

PRAYAS

JEE 2025

ATDB.uno

Lecture - 02

Physics

Capacitor

By- Saleem Ahmed Sir



Today's Goal

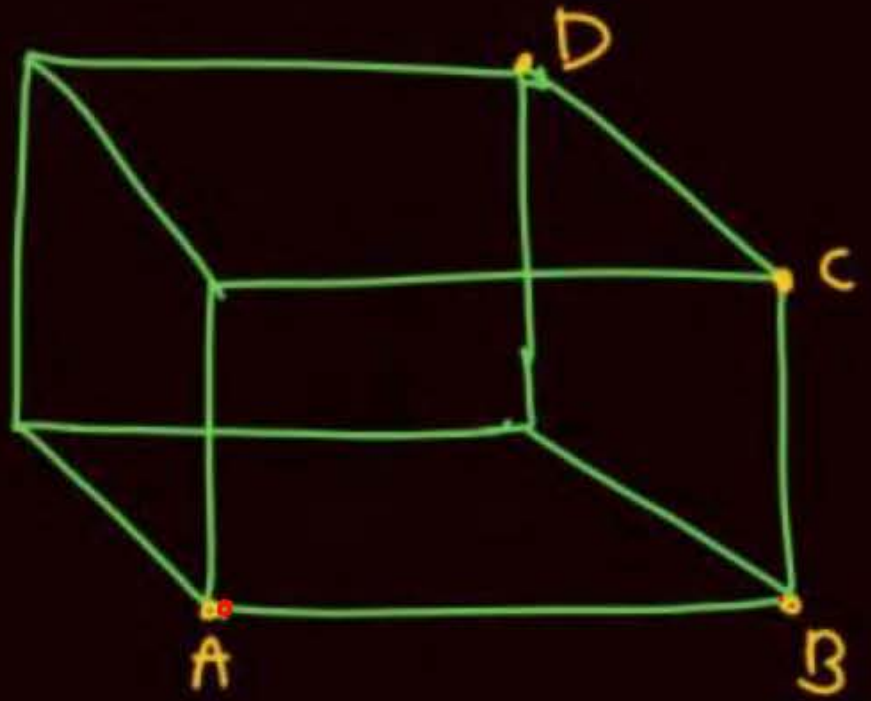


— Circuit Analysis

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Cube each of length l , Resistance R



पास-पास

$\frac{7R}{12}$

R_{AB}

$\frac{7}{12}R$

शोडाहूट

$\frac{3R}{4}$

R_{AC}

$\frac{3}{4}R$

सबसे दूर

$\frac{5R}{6}$

R_{AD}

$\frac{5}{6}R$

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(Not in mains/Advanced)
Colour coding

Black	→	B	→	0
Brown	→	B	→	1
Red	→	R	→	2
Orange	→	O	→	3
Yellow	→	Y	→	4
Green	→	G	→	5
Blue	→	B	→	6
Violet	→	V	→	7
Grey	→	G	→	8
White	→	W	→	9

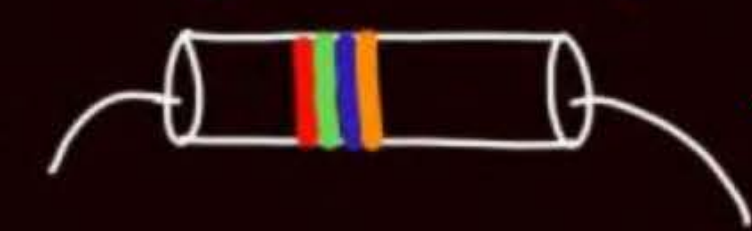
Gold → 5%
Silver → 10%
no colour → 20%



tolerance

Value ⇒ $I\ II \times 10^{\text{III}} \pm \text{IV} \%$

Q Red green blue gold



$25 \times 10^6 \pm 5\%$

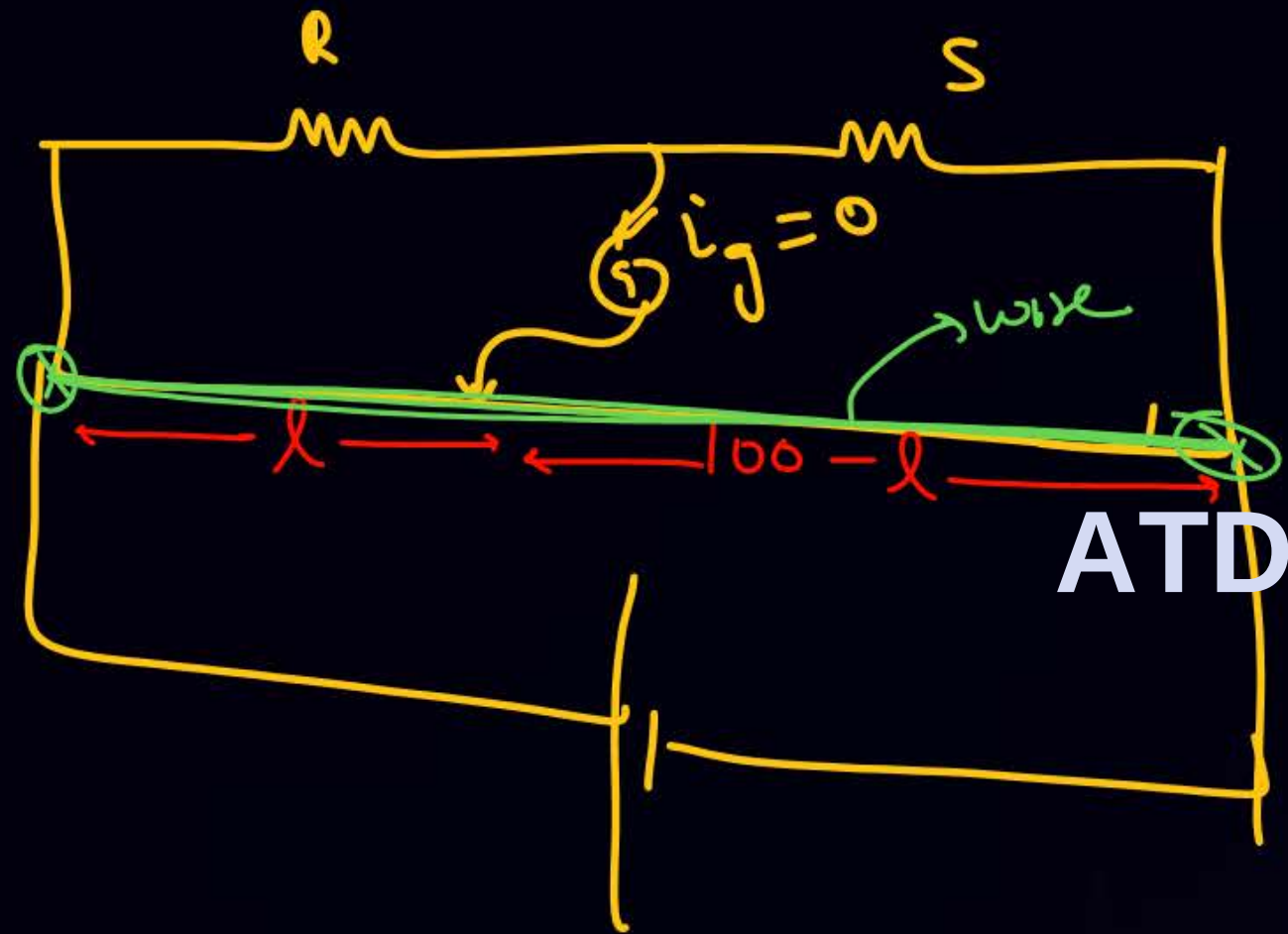
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Q Violet Blue Red silver
 $76 \times 10^2 \pm 10\%$

Q $5200 \Omega \pm 5\% \Rightarrow$ colour sequence = ?
 $52 \times 10^2 \pm 5\% = G\ R\ R\ Gold$



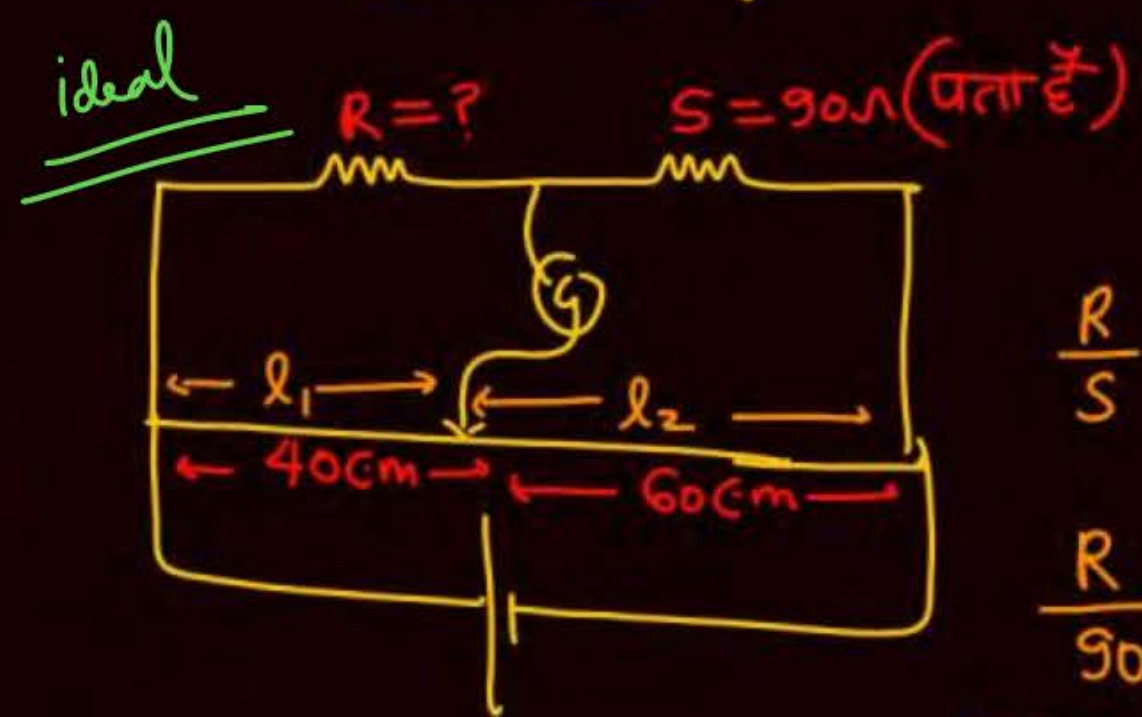
meter Bridge



$$\frac{R}{S} = \frac{l}{100-l}$$

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Meter Bridge



$$\frac{R}{90} = \frac{40}{60}$$

$$R = 60\Omega$$

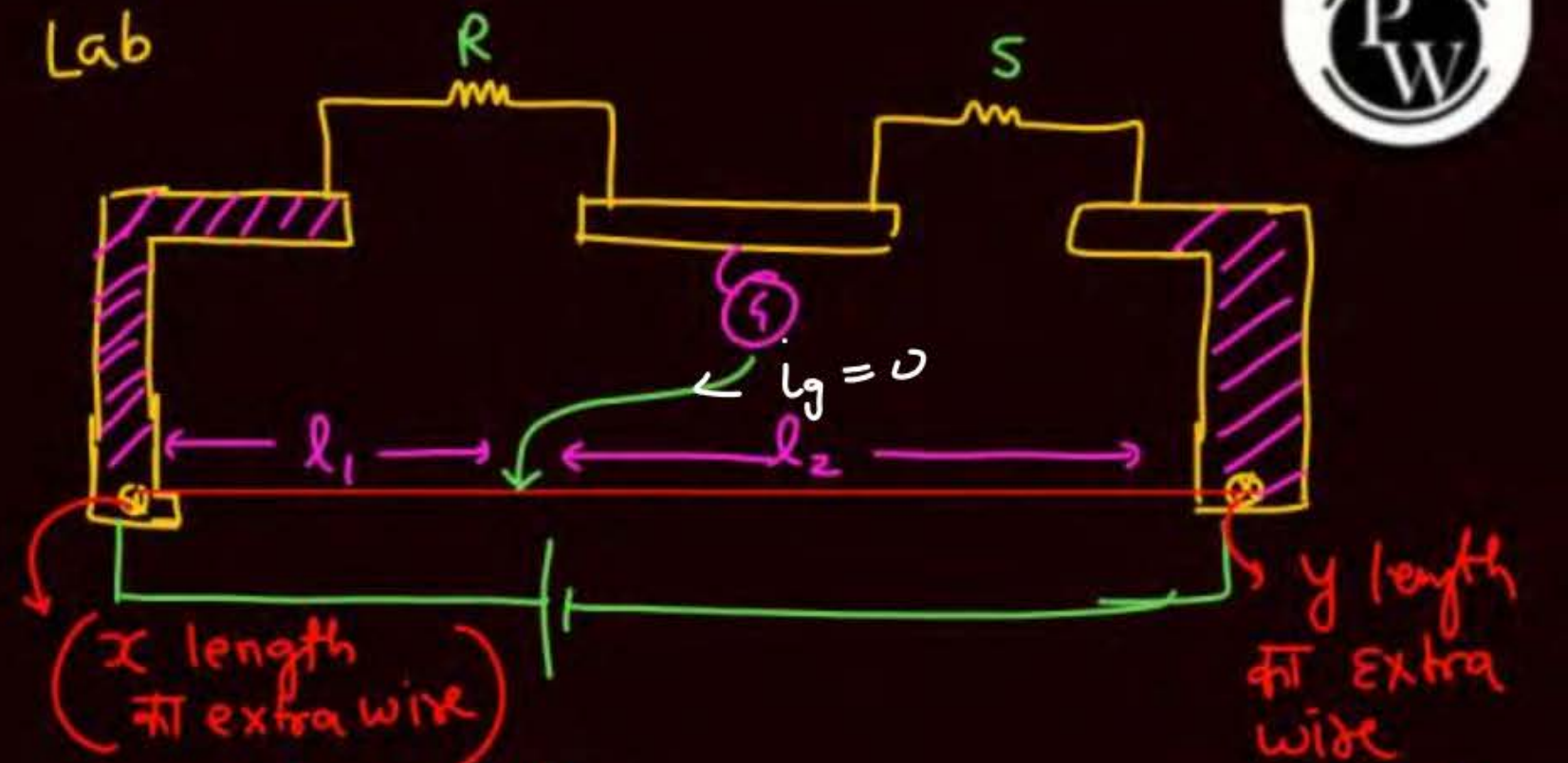
$$\frac{R}{S} = \frac{l_1}{l_2} = \frac{l}{100-l}$$

$$\frac{R}{90} = \frac{40}{60}$$

$$R = 60\Omega$$

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Lab



end correction

पहले $\Rightarrow \frac{R}{S} = \frac{l_1}{l_2}$

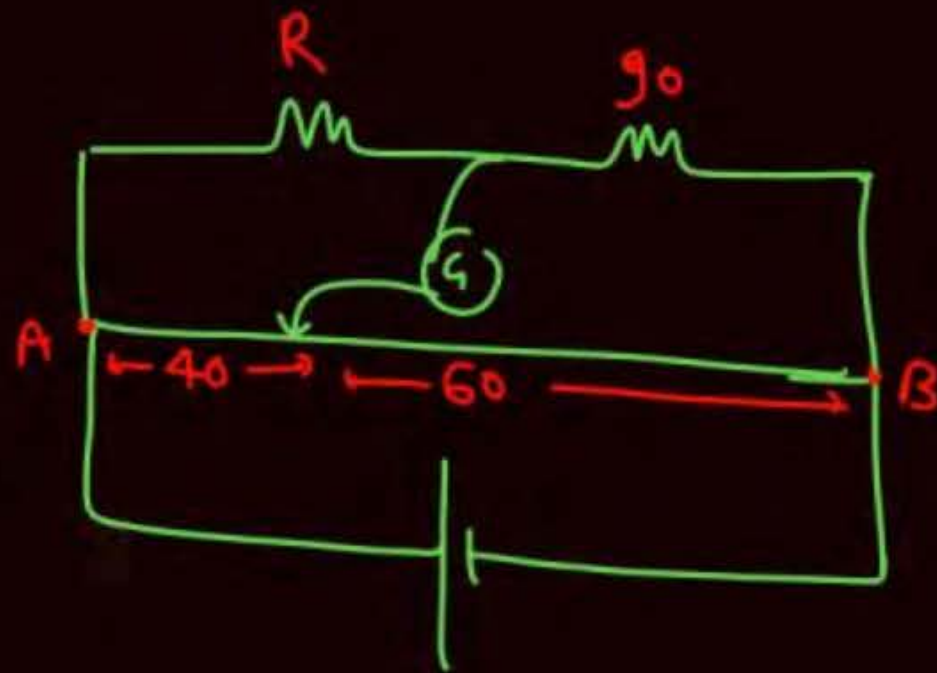
ideal

$$\frac{R}{S} = \frac{l_1 + x}{l_2 + y}$$

$$\frac{R}{S} = \frac{l + x}{(100-l) + y}$$

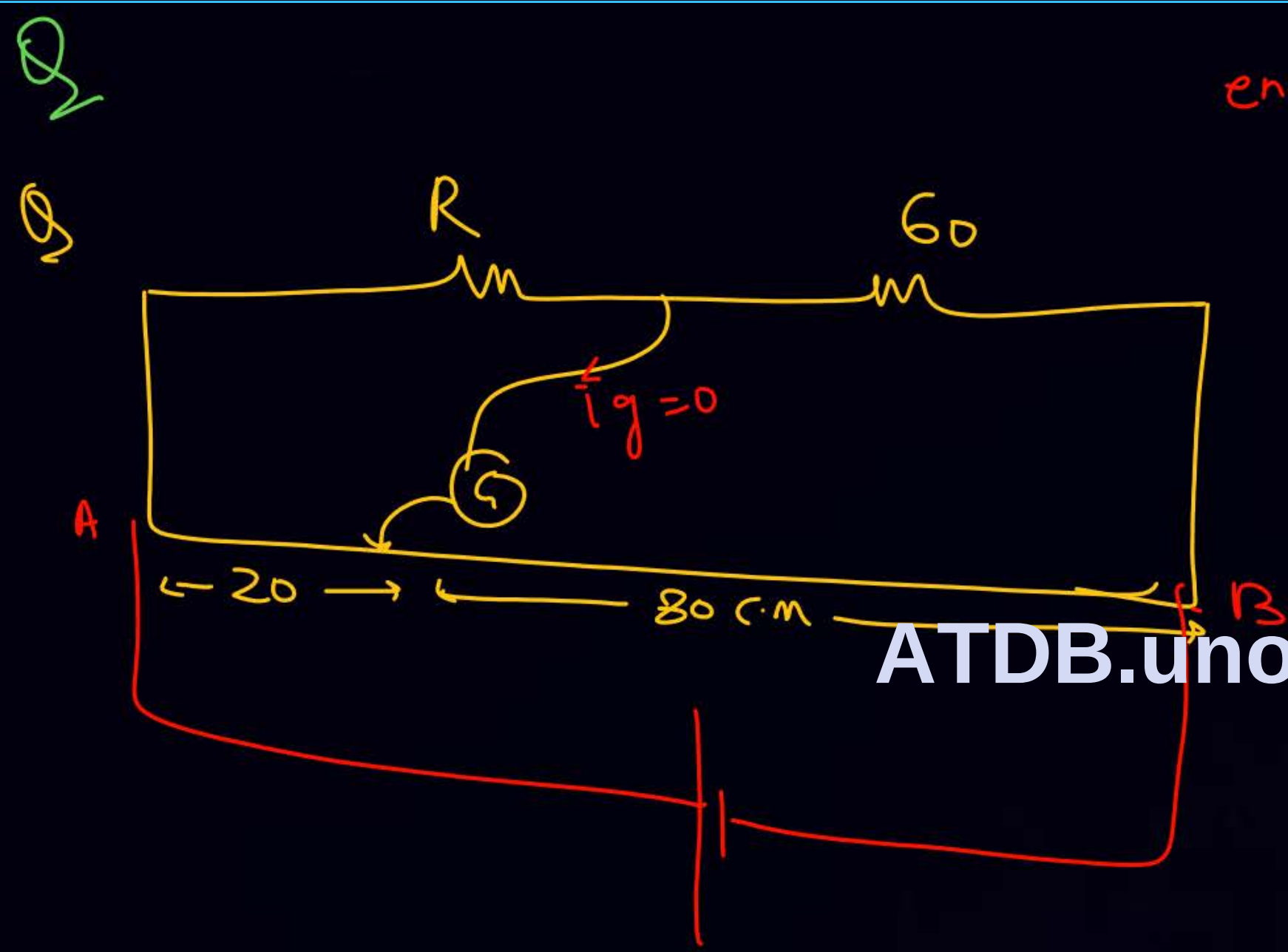


Q In meter bridge find value of R if end correction are 1cm & 3cm .
at end A & end B



$$\frac{R}{90} = \frac{40+1}{60+3}$$

$$\frac{R}{90} = \frac{40+1}{60+3}$$

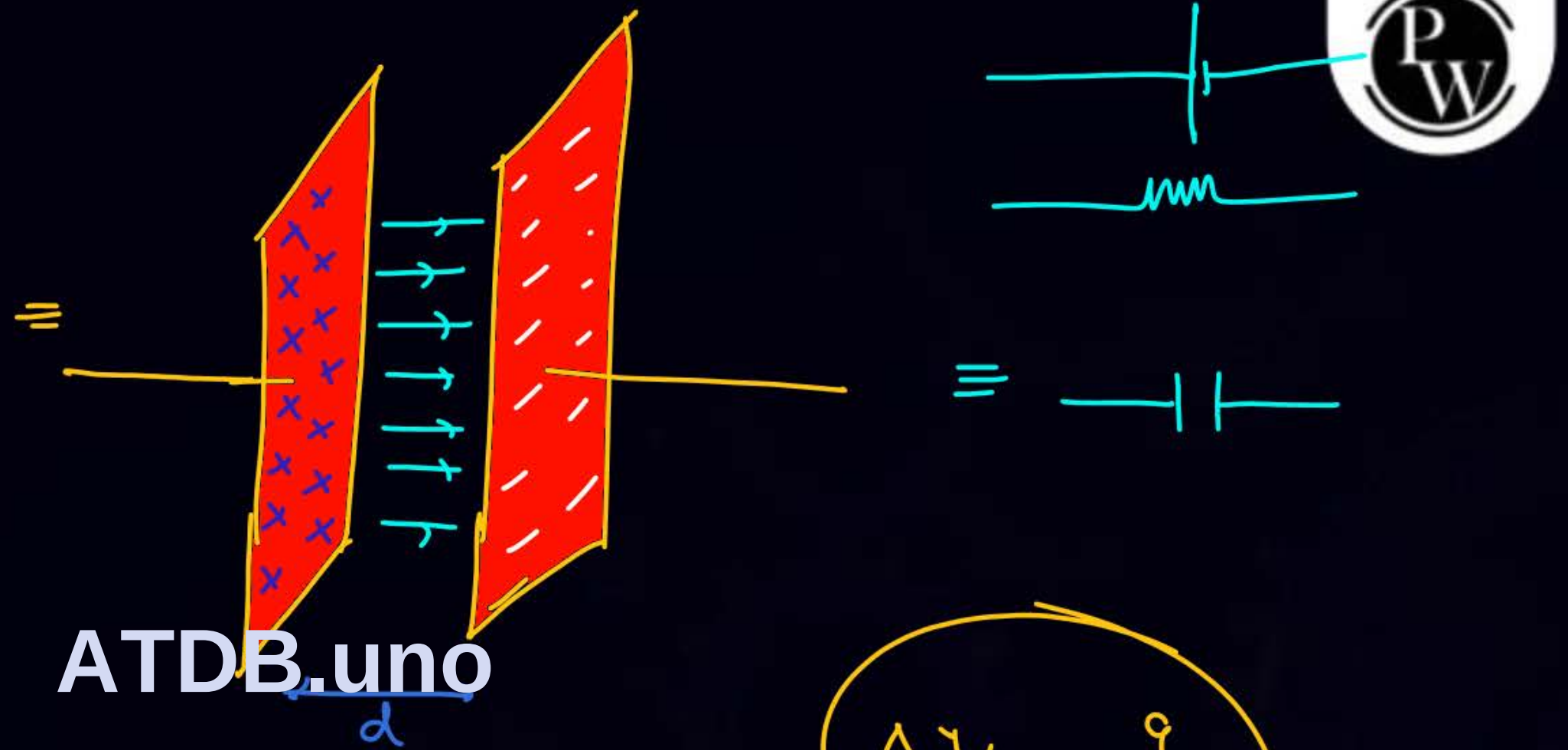
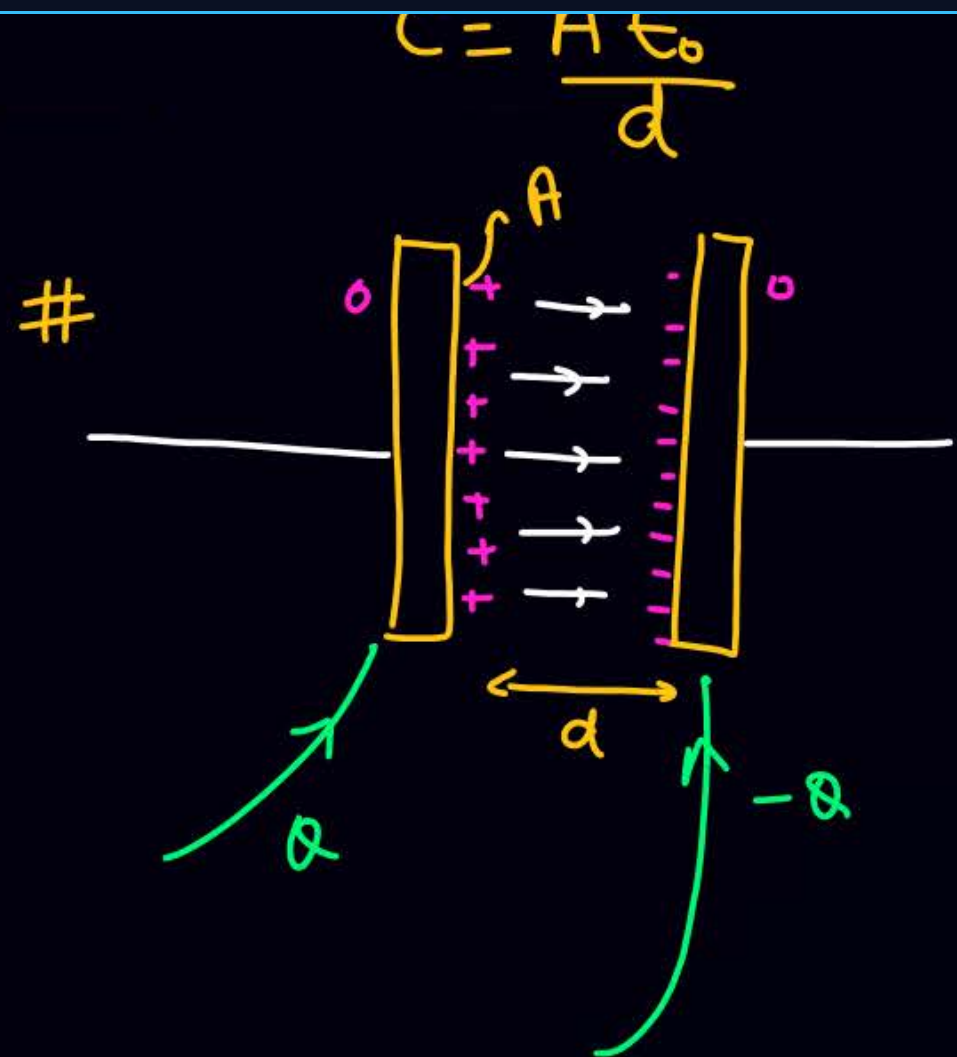


end correctly - are 1 cm & 2 cm
at A & B.

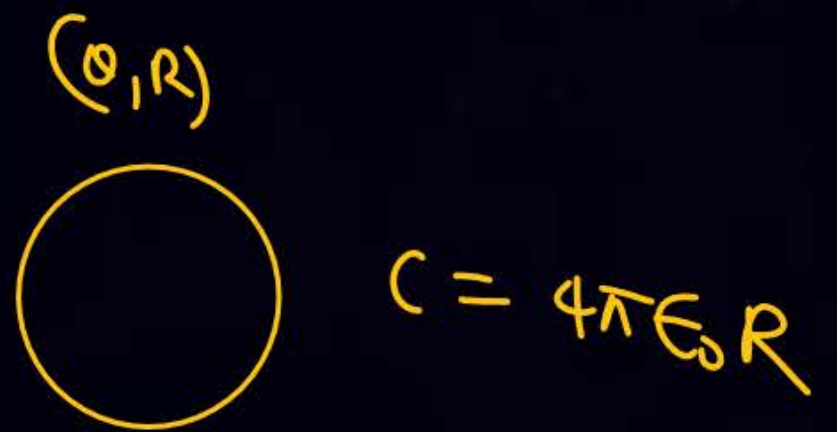
$$\frac{R}{60} = \frac{20 + 1}{80 + 2}$$



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$\Delta V = \frac{Q}{C}$

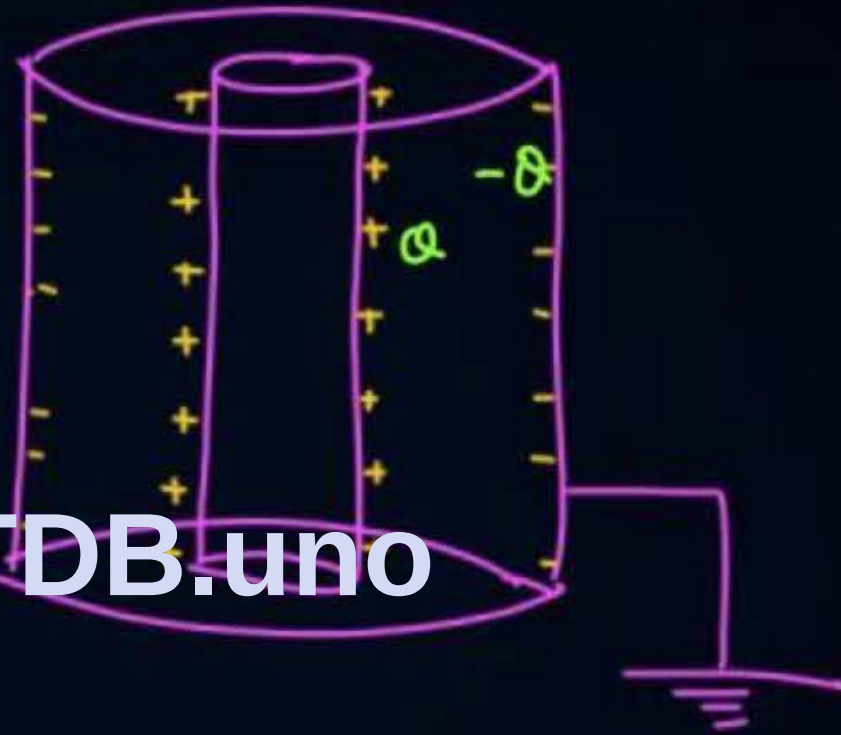


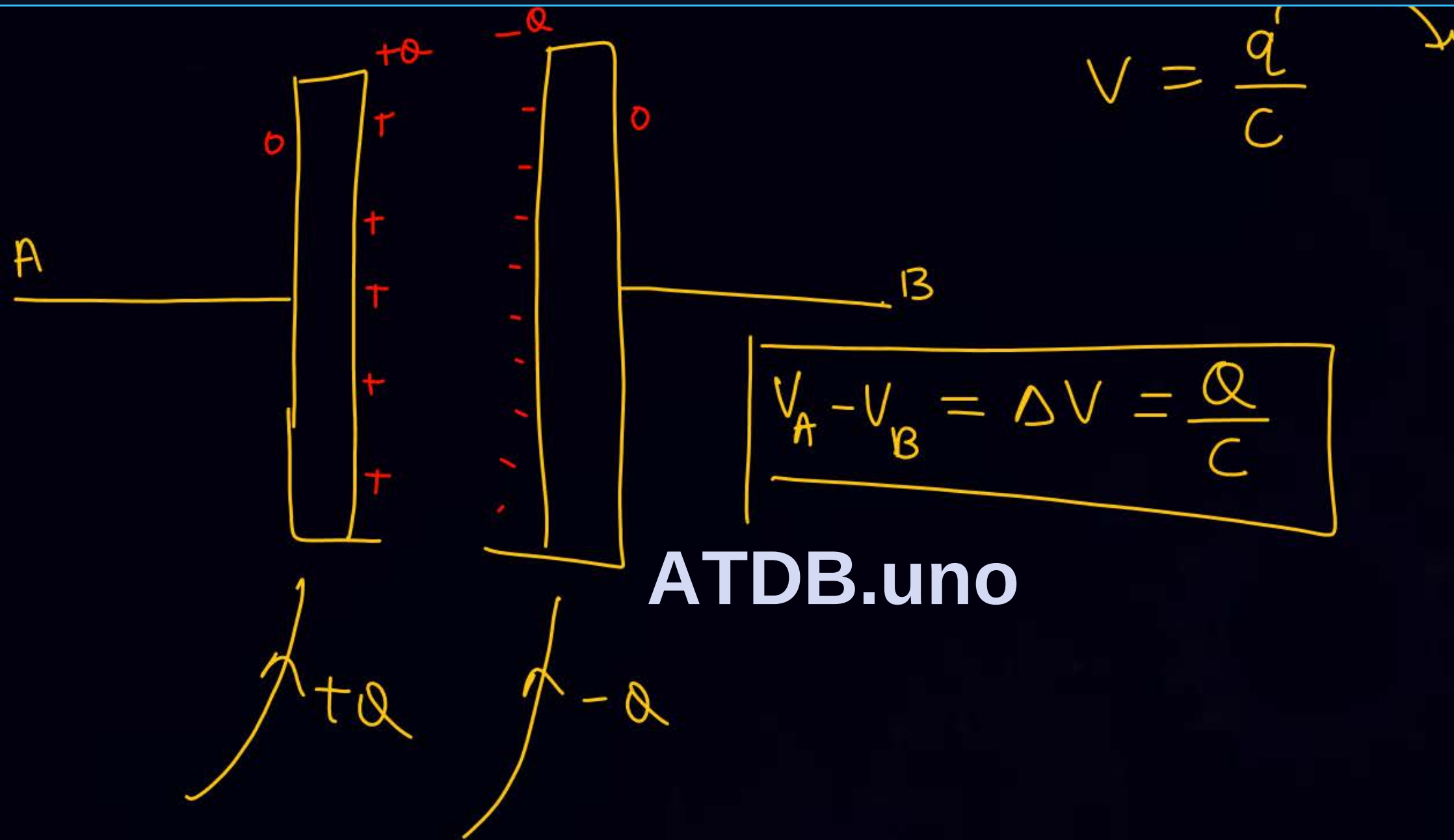
* Cylindrical capacitor

(R.m)

$$C = \frac{2\pi\epsilon_0 l}{\ln(R_2/R_1)}$$

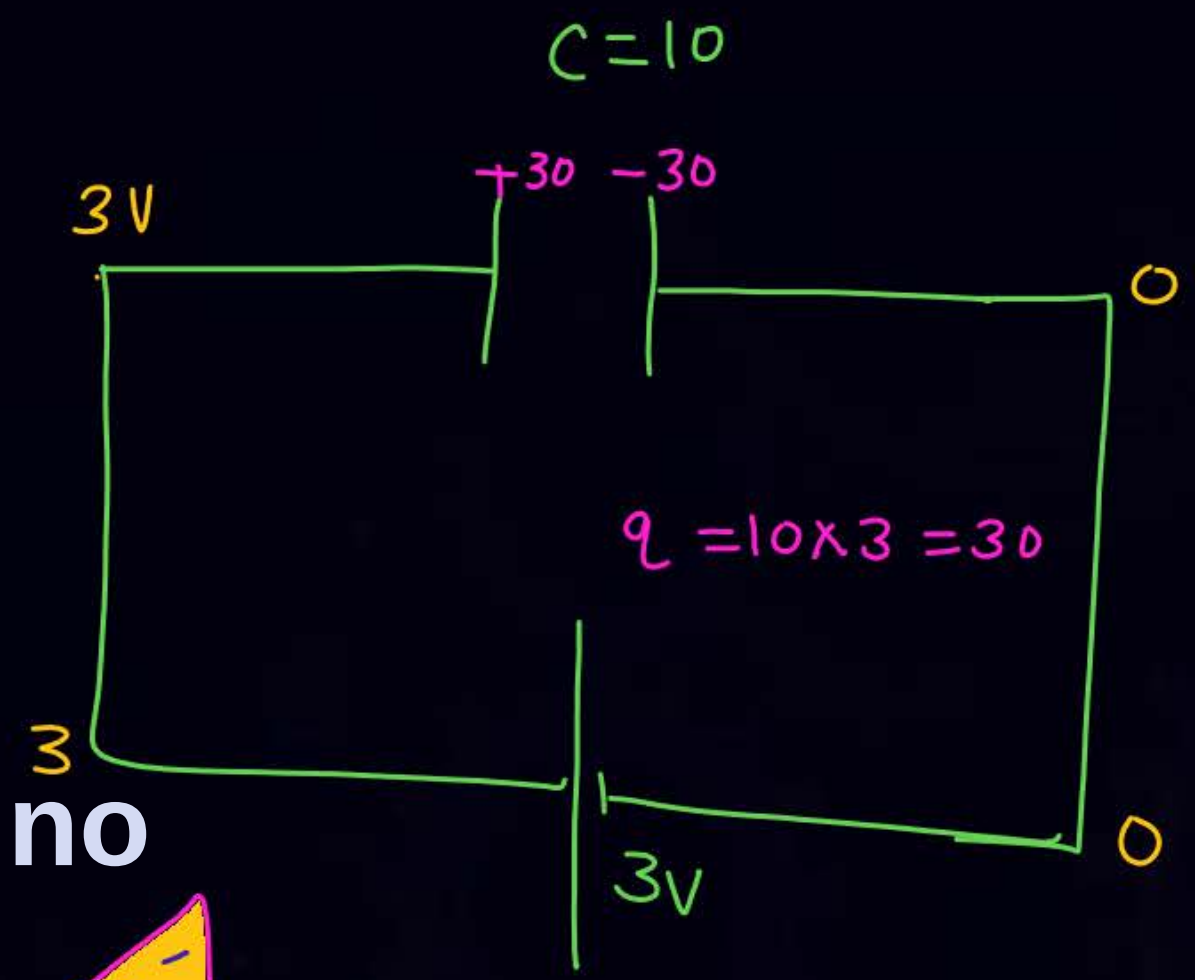
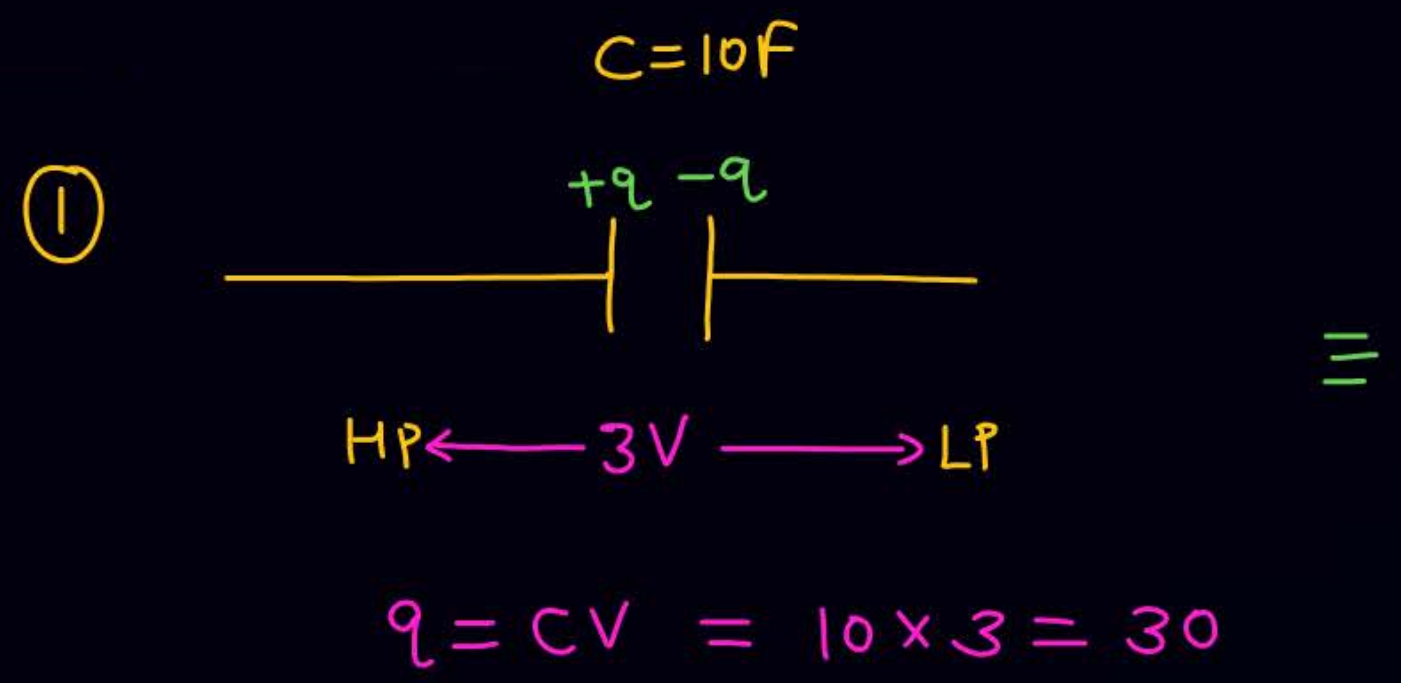
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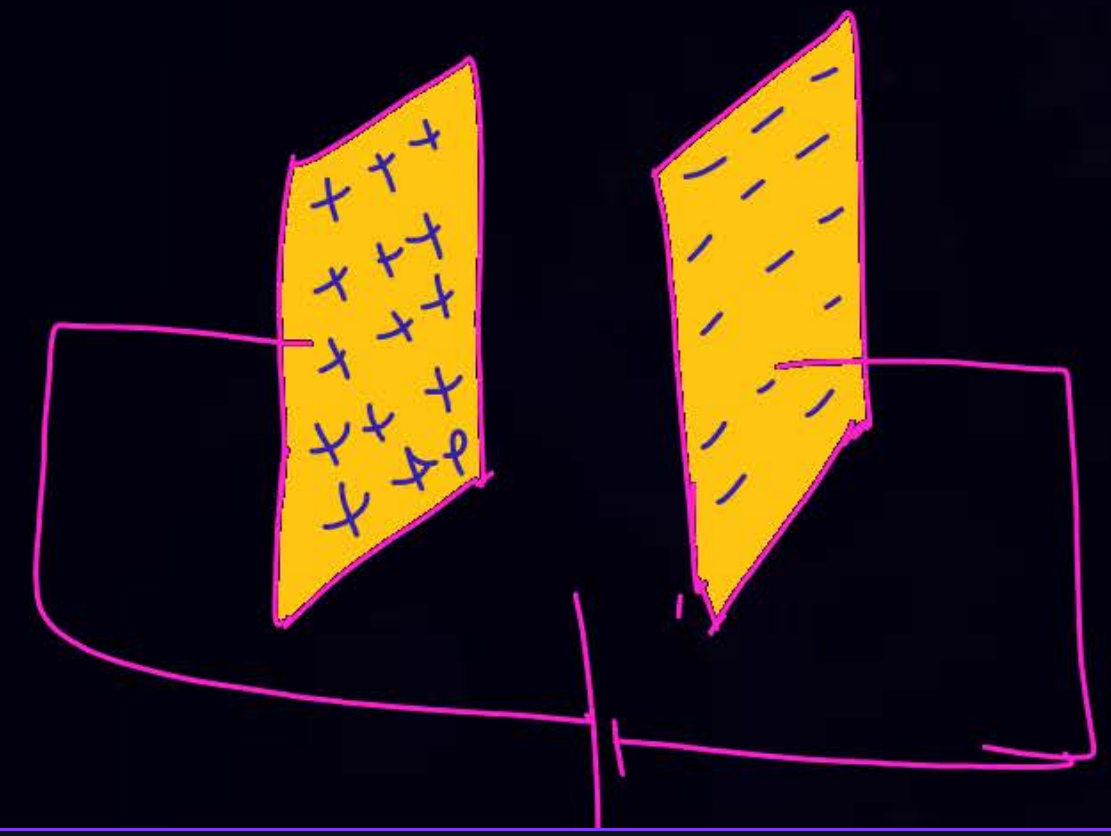


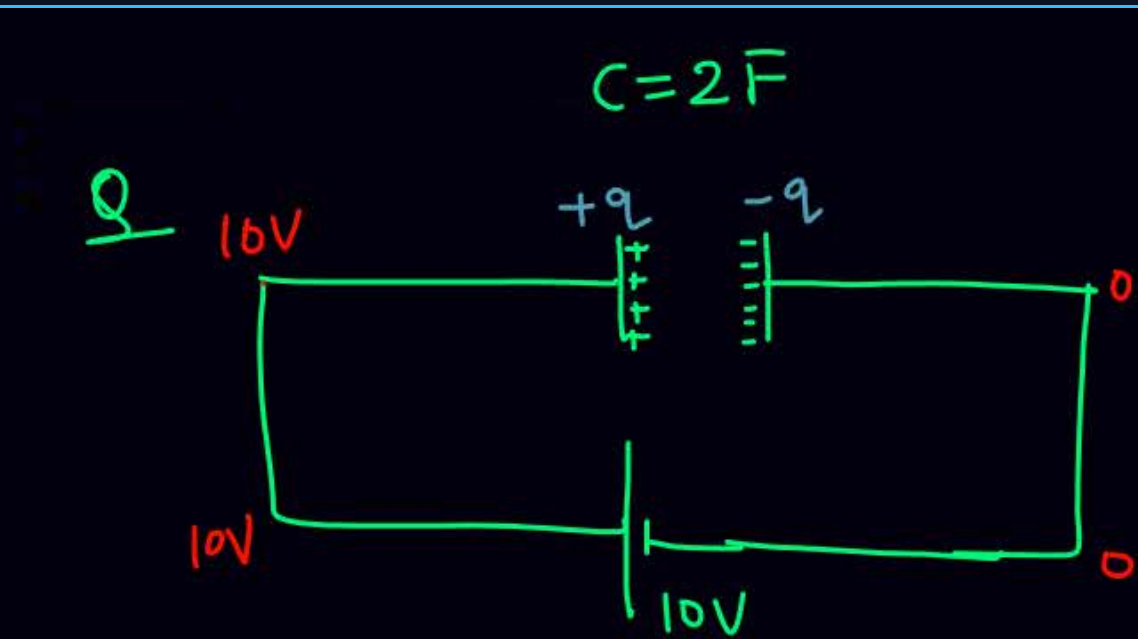
ATDB.uno

QUESTION



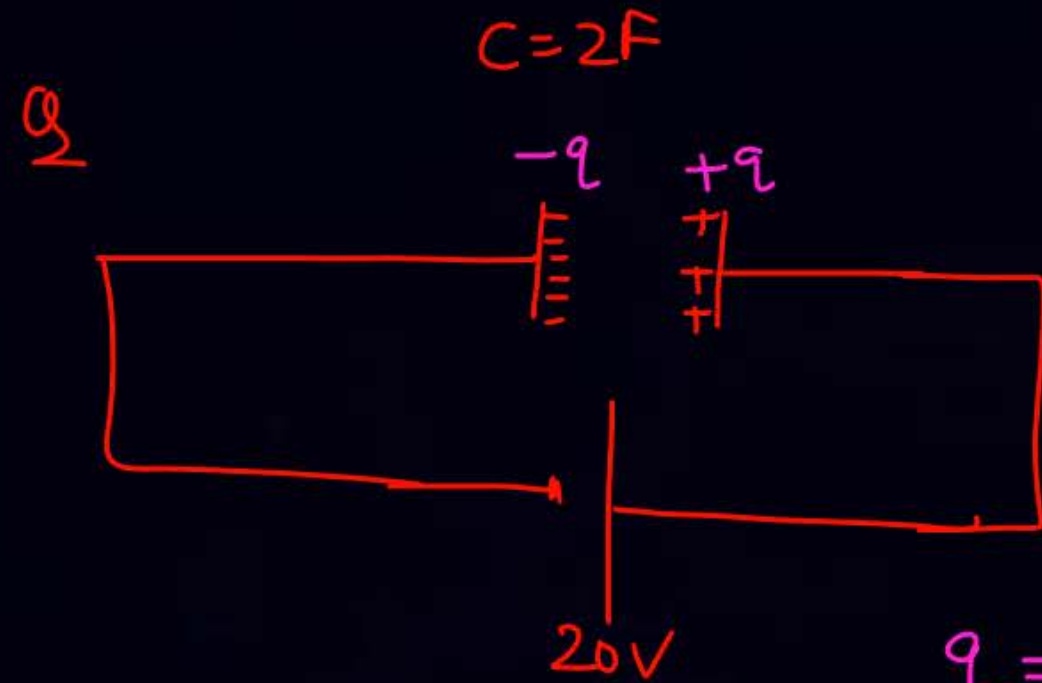
ATDB.uno





$Q = CV$

$q = 2 \times 10 = 20$



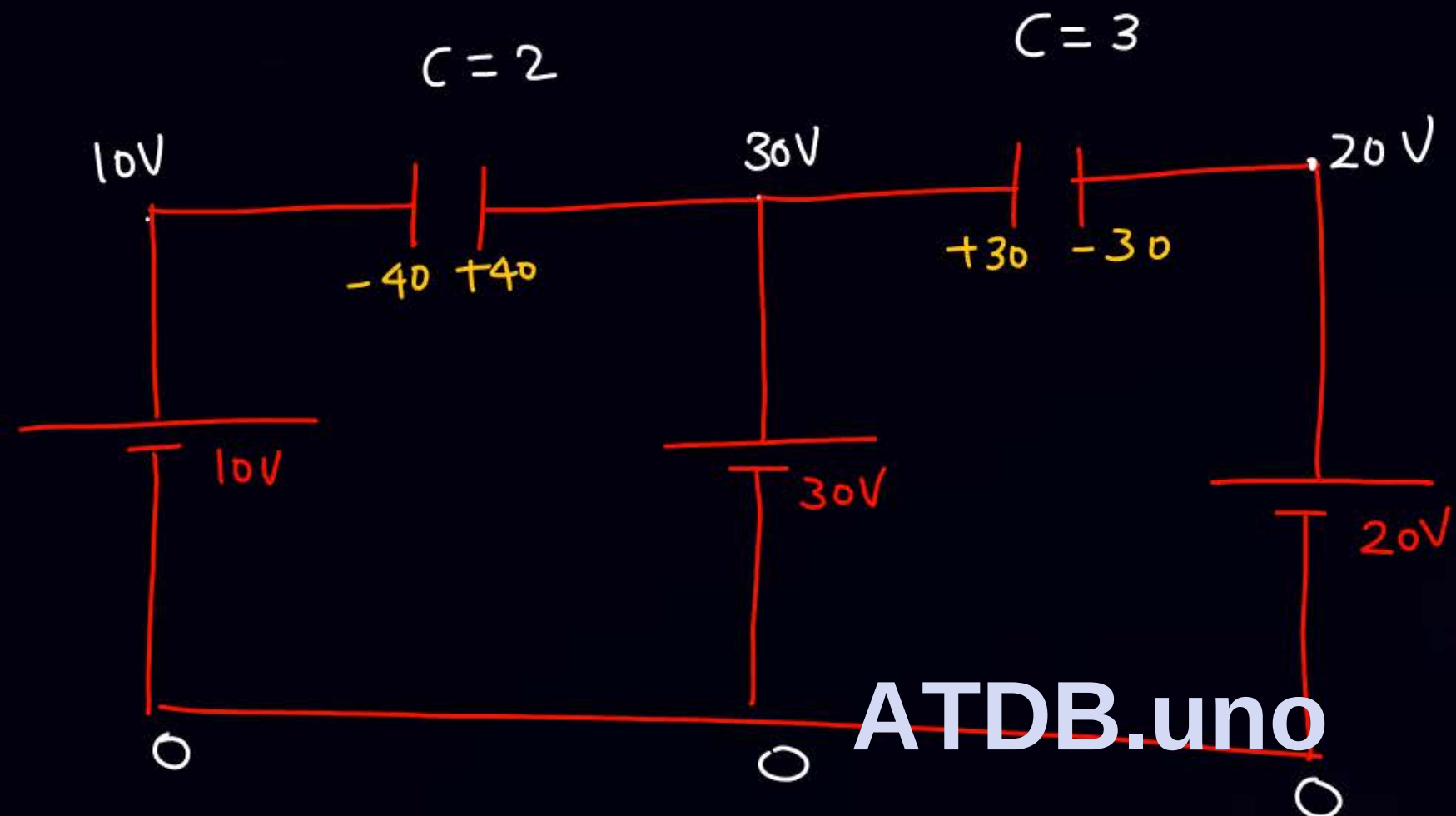
$q = 2 \times 20$

$q = 40$

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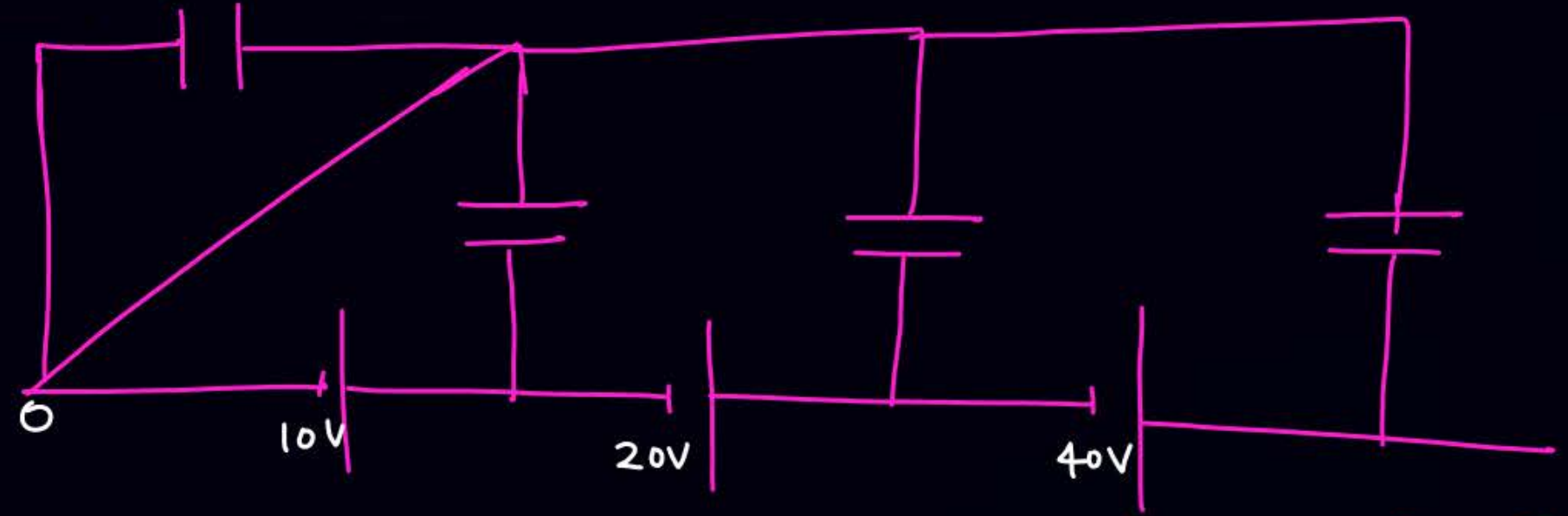
Q



$$Q = CV$$

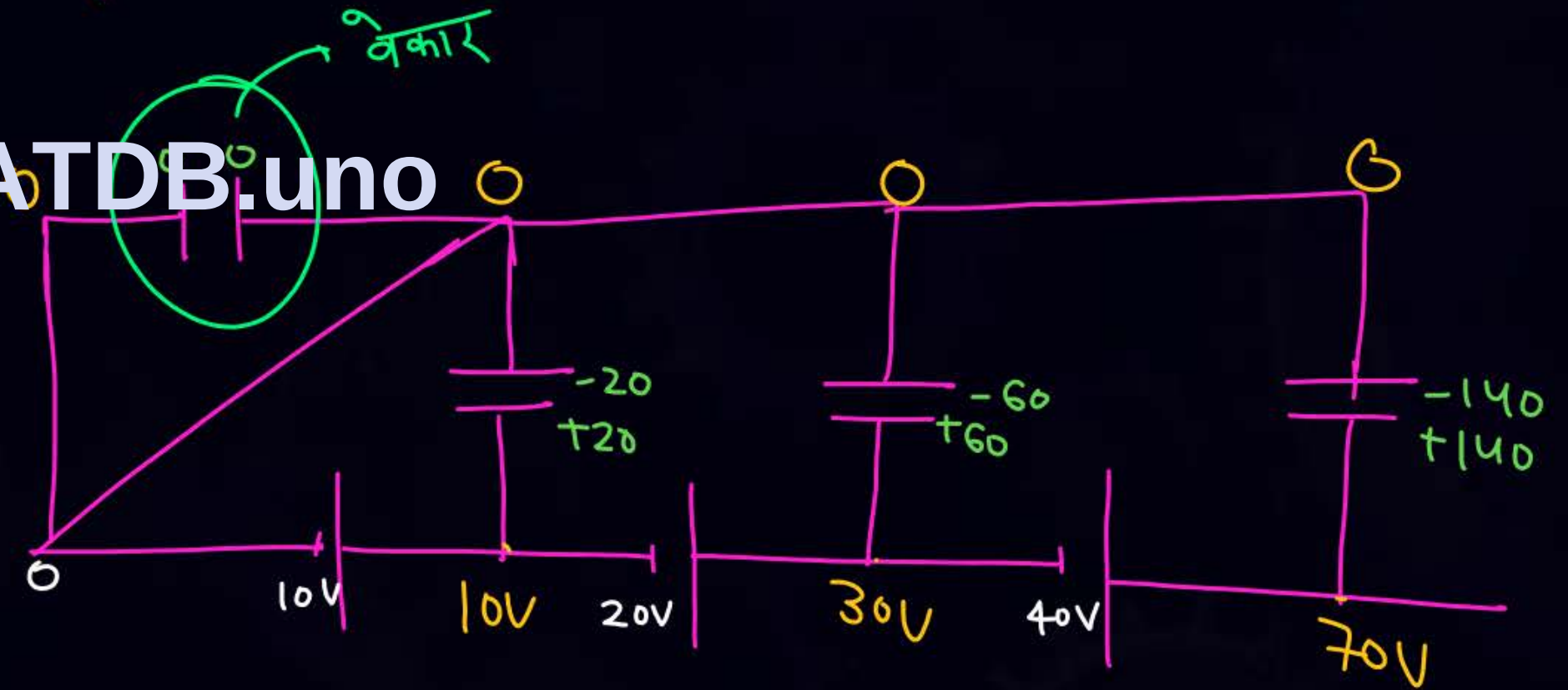
Q2

$C = 2\text{ F (each)}$



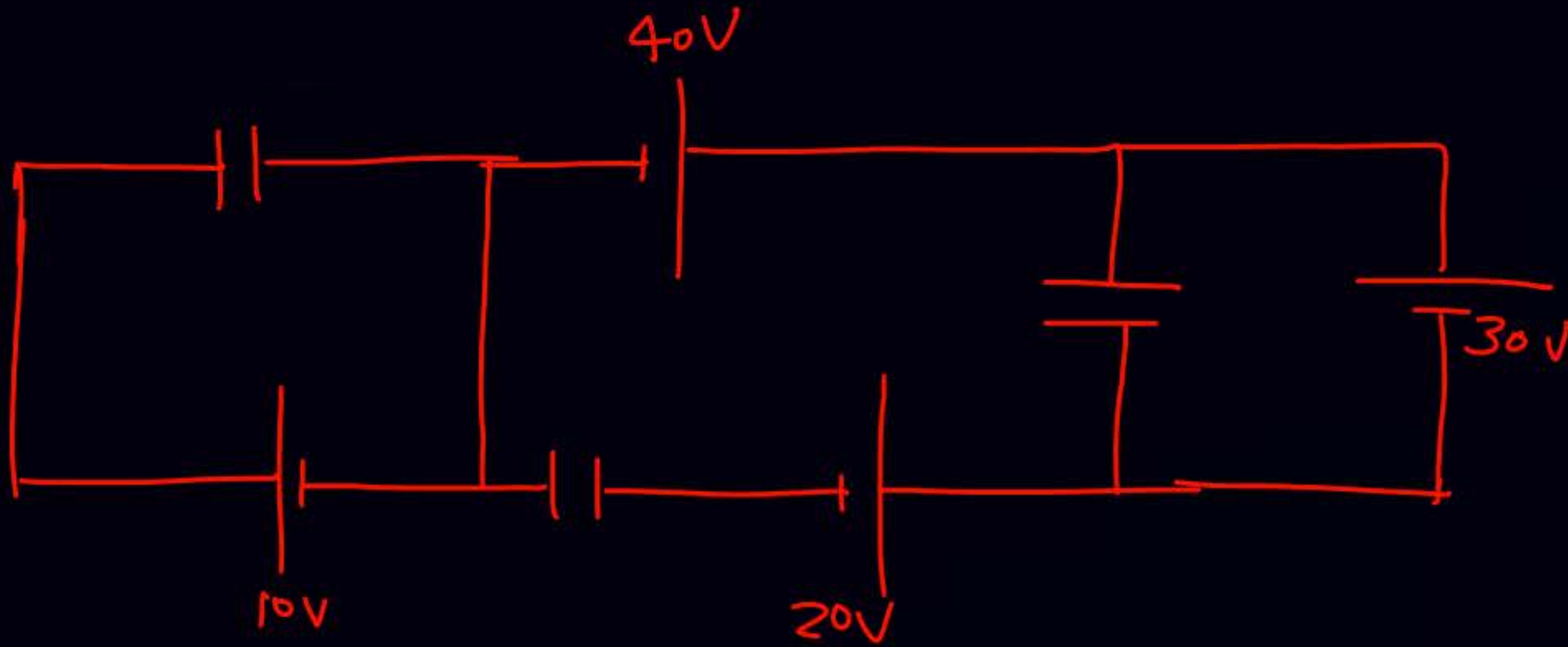
$$q = CV$$

ATDB.uno

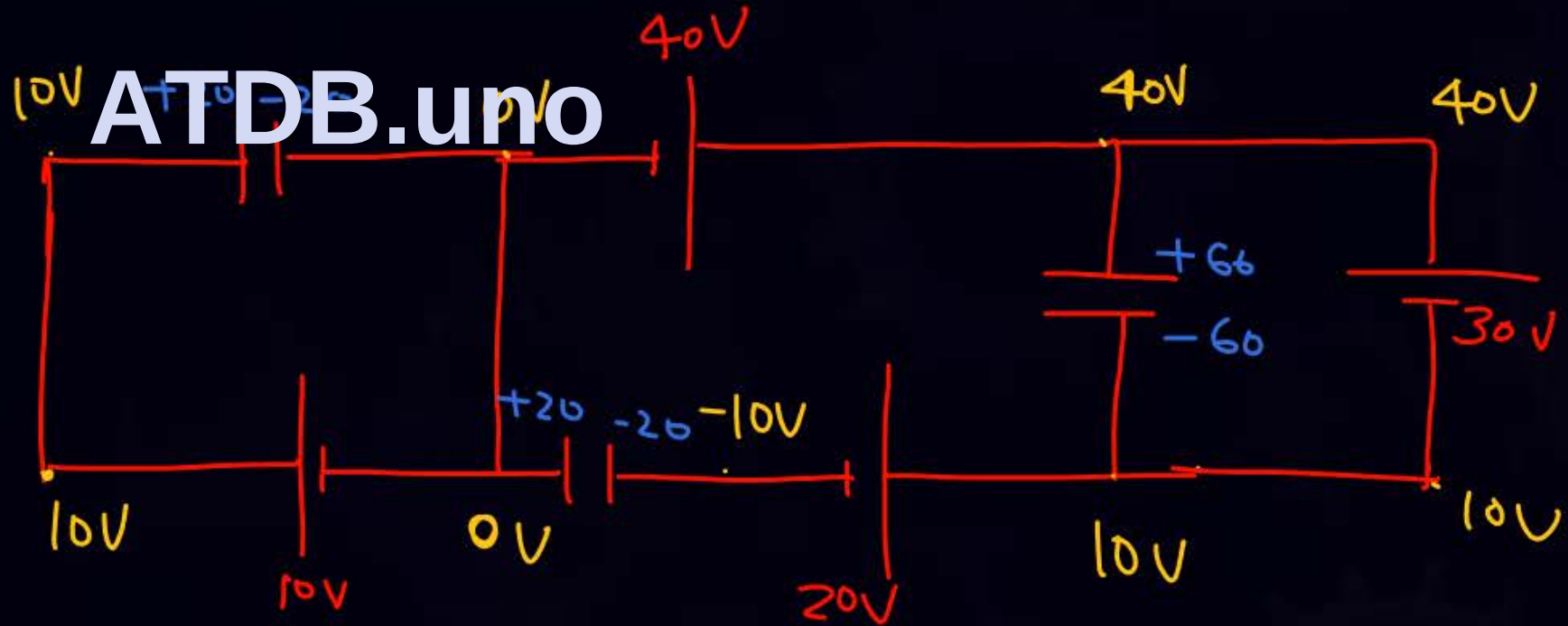




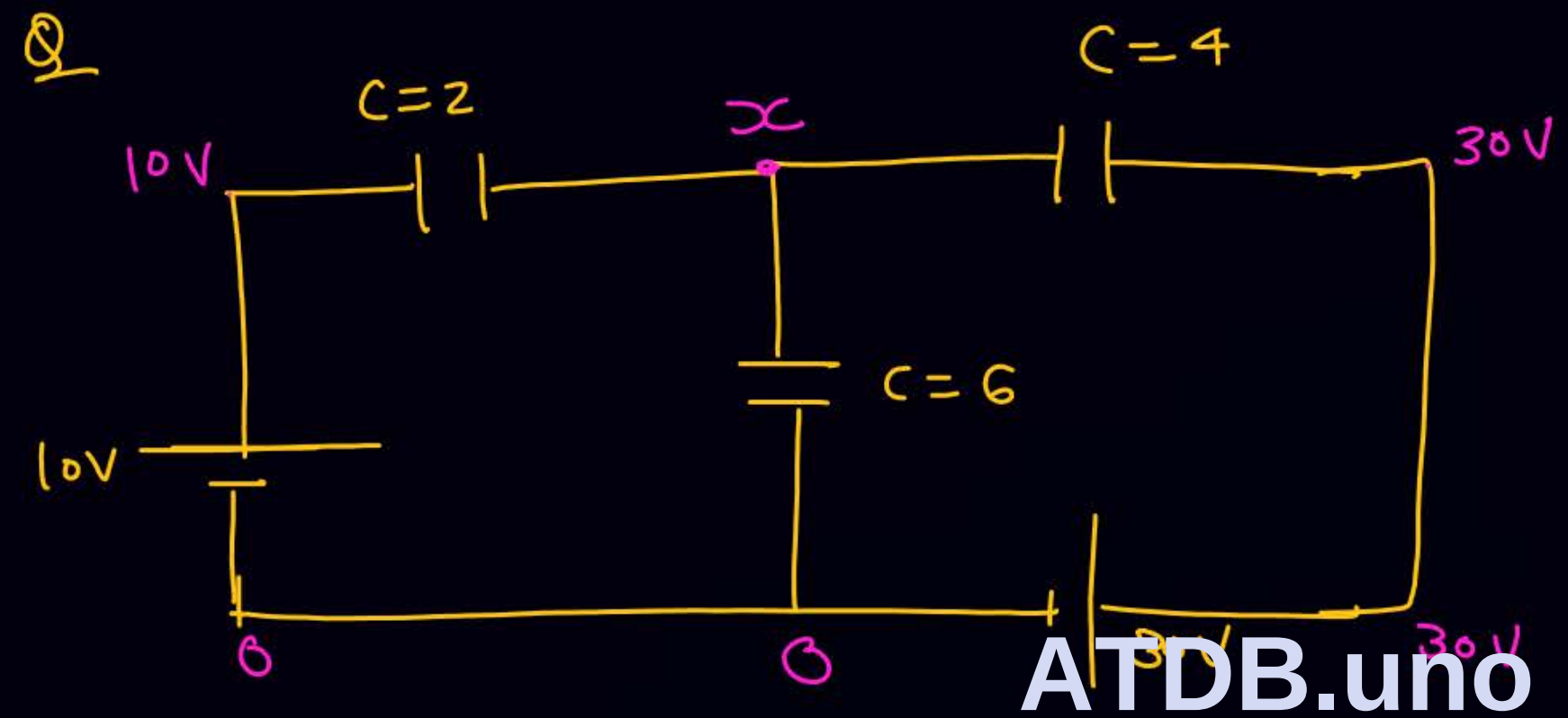
①



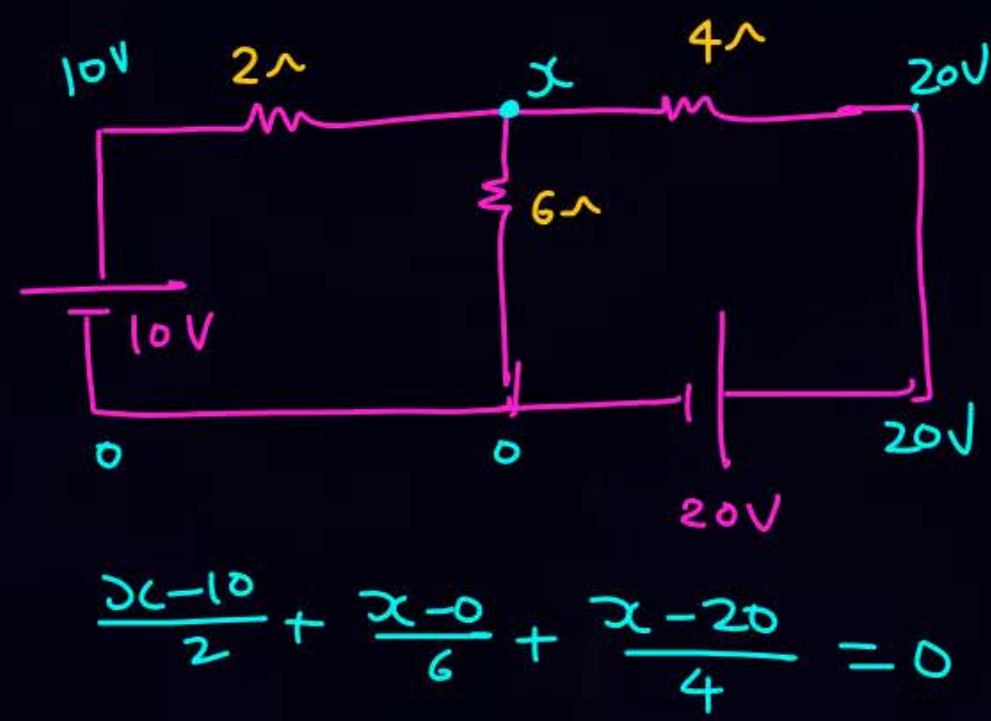
$C = 2.F(\text{each})$

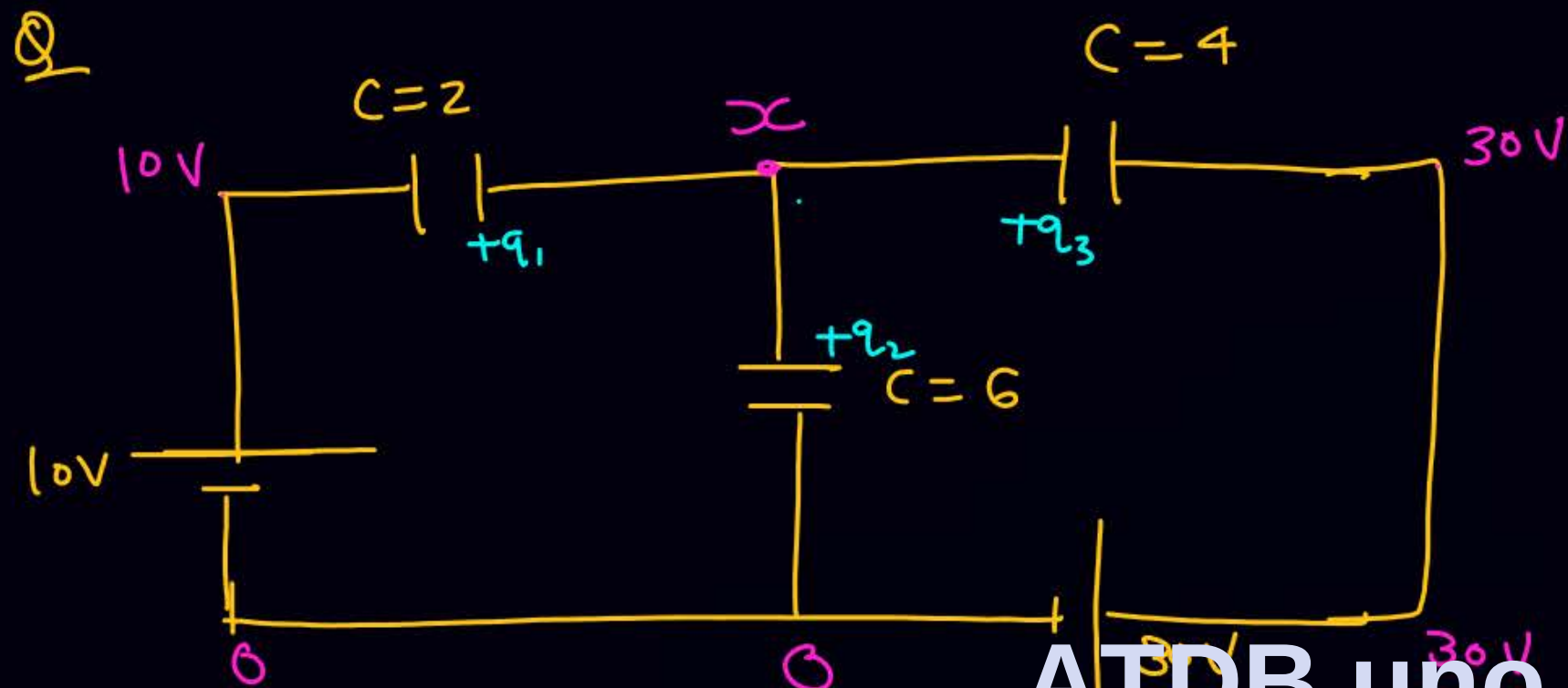


QUESTION



SOLUTION





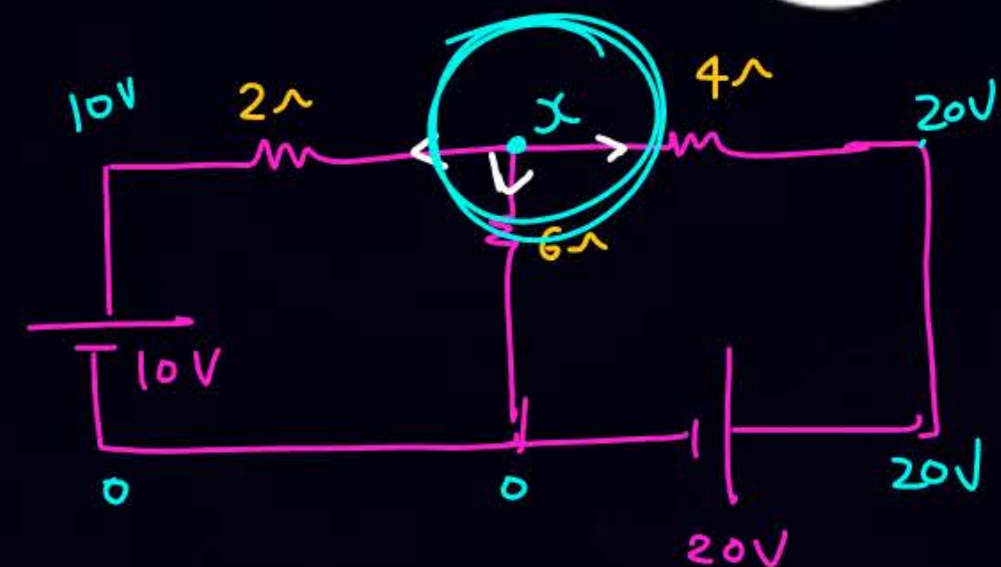
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$$q_1 + q_2 + q_3 = 0$$

$$2(x-10) + 6(x-0) + 4(x-30) = 0$$

$$2x - 20 + 6x + 4x - 120 = 0$$

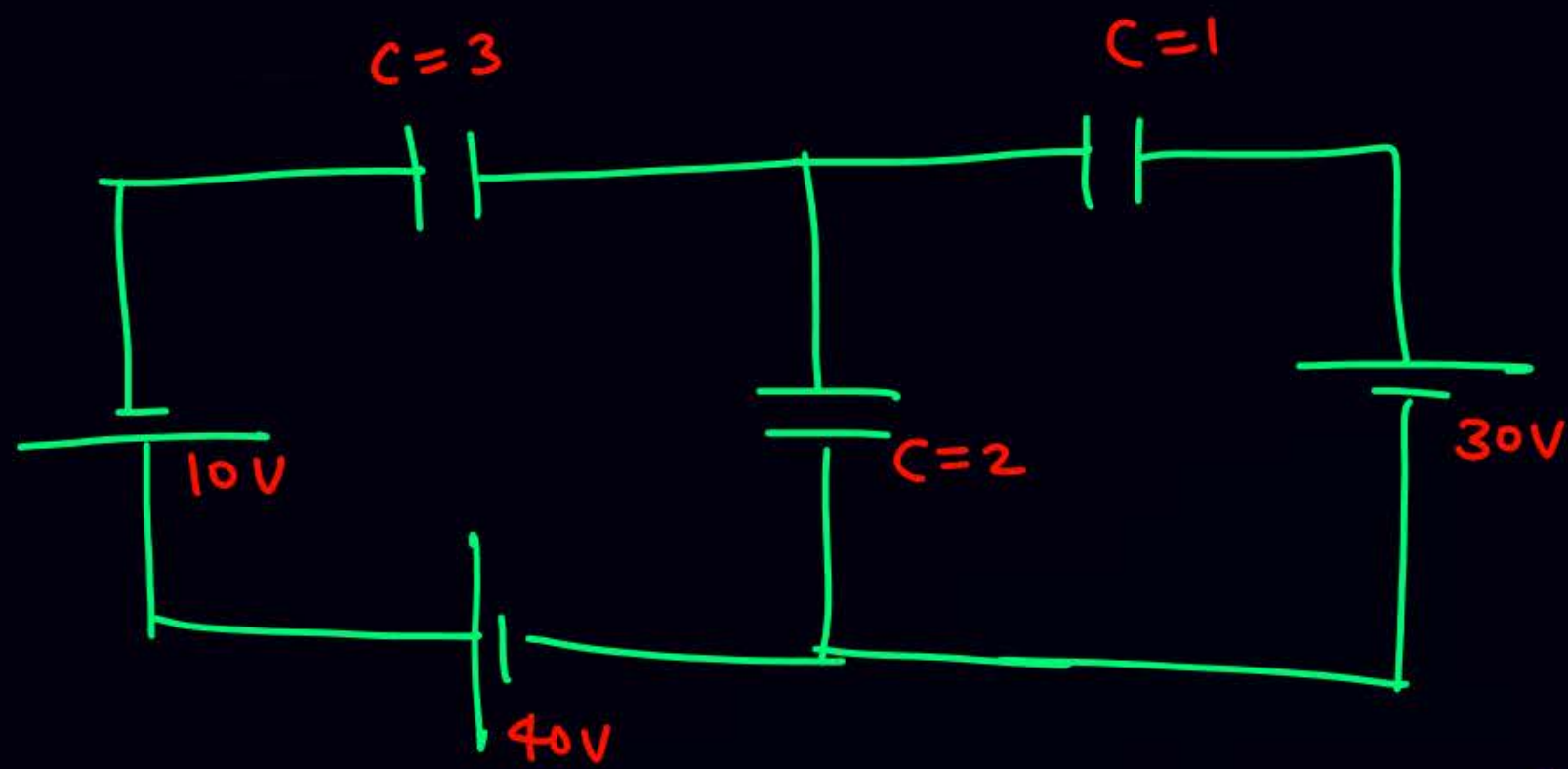
$$12x = 140 \quad x = \checkmark$$



$$\frac{x-10}{2} + \frac{x-0}{6} + \frac{x-20}{4} = 0$$

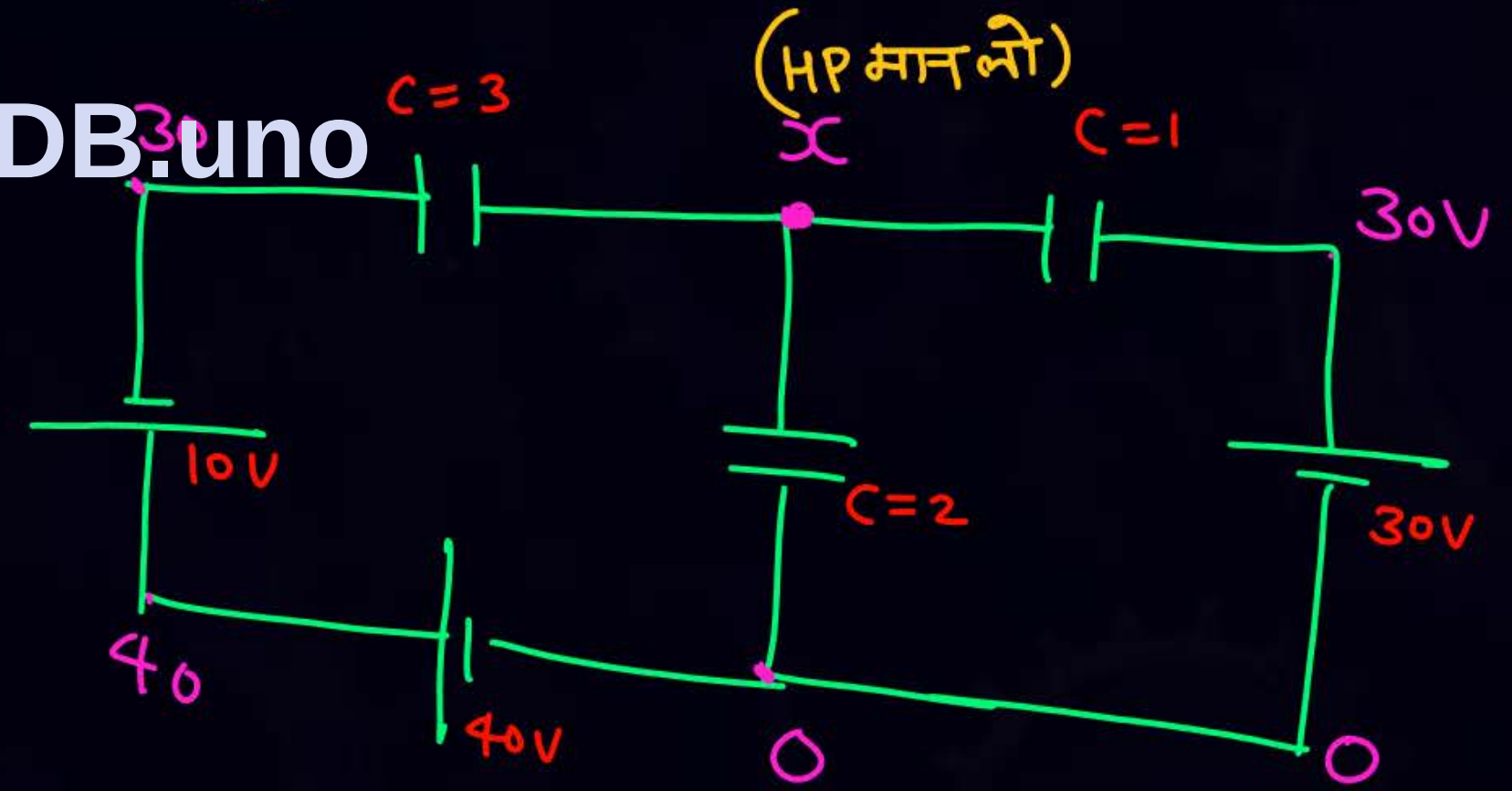


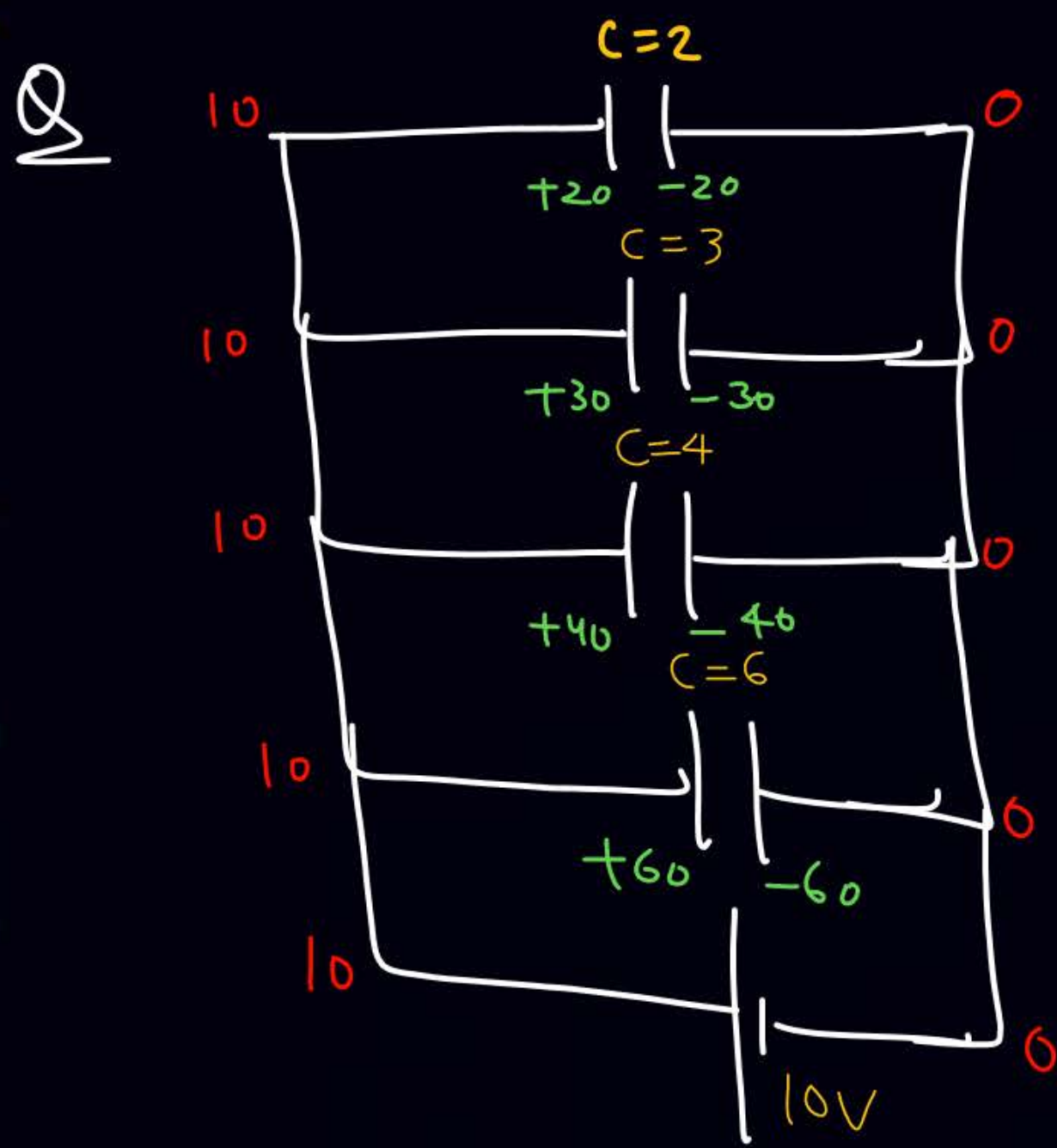
Ques



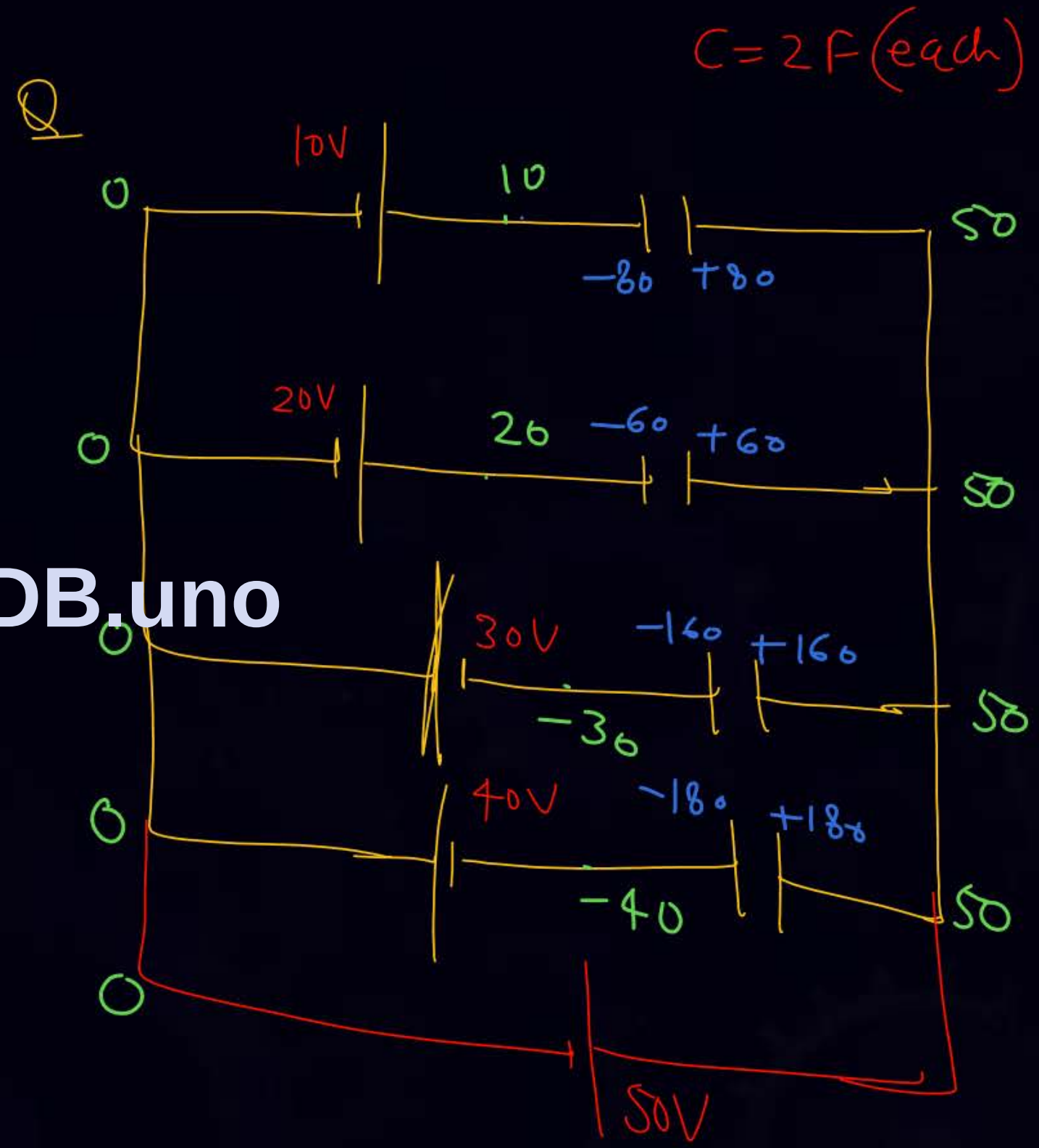
$$3(x-30) + 2(x-0) + 1 \times (x-30) = 0$$
$$6x = 120 \quad \boxed{x = 20V}$$

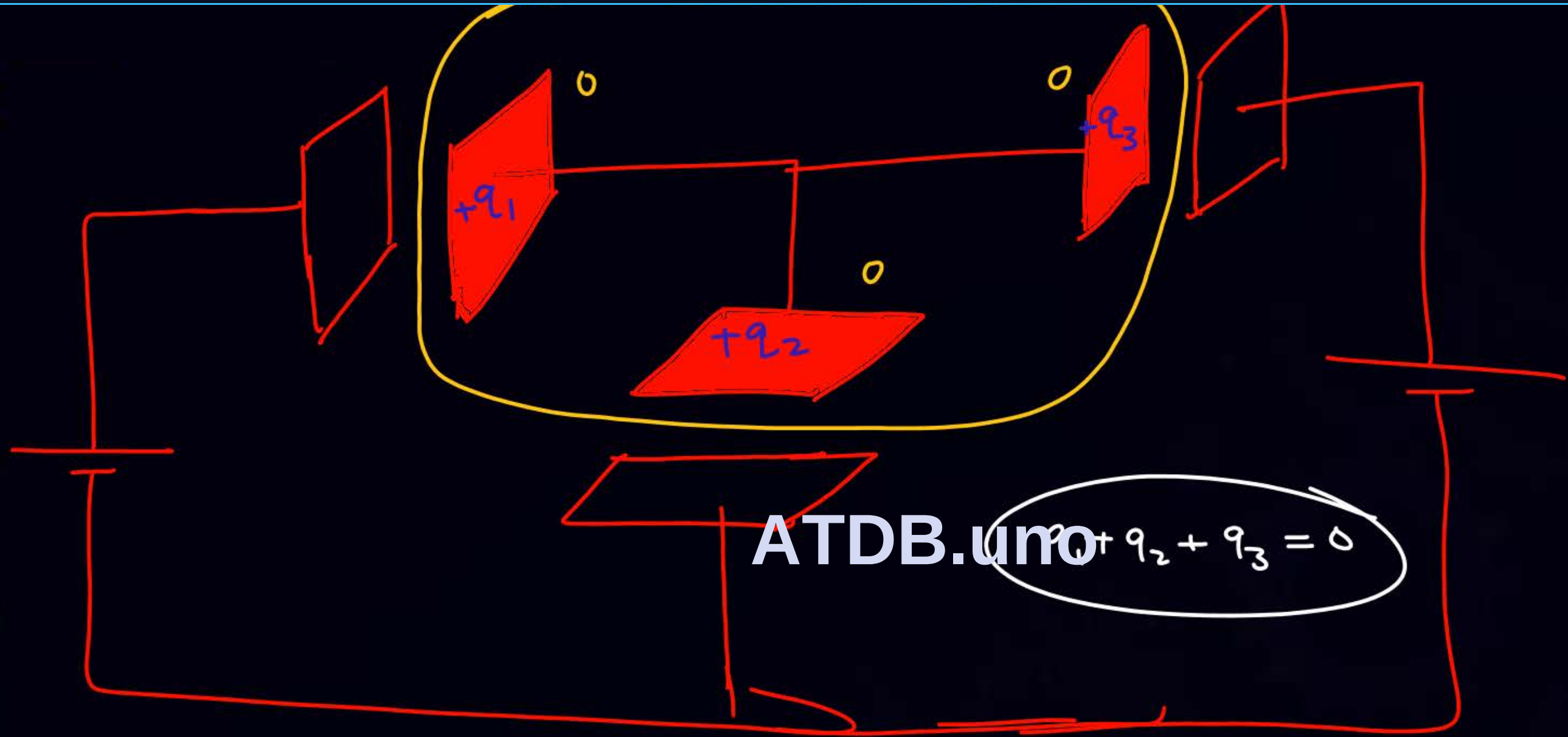
ATDB.uno





ATDB.uno



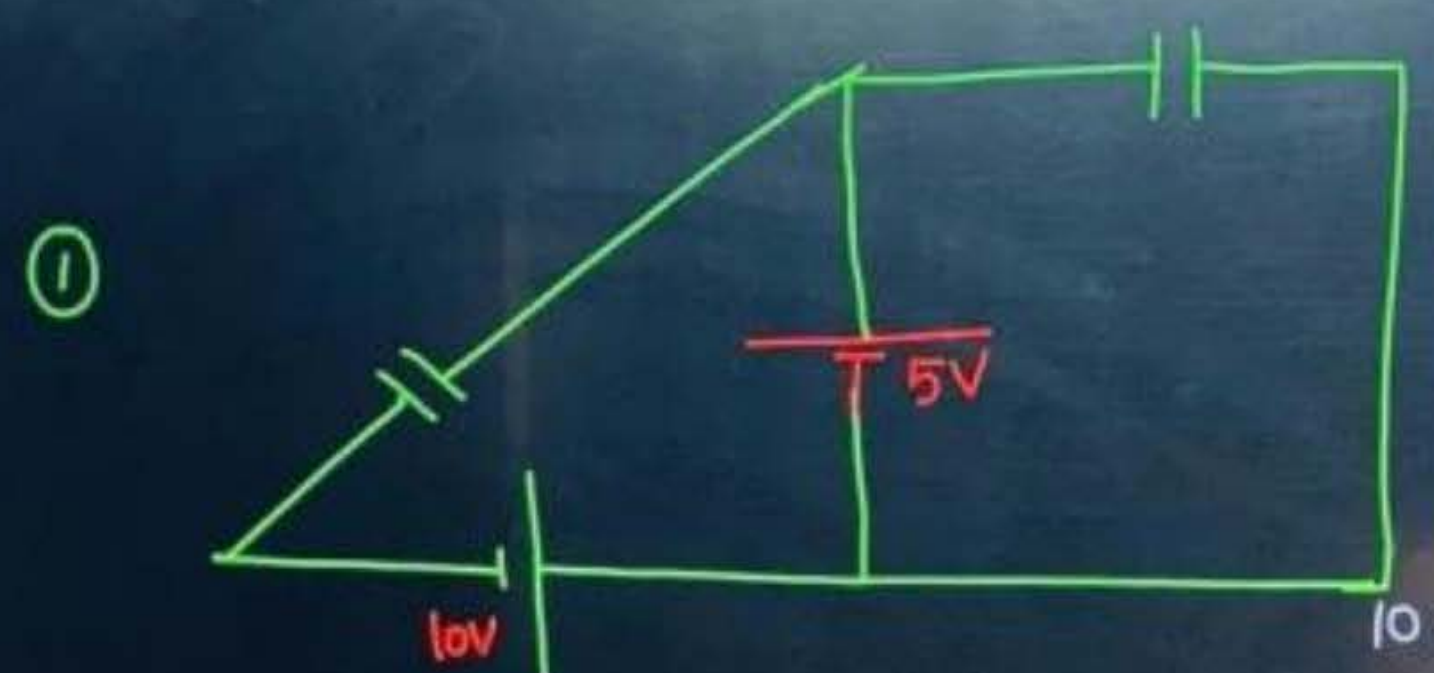




Home Work Ques

(will upload vedio today)

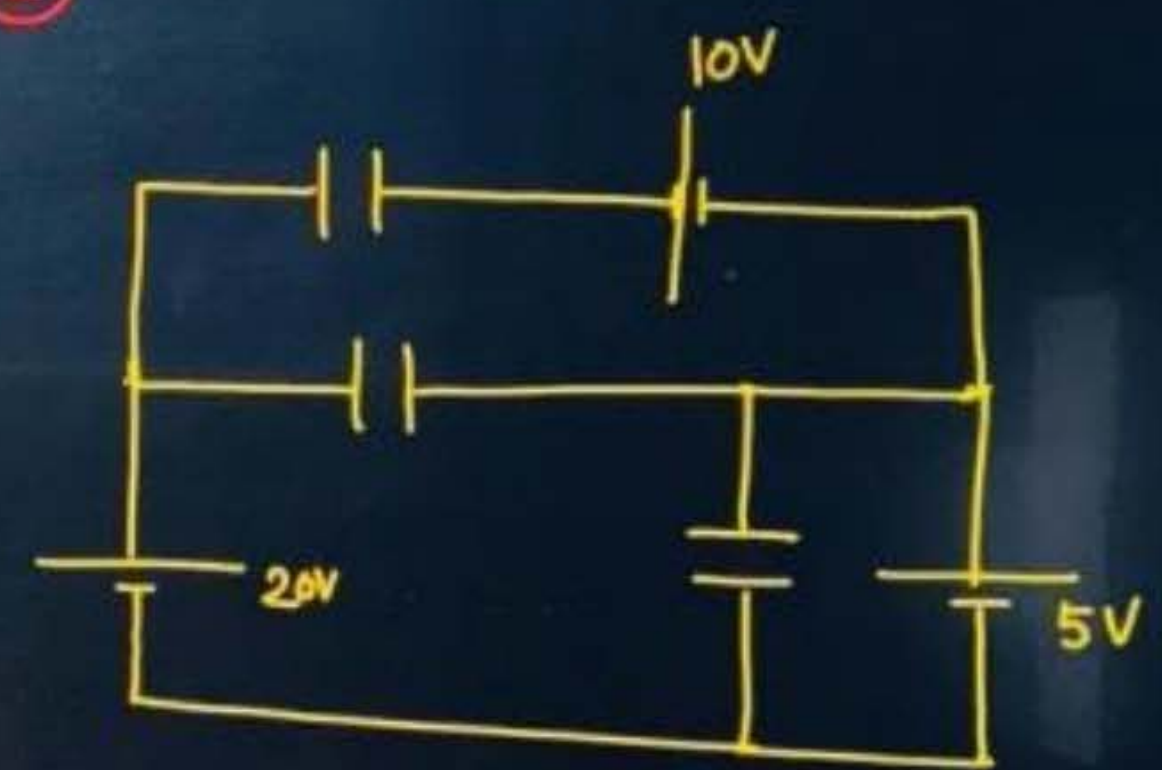
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$C = 2\text{ F (each)}$

ATDB.uno

②

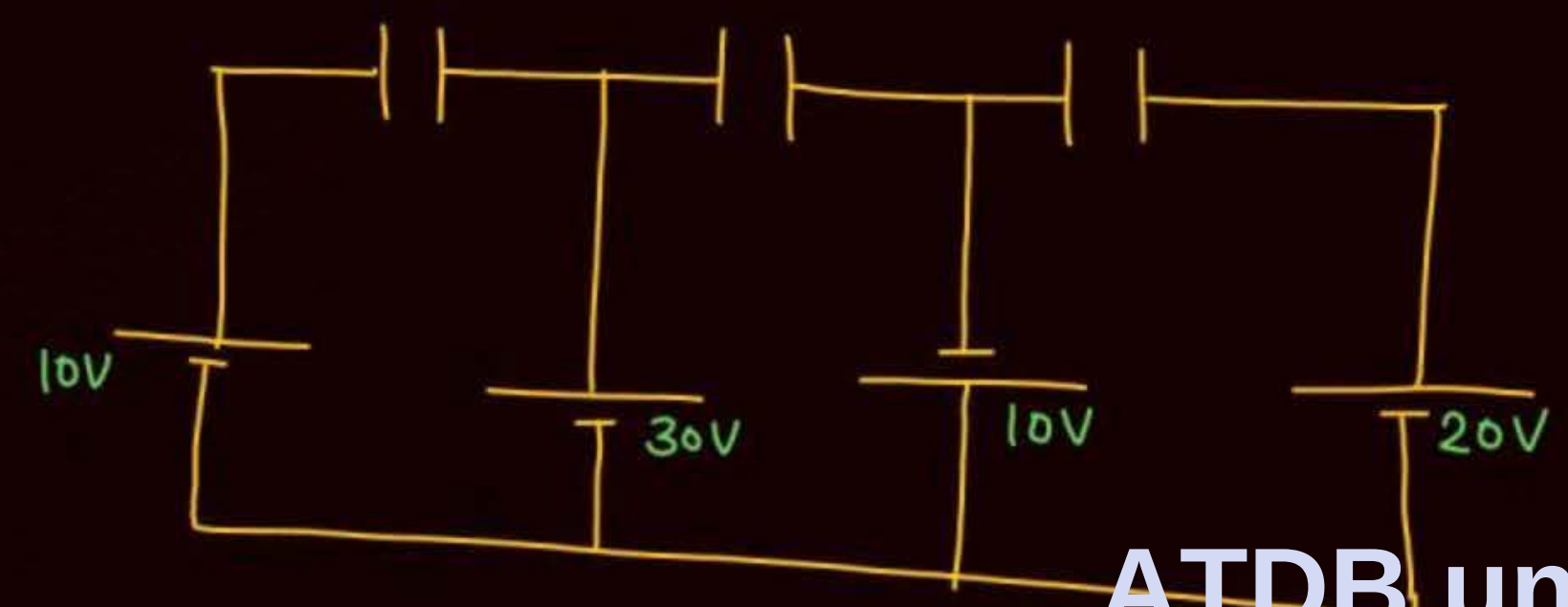


$C = 2\text{ F (each)}$

02.pdf



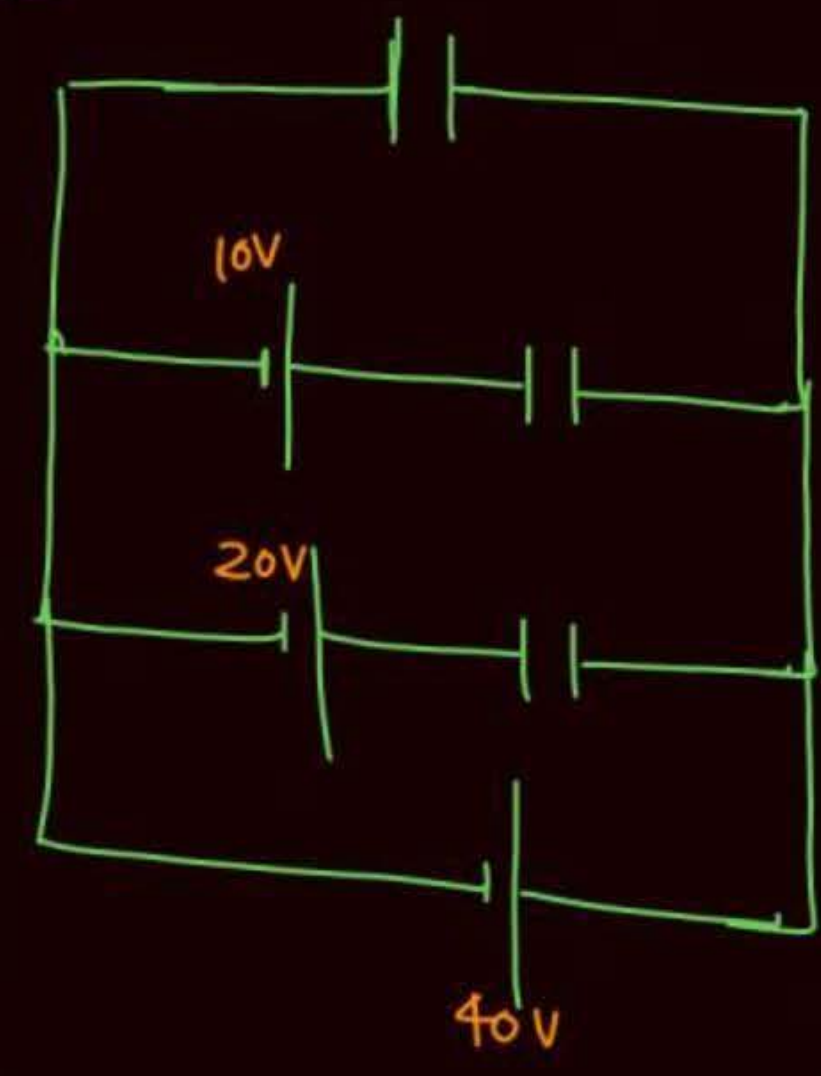
3



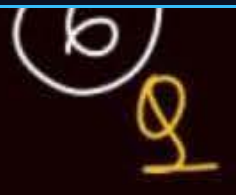
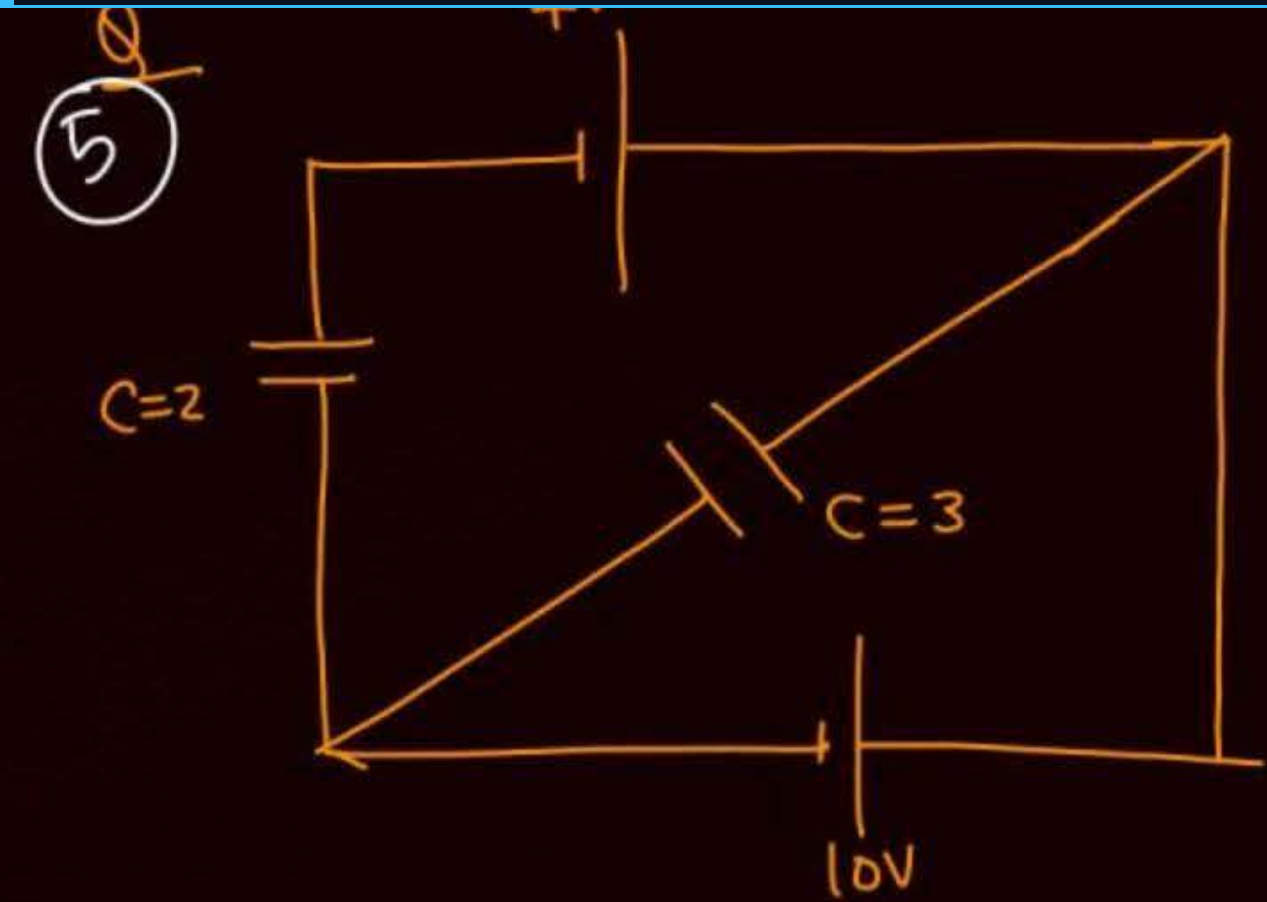
4

Q

$C = 2F$ (each)



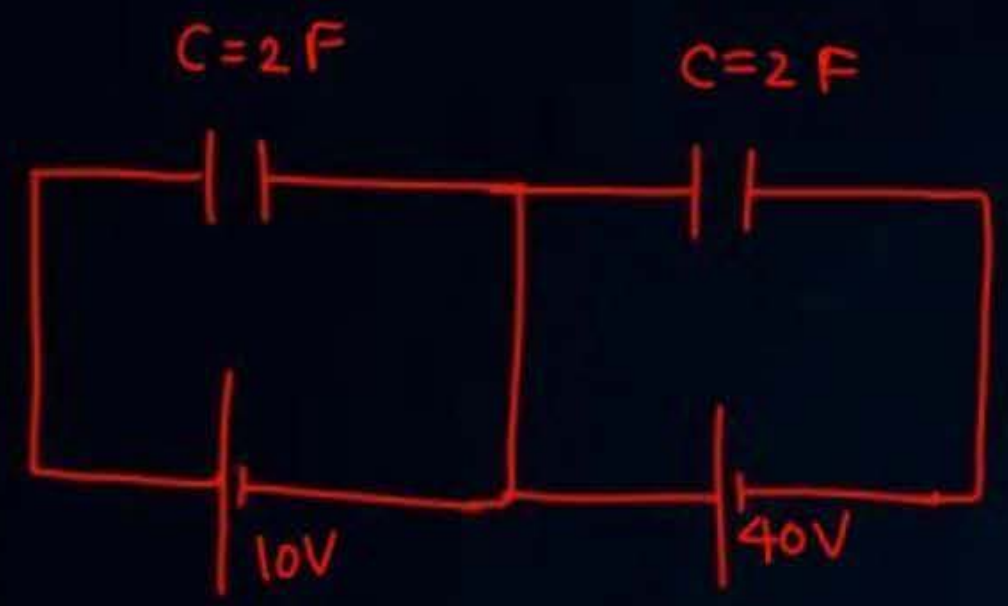
ATDB.uno



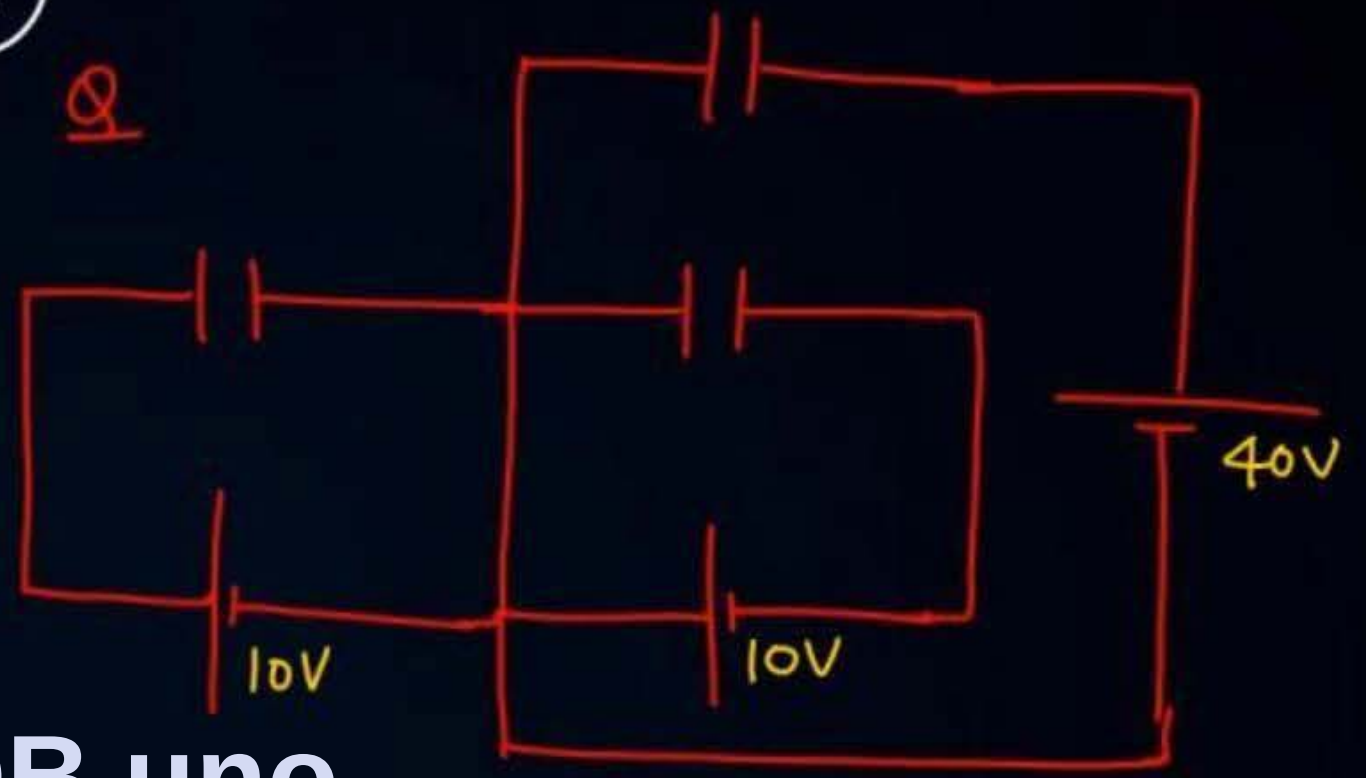
Find charge
on capacitor
 C_1 & C_2
and current
through 2Ω
and 3Ω

ATDB.uno

7
Q



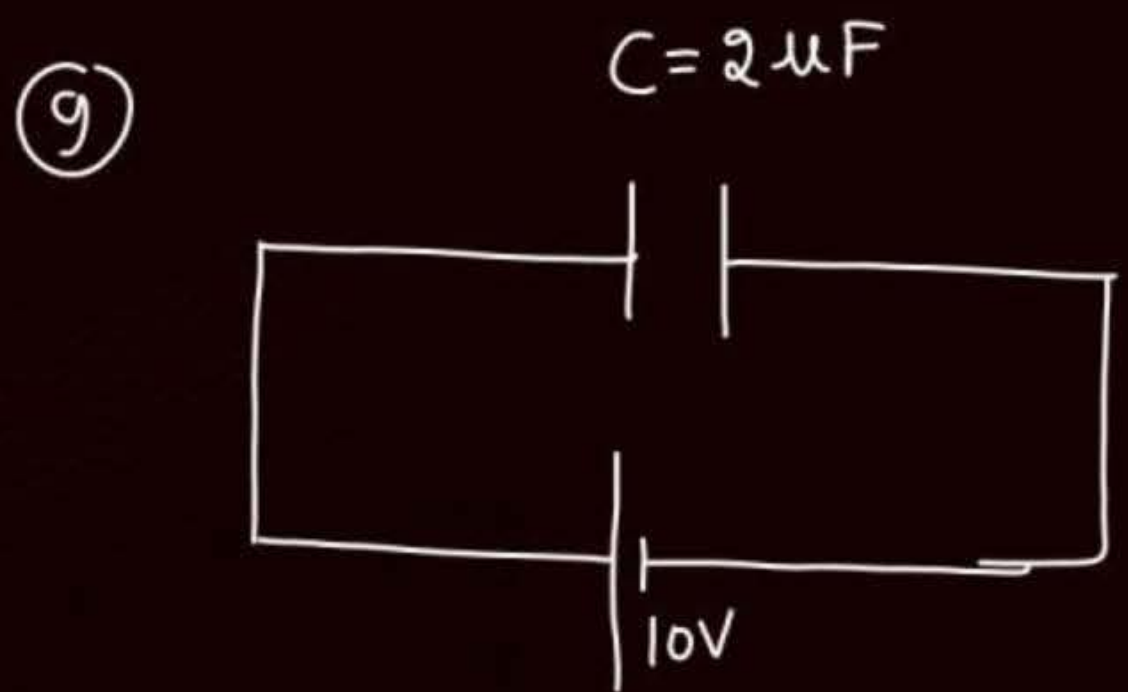
8
Q



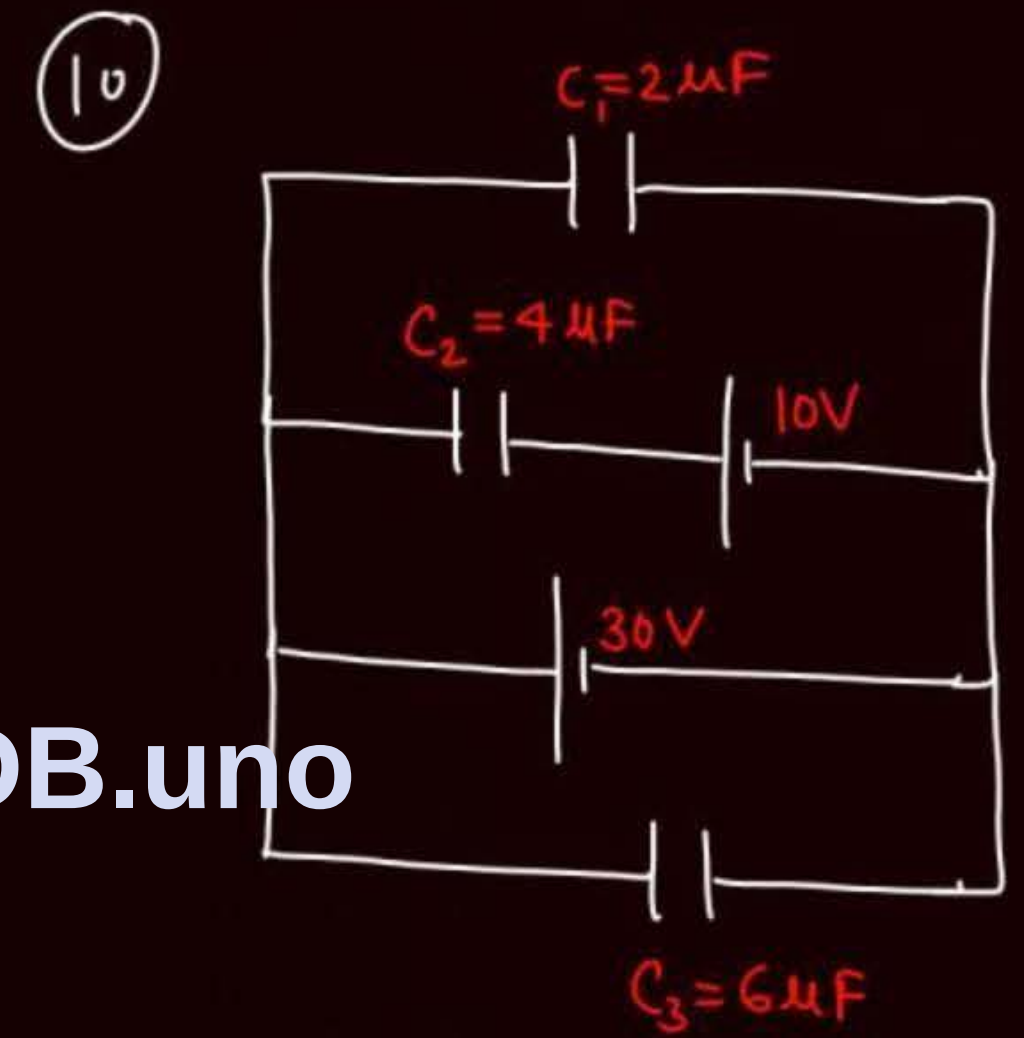
ATDB.uno

$C = 2\text{ F}$ (each)





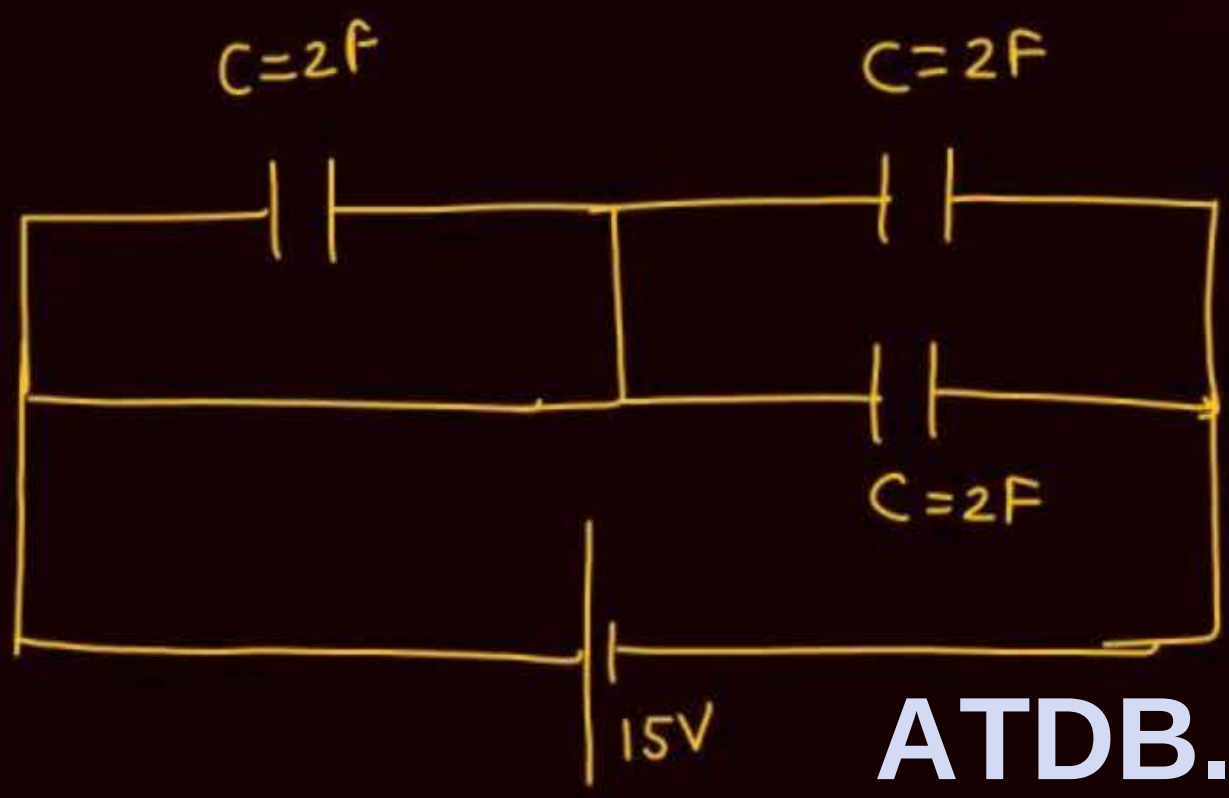
$$C = 2\mu F = 2 \times 10^{-6} F$$



ATDB.uno



12

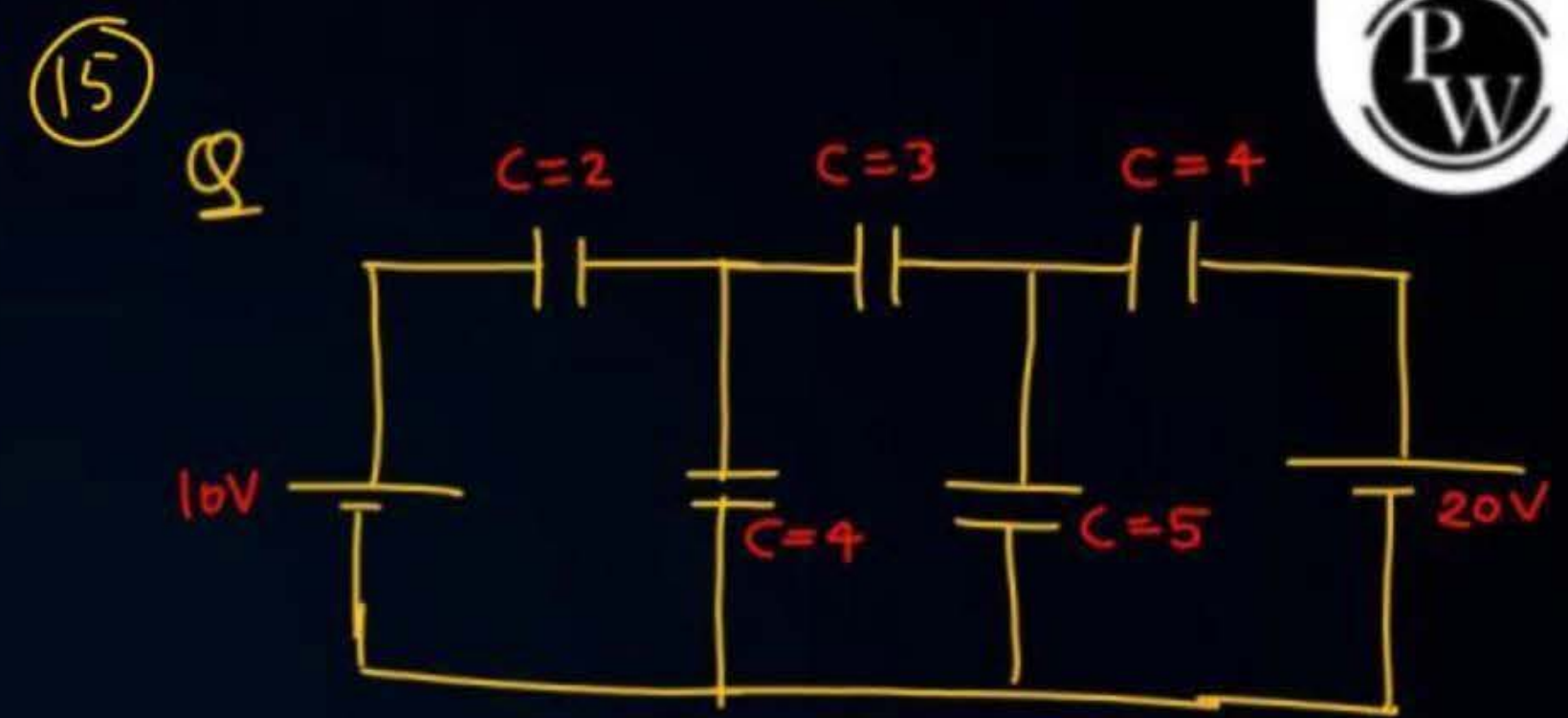
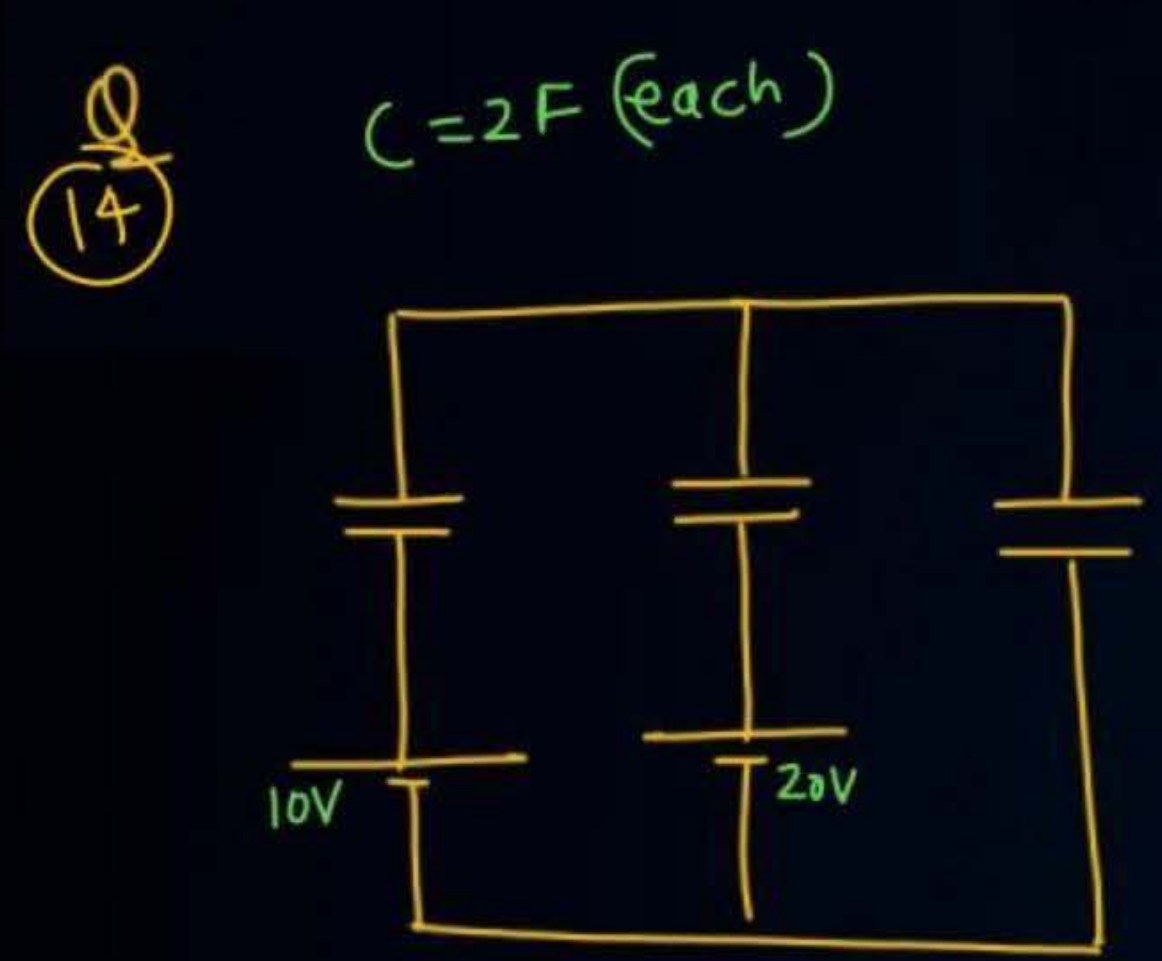


ATDB.uno

Q (13)



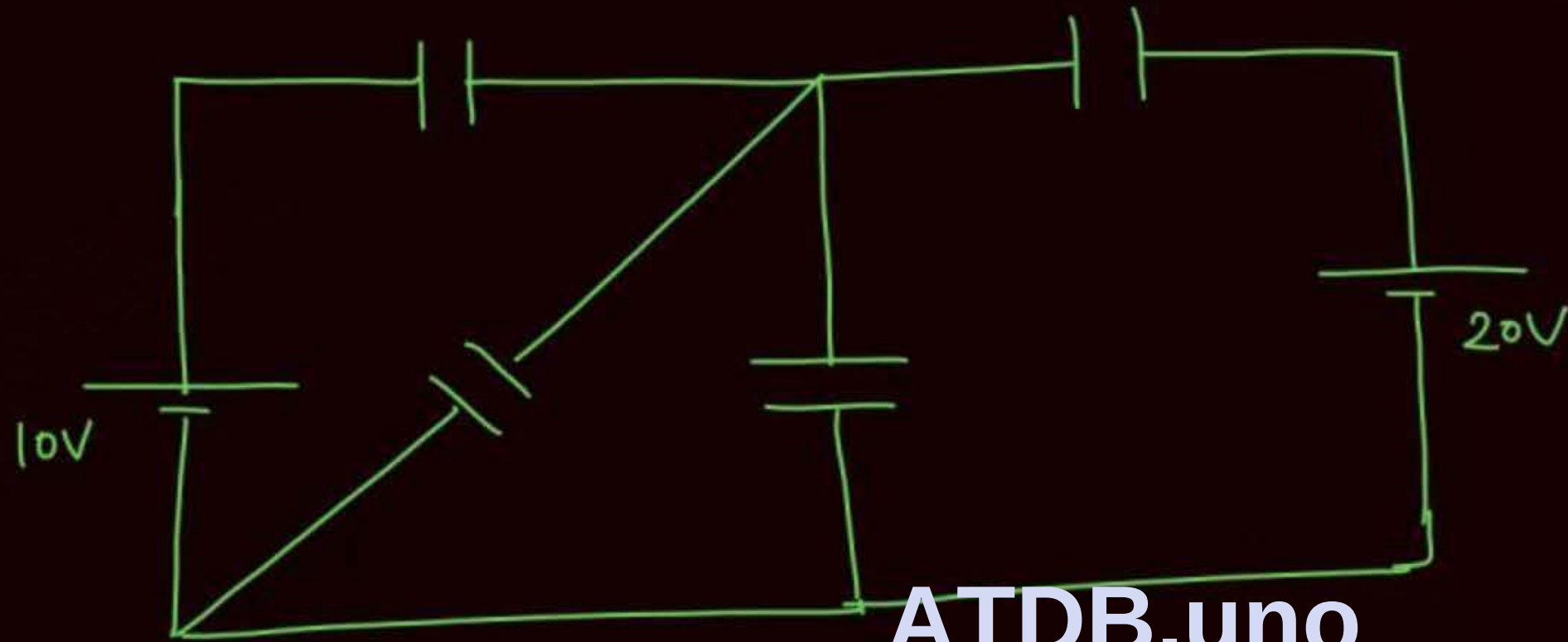
ATDB.uno



ATDB.uno



16

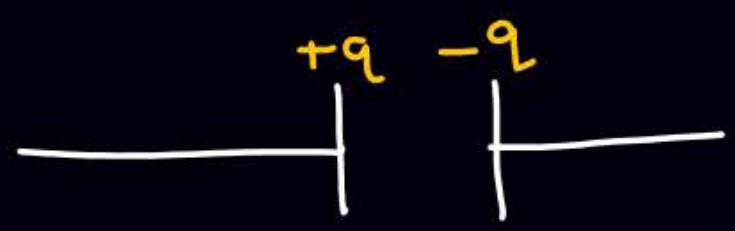


ATDB.uno

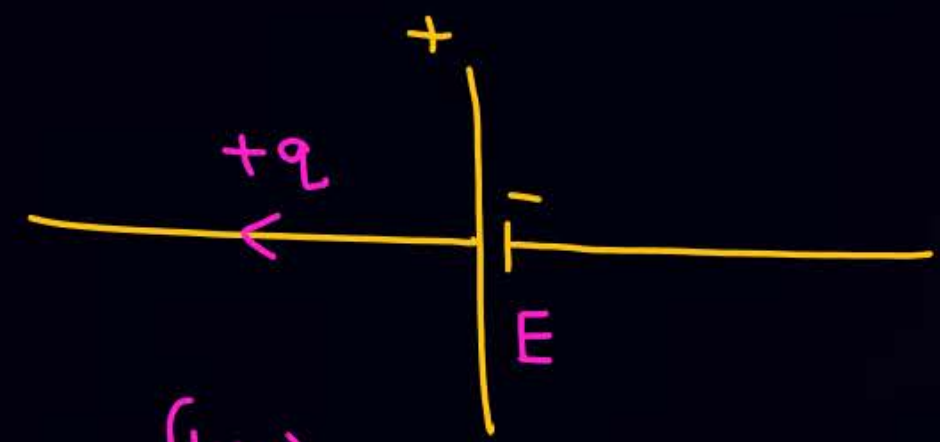
$C = 2\text{ }\mu\text{F (each)}$



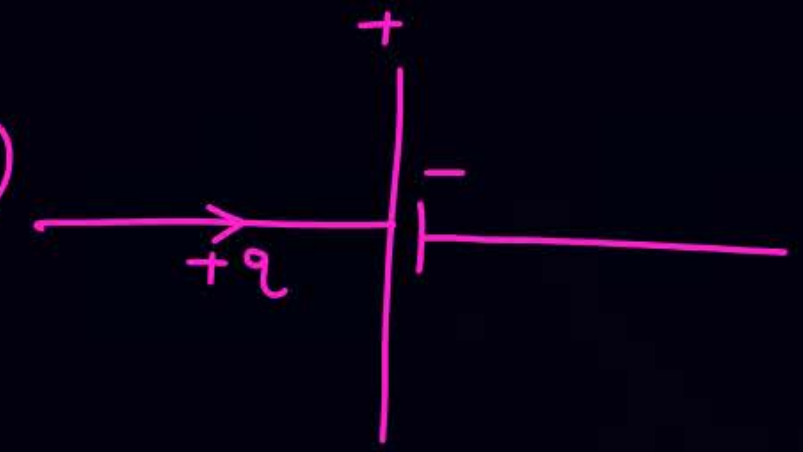
♥ $C = \frac{A \epsilon_0}{d}$



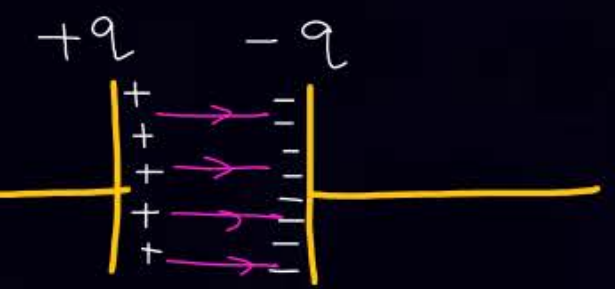
$q = CV$



$(W)_{battery} = +Eq$



$(W)_{battery} = -Eq$



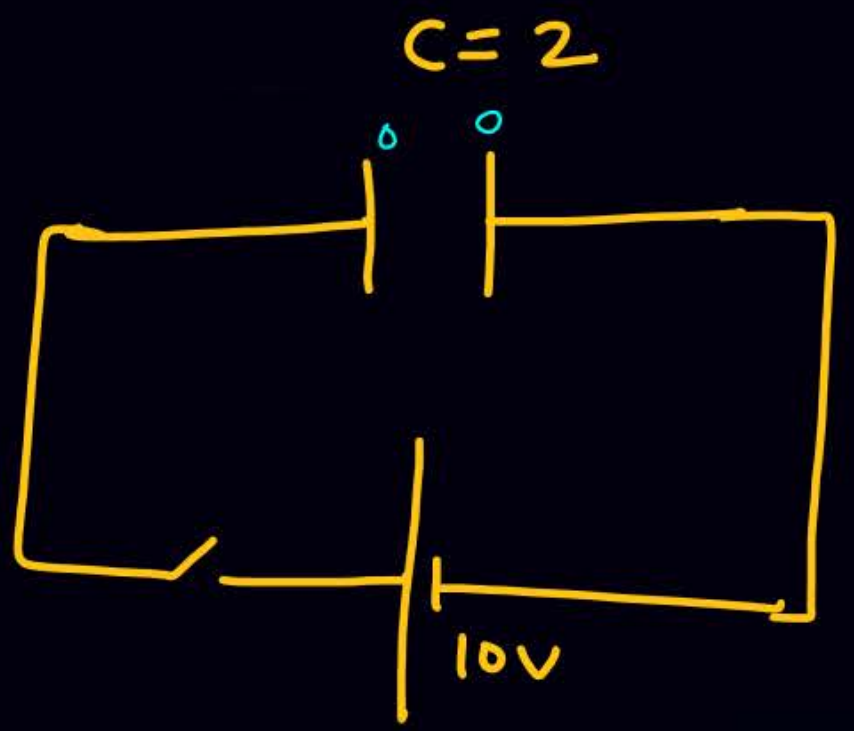
ATDB.uno

$U = \frac{1}{2} \frac{q^2}{C} = \frac{1}{2} CV^2$

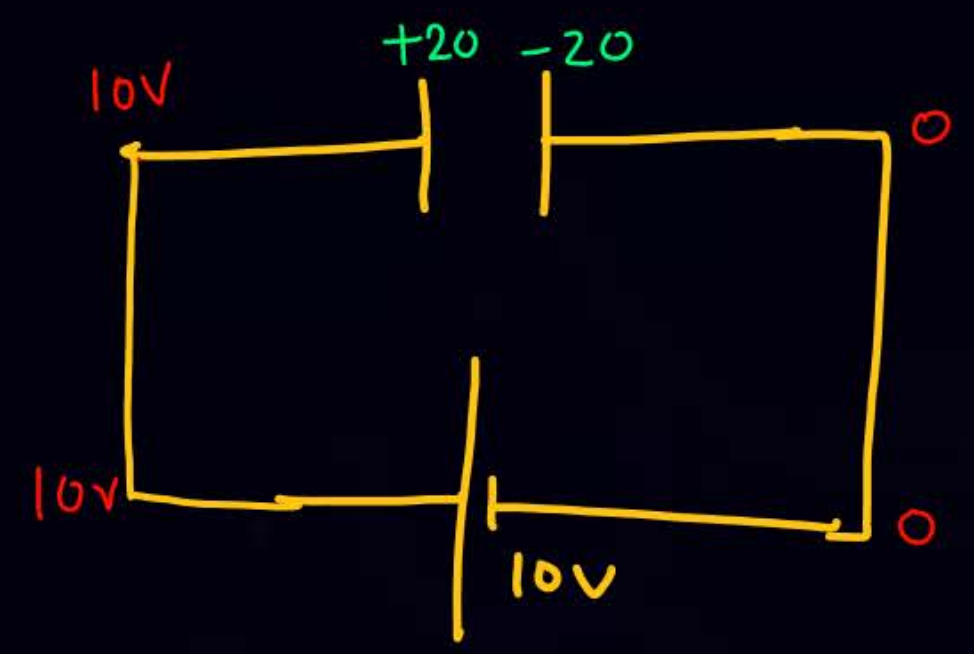
$q = CV$



Q



Switch
close



(WD) battery = $+20 \times 10 = \underline{\underline{+200}}$

or $U_f = \frac{1}{2} \frac{Q^2}{C} = \frac{1}{2} \times \frac{(20)^2}{2} = \underline{100}$

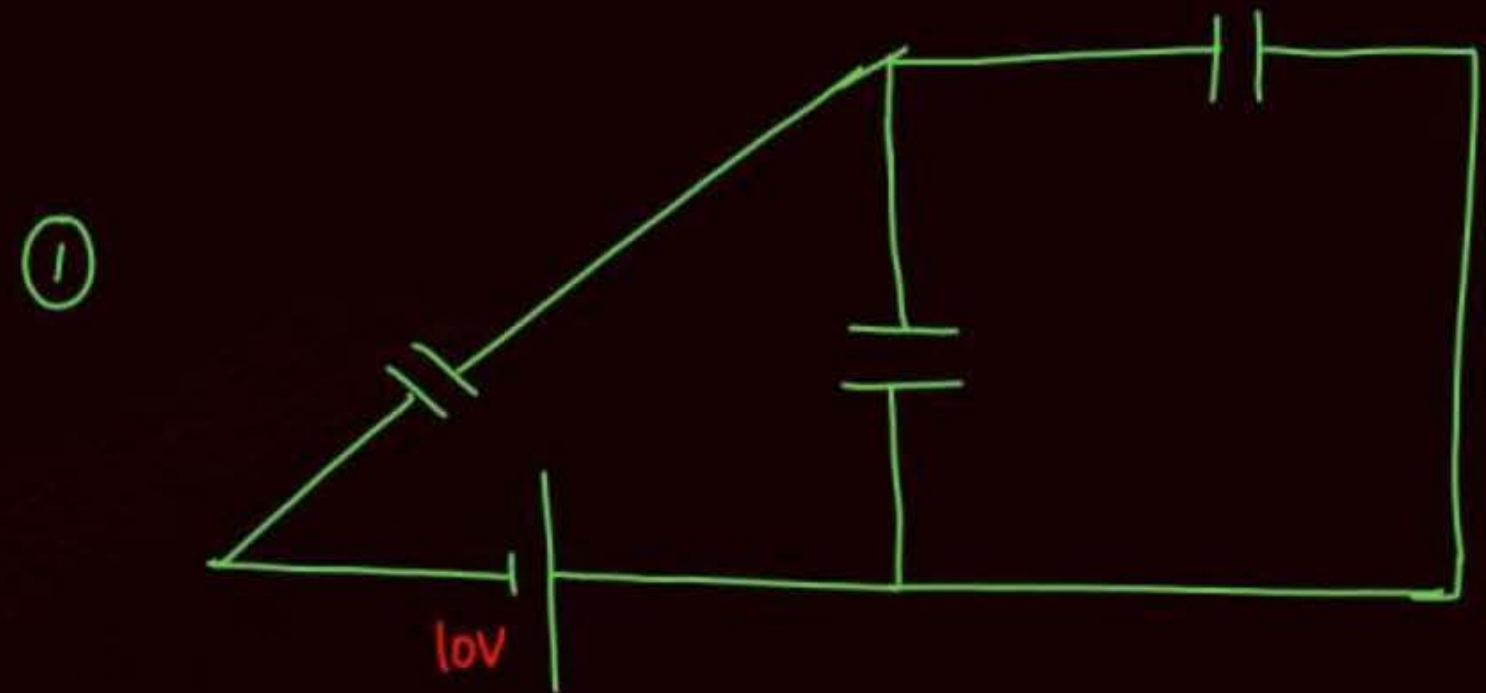
$U_f = \frac{1}{2} CV^2 = \frac{1}{2} \times 2 \times (10)^2 = 100$

heat = $200 - 100 = 100$



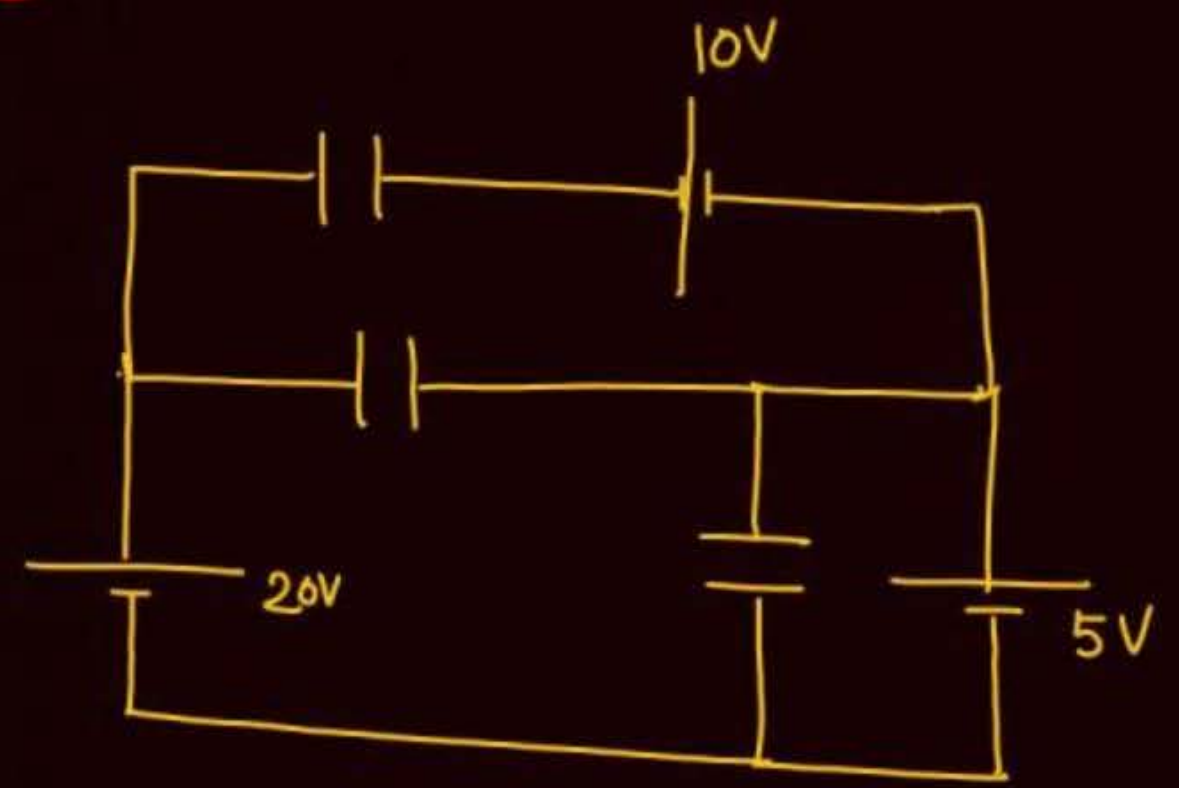
Homework of the class soñ pdf

ATDB.uno



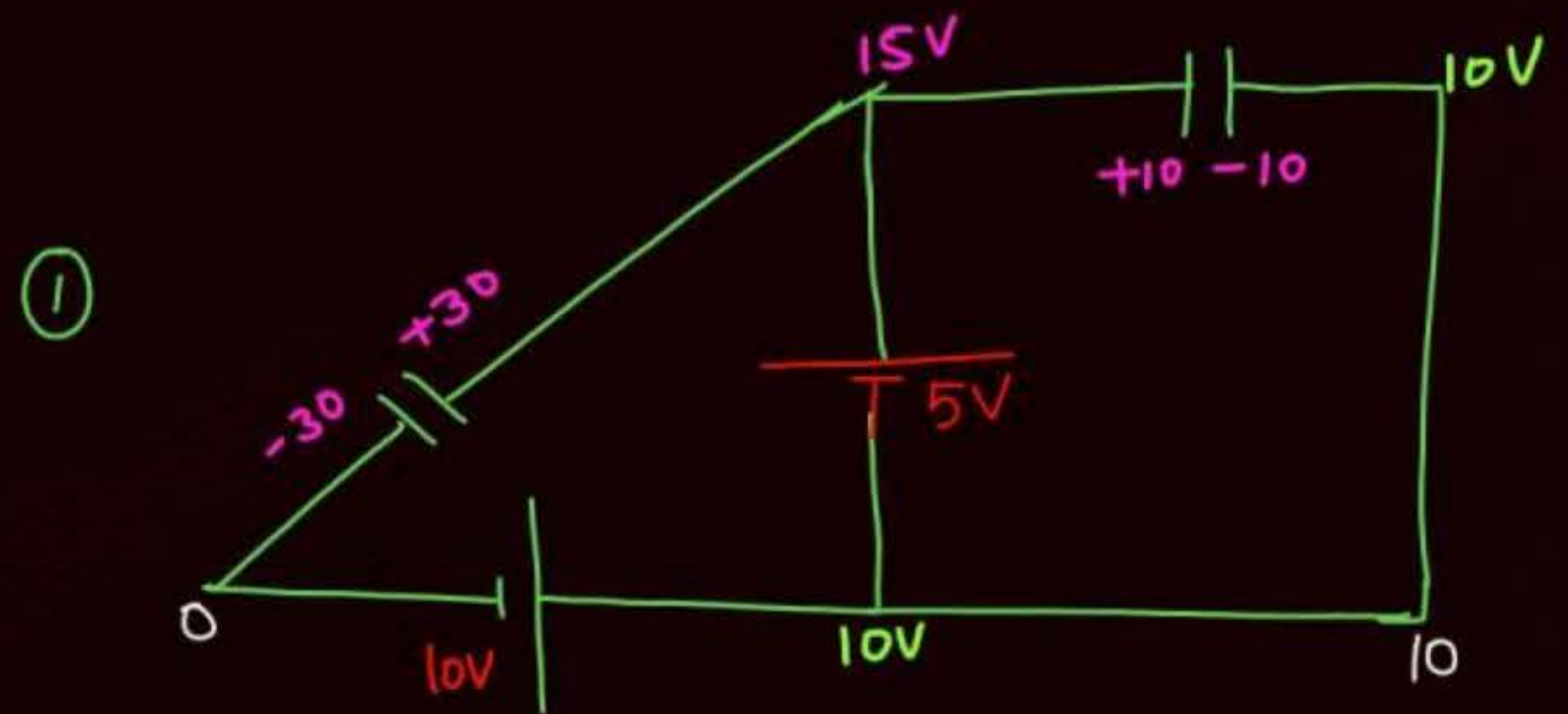
$C = 2\text{ F (each)}$

②



$C = 2\text{ F (each)}$

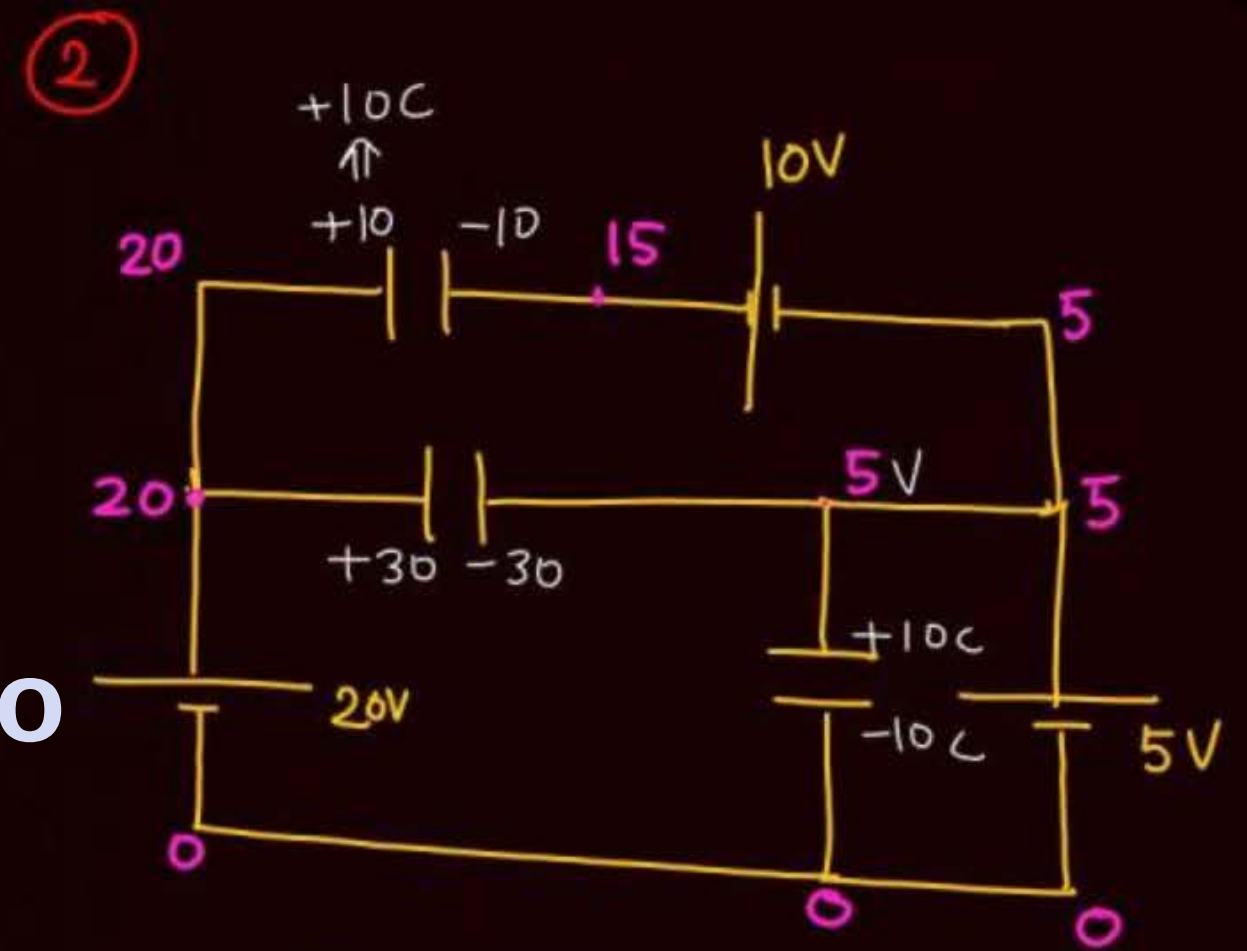
ATDB.uno



$C = 2\text{ F (each)}$

ATDB.uno

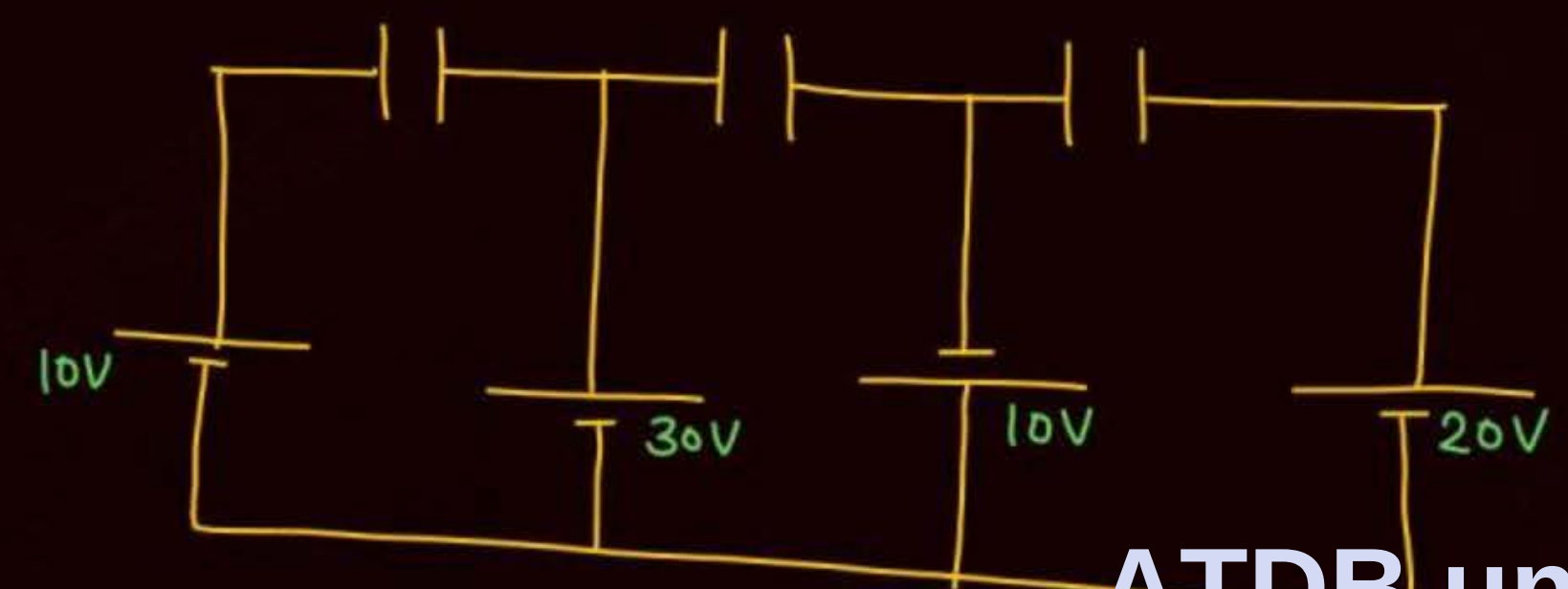
$\theta = CV$



$C = 2\text{ F (each)}$



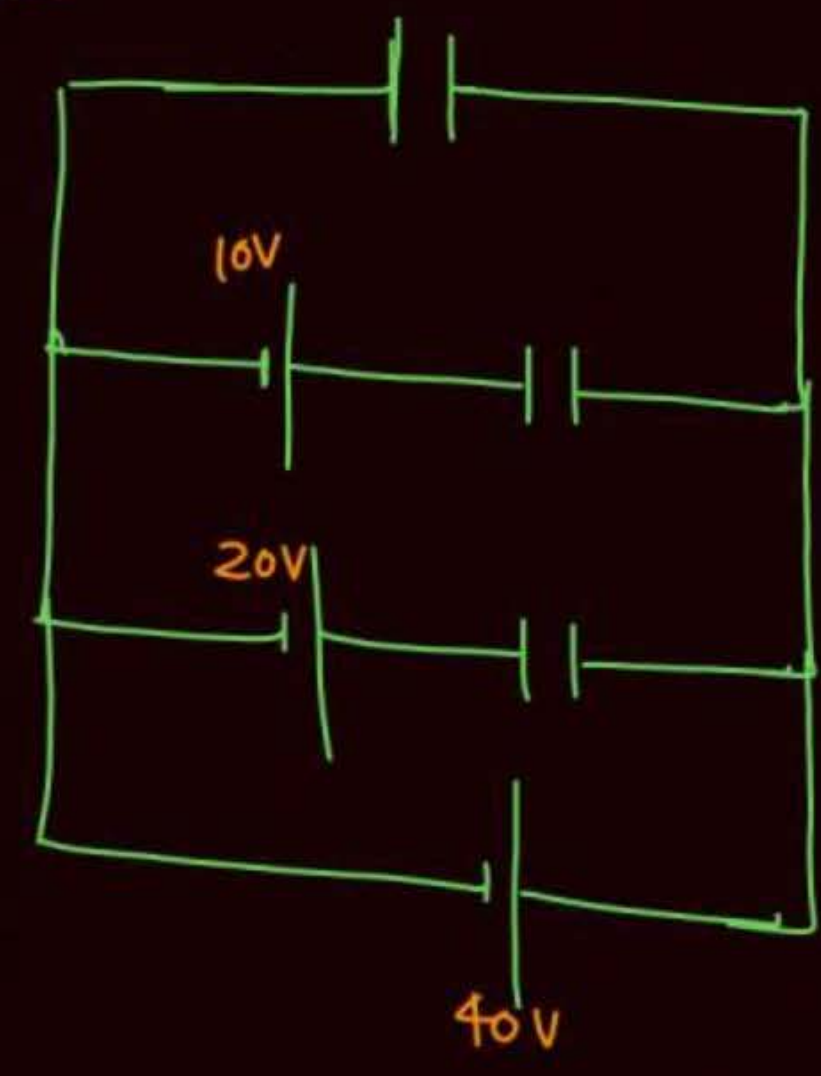
3



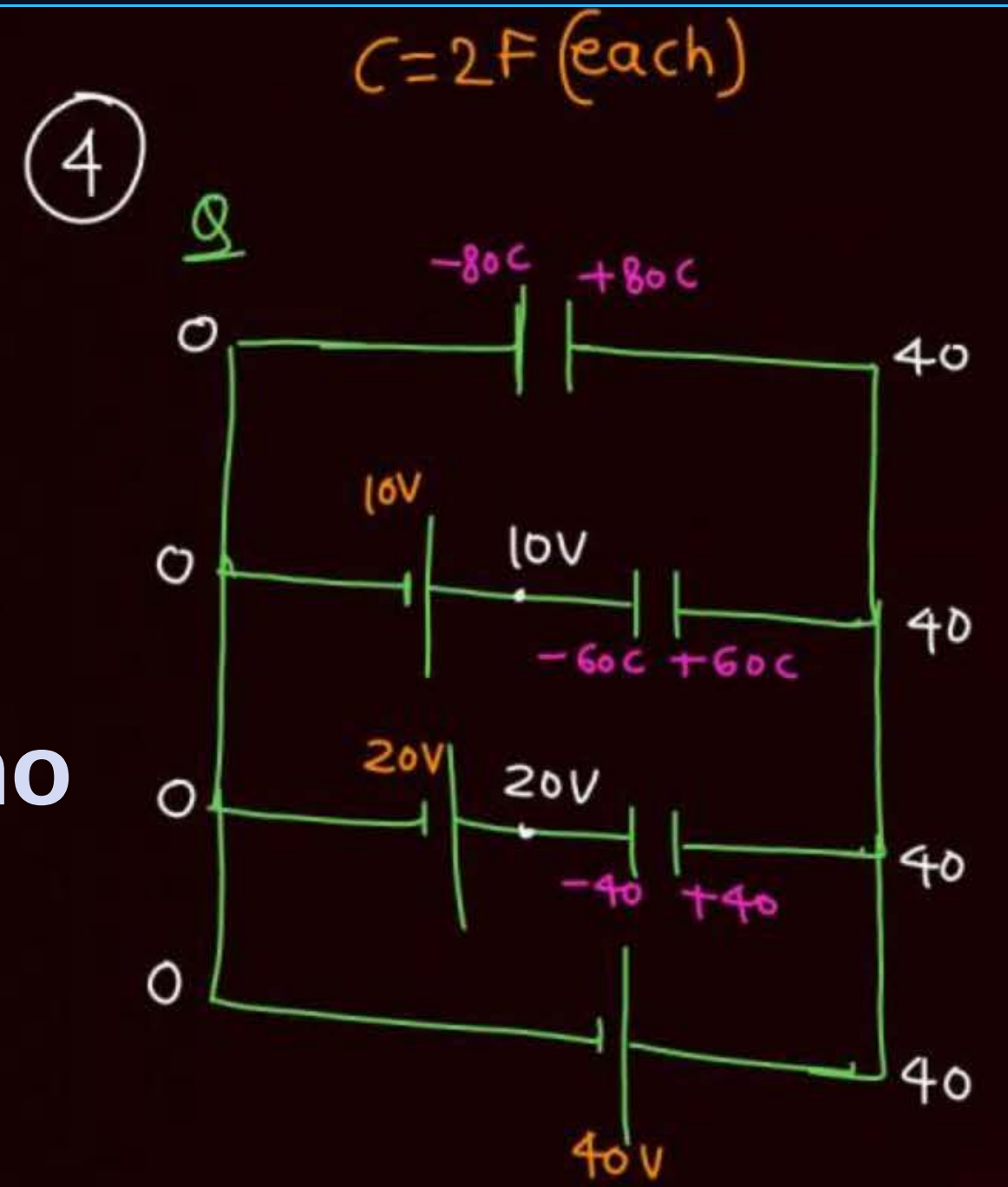
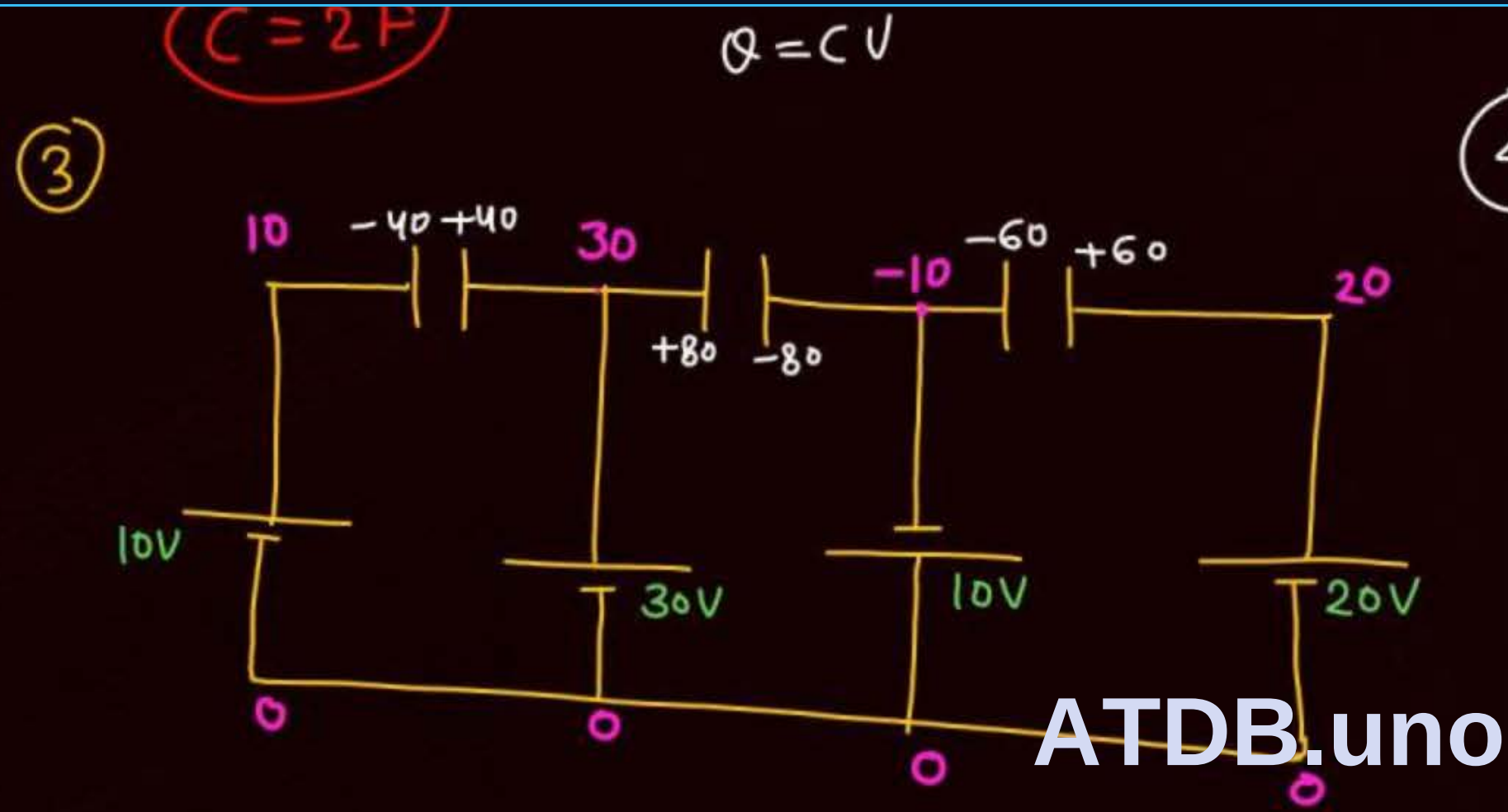
4

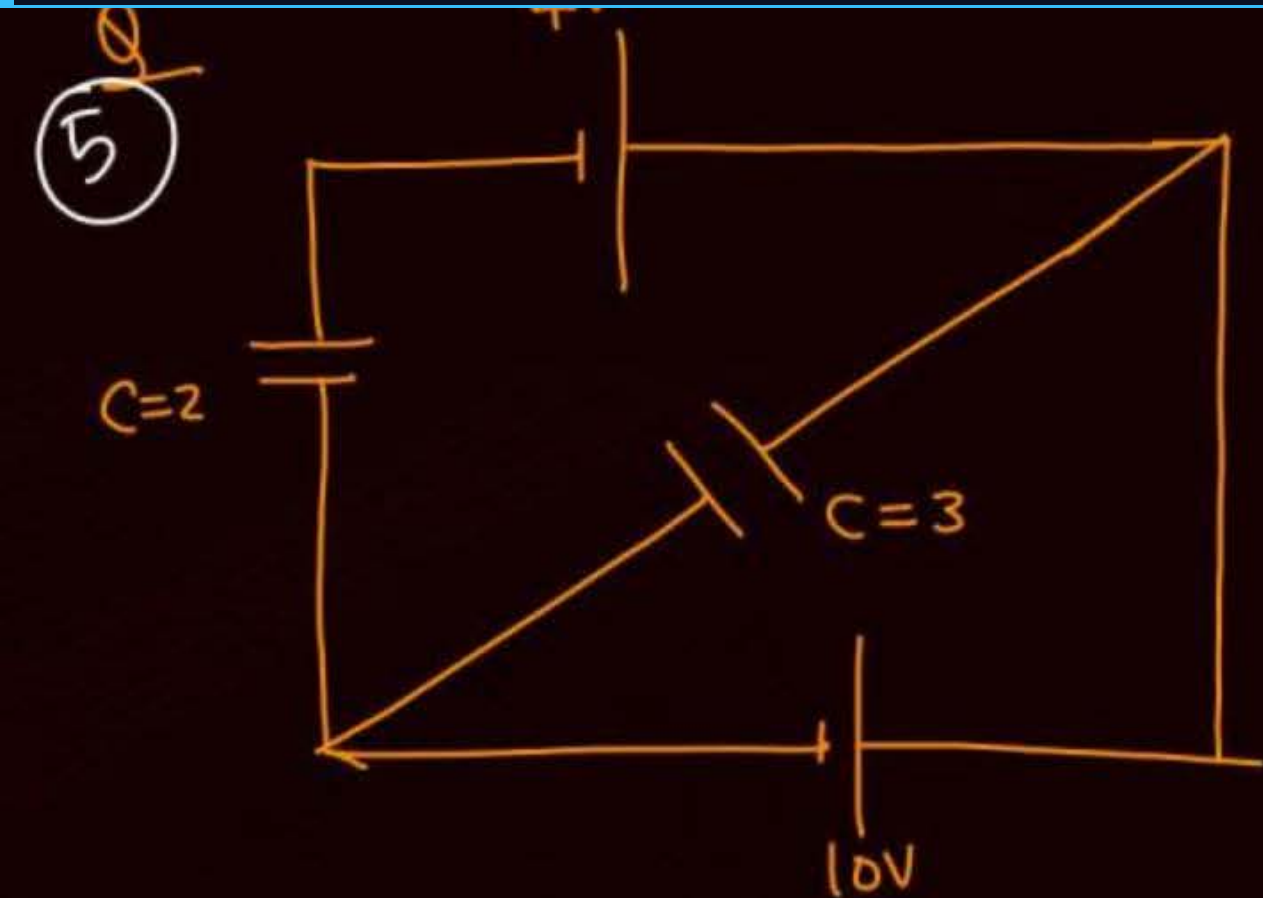
Q

$C = 2F$ (each)



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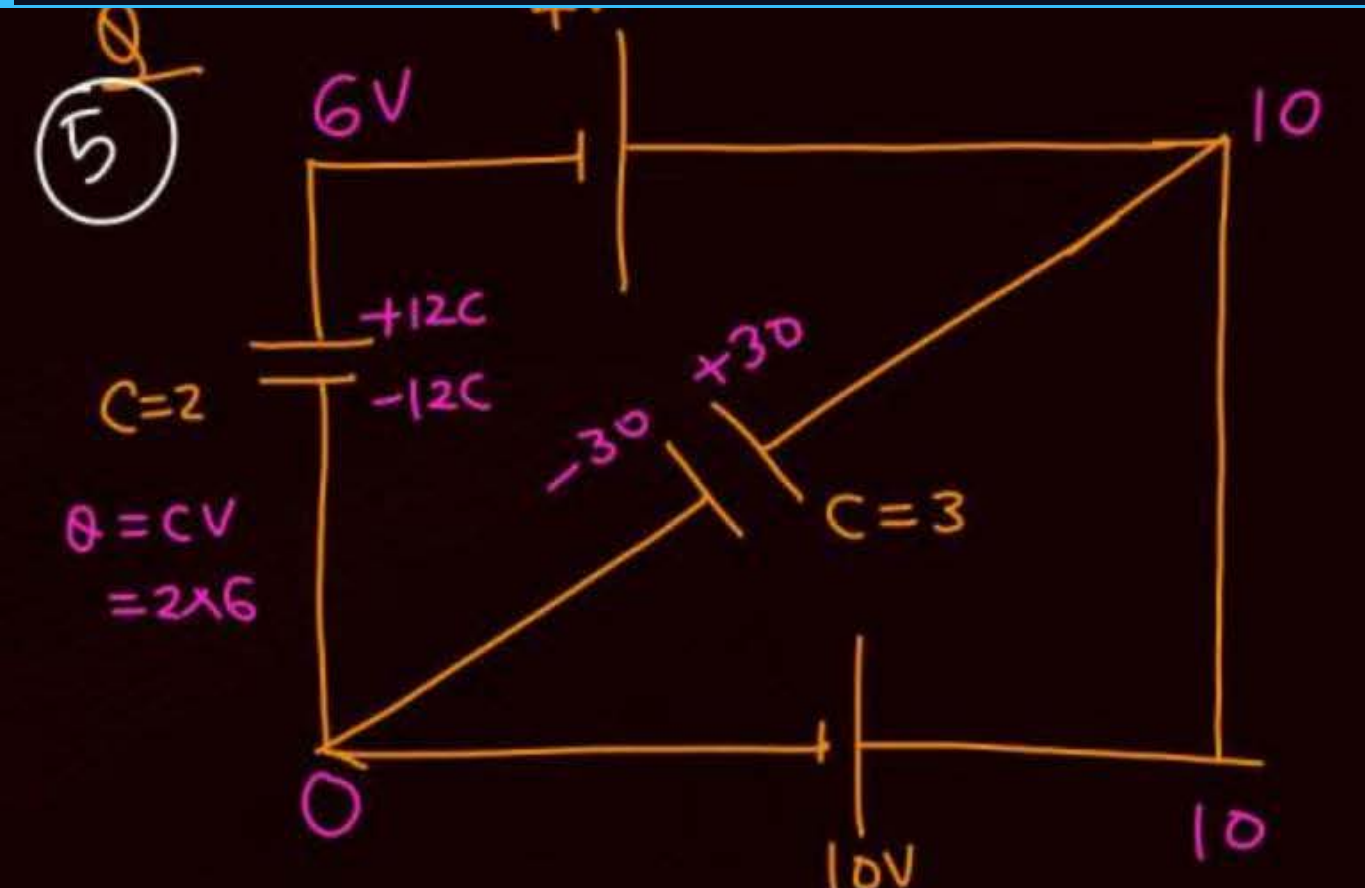




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Find charge
on capacitor
 C_1 & C_2
and current
through 2Ω
and 3Ω



$Q = CV$
 $= 2 \times 6$

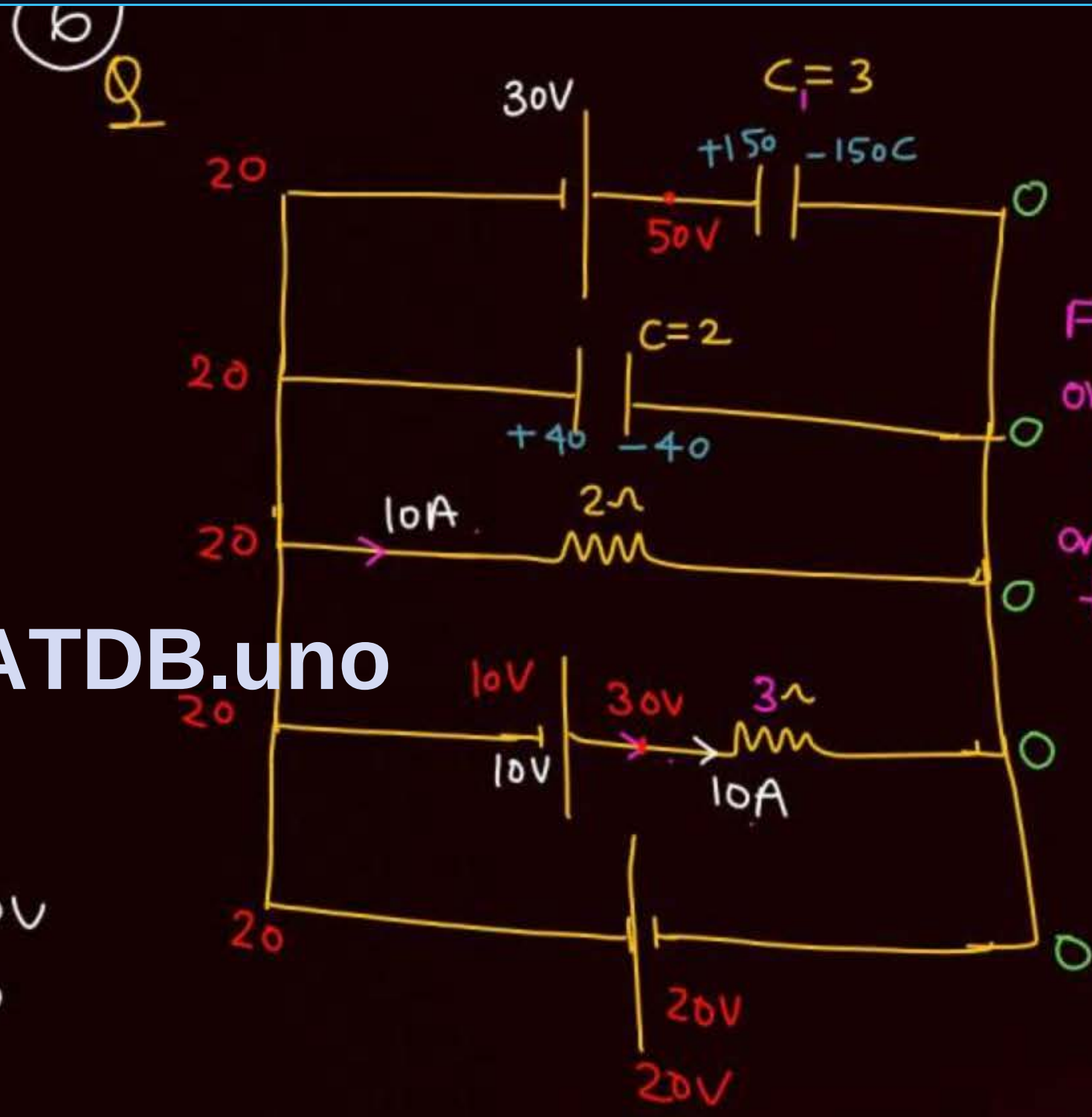
$20V$

2Ω

$0V$

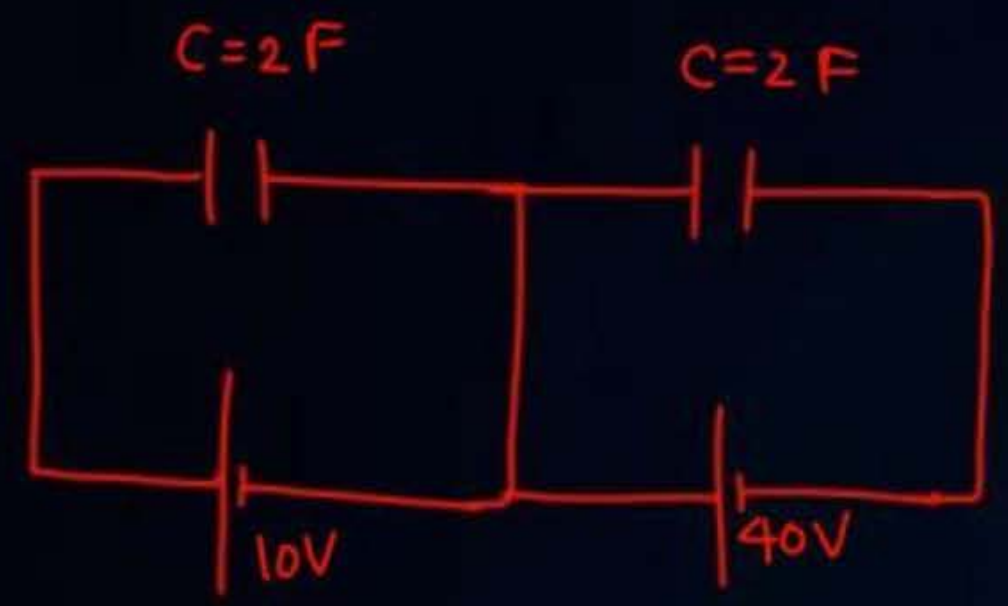
$I = \frac{20-0}{2} = 10$

ATDB.uno

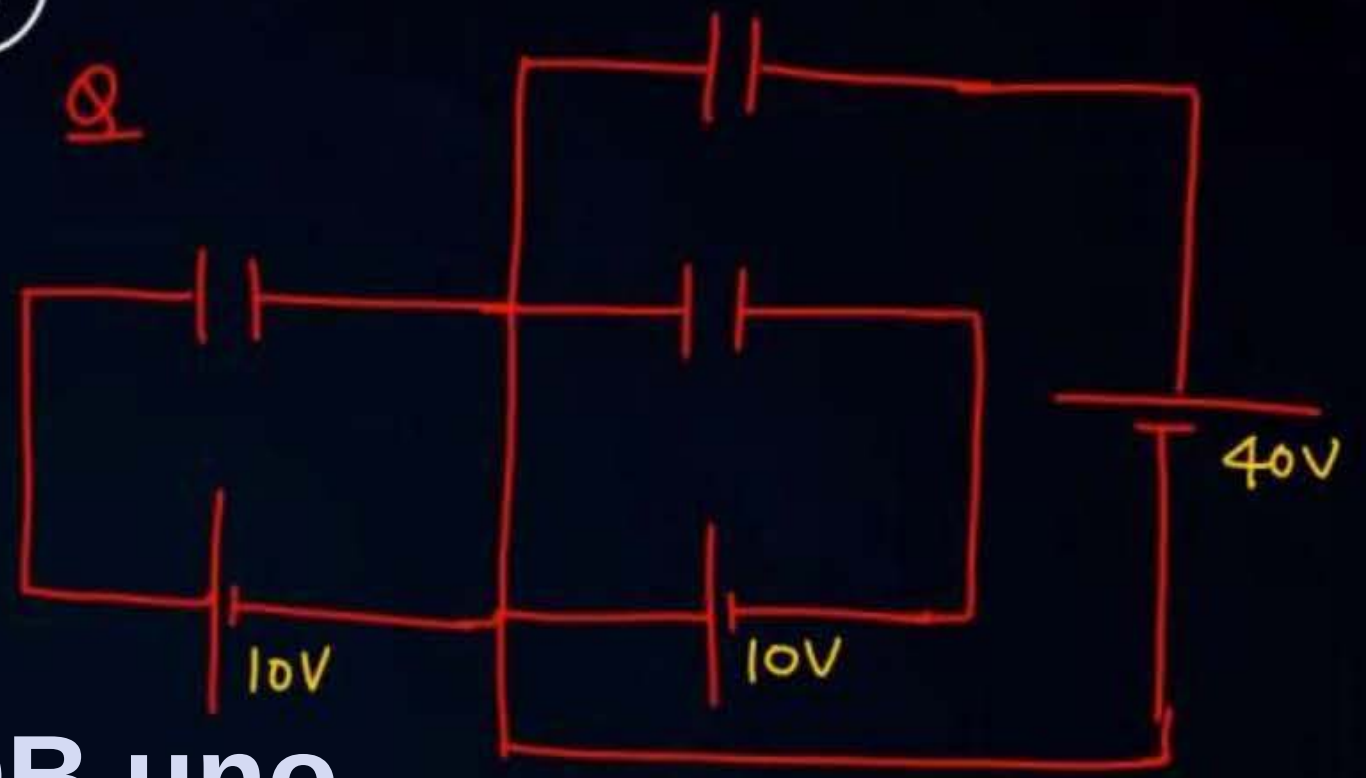


Find charge on capacitor C_1 & C_2 and current through 2Ω and 3Ω

7
Q

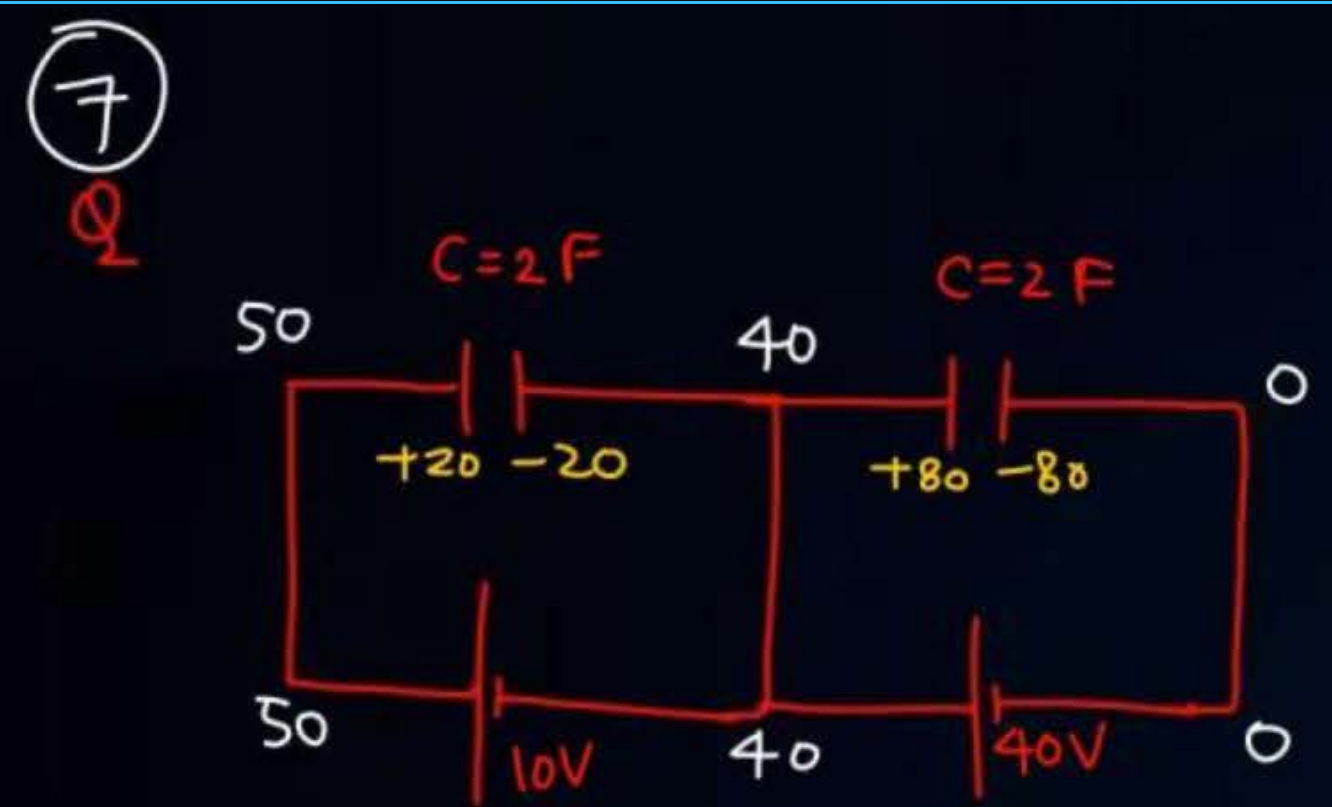


8
Q



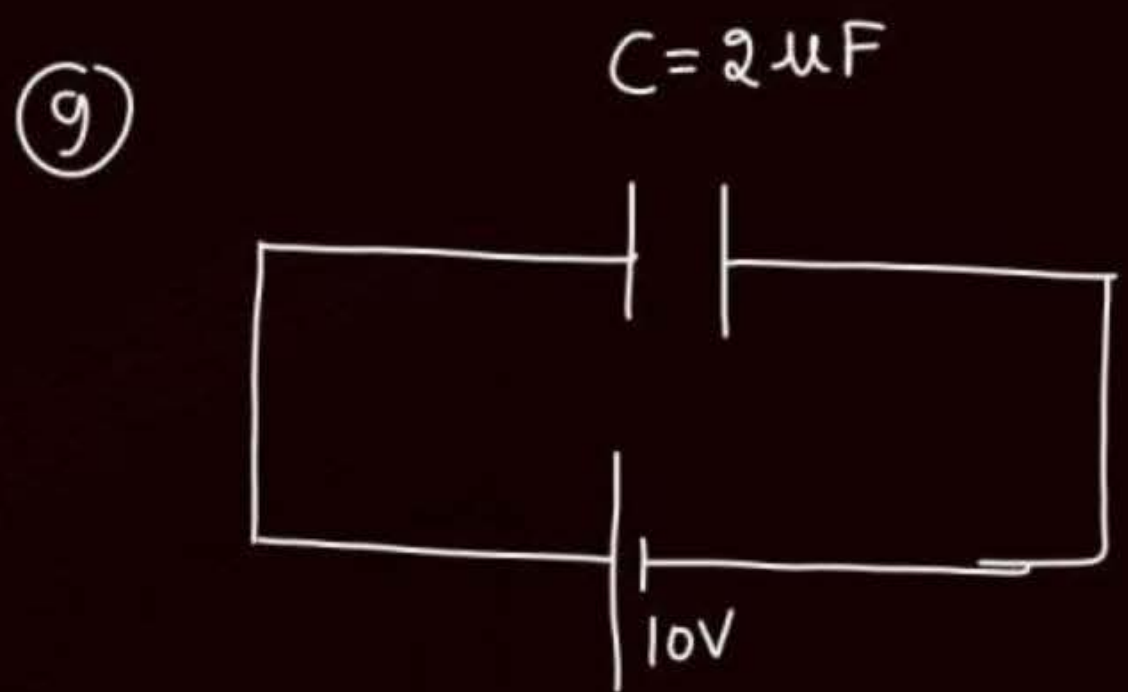
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C = 2 F (each)

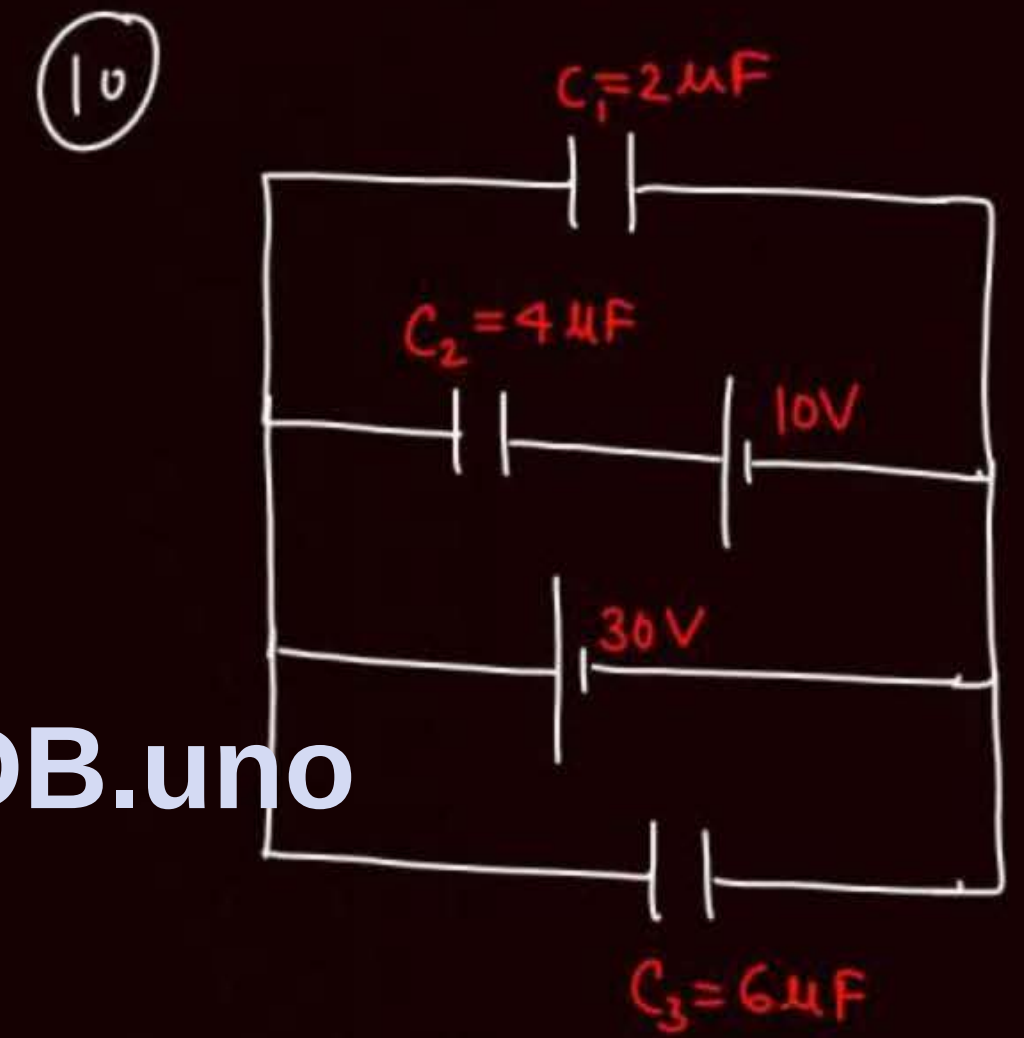


ATDB.uno

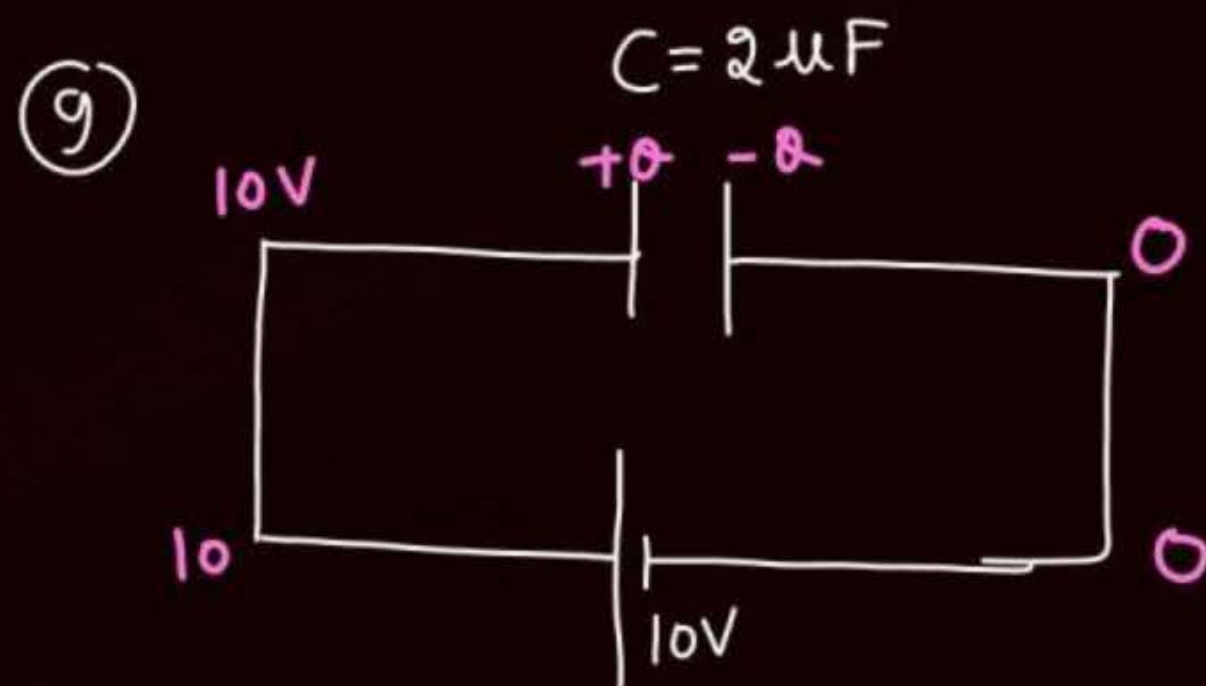
$C = 2\text{ F (each)}$



$C = 2\mu F = 2 \times 10^{-6} F$

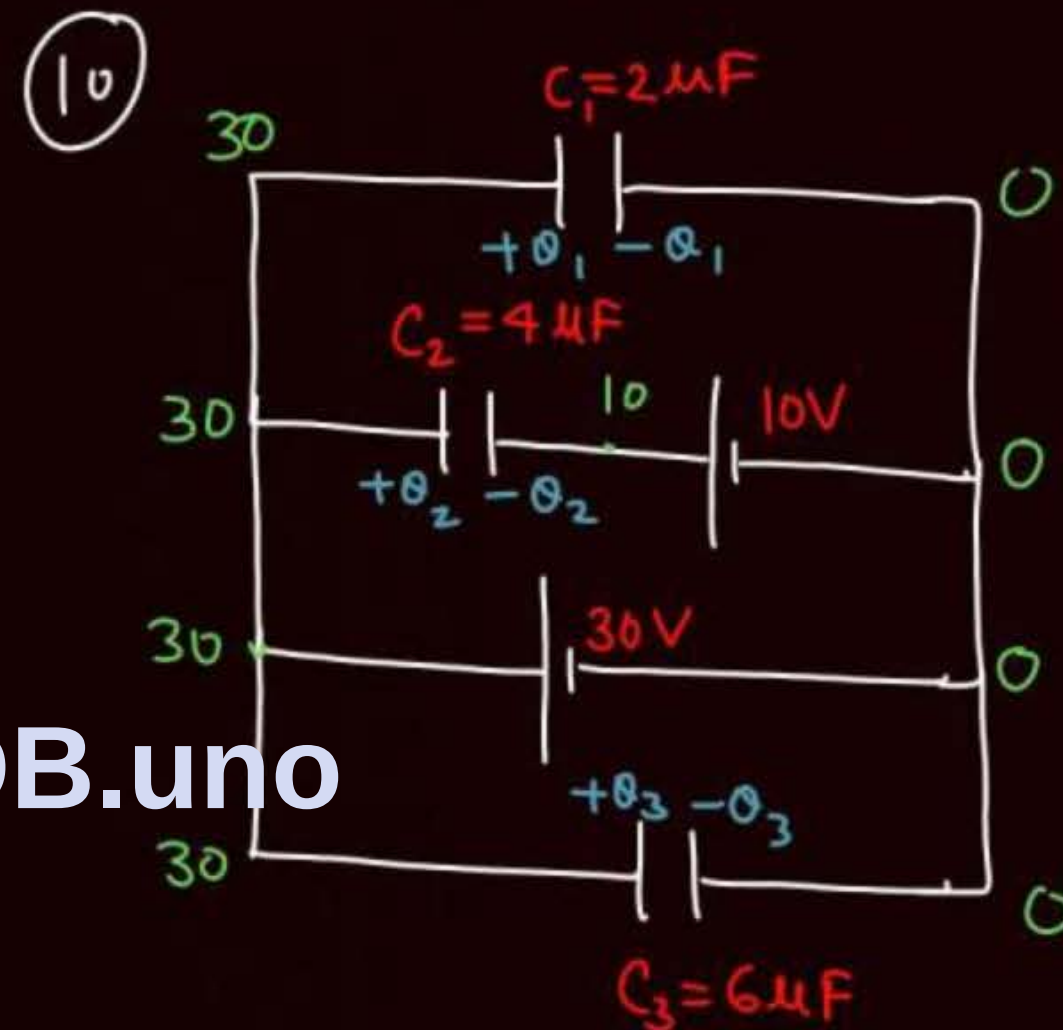


ATDB.uno



$$C = 2 \mu F = 2 \times 10^{-6} F$$

$$\begin{aligned} Q &= CV = 2 \times 10^{-6} \times 10 \\ &= 20 \times 10^{-6} \text{ Coulomb} \\ &= 20 \mu C \end{aligned}$$



$$Q_1 = 2 \times 30 = 60 \mu C$$

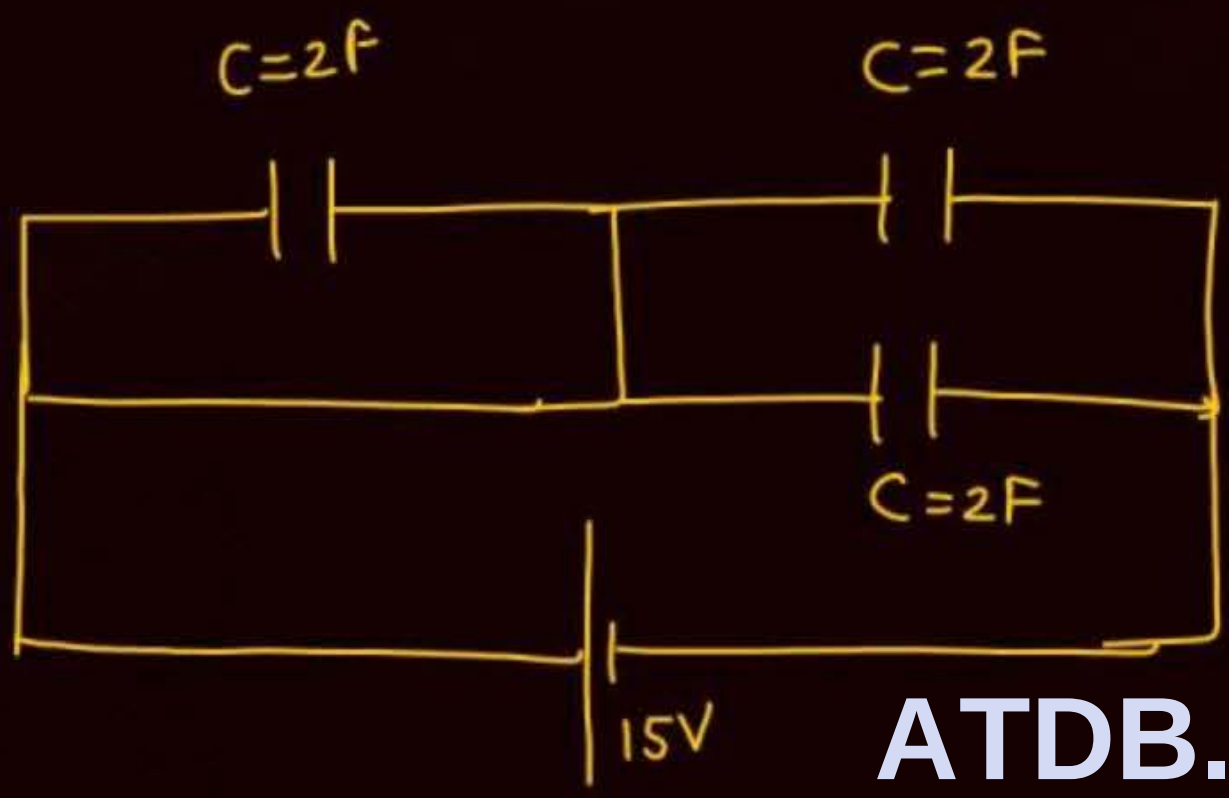
$$Q_2 = 4 \times 20 = 80 \mu C$$

$$Q_3 = 6 \times 30 = 180 \mu C$$

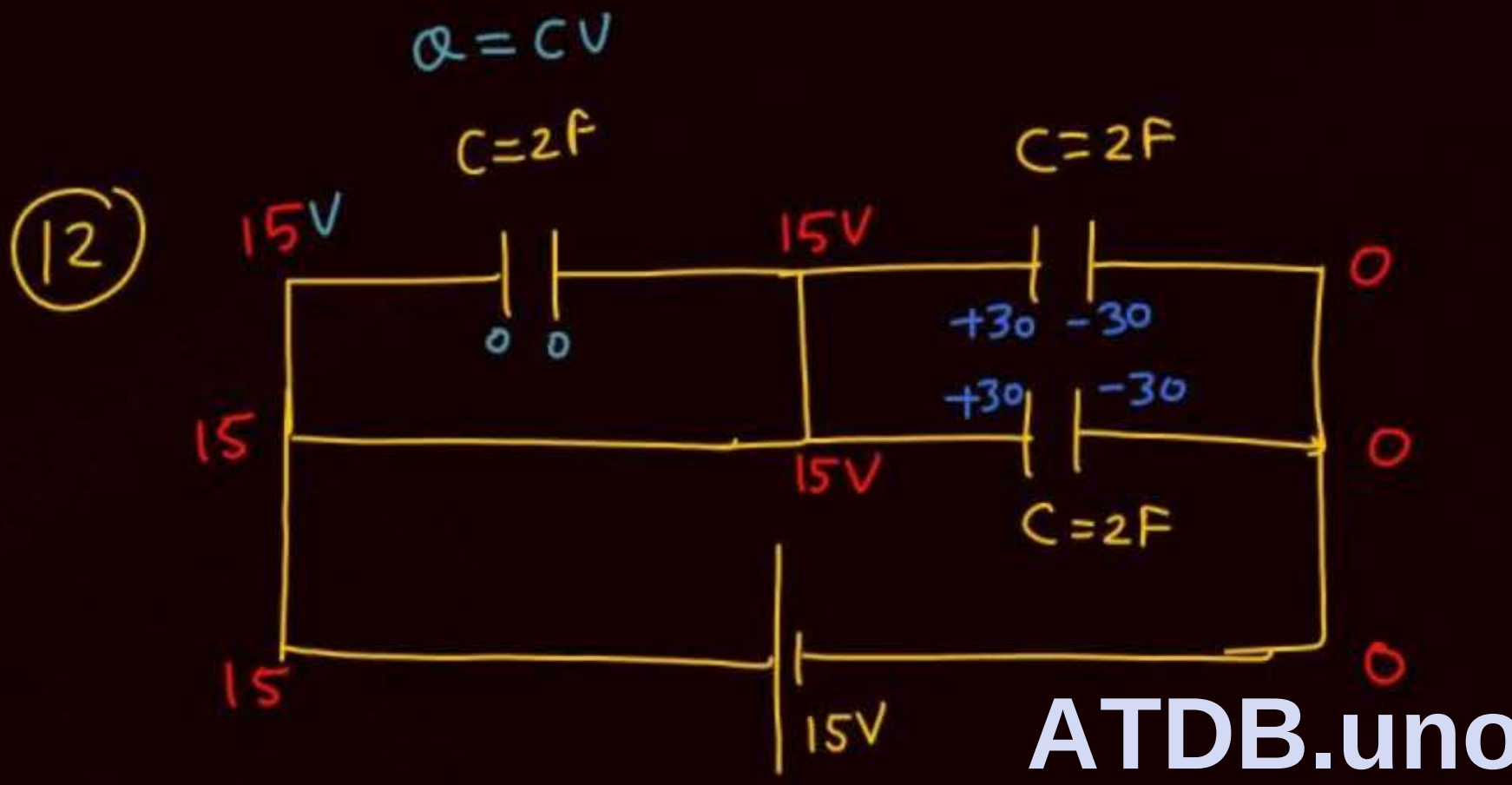
ATDB.uno



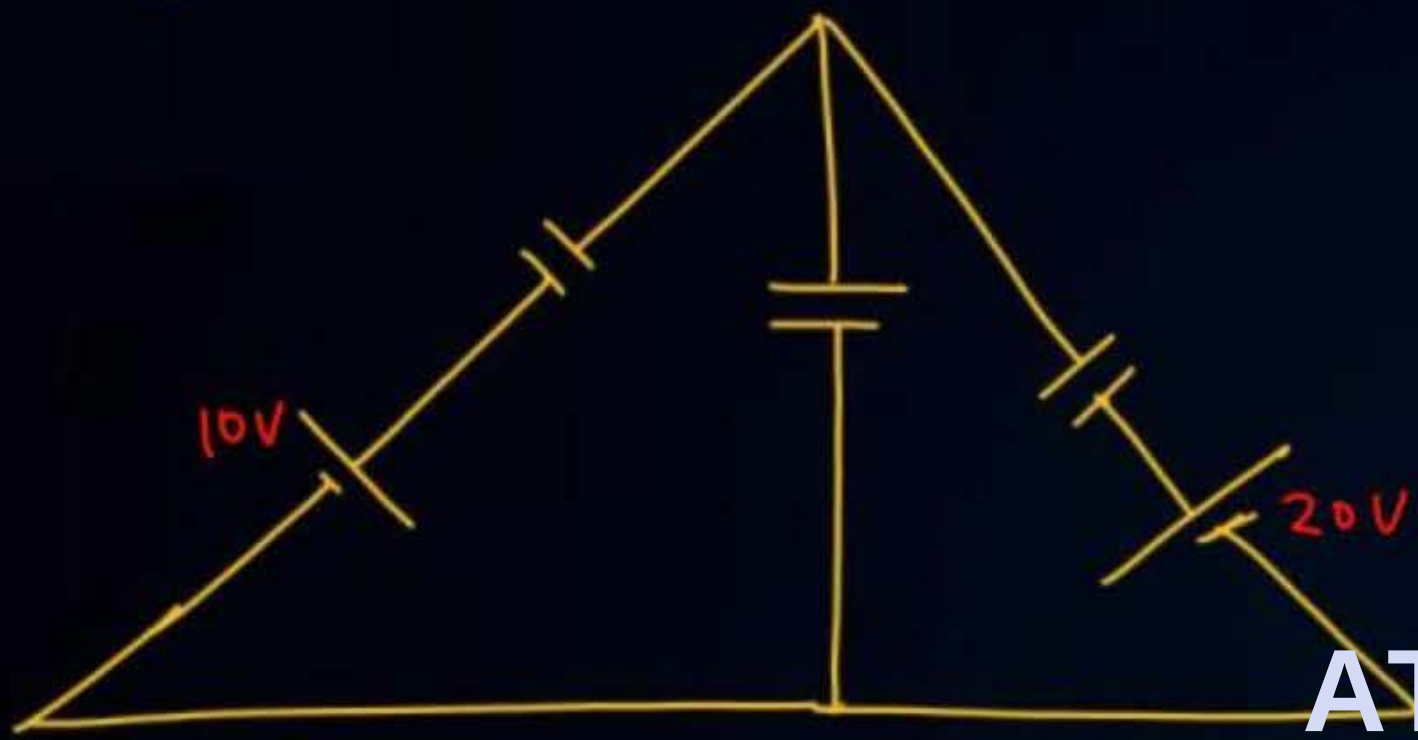
12



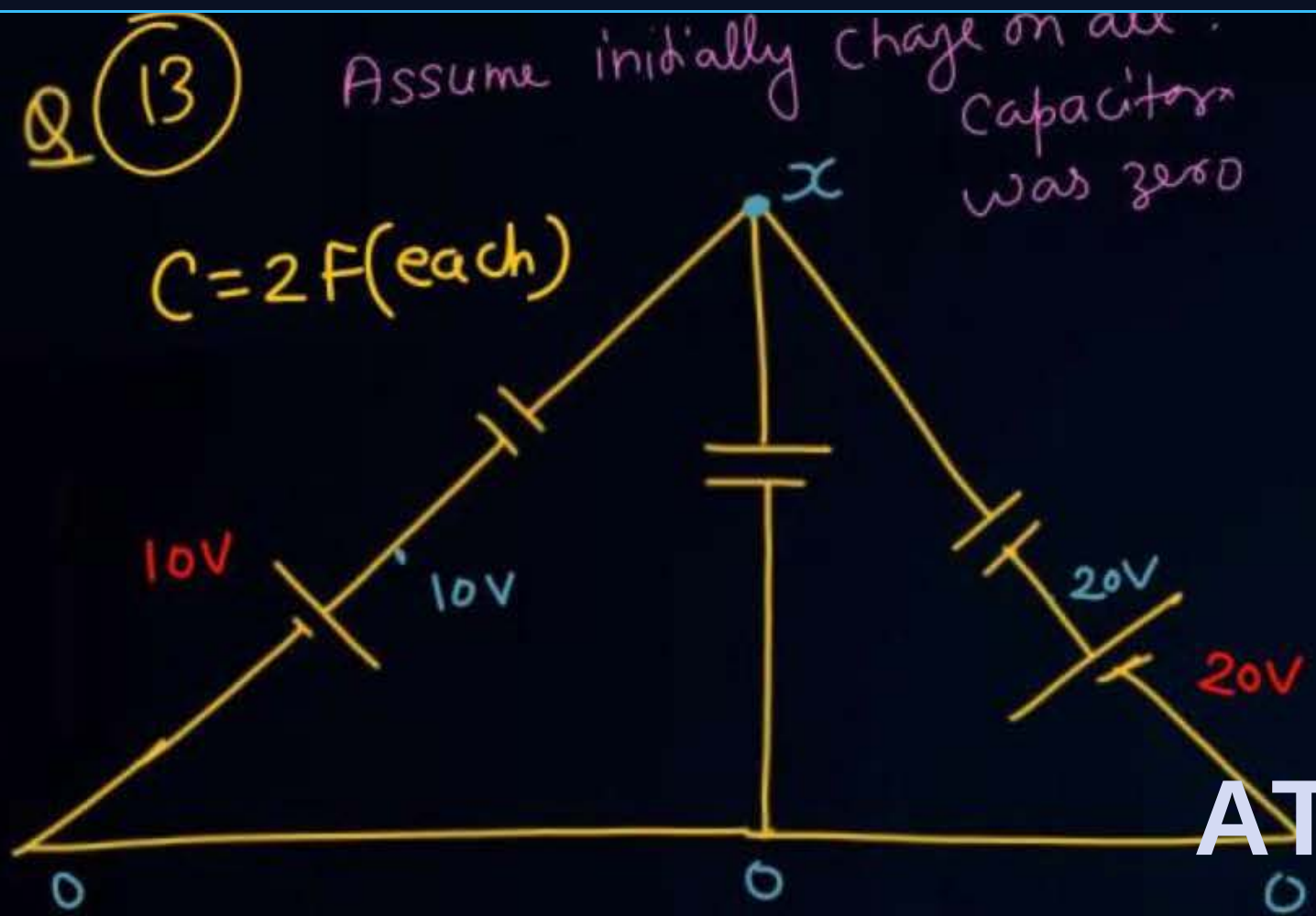
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Q (13)

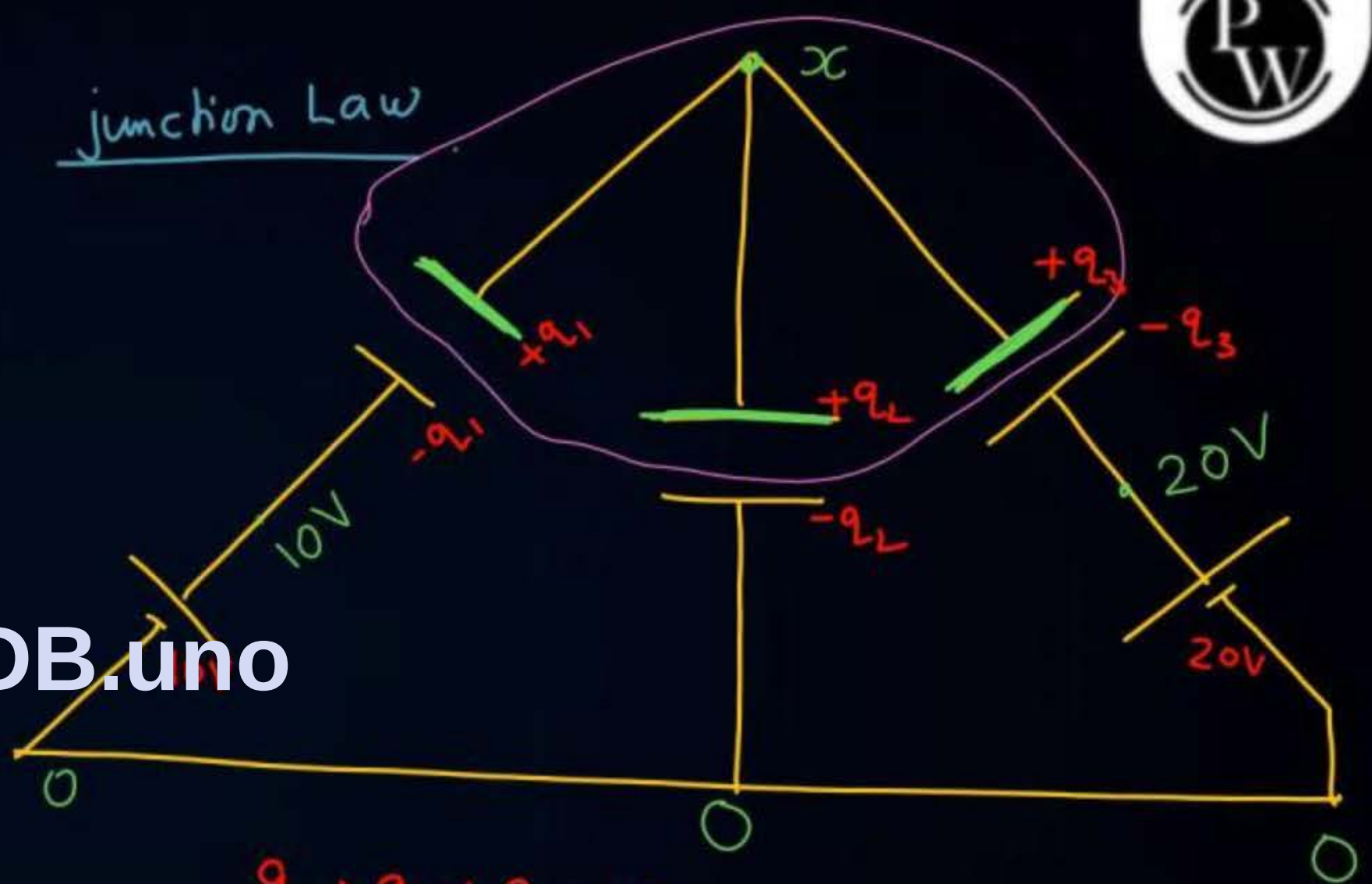


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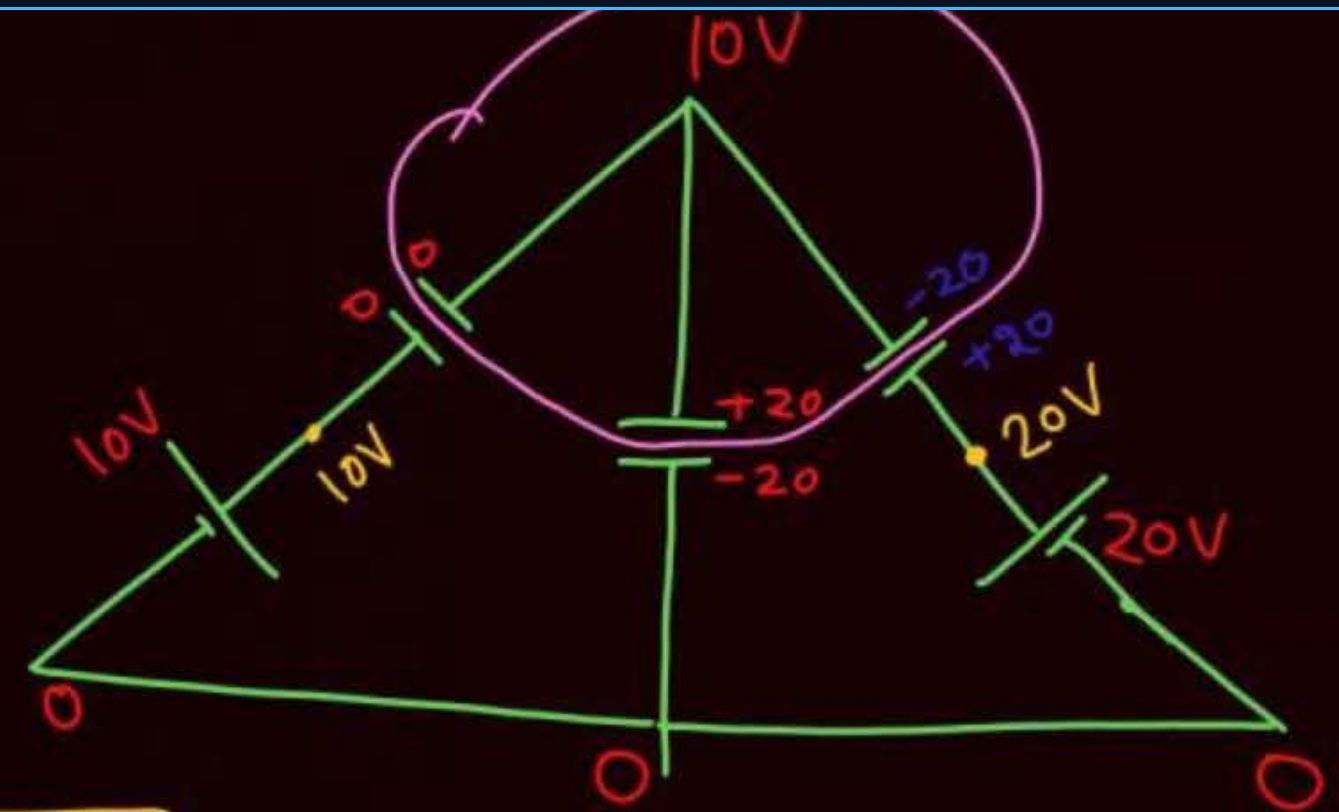
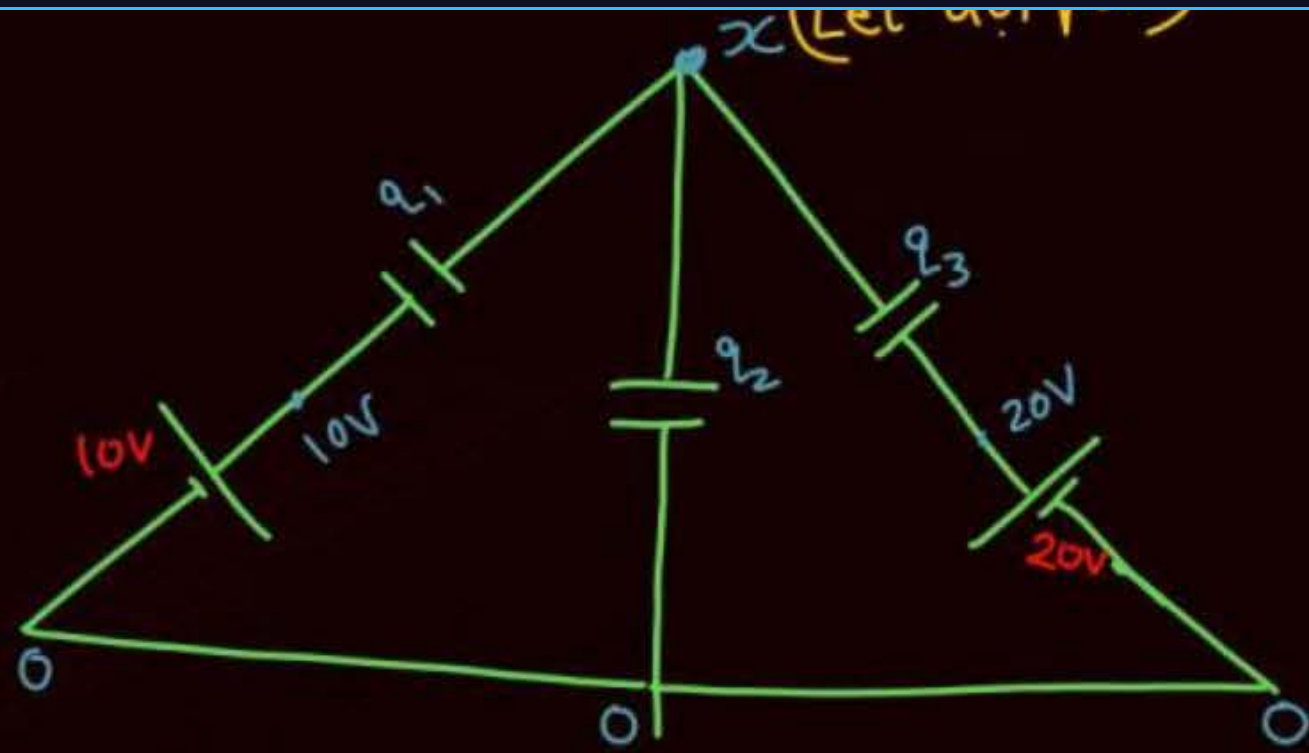
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junction Law



$$q_1 = 2 \times 0 = 0$$
$$q_2 = 2 \times 10 = 20$$
$$q_3 =$$

$$q_1 + q_2 + q_3 = 0$$
$$2 \times (x - 10) + 2 \times (x - 0) + 2 \times (x - 20) = 0$$
$$6x - 20 - 40 = 0$$
$$x = 10$$



$$C = 2 \text{ F (each)}$$

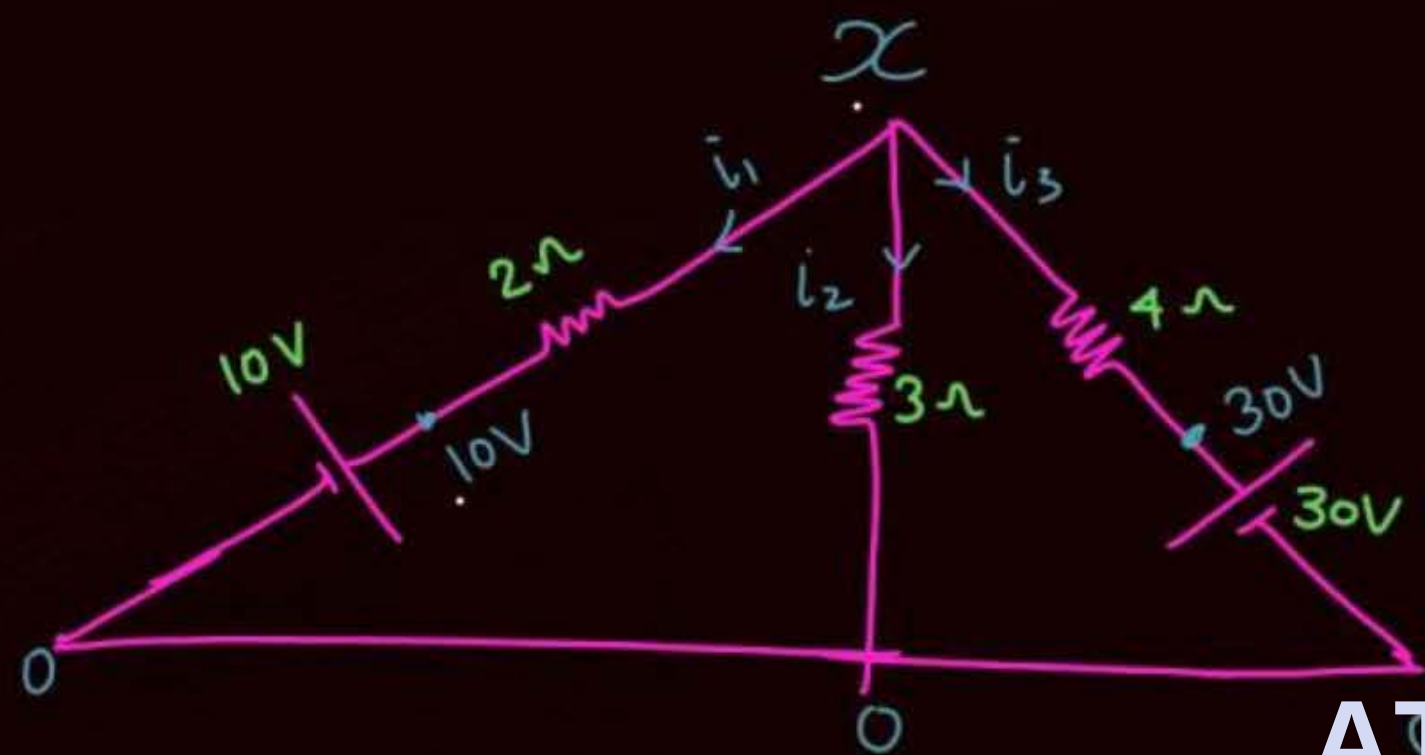
$$q = CV = QC$$

$$q_1 + q_2 + q_3 = 0$$

$$(x-10) \times 2 + (x-0) \times 2 + (x-20) \times 2 = 0$$

$$6x = 60$$

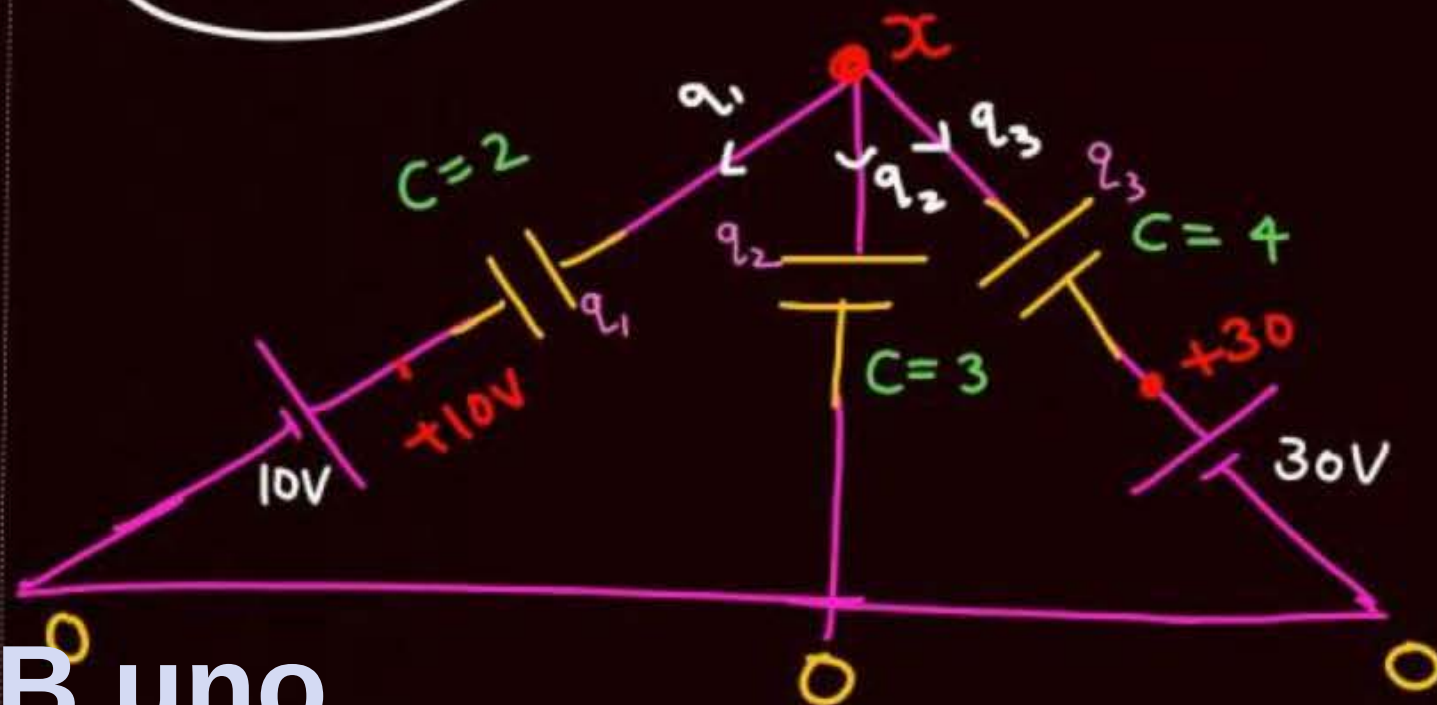
$$x = 10 \text{ (matlab)}$$



$$i_1 + i_2 + i_3 = 0$$

$$\frac{x-10}{2} + \frac{x-0}{3} + \frac{x-30}{4} = 0$$

$$q = VC$$



$$q_1 + q_2 + q_3 = 0$$

$$(x-10) \times 2 + (x-0) \times 3 + (x-30) \times 4 = 0$$

Initial charge on each capacitor was zero

q_1 q_2 q_3 q_4

$C=2F$ $C=5F$ $C=3F$ $C=4F$

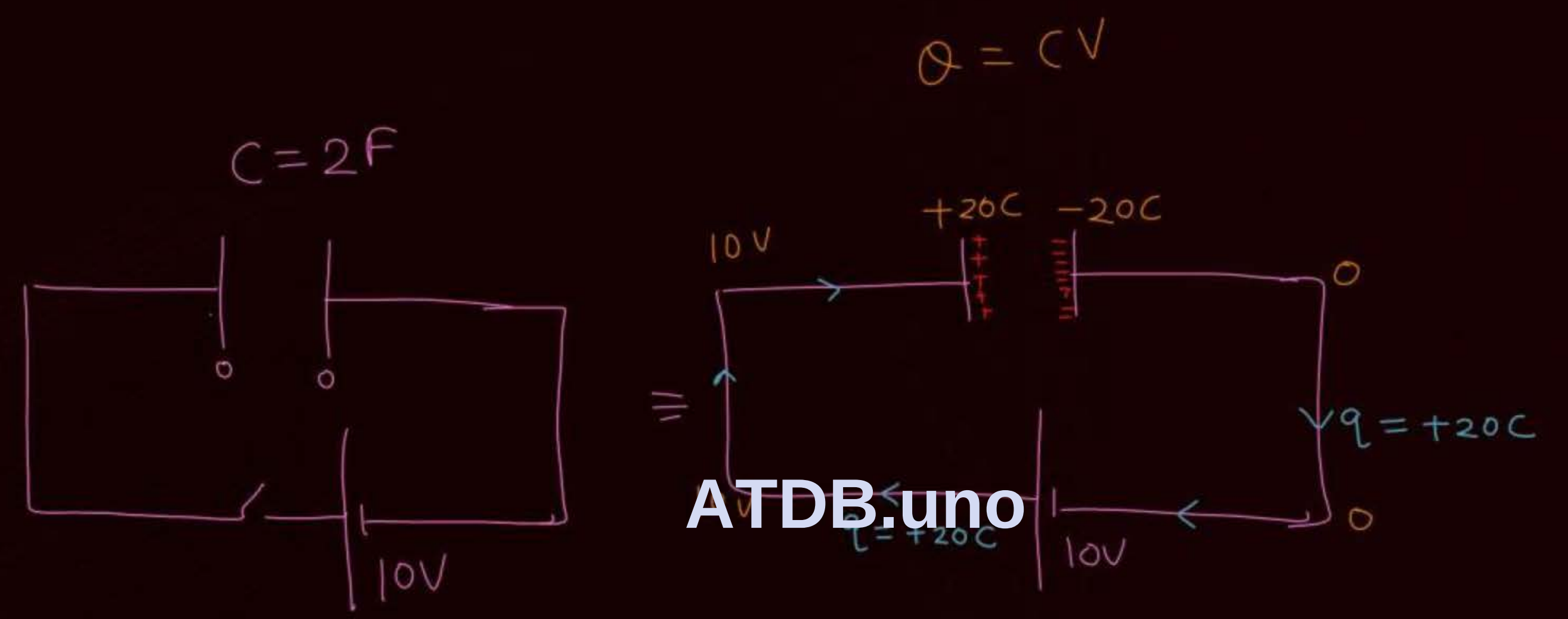
10V 10V 20V 30V 30V

q_1 q_2 q_3 q_4

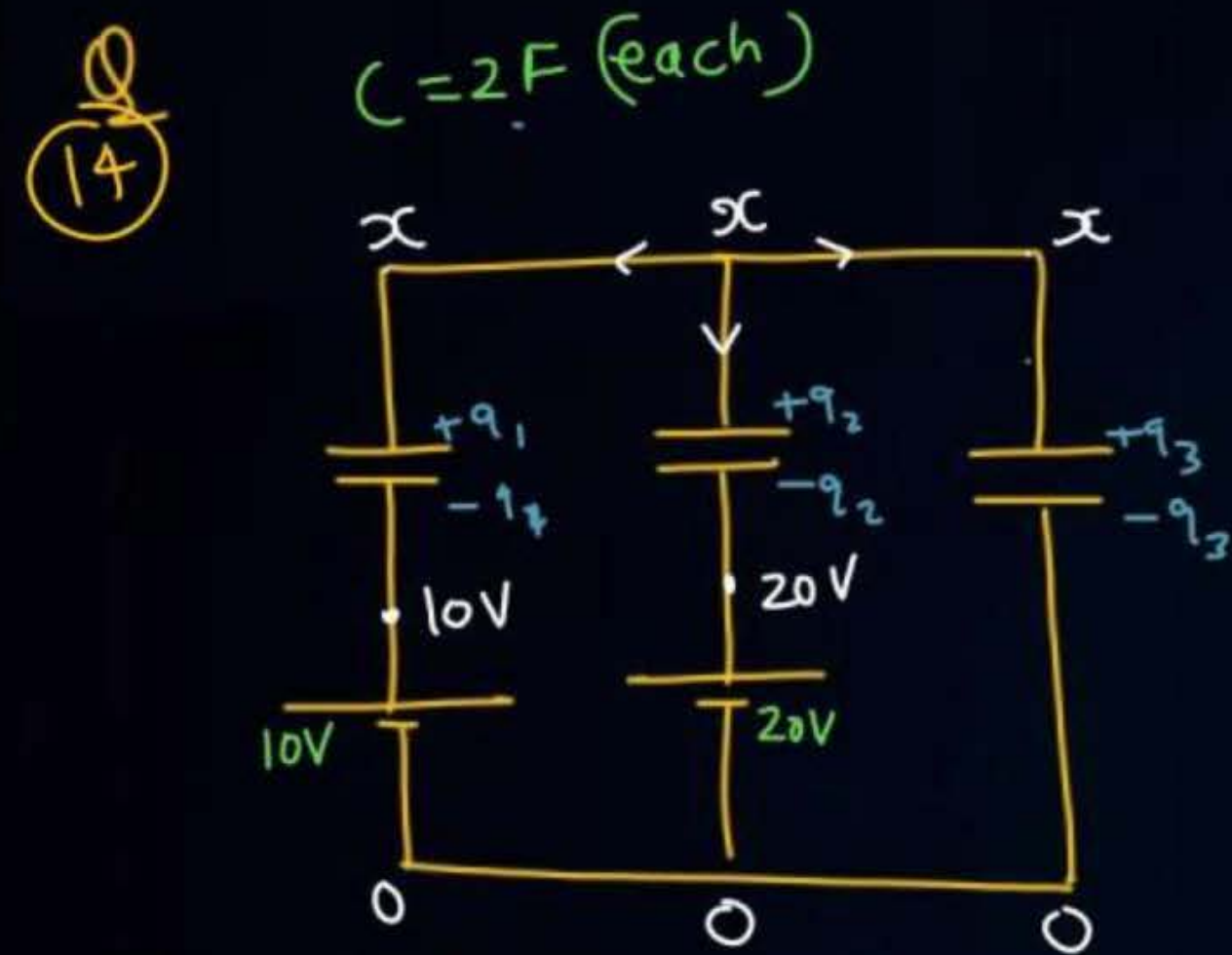
x

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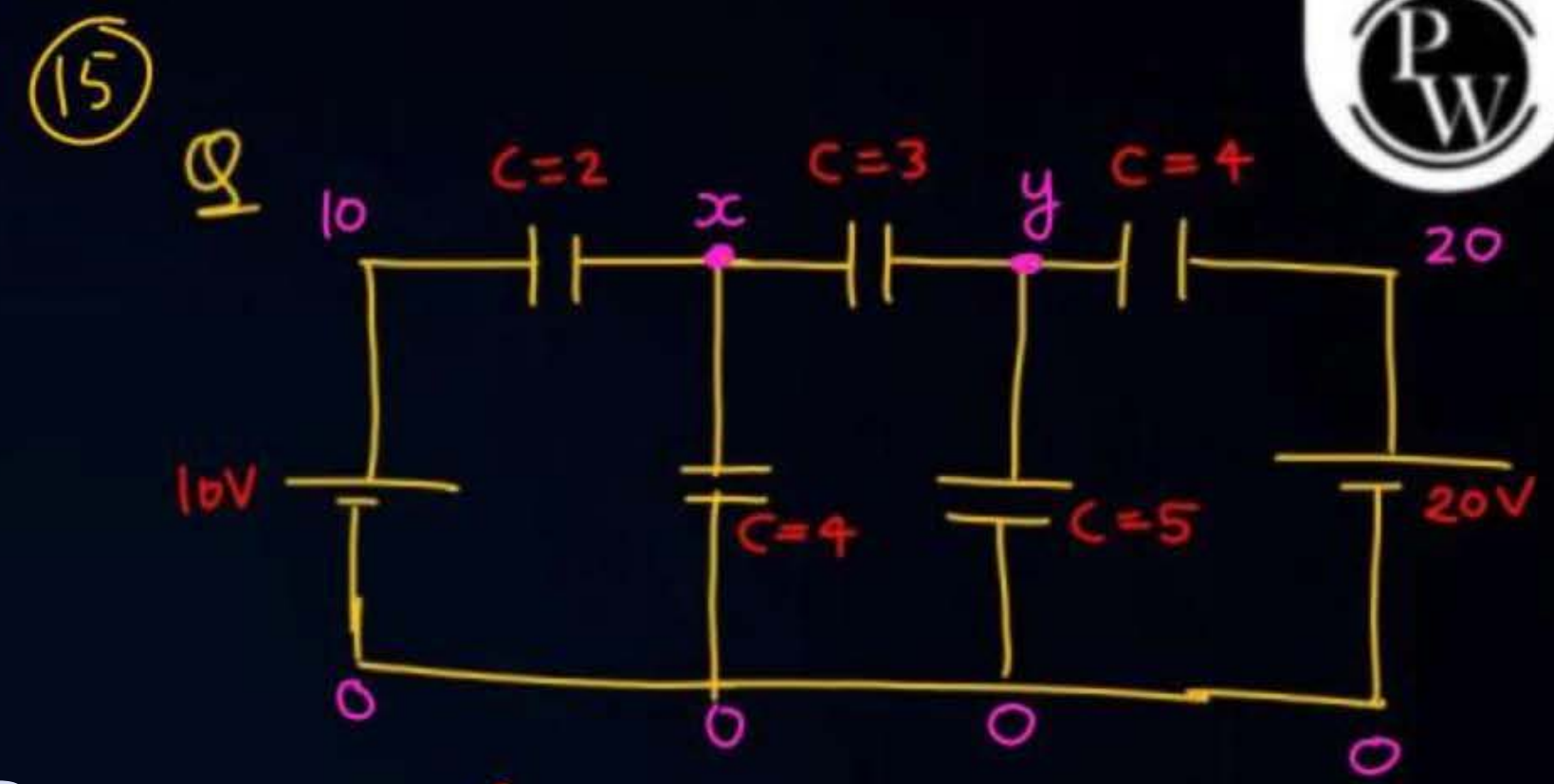
$$q_1 + q_2 + q_3 + q_4 = 0$$
$$(x-0) \times 2 + (x-10) \times 4 + (x-30) \times 3 + (x-30) \times 5 = 0$$



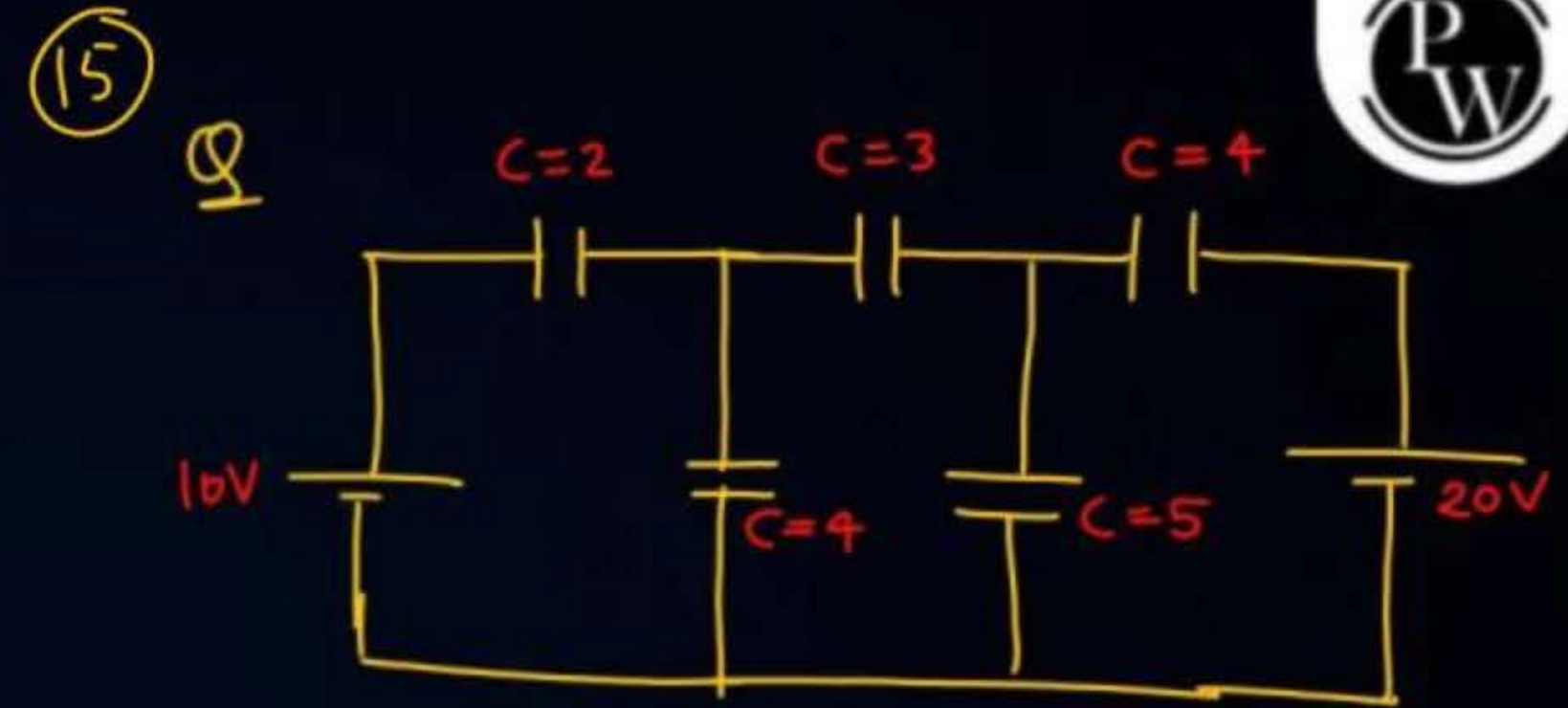
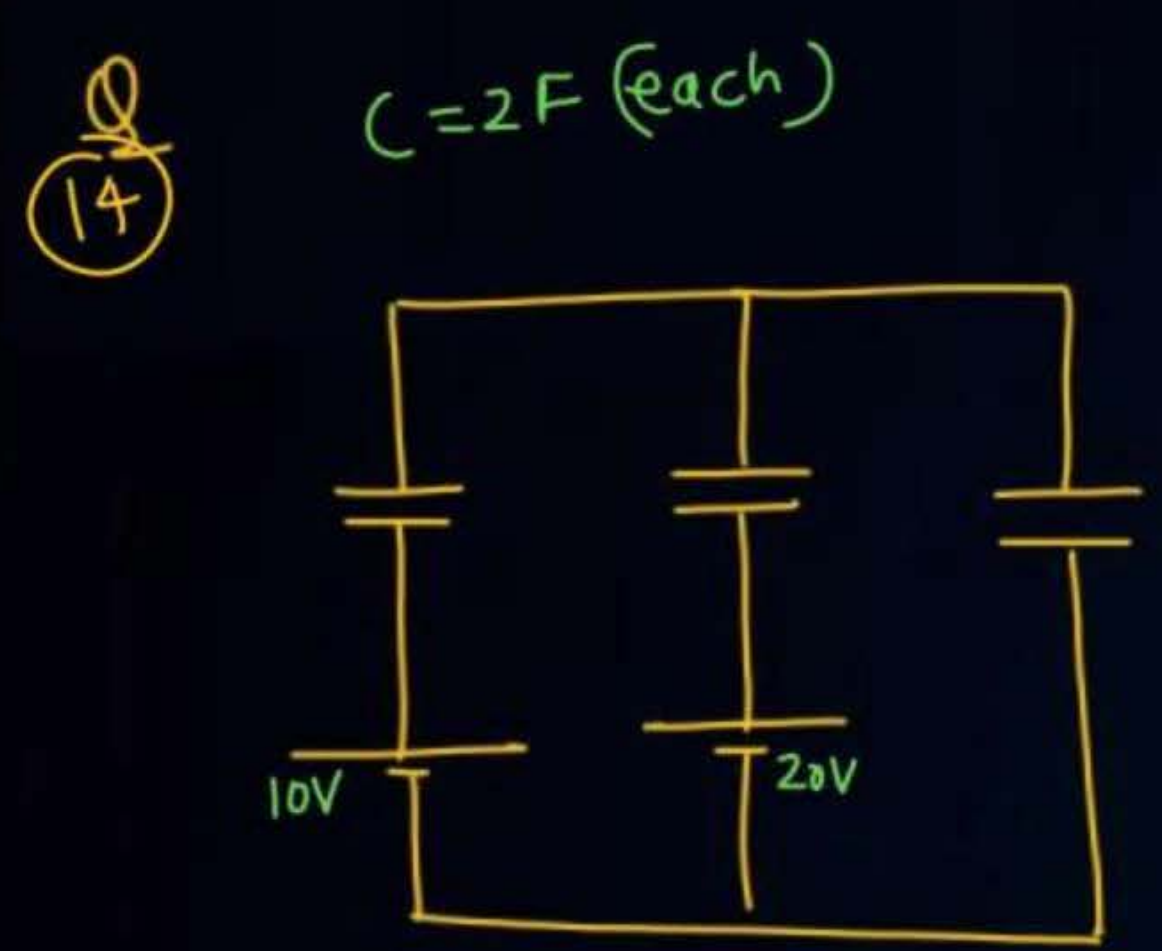
ATDB.uno



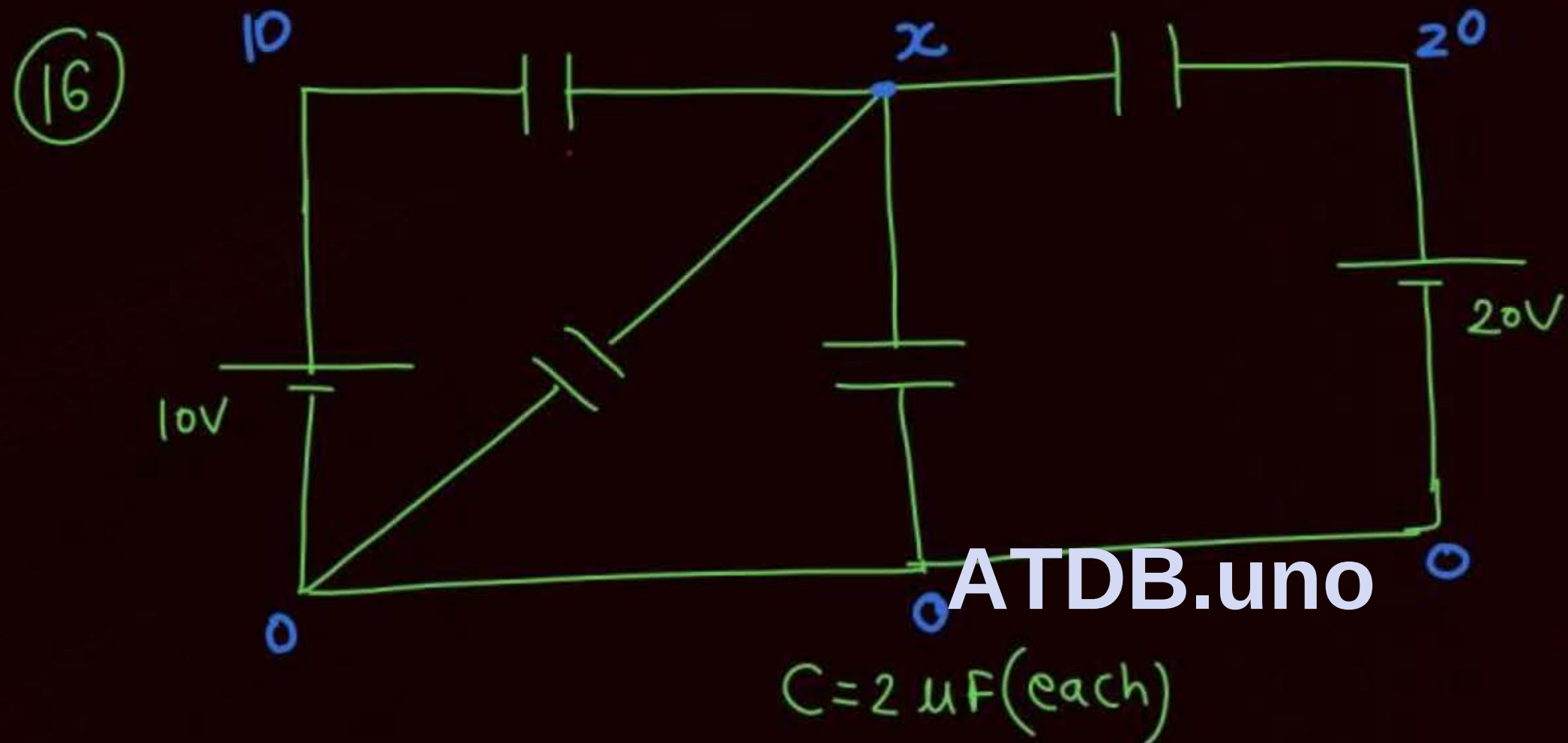
$$(x-10)^2 + (x-20)^2 + (x-0)^2 \times 2 = 0$$



$$(x-10)^2 + (x-0)^4 + (x-y)^2 \times 3 = 0$$
$$(y-x)^2 \times 3 + (y-0)^2 \times 5 + (y-20)^2 \times 4 = 0$$



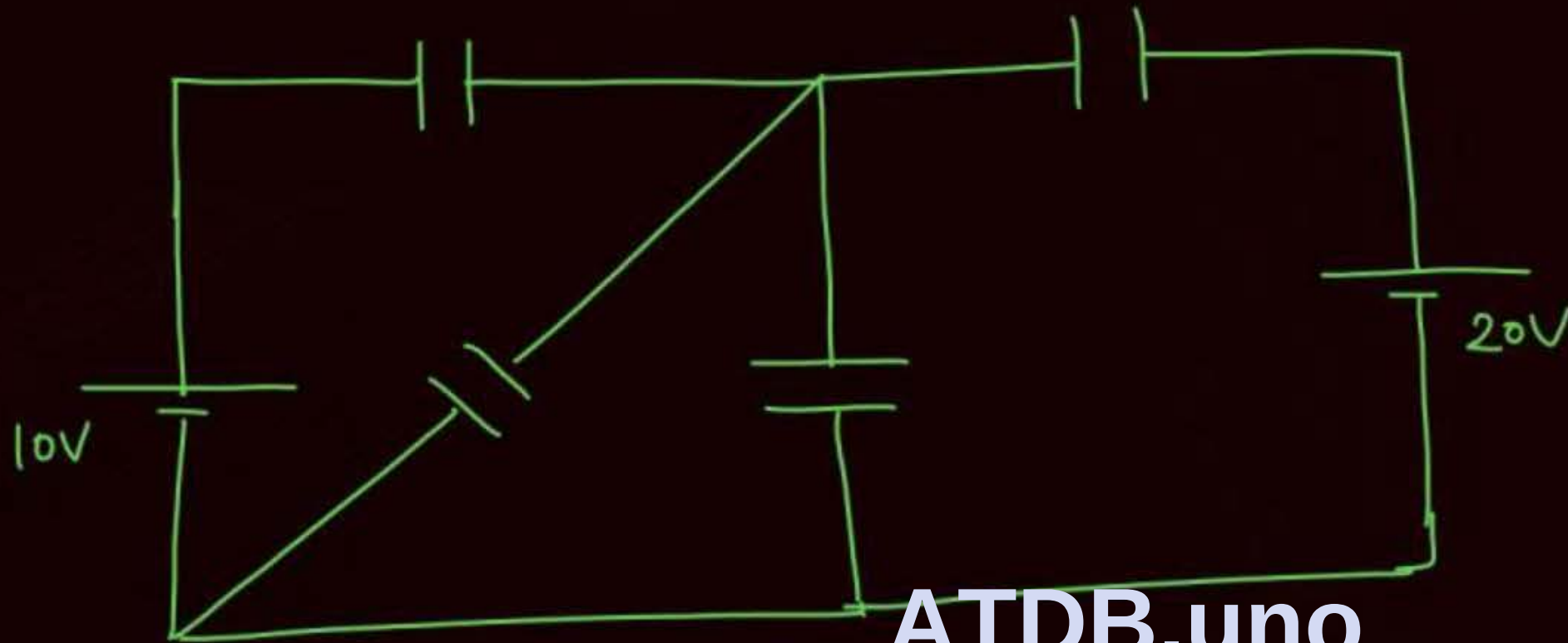
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$$(x - 10)^2 + (x - 0)^2 + (x - 0)^2 + (20 - x)^2 = 0$$



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$C = 2\text{ }\mu\text{F (each)}$



Homework

— PYQ (CE) module

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THANK YOU

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