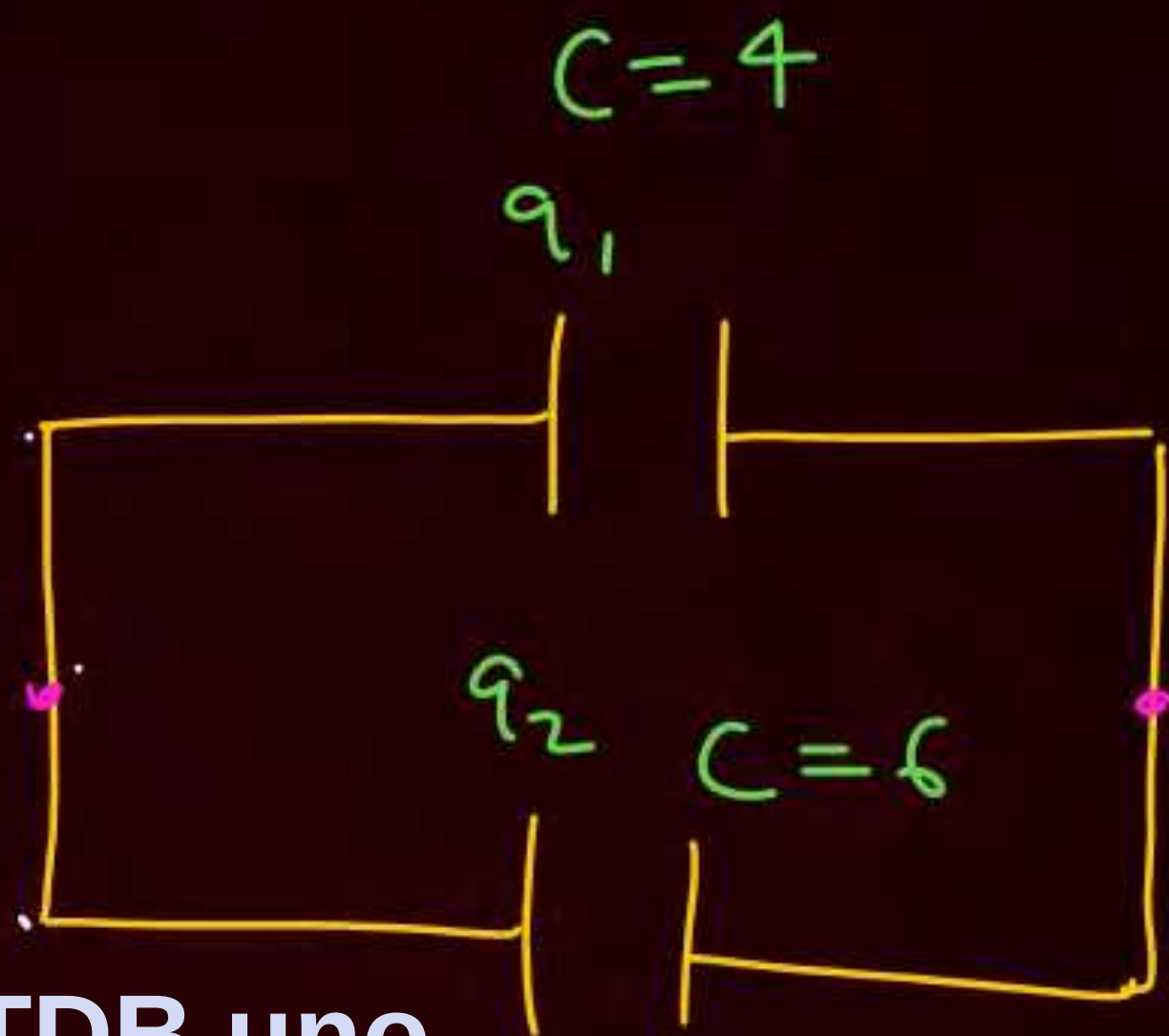
switch close



$$60 = 10 \times V_C$$
$$V_C = 6$$



switch close

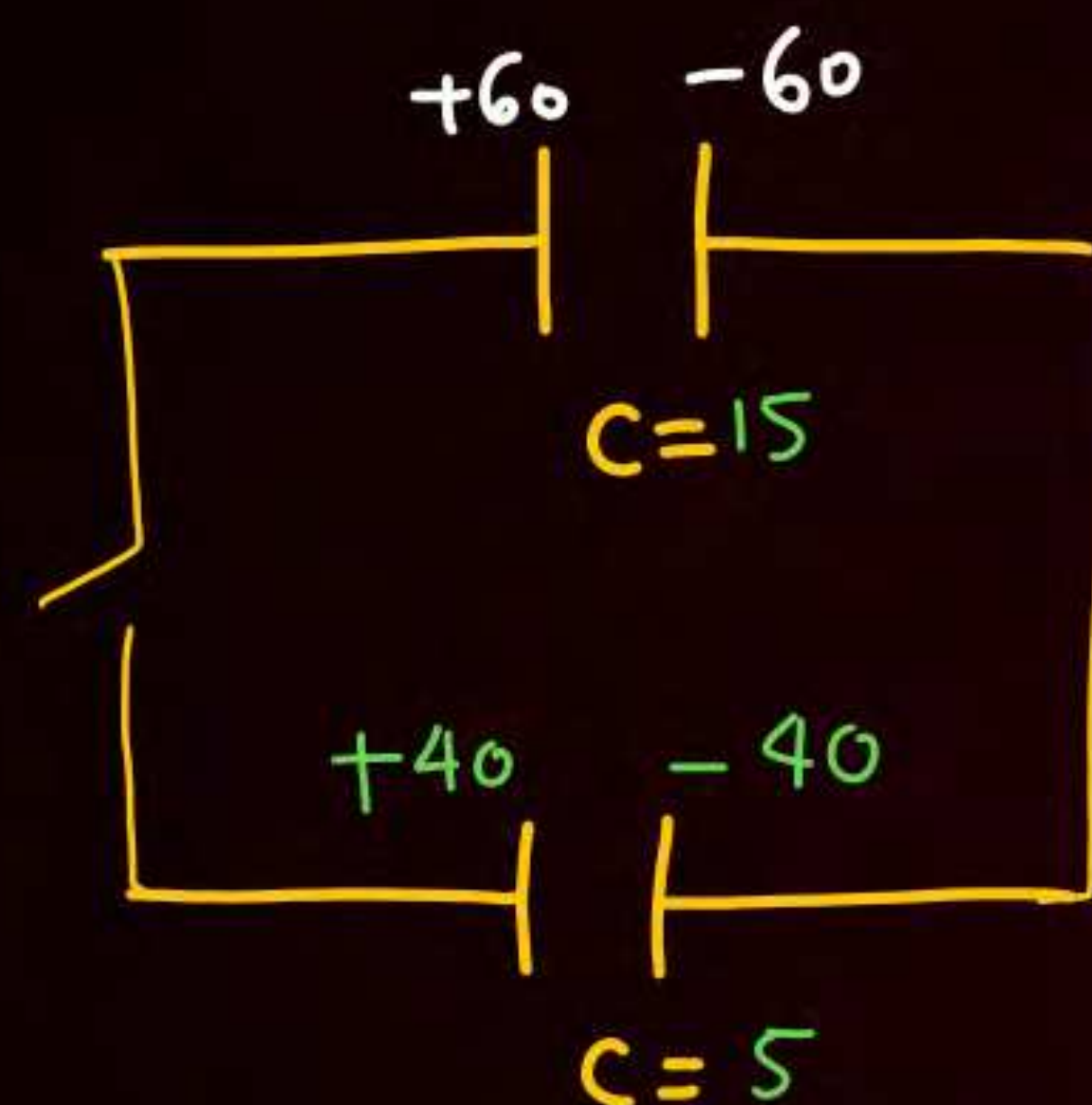


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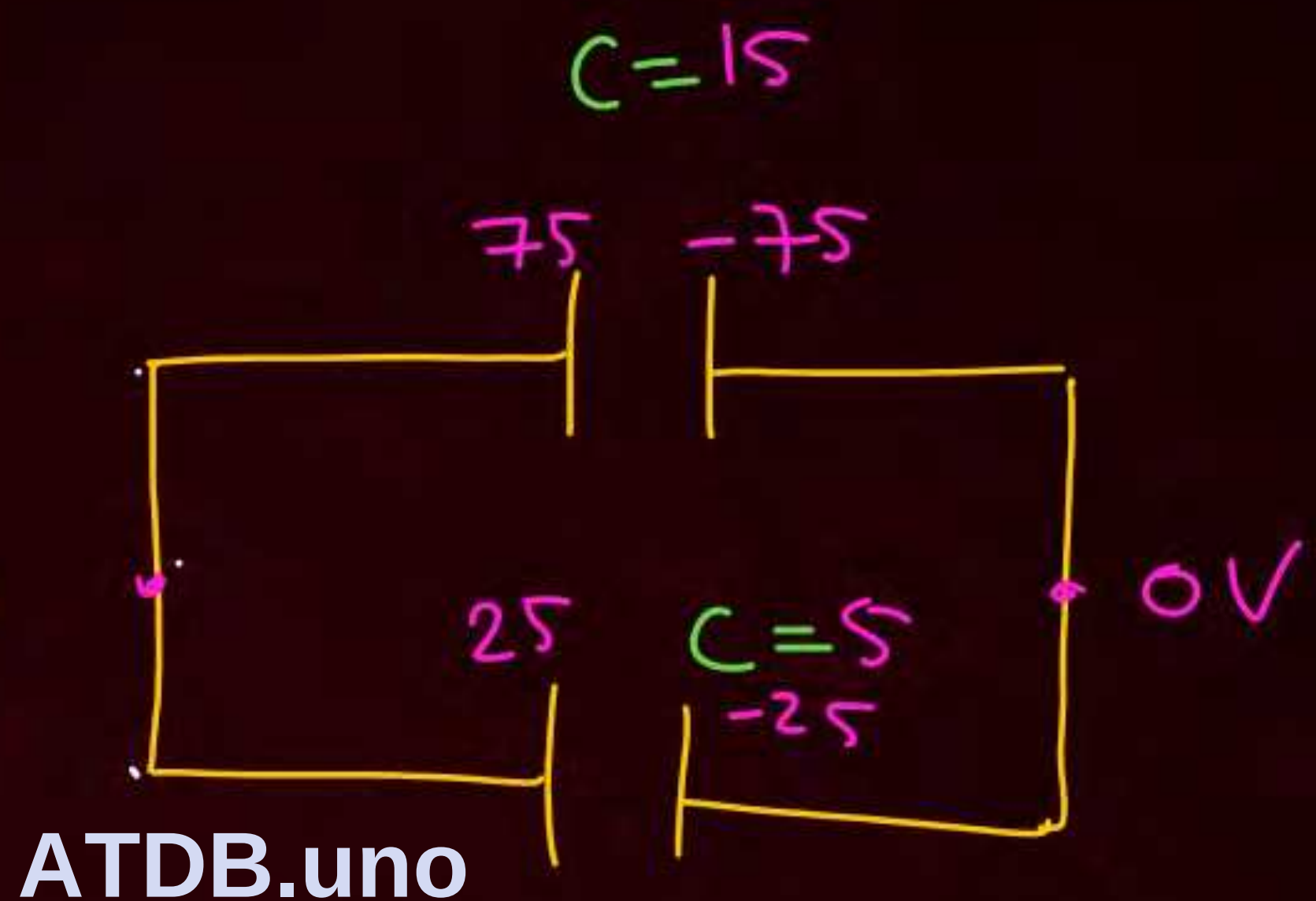
$$60 + 20 = (6 + 4) V$$

$$V = 8$$

$$\begin{cases} q_1 = 32 \\ q_2 = 48 \end{cases}$$

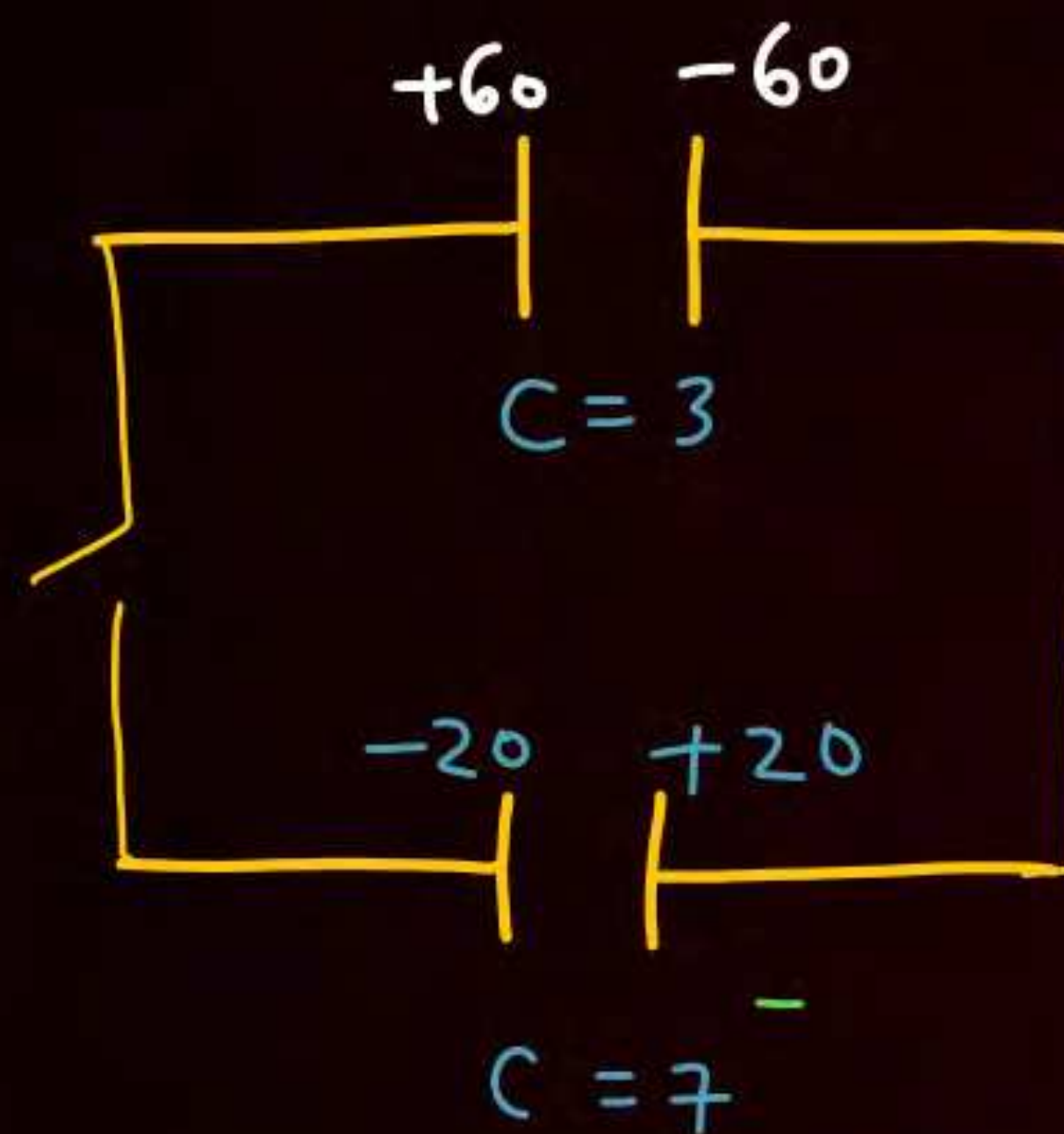


switch close

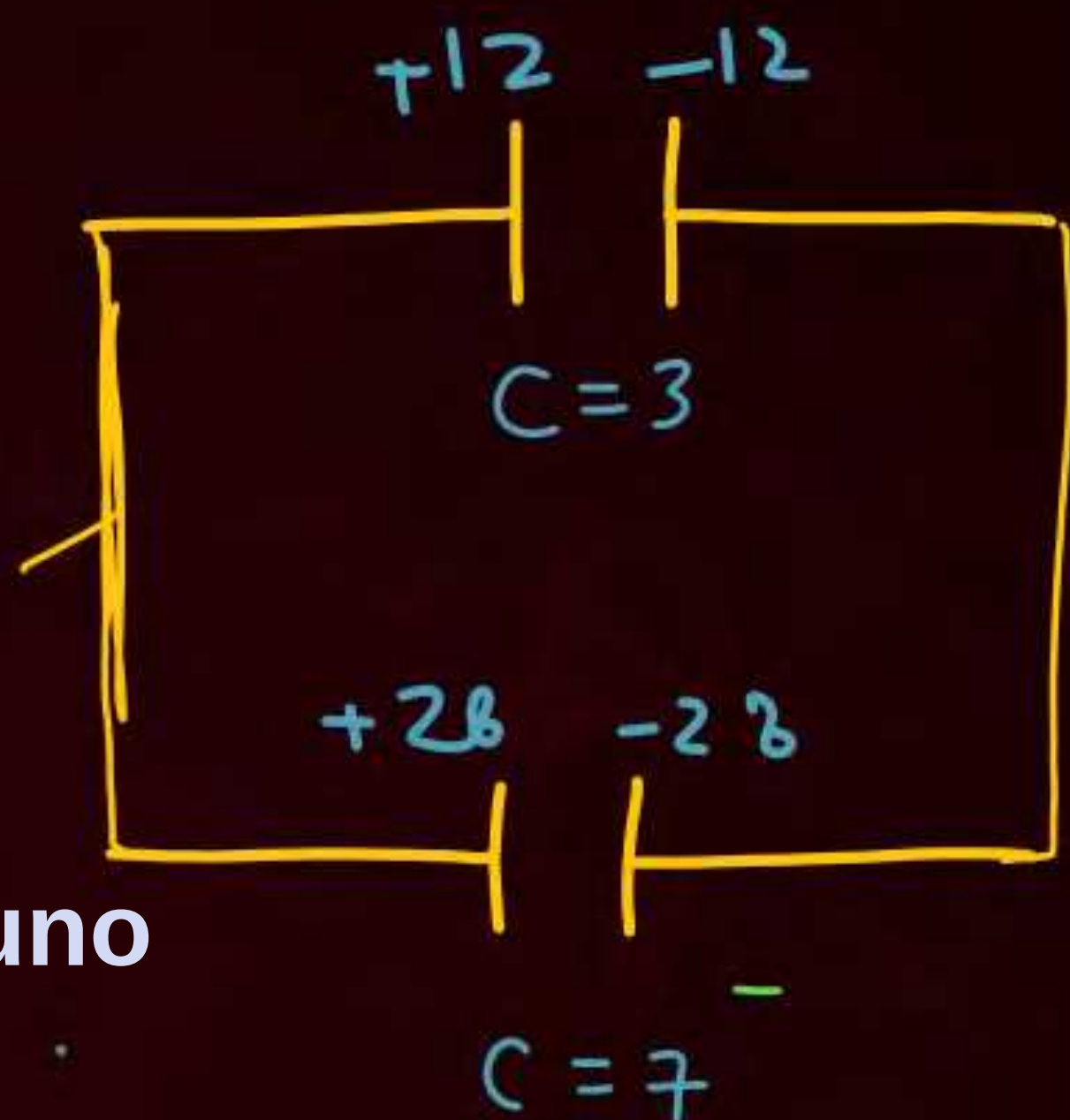


$$60 + 40 = 100 = (15 + 5) V$$

$$V = -5$$



switch close

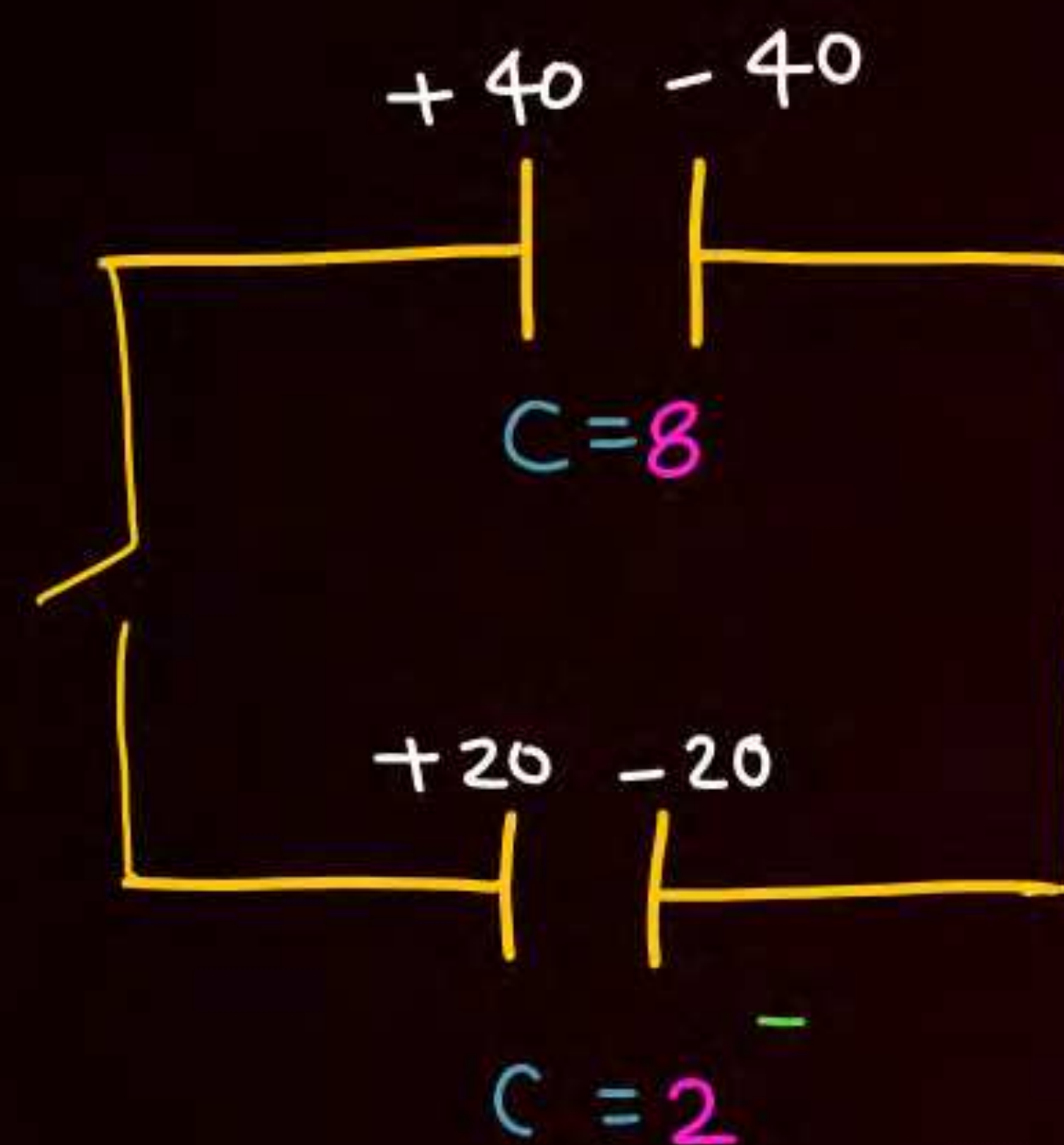


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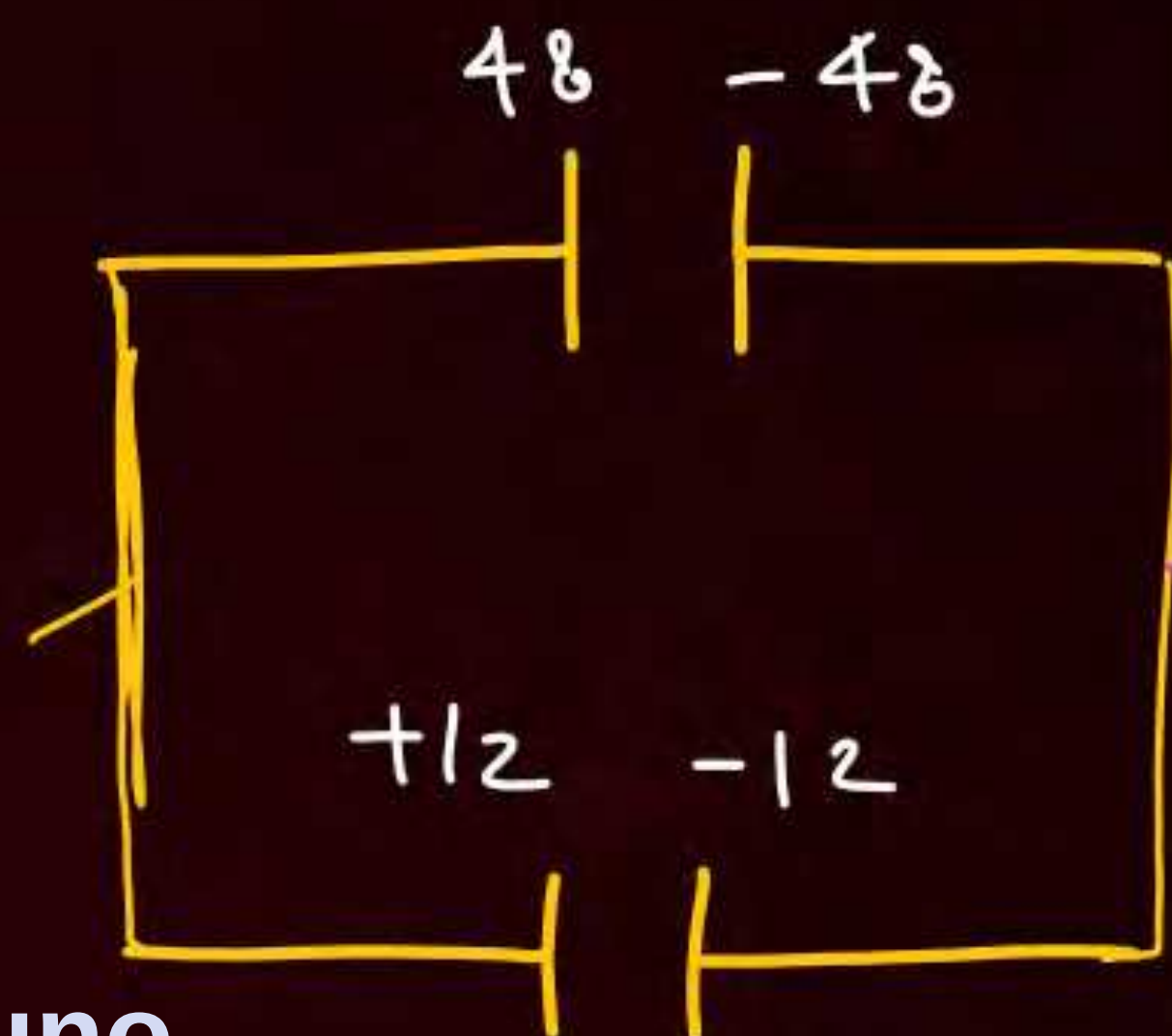
$$Q_{\text{net}} = C_{\text{eq}} \cdot V$$

$$40 = 10 V$$

$$V = 4$$



switch close



$$V_{\text{common}} = 6 \text{ volt}$$

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$$U_f = \frac{1}{2} \times 8 \times 6^2 + \frac{1}{2} \times 2 \times 6^2$$

$$= 144 + 36 = 180$$

$$U_i = \frac{1}{2} \frac{(40)^2}{8} + \frac{1}{2} \frac{(20)^2}{2}$$

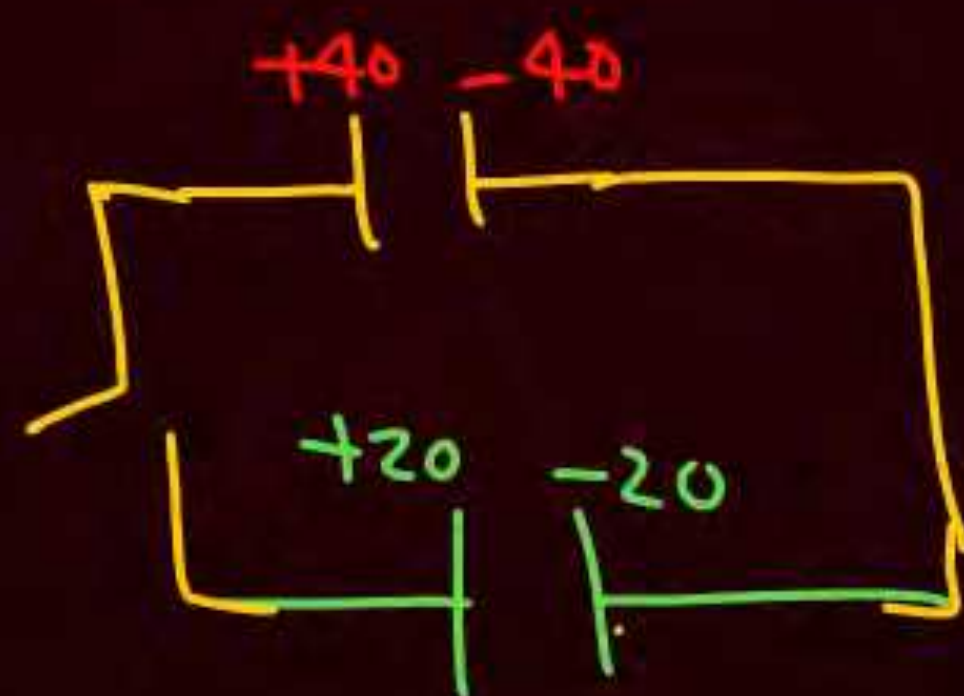
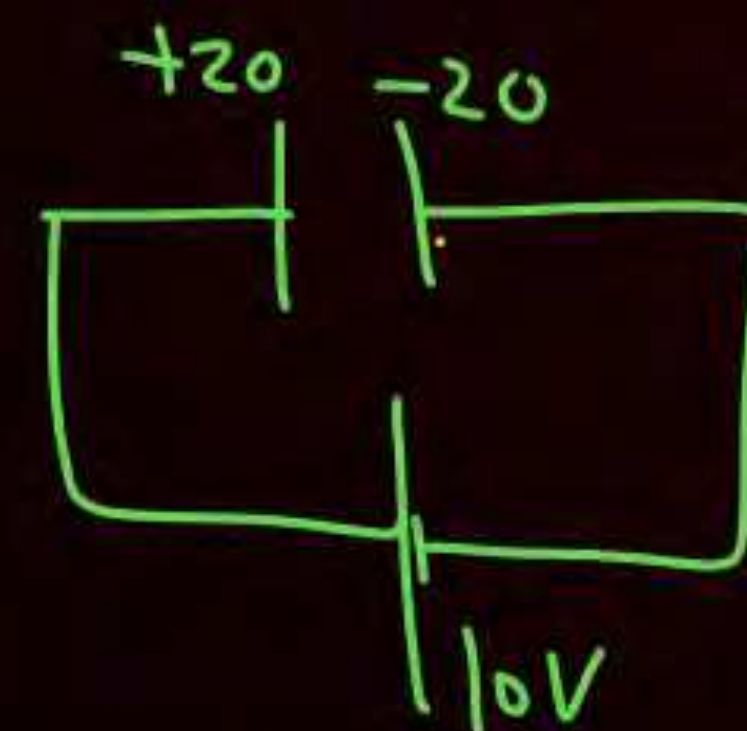
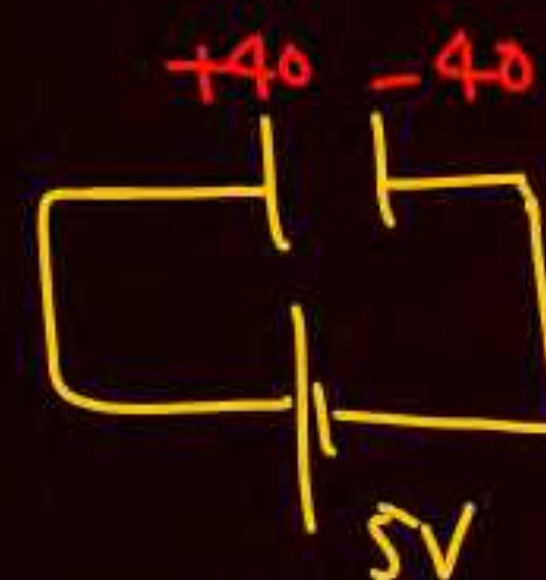
$$= 100 + 100 = 200$$

$$\text{heat loss} = 200 - 180$$



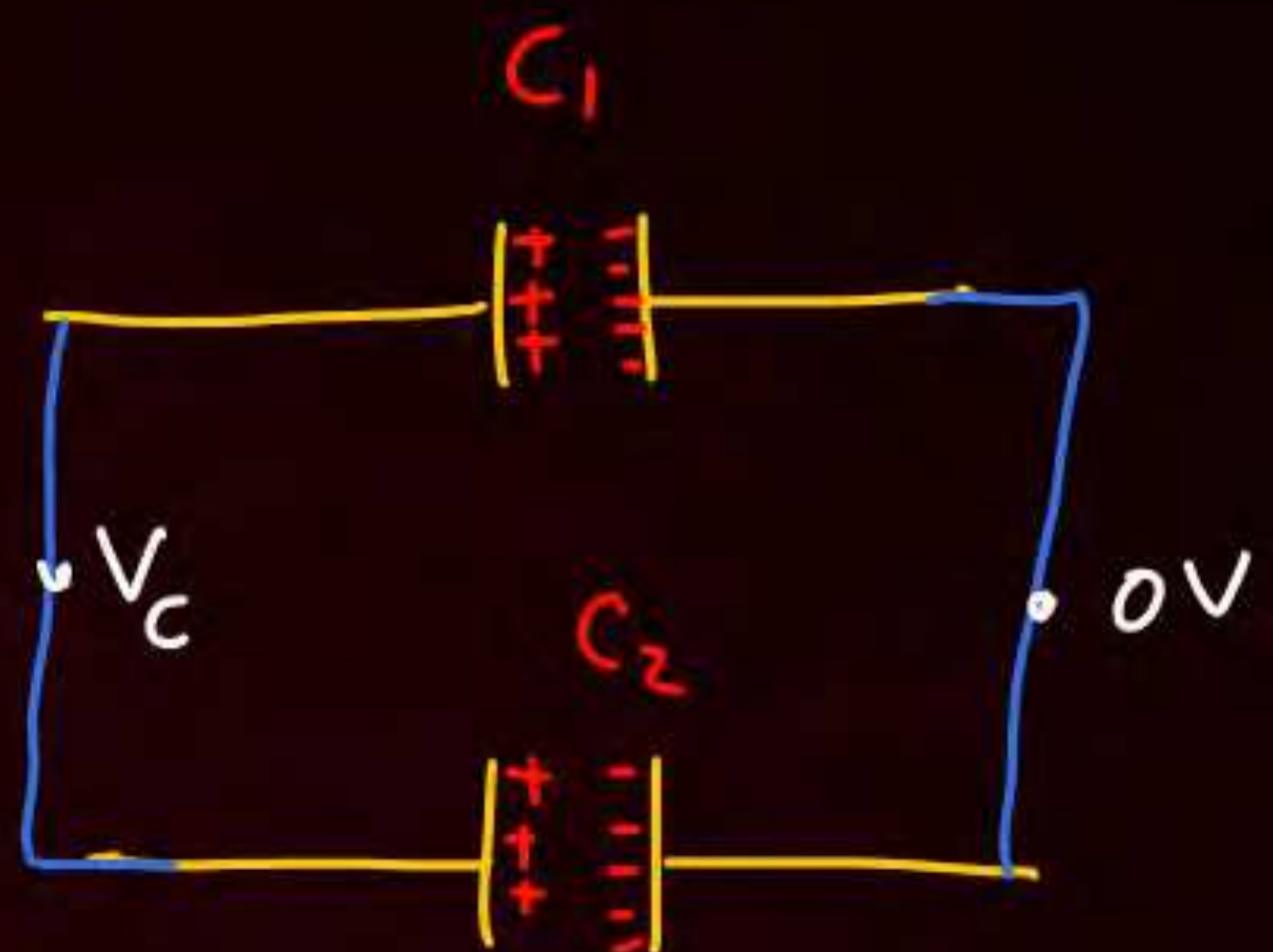
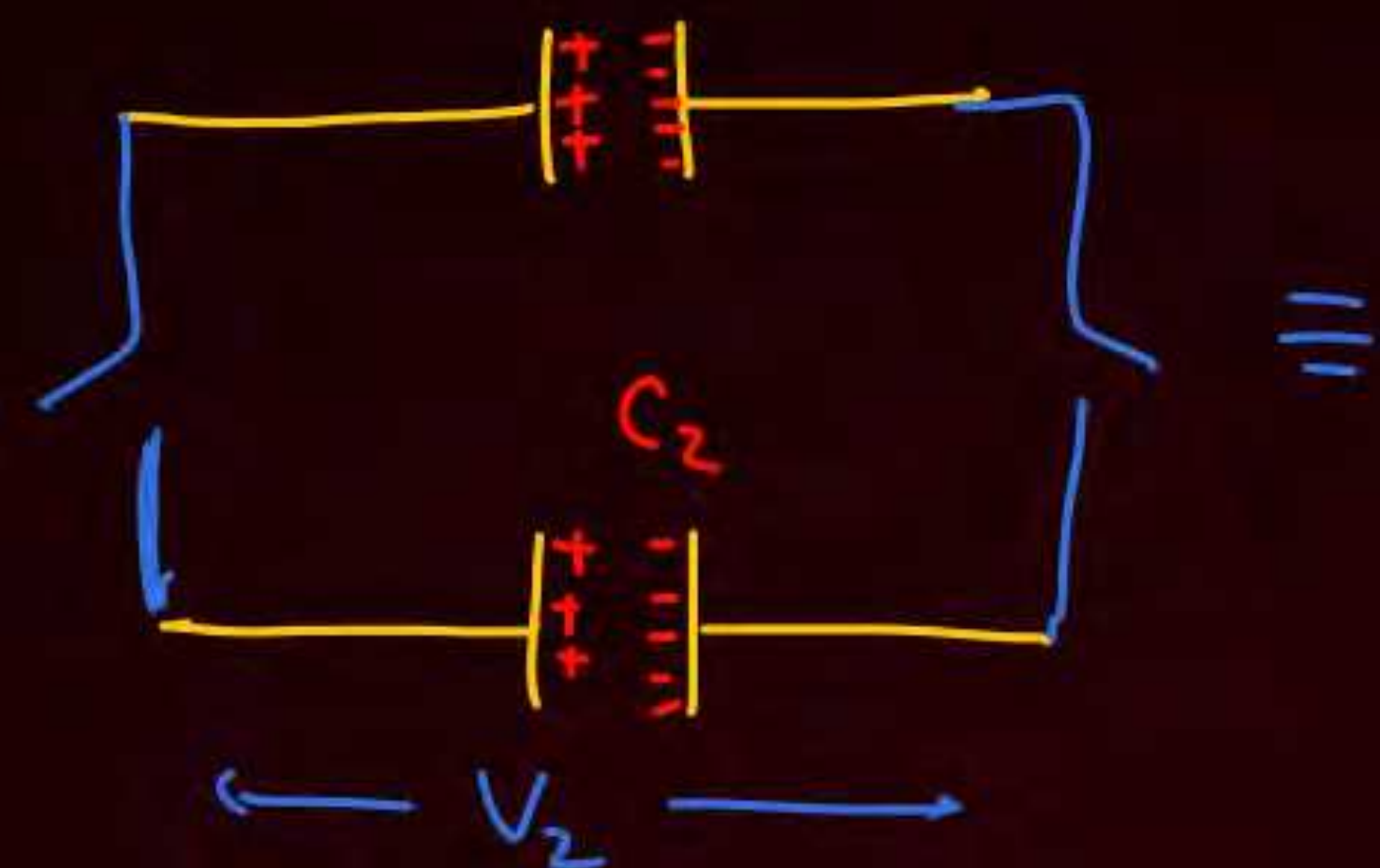
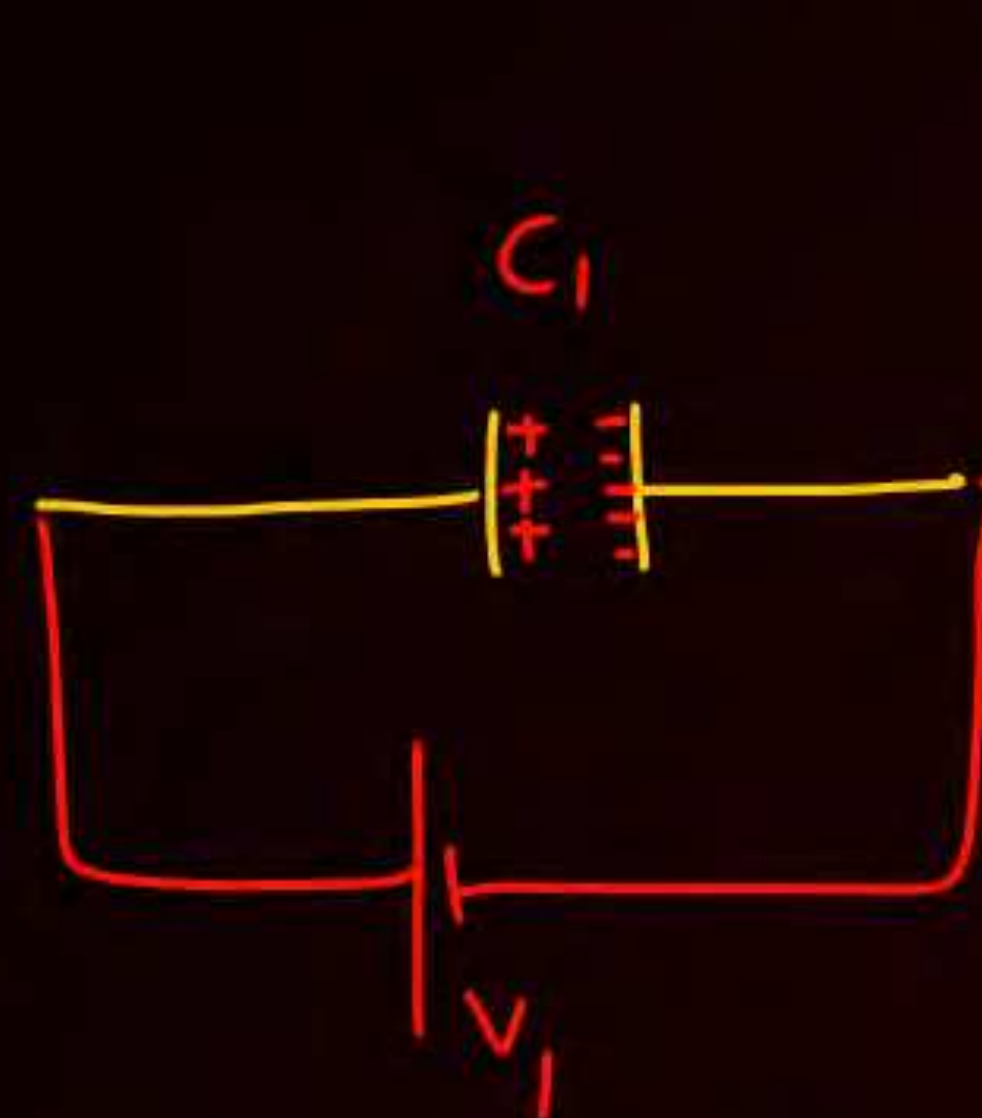
Q A capacitor $C_1 = 8F$ is fully charge from a battery of 5 volt. and an another capacitor of $C_2 = 2F$ is also fully charge with battery of emf 10 volt. Now both capacitor are disconnected from their battery & connect each other such that positive plate of one plate is connected to positive plate of another capacitor. find ① common potential ② heat loss

Solⁿ





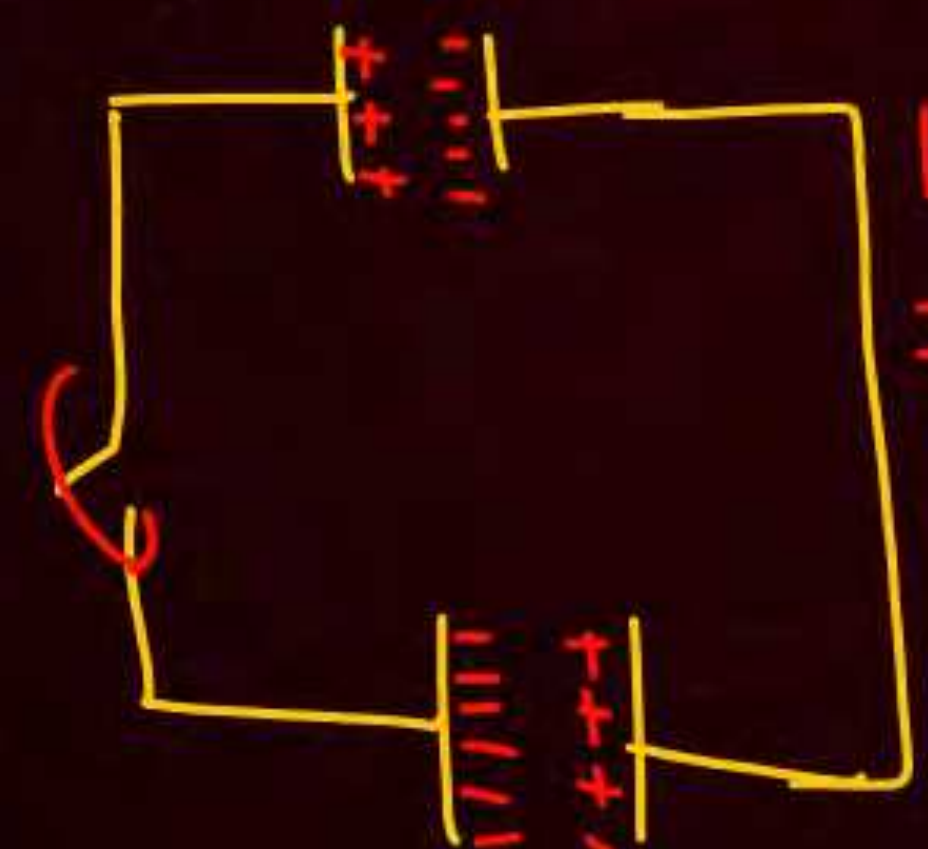
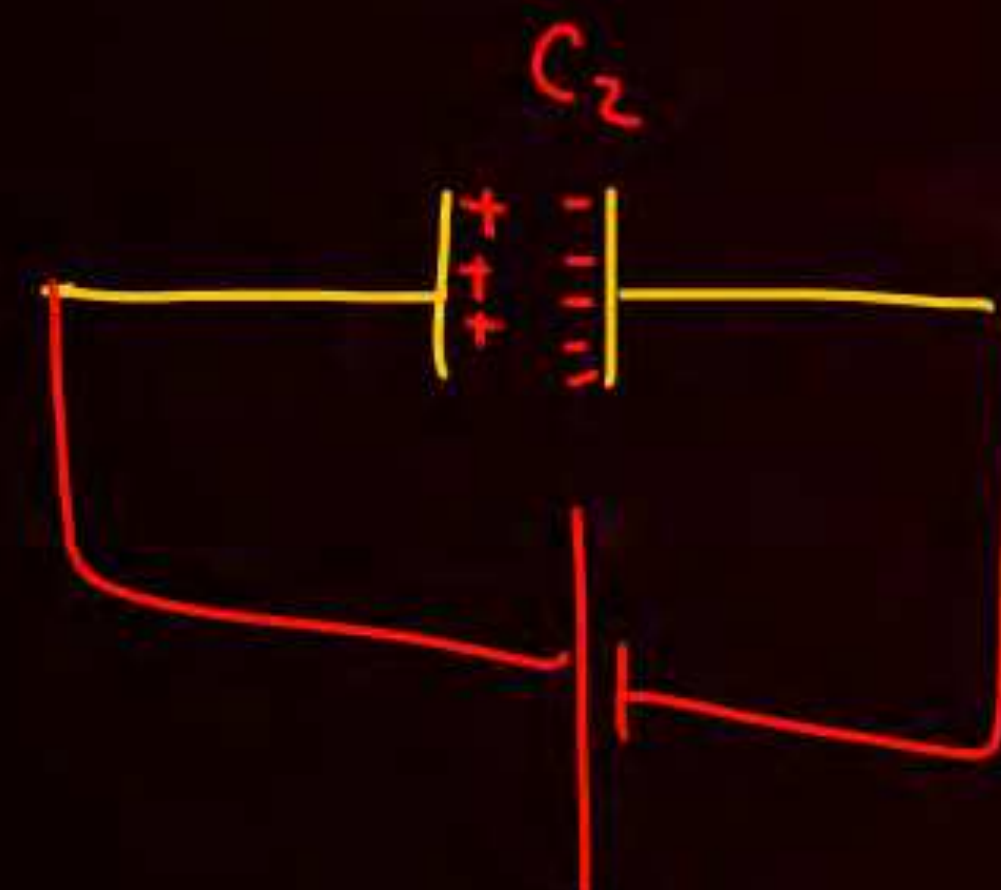
$$C_1 V_1 + C_2 V_2 = (C_1 + C_2) V_C$$



$$V_C = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$$

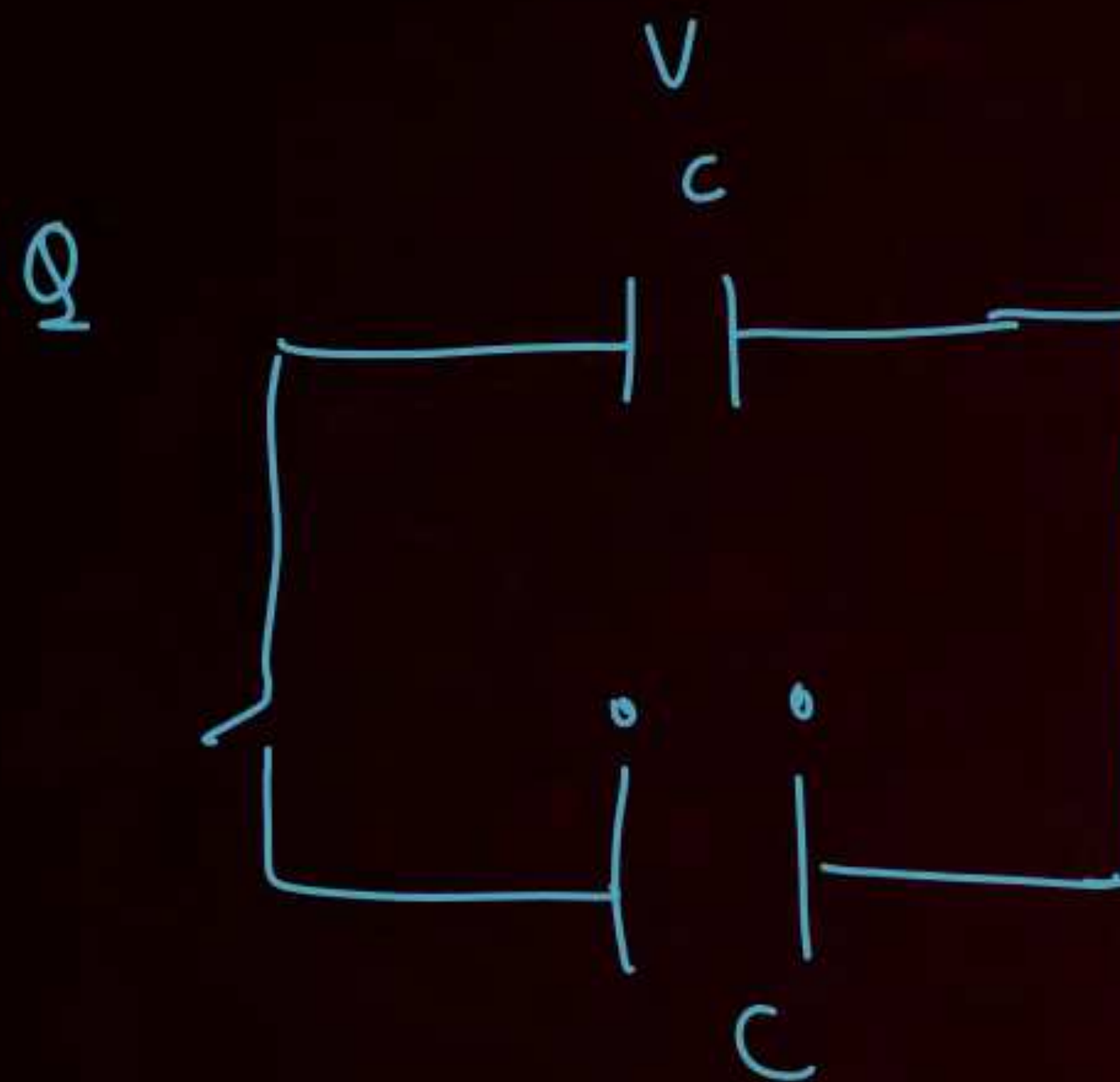
$$\text{heat loss} = \frac{1}{2} \left(\frac{C_1 C_2}{C_1 + C_2} \right) (V_1 - V_2)^2$$

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$$V_C = \frac{C_1 V_1 - C_2 V_2}{C_1 + C_2}$$

$$\text{heat loss} = \frac{1}{2} \left(\frac{C_1 C_2}{C_1 + C_2} \right) (V_1 - V_2)^2$$



$$\text{heat loss} = \frac{1}{2} \left(\frac{C \times C}{C + C} \right) (V - 0)^2$$

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$$\begin{aligned}
 & \left(\frac{1}{2} C_1 V_1^2 + \frac{1}{2} C_2 V_2^2 \right) - \left(\frac{1}{2} C_1 (V_C)^2 + \frac{1}{2} C_2 (V_C)^2 \right) \\
 &= \cancel{\frac{1}{2} C_1 V_1^2} + \cancel{\frac{1}{2} C_2 V_2^2} - \cancel{\frac{1}{2} (C_1 + C_2)} \left(\frac{C_1 V_1 + C_2 V_2}{C_1 + C_2} \right)^2 = \checkmark \\
 &= \frac{1}{2} \left[\frac{C_1 C_2 \cdot (V_1 - V_2)^2}{(C_1 + C_2)} \right] \quad \text{---}
 \end{aligned}$$



THANK YOU

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