# PRAYAS

## JEE 2025



Lecture - 02

Physics

# Capacitor

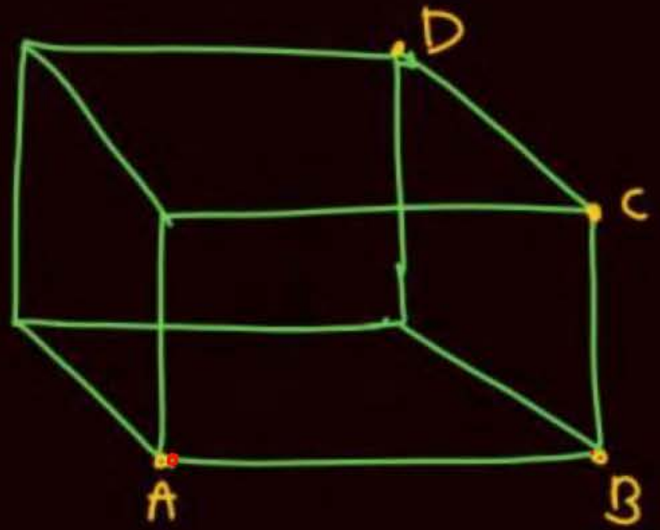

By- Saleem Ahmed Sir

Todays Goal



— Circuit Analysis

# Cube each of length $\ell$, Resistance $R$




पास-पास → $\frac{7R}{12}$ → $R_{AB}$

थोड़ा दूर → $\frac{3R}{4}$ → $R_{AC}$

सबसे दूर → $\frac{5}{6}R$ → $R_{AD}$



$\frac{7R}{12}$ $\frac{3R}{4}$ $\frac{5R}{6}$

(Not in mains/Advance)

# 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%

Value ⇒ I II × 10^III ± IV % (IV: tolerance)

Q Red green blue gold

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

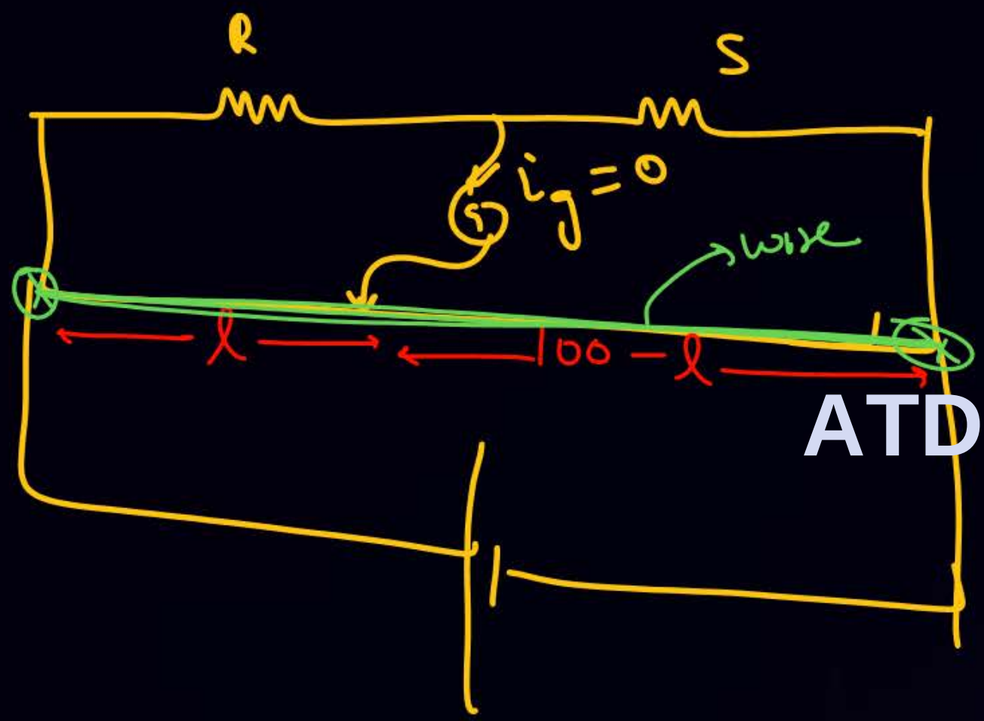
Q Violet Blue Red Silver

$76 \times 10^2 \pm 10\%$

Q 5200Ω ± 5% ⇛ Colour sequence = ?

$52 \times 10^2 \pm 5\% \equiv$ G R R Gold

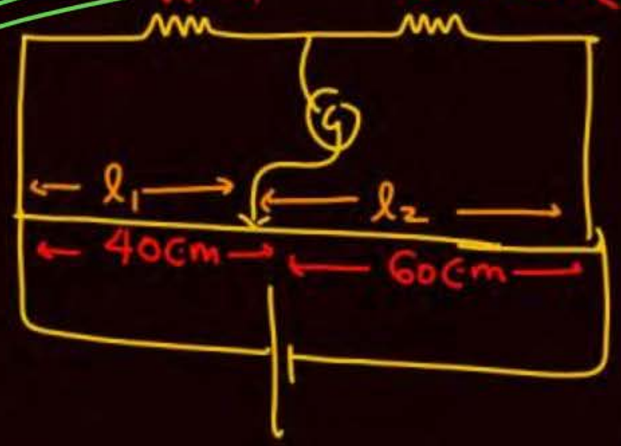
# meter Bridge




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

# Meter Bridge

## ideal




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

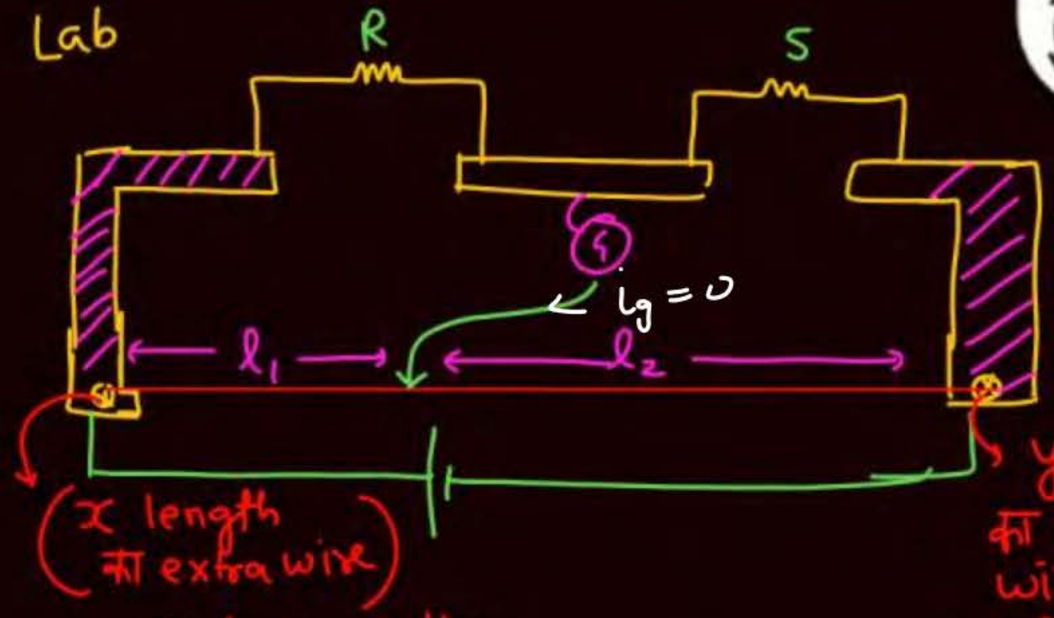
$$\frac{R}{90} = \frac{40}{60}$$

$$R = 60\,\Omega$$

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

$$R = 60\,\Omega$$

## Lab




end Correction

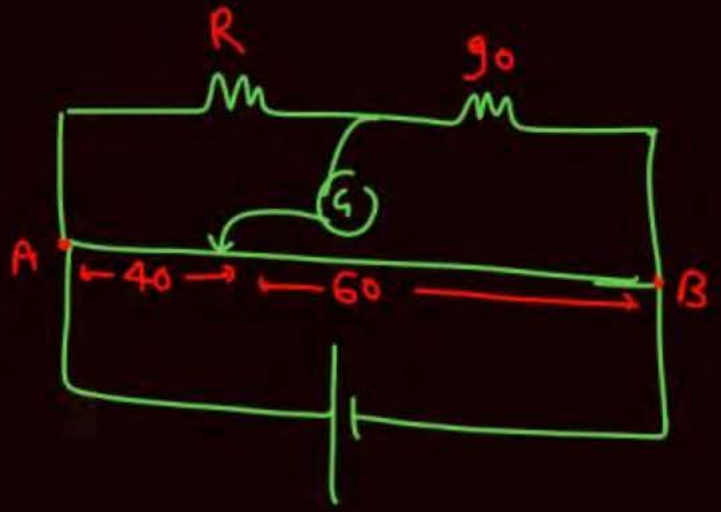
पहले ⇒ $\frac{R}{S} = \frac{l_1}{l_2}$

ideal

$$\frac{R}{S} = \frac{l_1 + x}{l_2 + y} \quad (\text{end correction})$$

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

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




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

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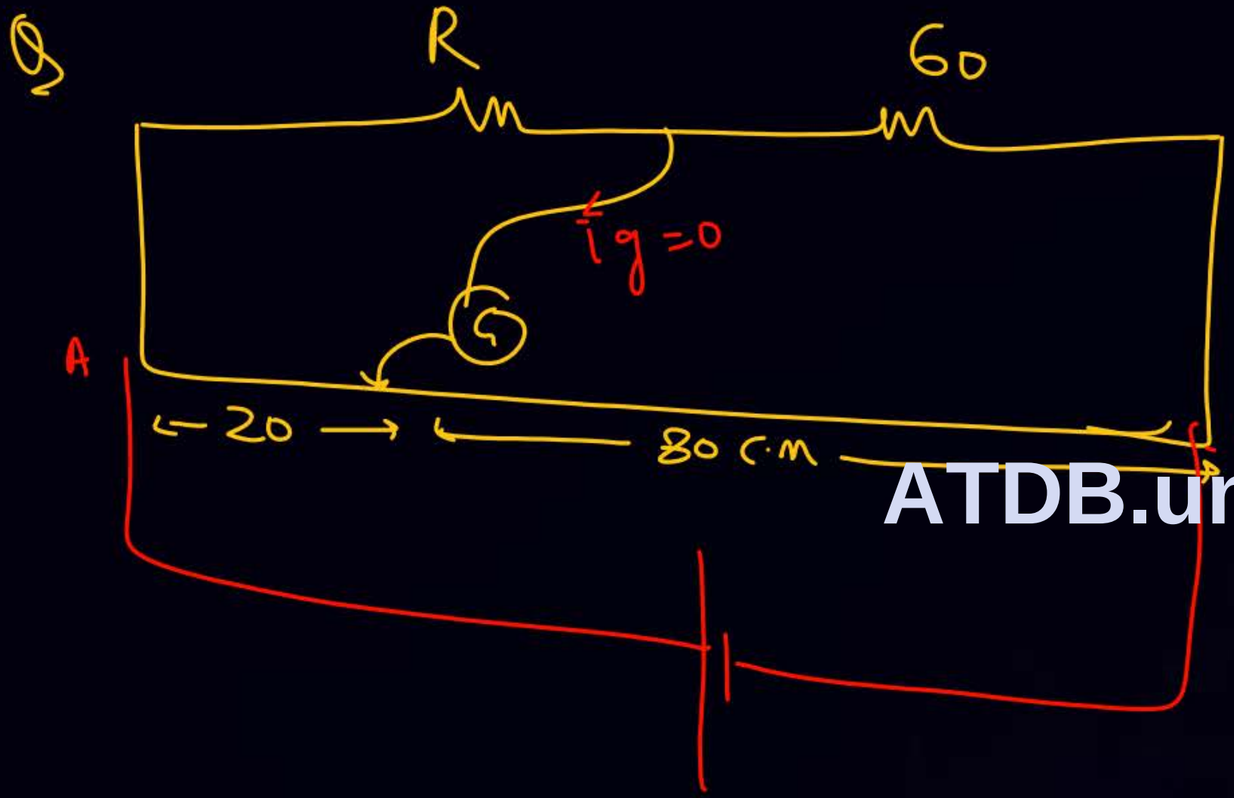
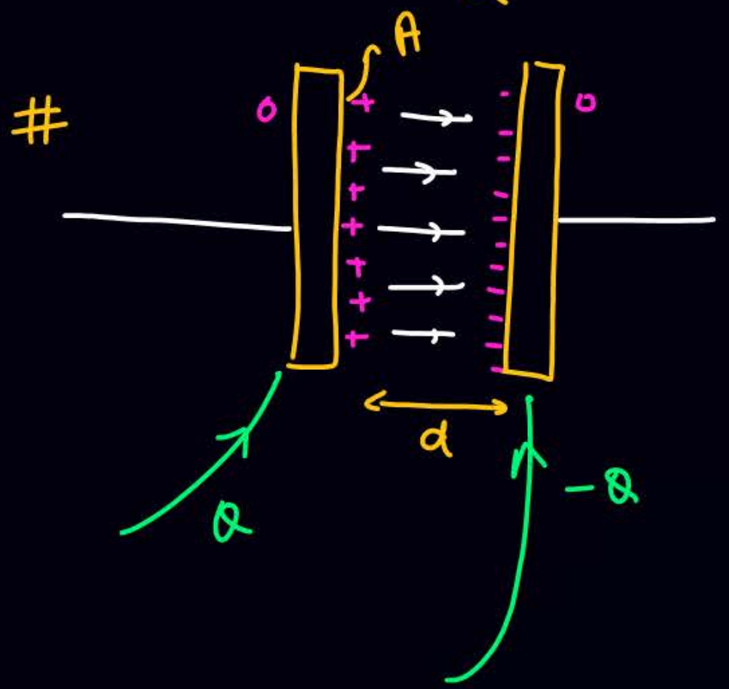
Q

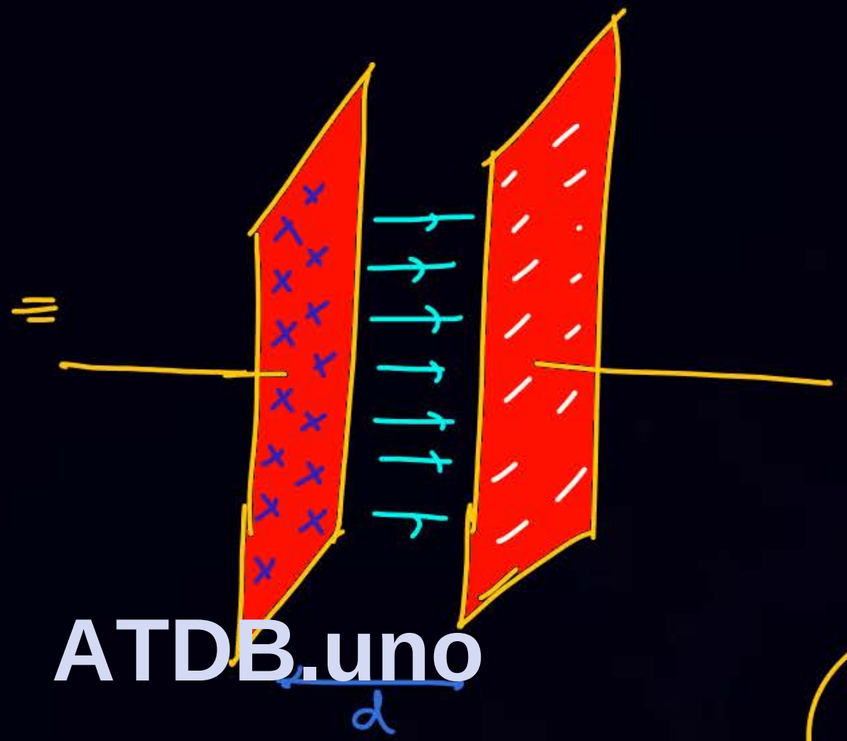
end correction are 1 cm & 2 cm at A & B.




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

$C = \frac{A\epsilon_0}{d}$






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

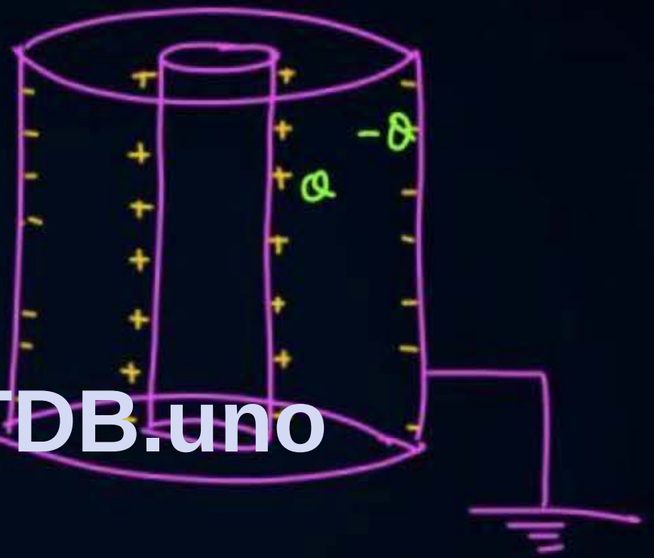
(0, R)

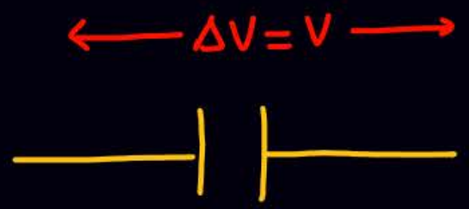
$C = 4\pi\epsilon_0 R$

# * Cylindrical Capacitor

R·m

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






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

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

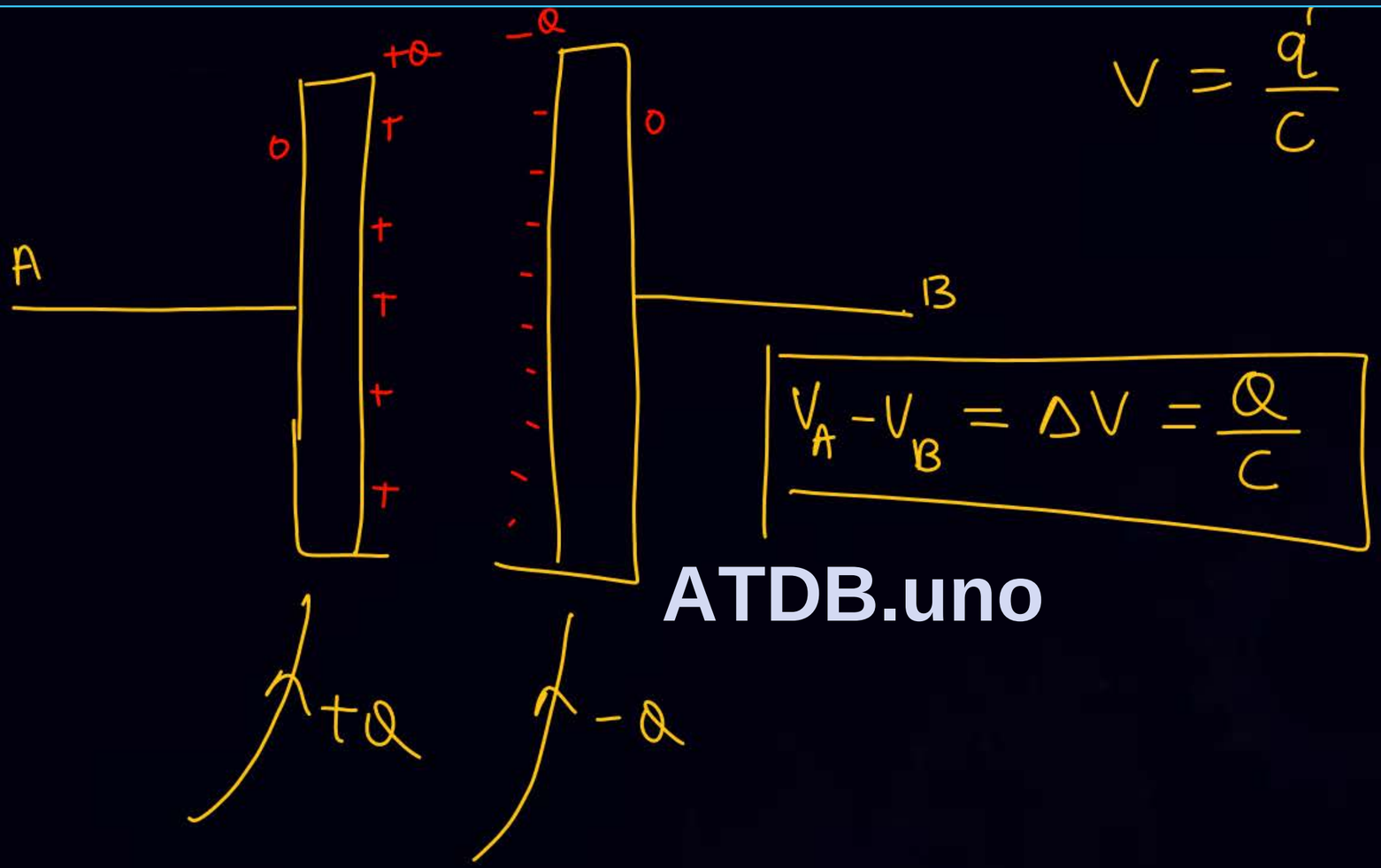
or

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

charge on the capacitor ⟹

capacitance

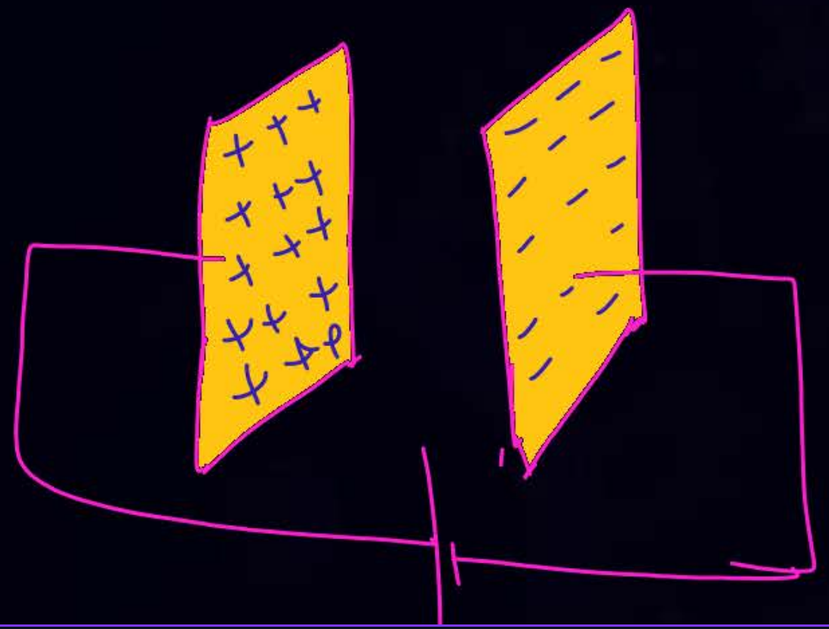
$$q = CV$$

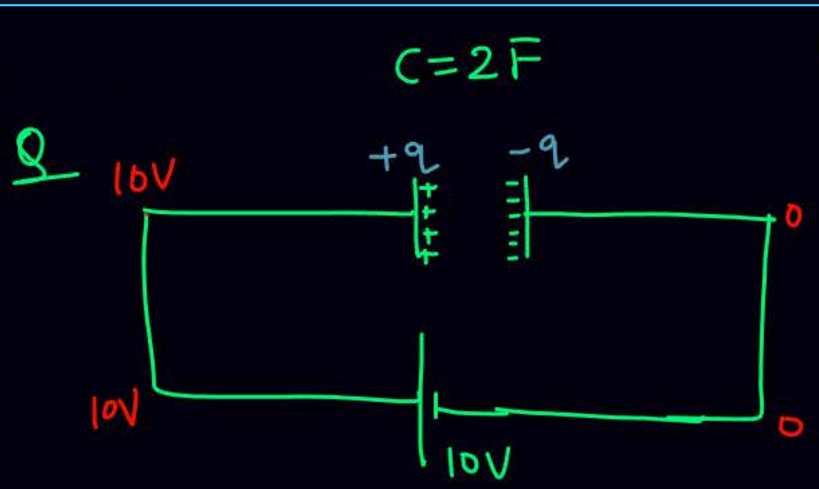



$$V = \frac{q}{C}$$

$$V_A - V_B = \Delta V = \frac{Q}{C}$$

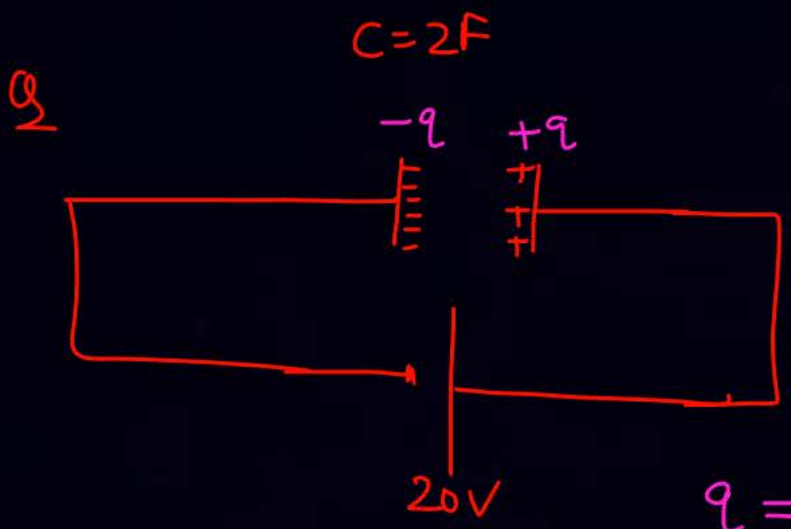





$q = CV$

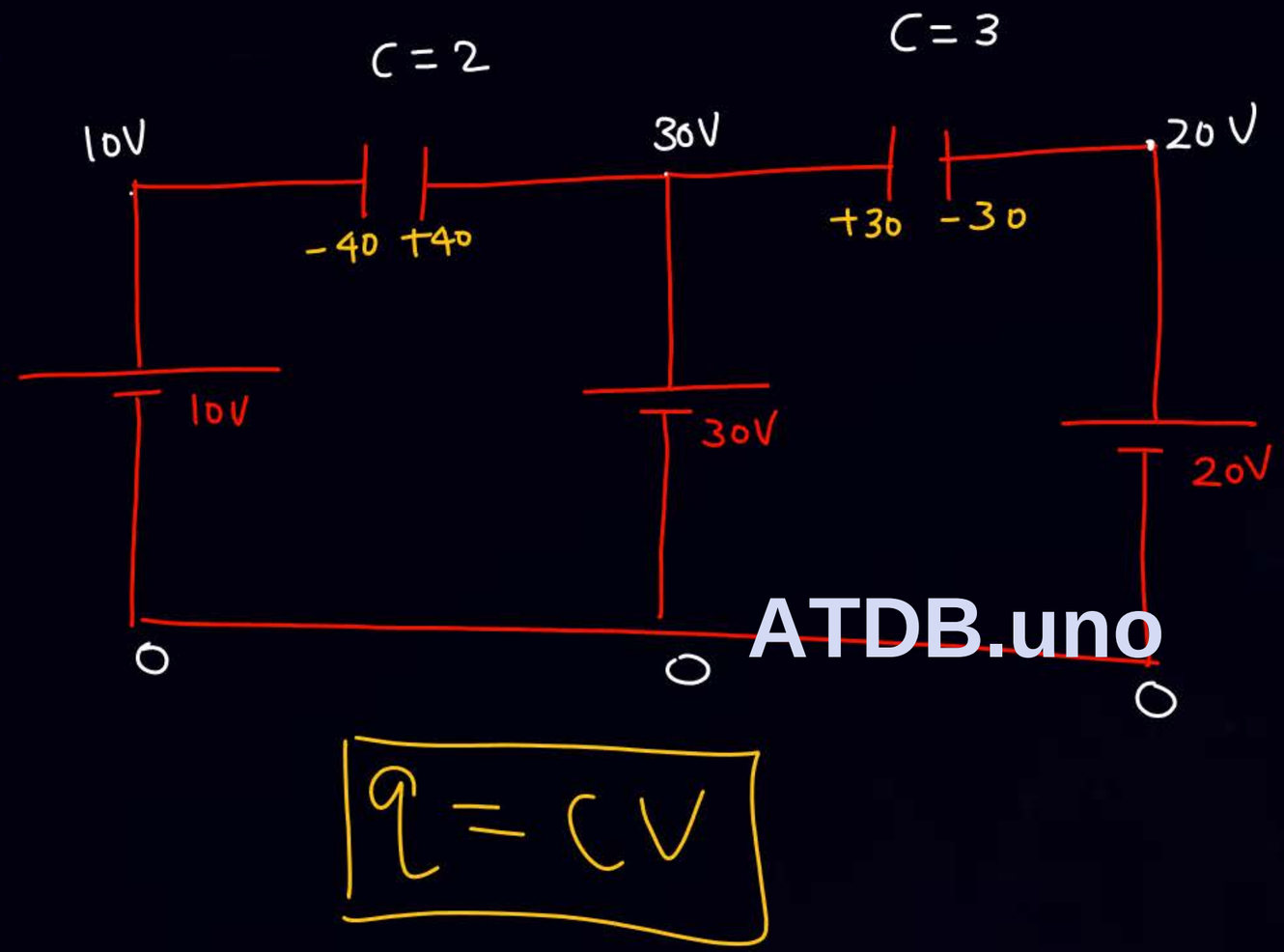
$q = 2 \times 10 = 20$




$q = 2 \times 20$

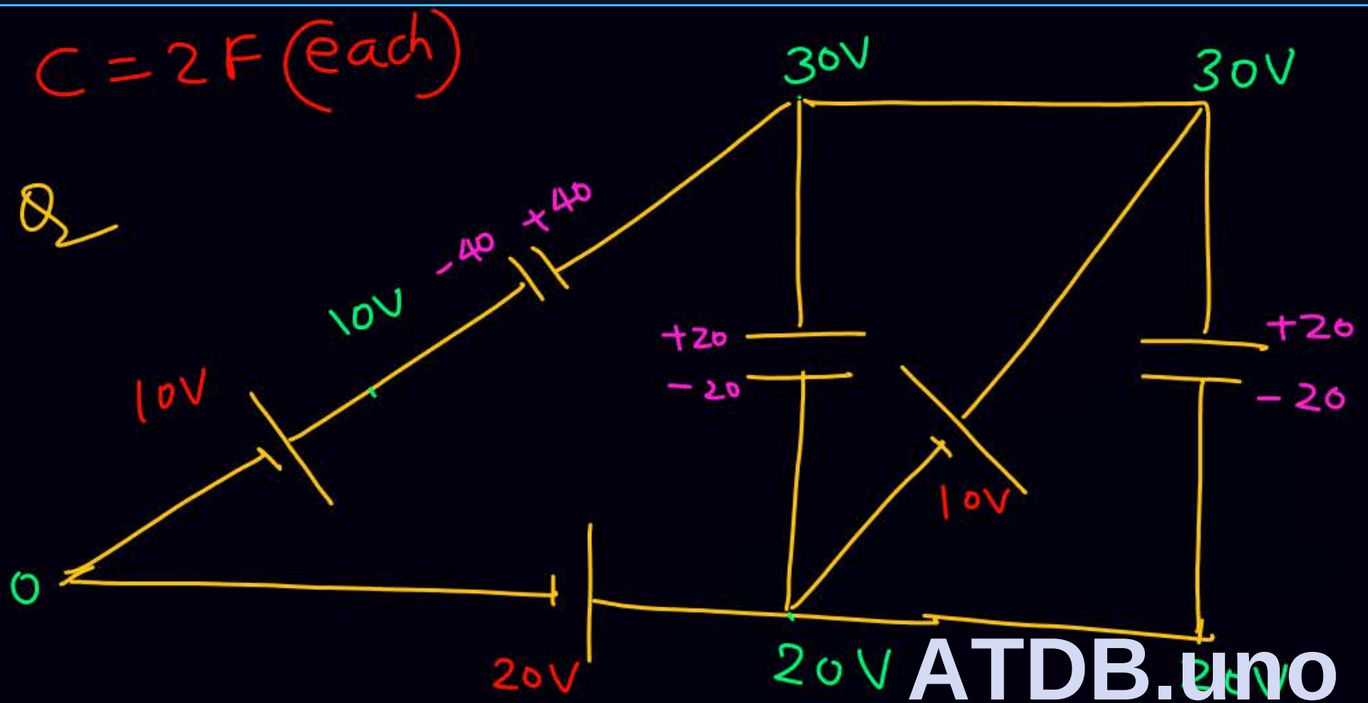
$q = 40$

# ATDB.uno



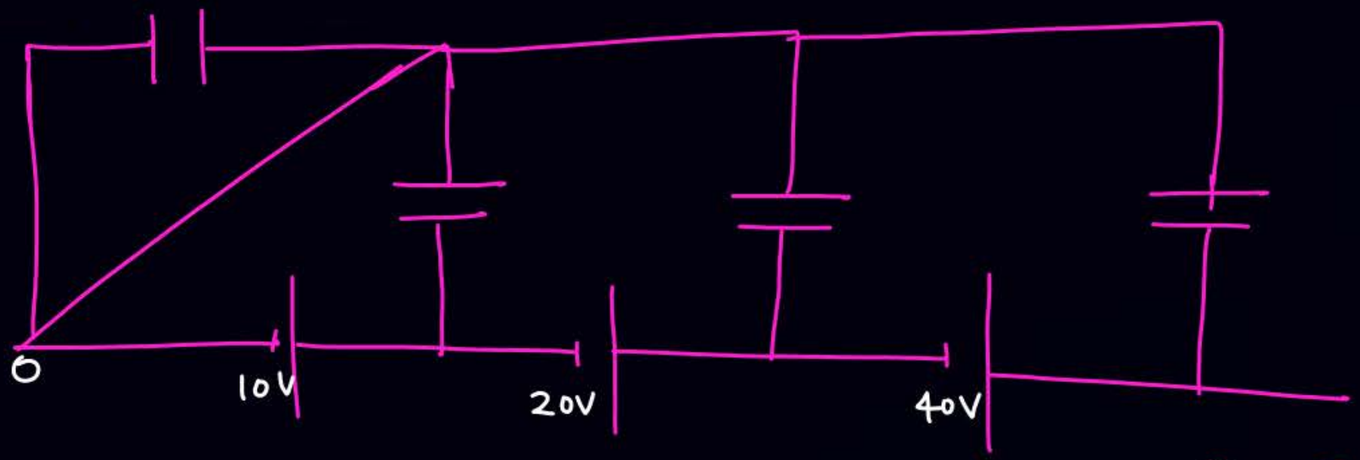



$$q = CV$$



Q

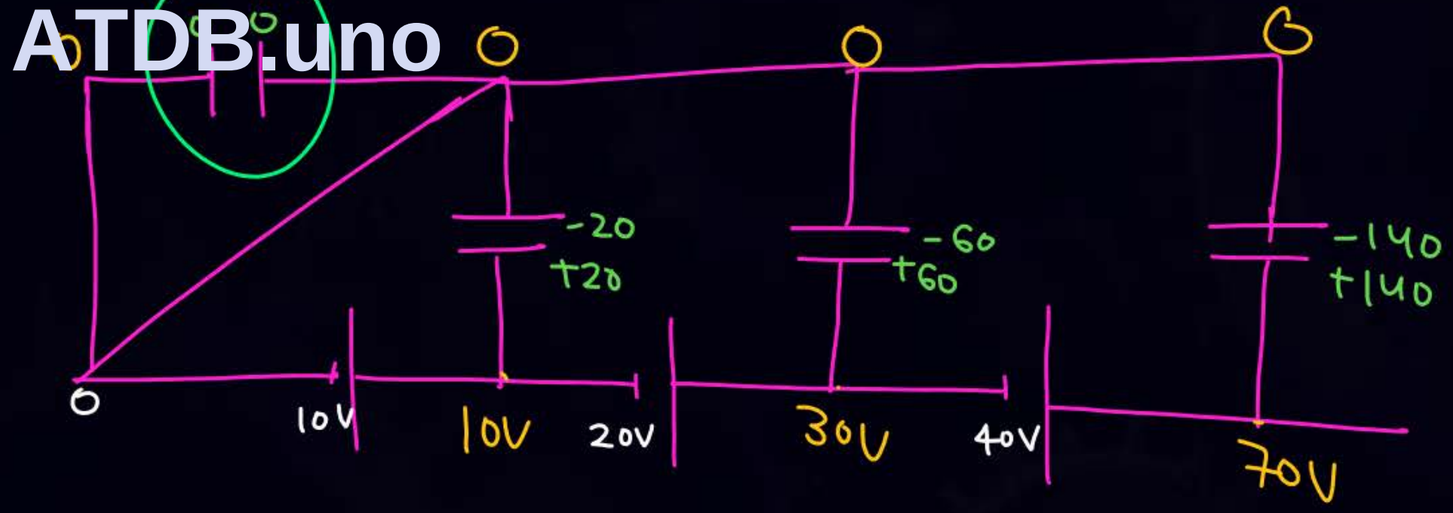
C = 2F (each)

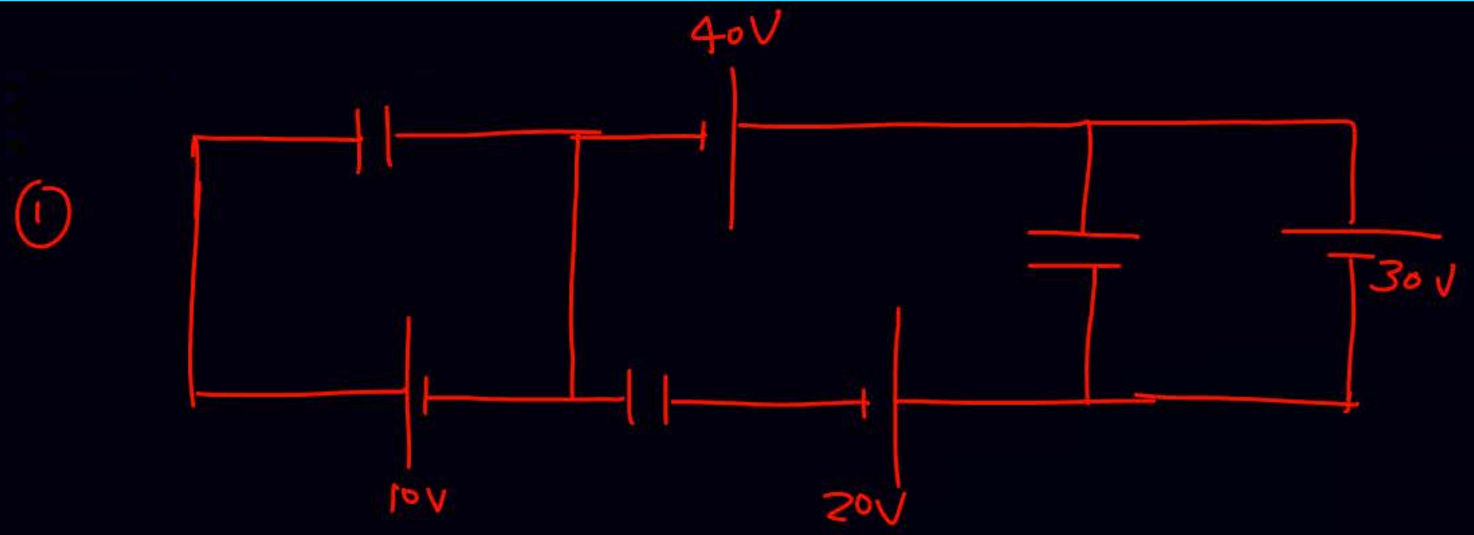



$q = CV$

बेकार

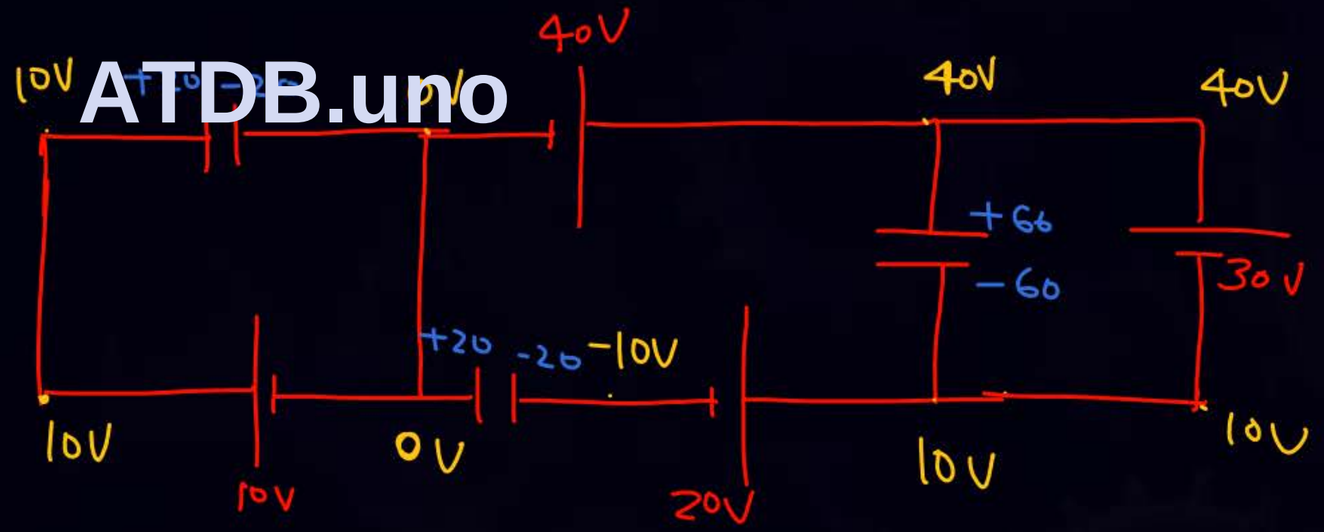




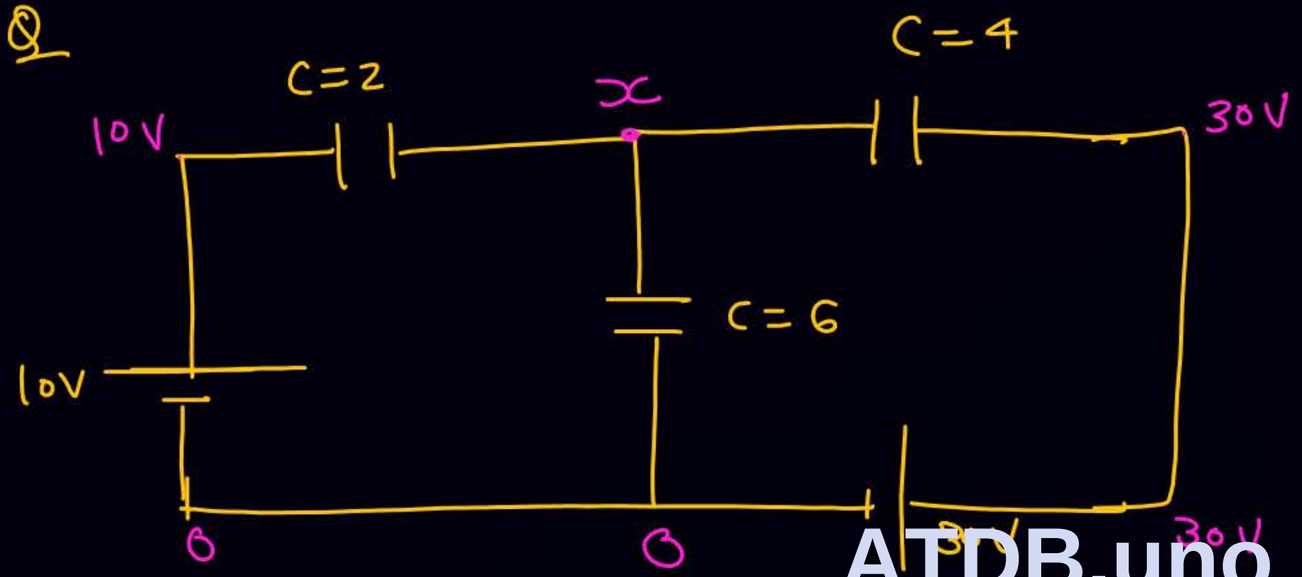



$C = 2.F (each)$

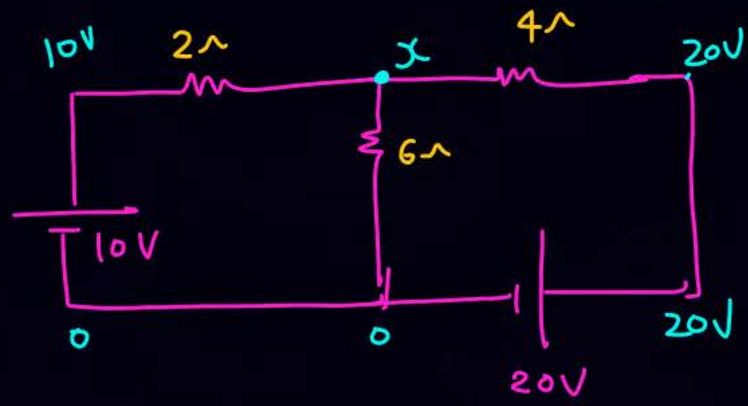




Q

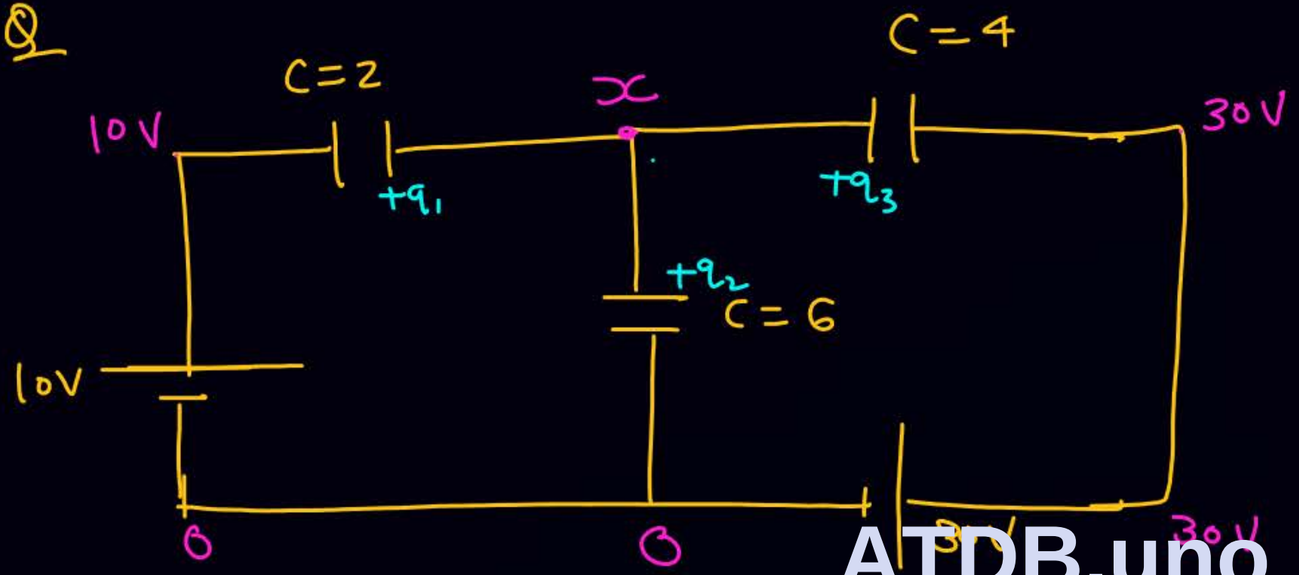




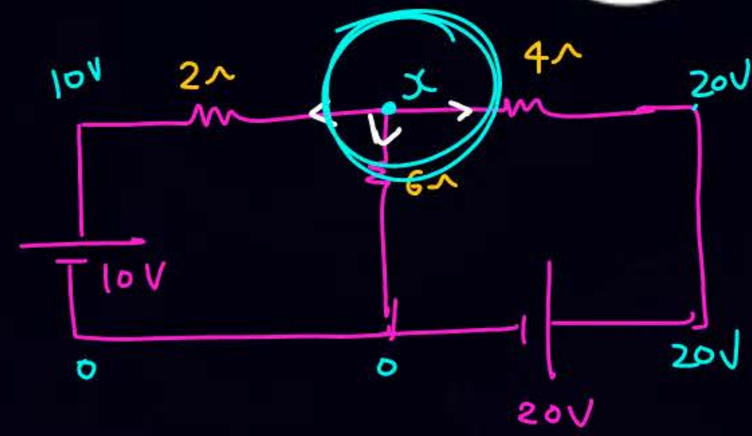




$$\frac{x-10}{2}+\frac{x-0}{6}+\frac{x-20}{4}=0$$

Q






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

$$q_1+q_2+q_3=0$$

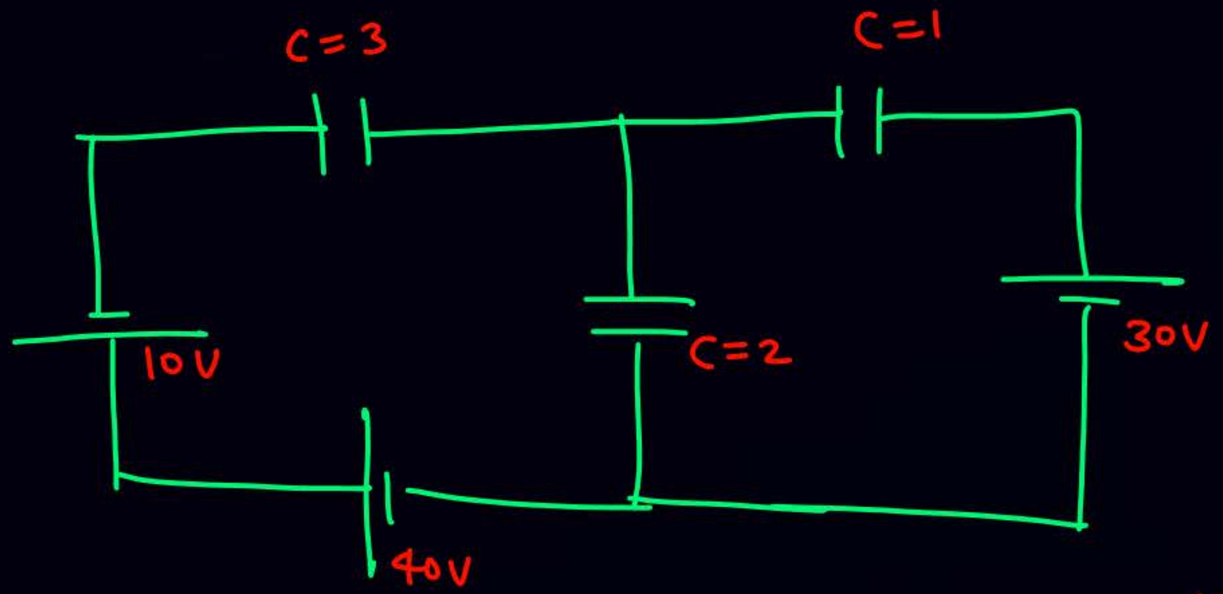
$$2(x-10)+6(x-0)+4(x-30)=0$$

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

$$12x=140$$

$x=$ ✓

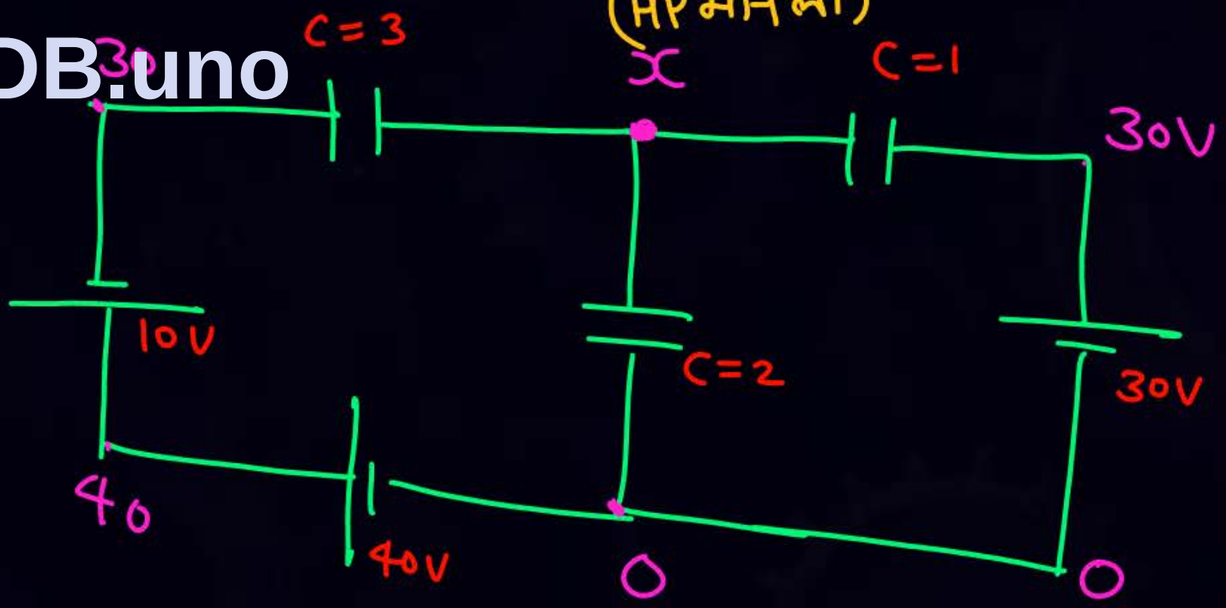
Q

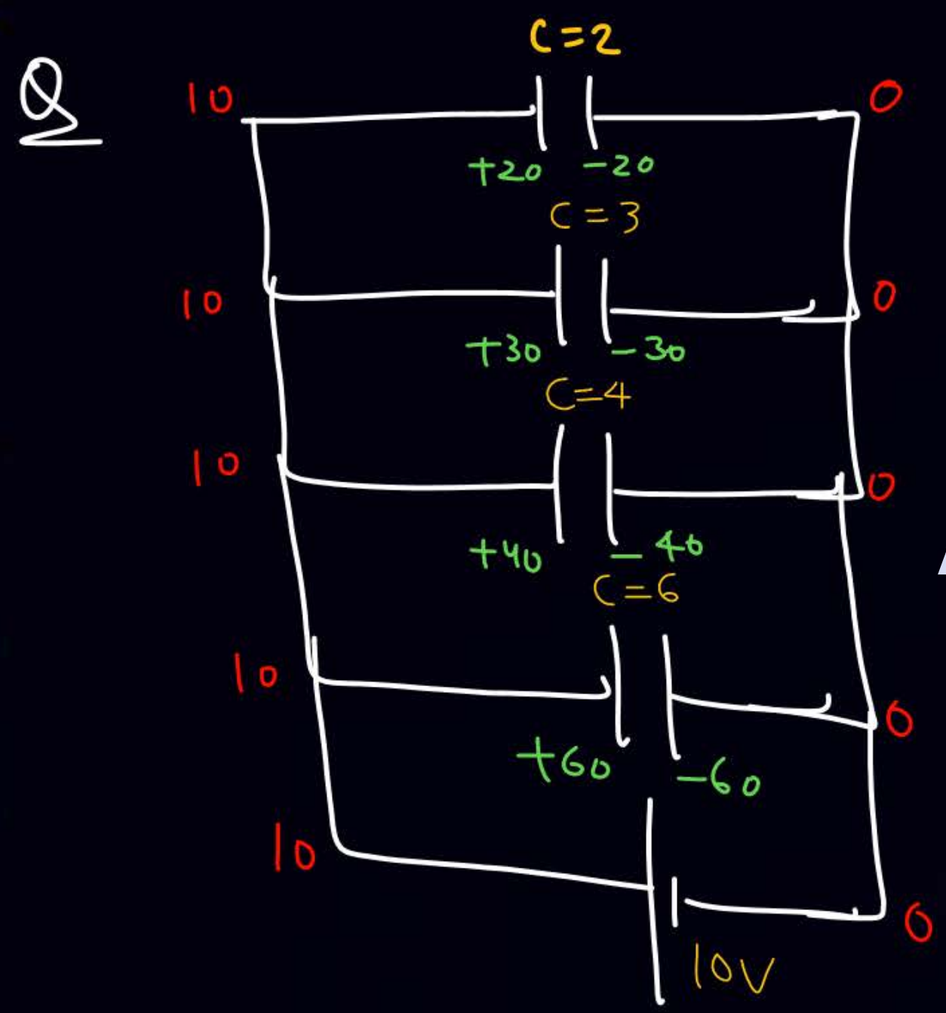


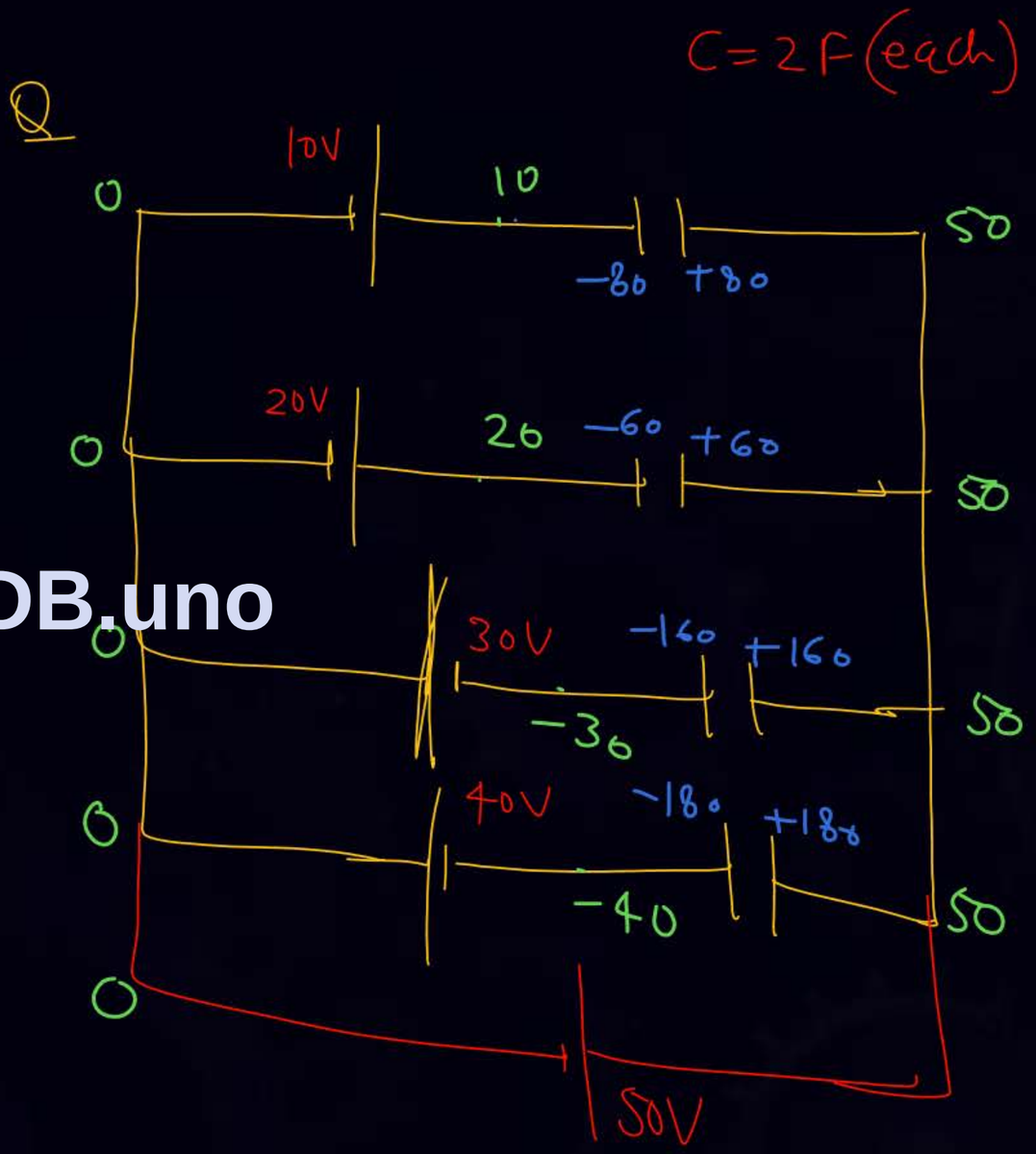

$3(x-30)+2(x-0)+1\times(x-30)=0$

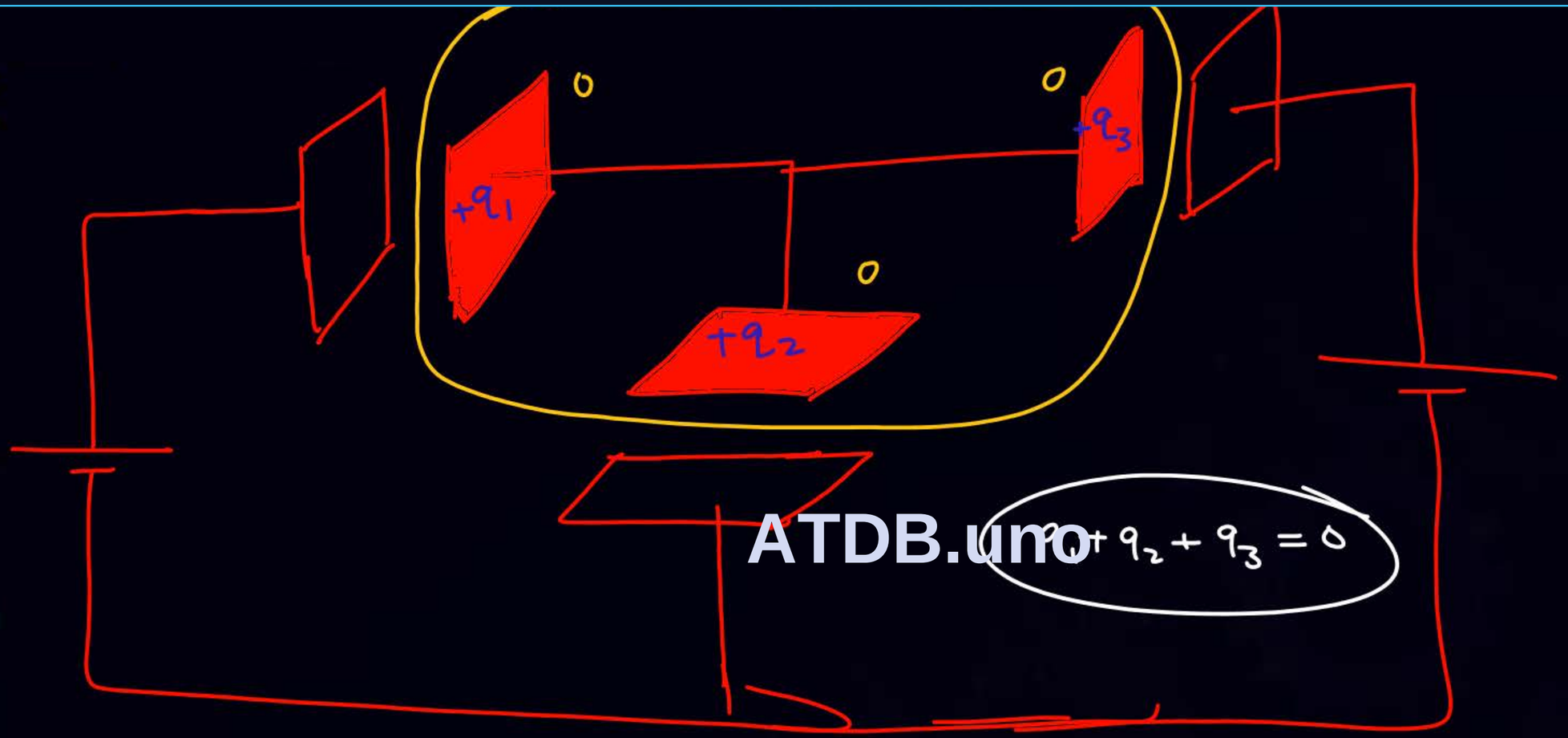
$6x=120$ $\quad x=20V$

(HP मान लो)



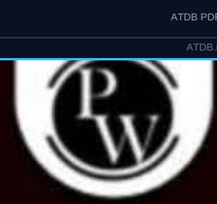






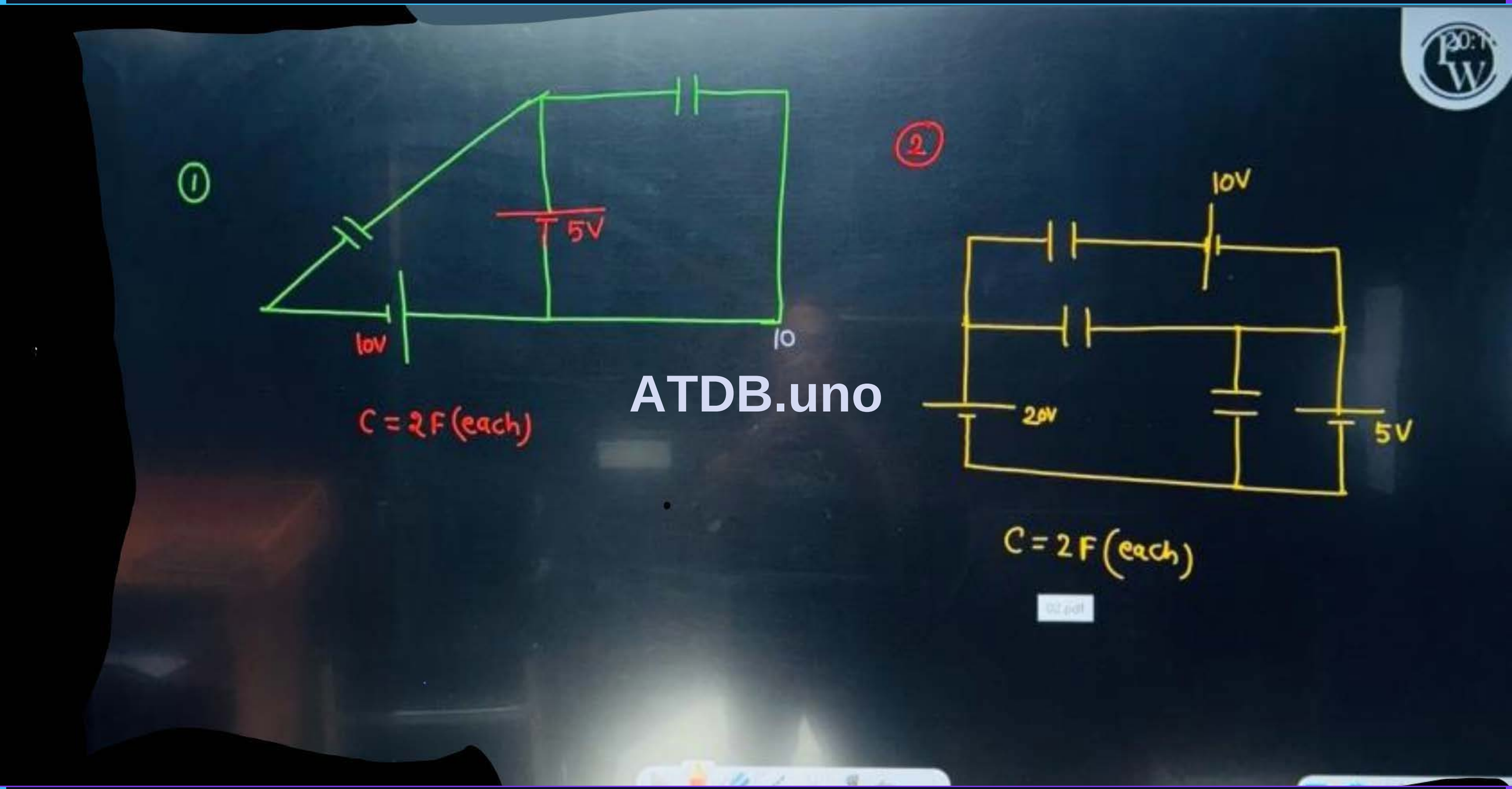

$$q_1 + q_2 + q_3 = 0$$



Home Work Ques

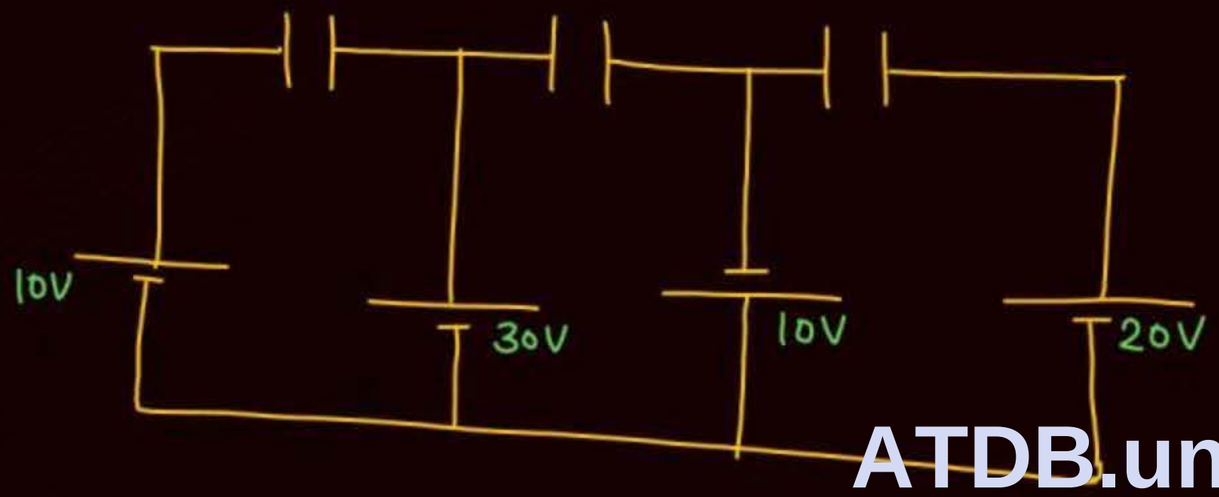
(will upload vedio today)

# ATDB.uno



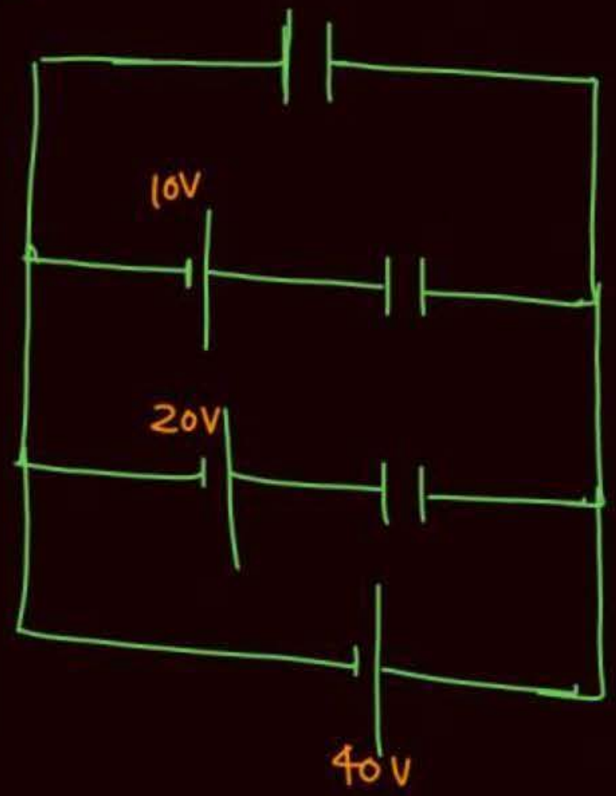
C=2F (each)

(3)

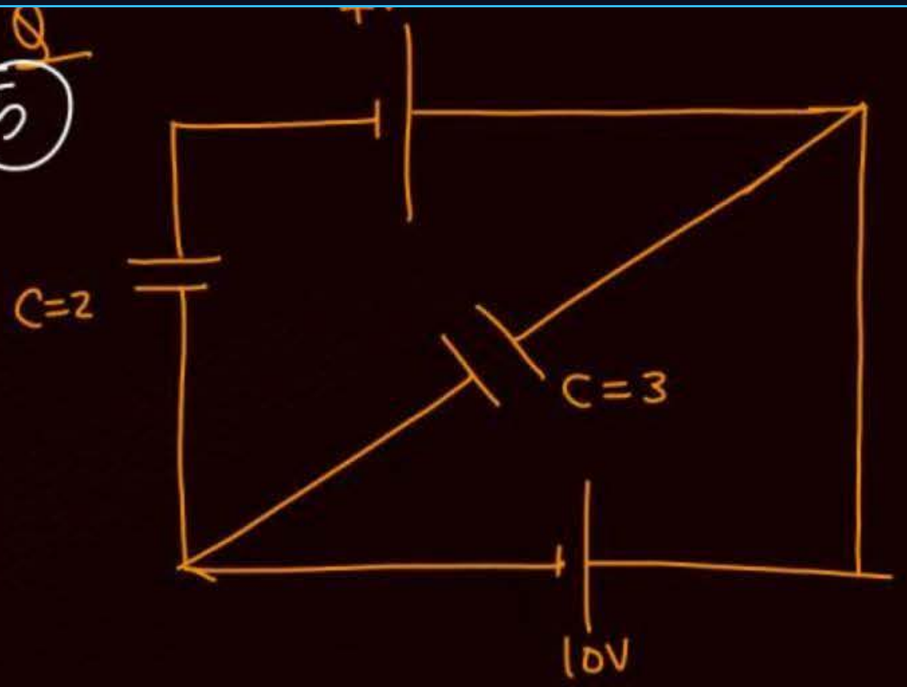



(4)

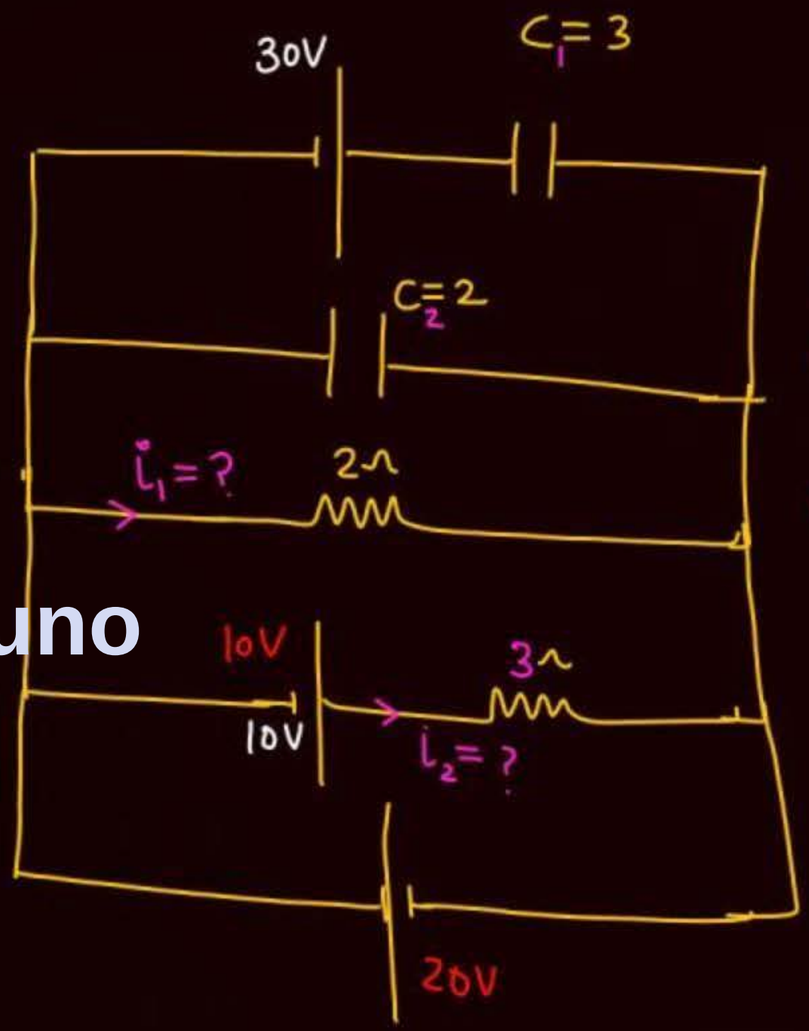
Q



5 Q



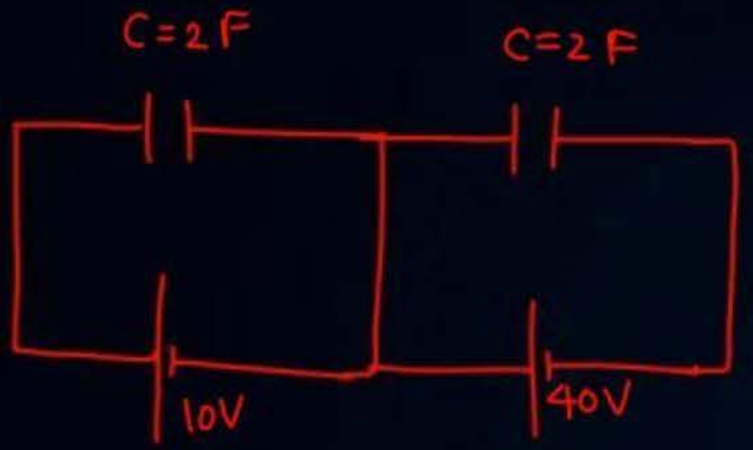

6 Q




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

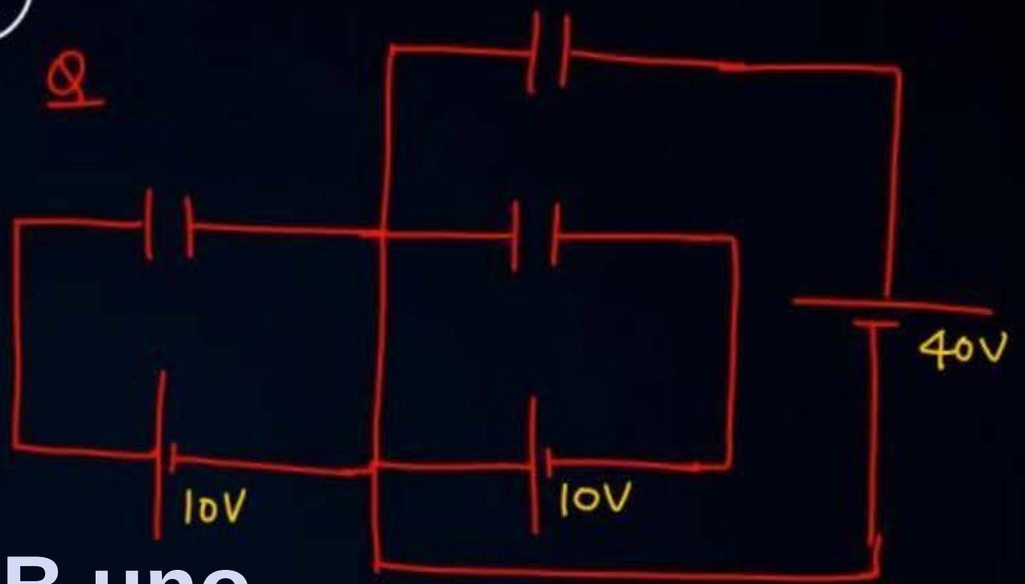
7

Q




8

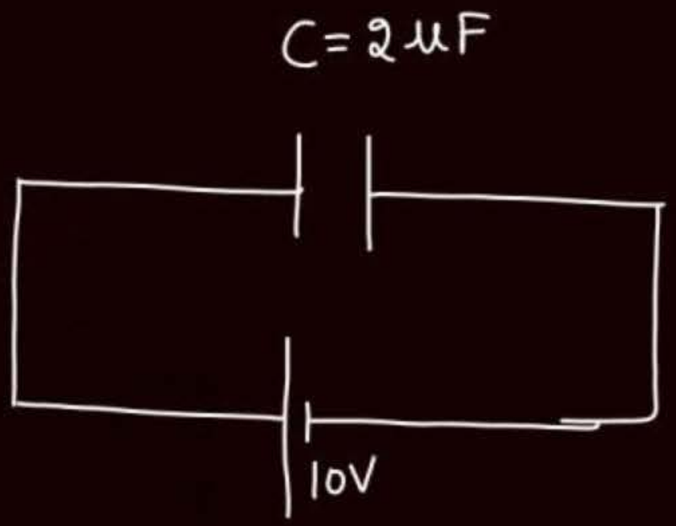
Q





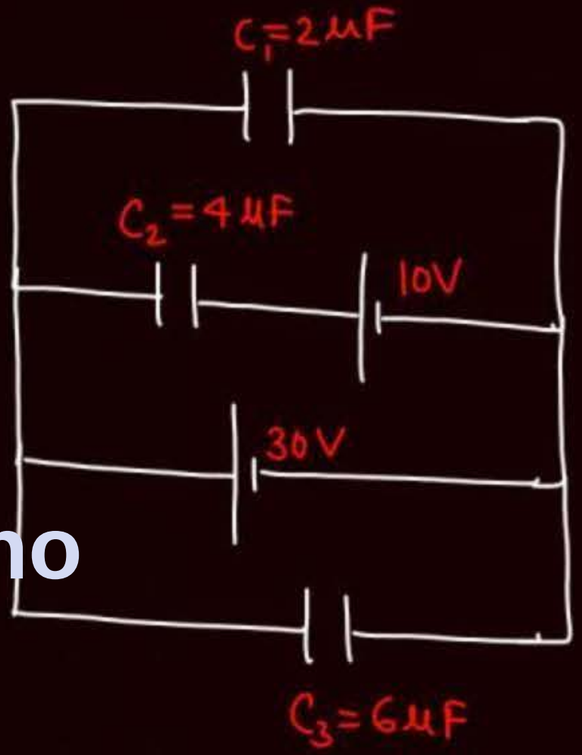

C = 2 F (each)

(9)

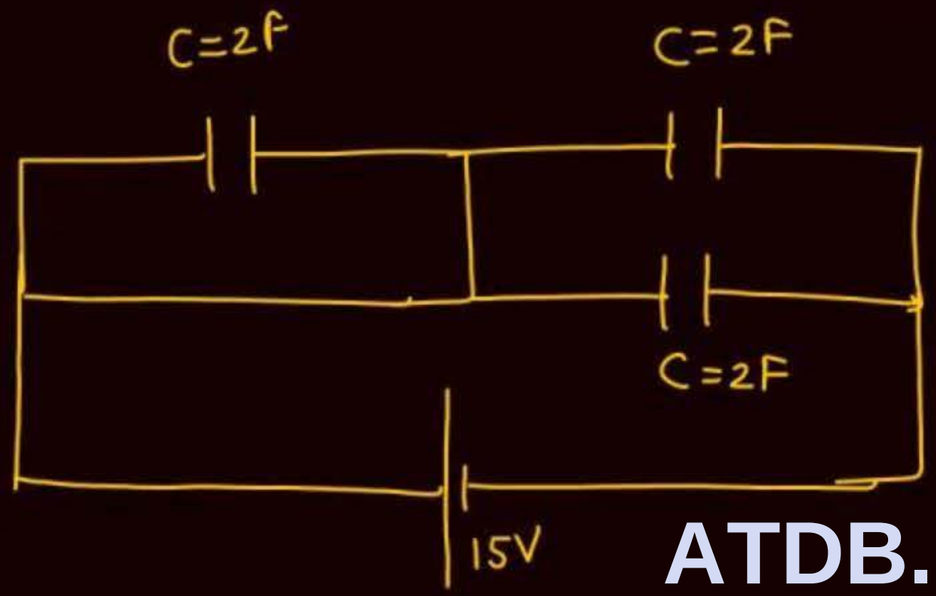



$C = 2\mu F = 2 \times 10^{-6} F$

(10)



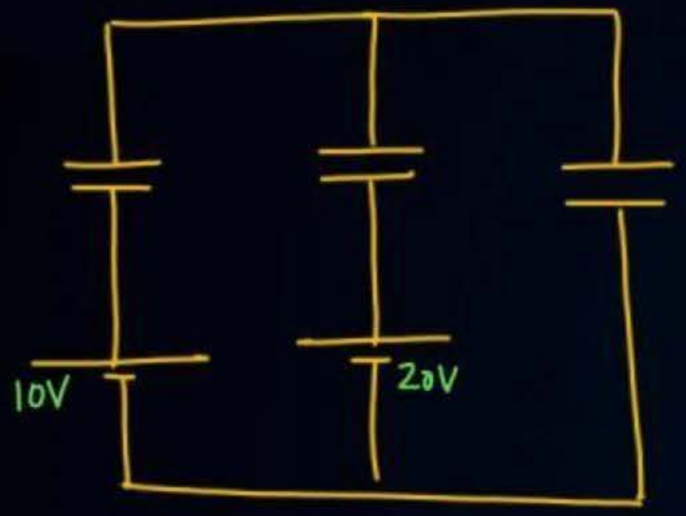
(12)



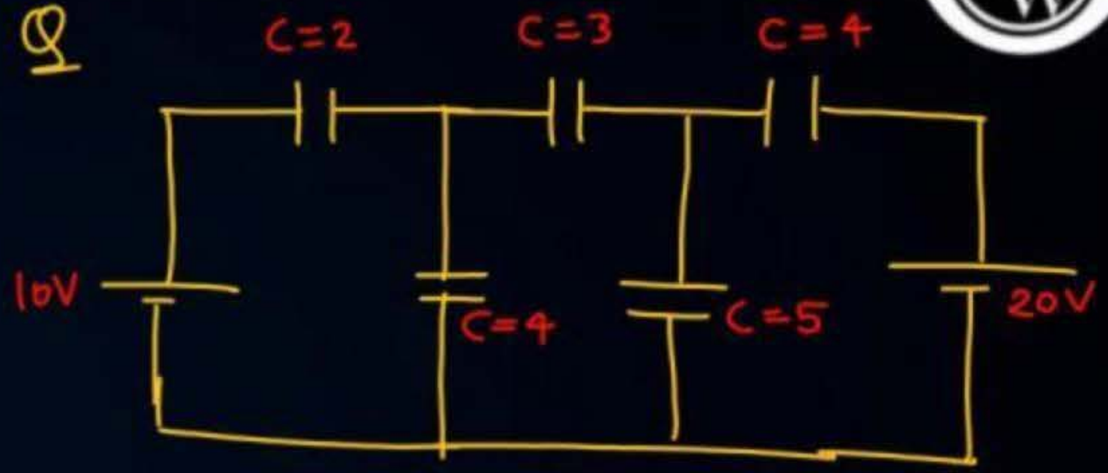
Q 13

Q 14

C = 2F (each)

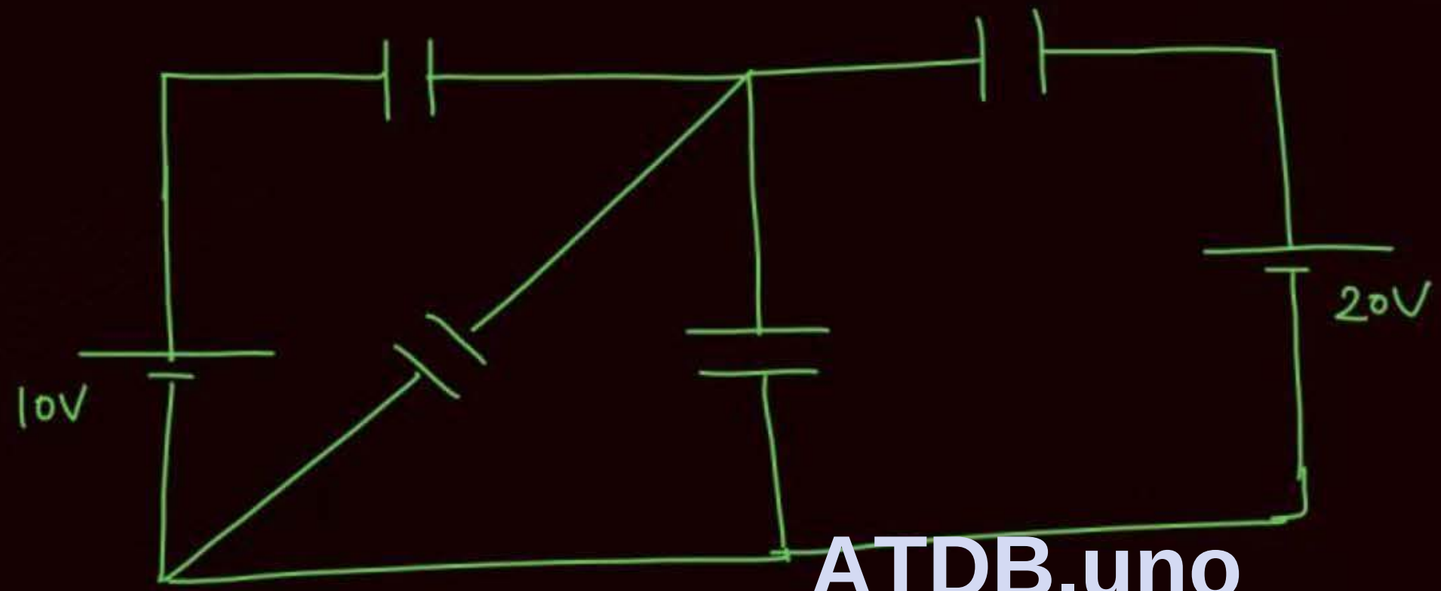



Q 15



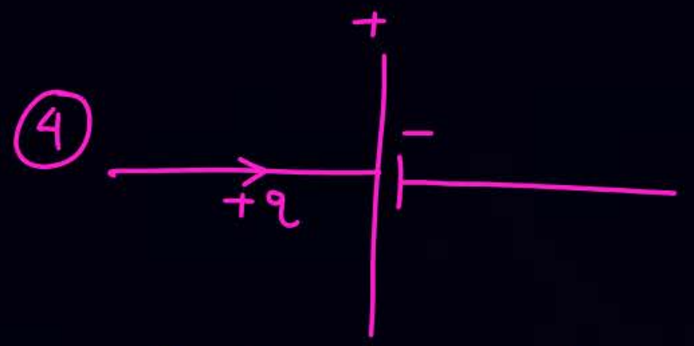

ATDB.uno

(16)

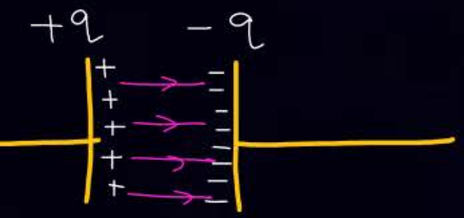




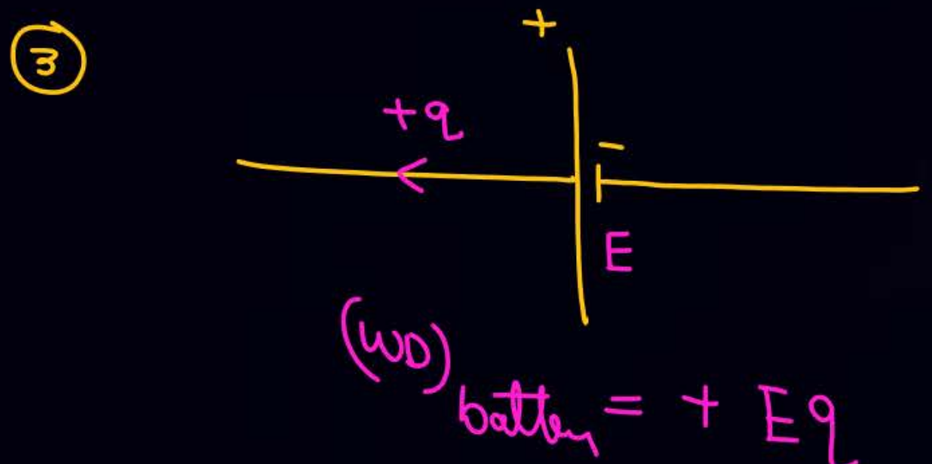

$C = 2\ \mu F$ (each)



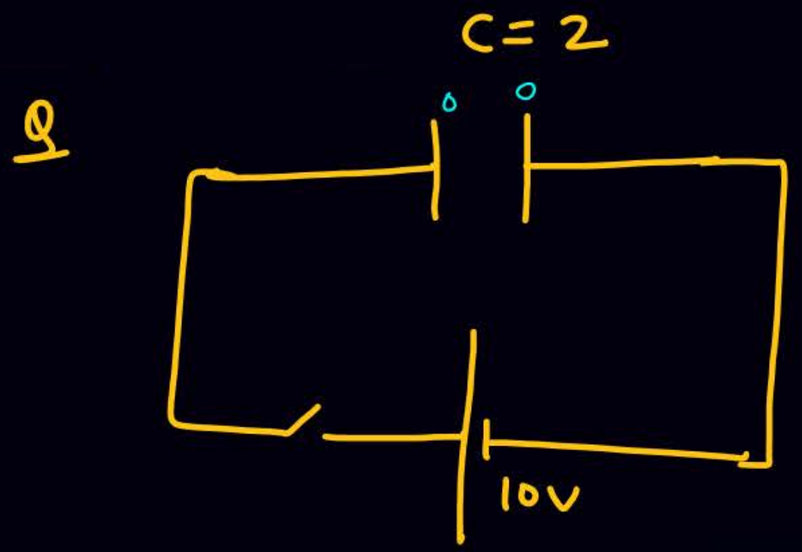


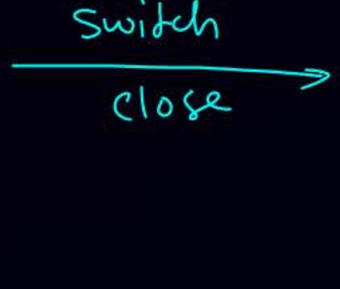



$$U = \frac{1}{2}\frac{q^2}{C} = \frac{1}{2}CV^2$$

$$\boxed{q = CV}$$





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

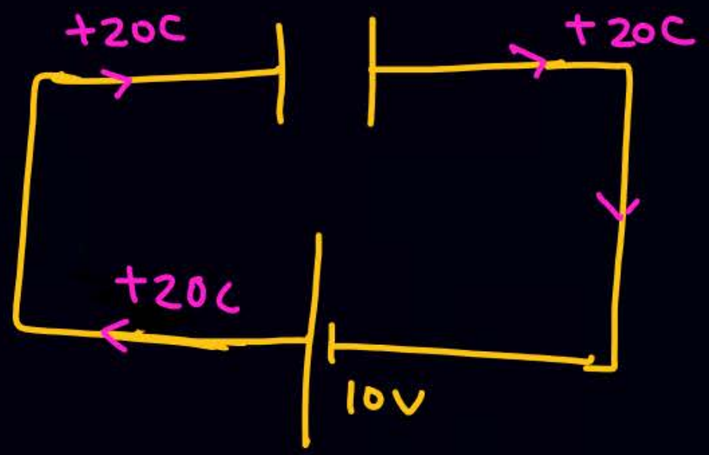


$U_f = \frac{1}{2}\frac{Q^2}{C} = \frac{1}{2} \times \frac{(20)^2}{2} = 100$

or

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

heat $= 200 - 100 = 100$

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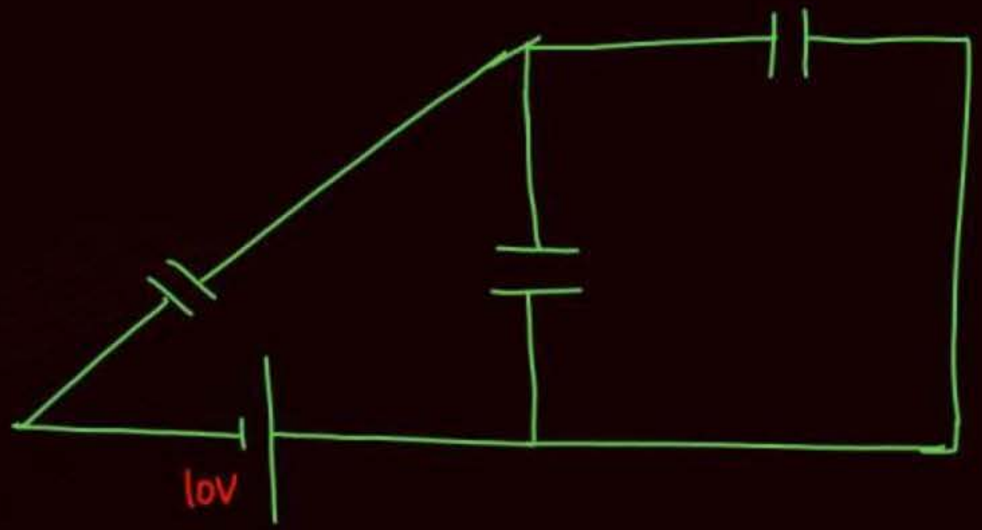
Homework of the class Soln Pdf

# ATDB.uno

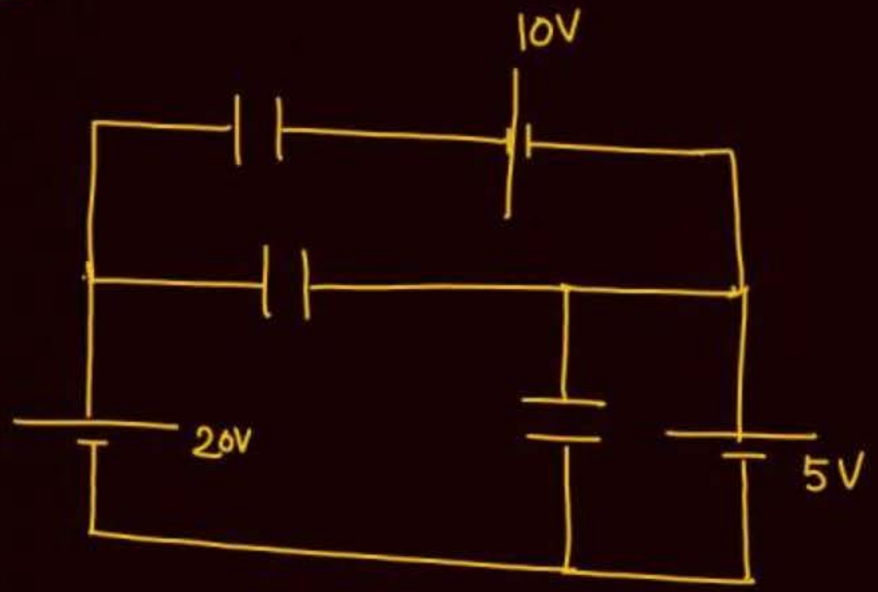
(1)



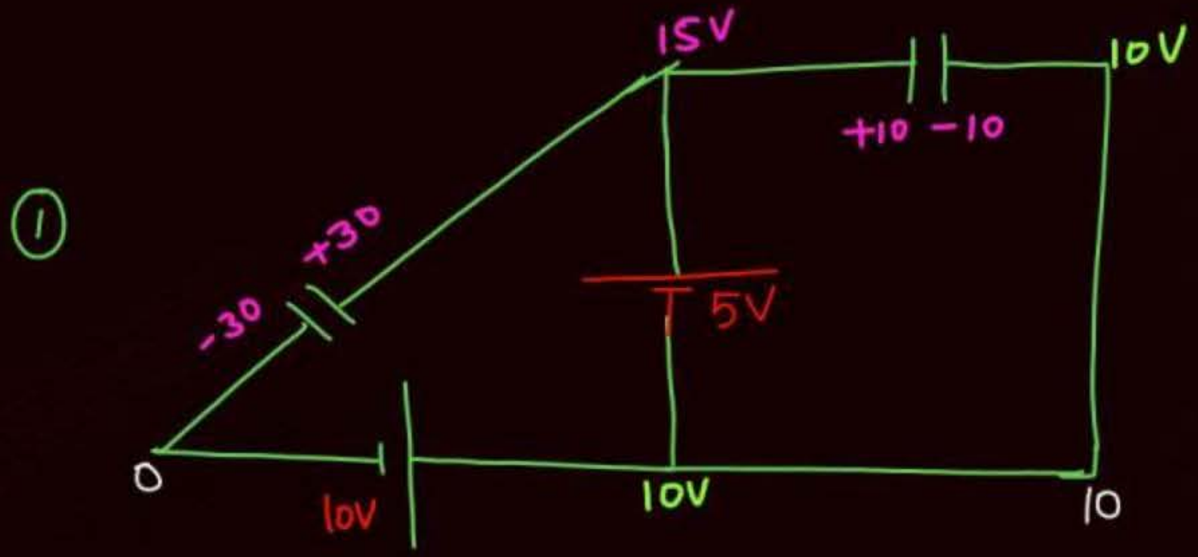

C = 2 F (each)



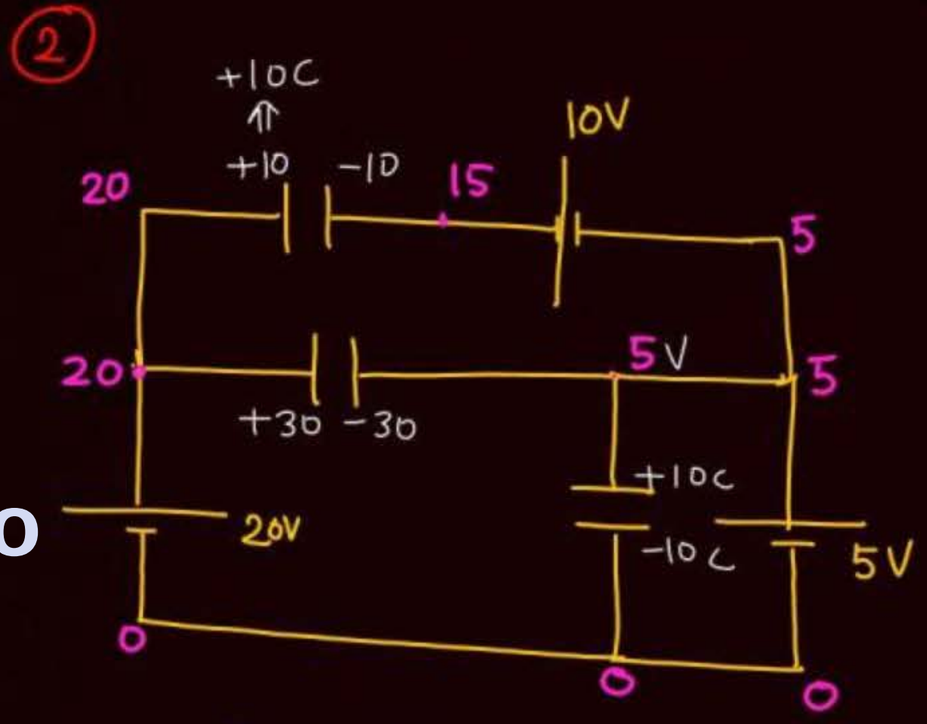
(2)




C = 2 F (each)




C = 2F (each)



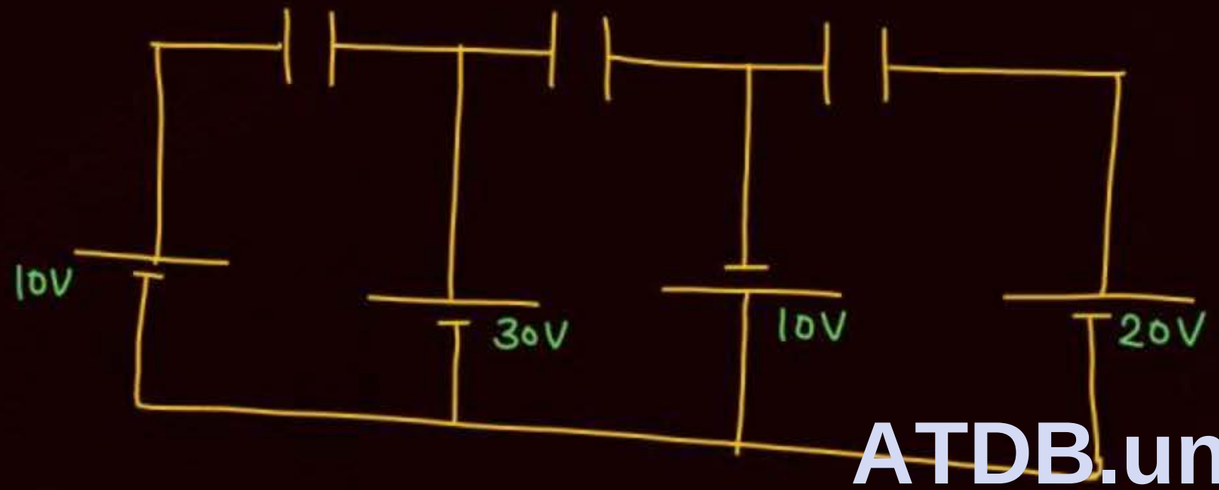

C = 2F (each)



$\theta = CV$

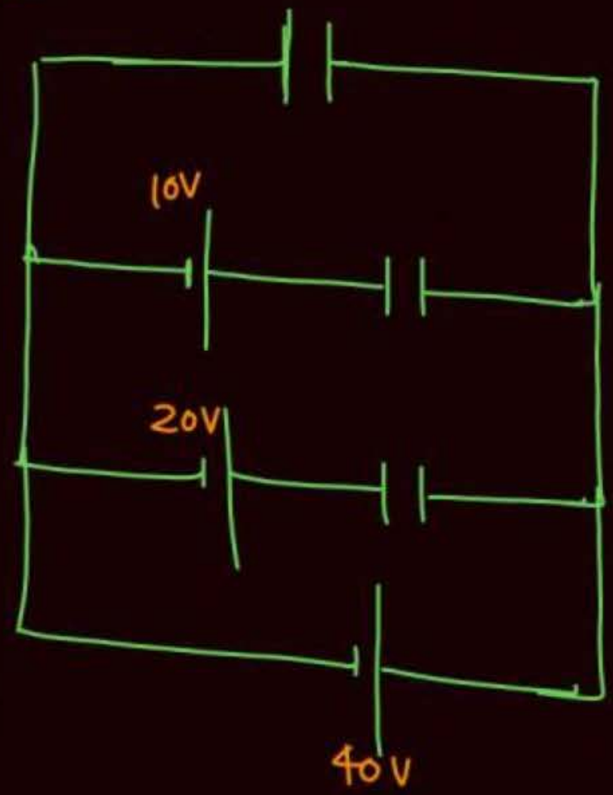
C=2F (each)

③




④

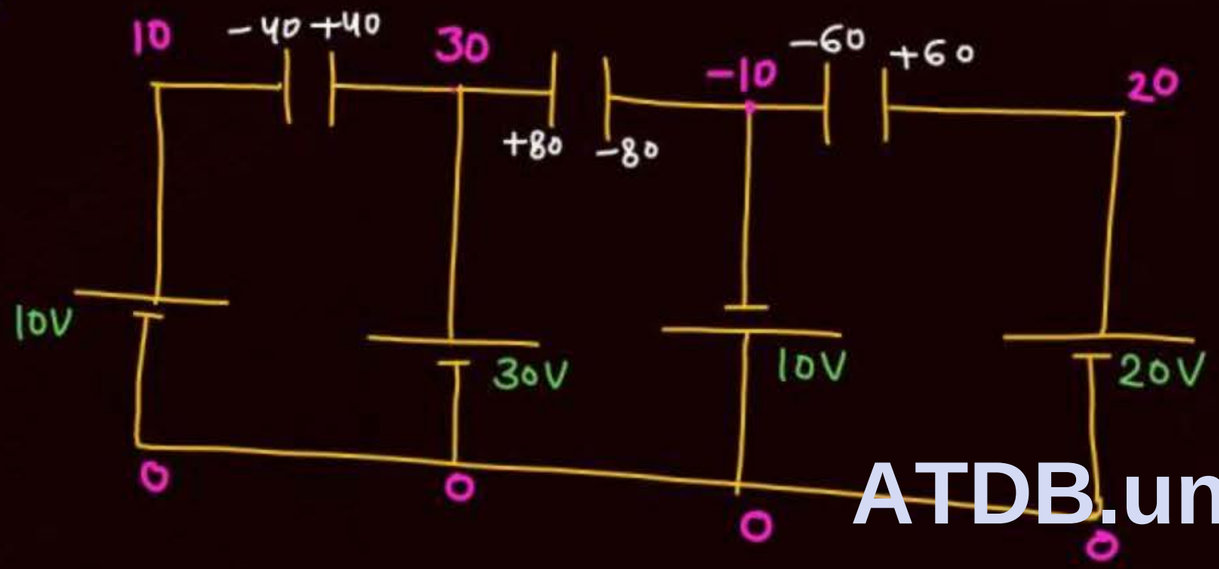
Q



C = 2F

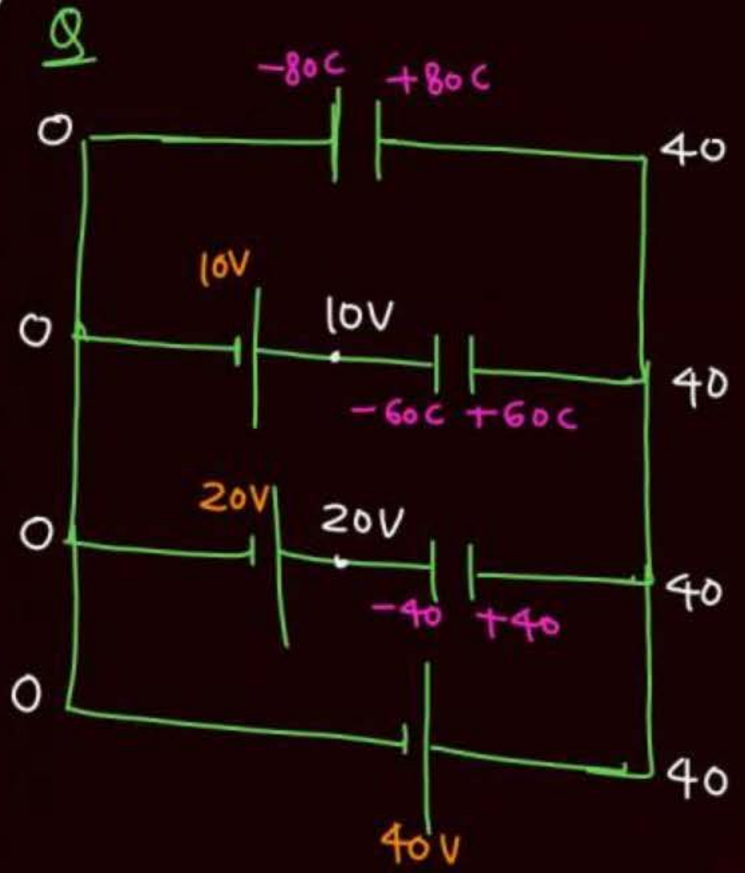
Q = CV

③

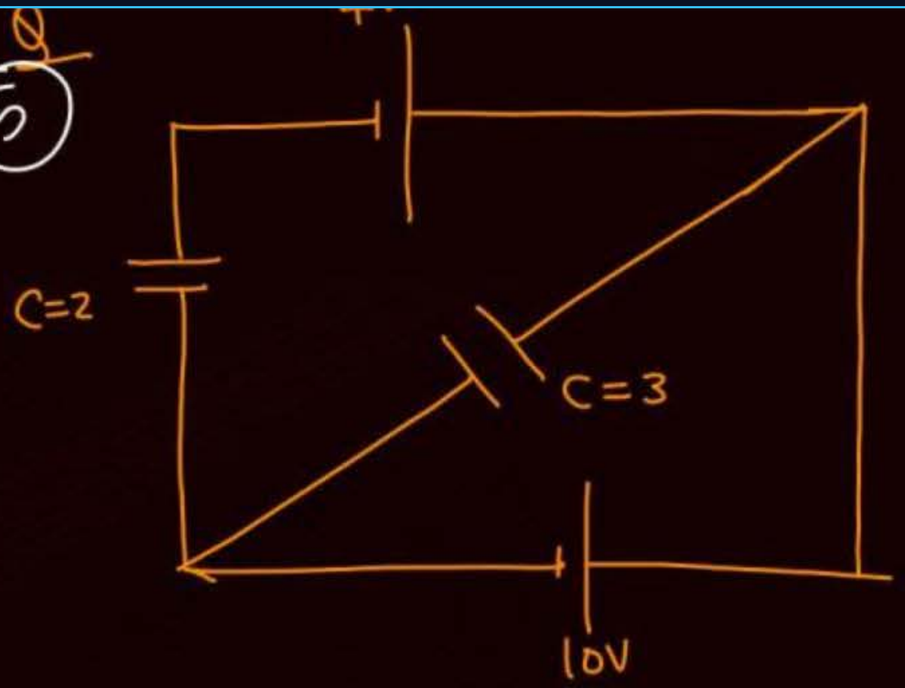



④

C = 2F (each)

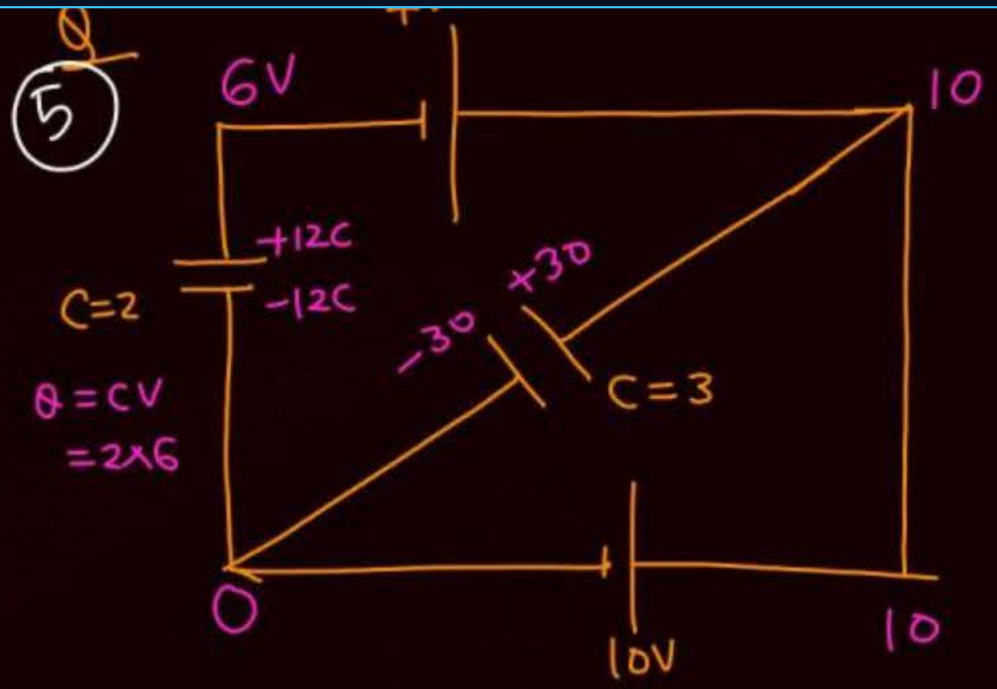


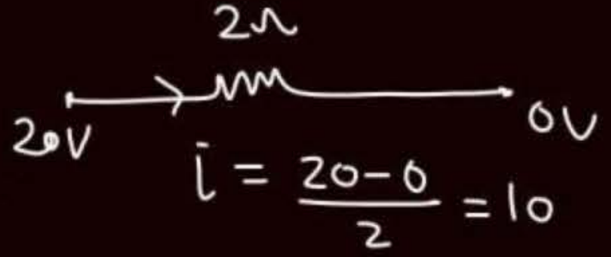
Q 5



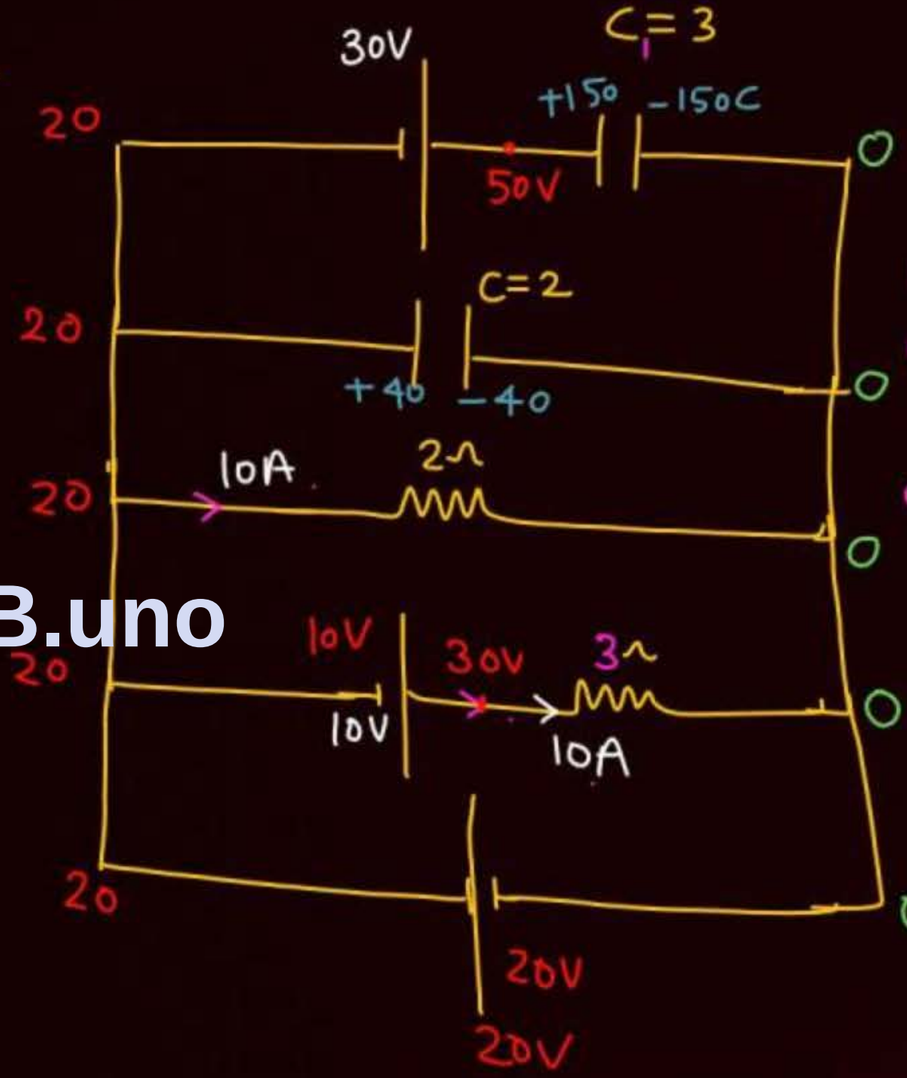

Q 6


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



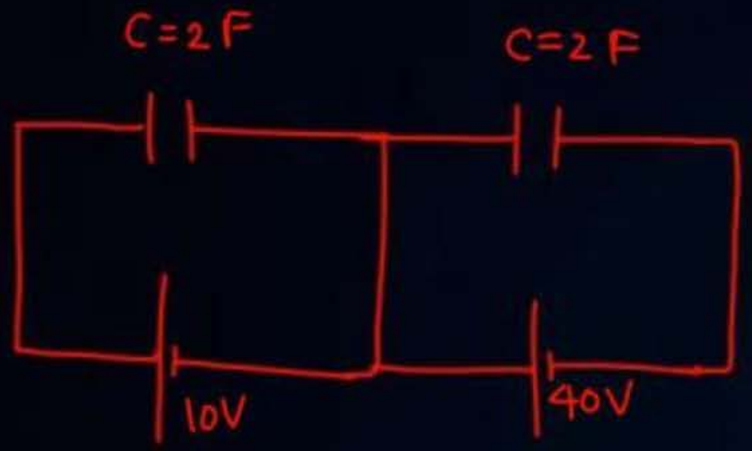





Find charge on capacitor $C_1$ & $C_2$ and current through 2Ω and 3Ω

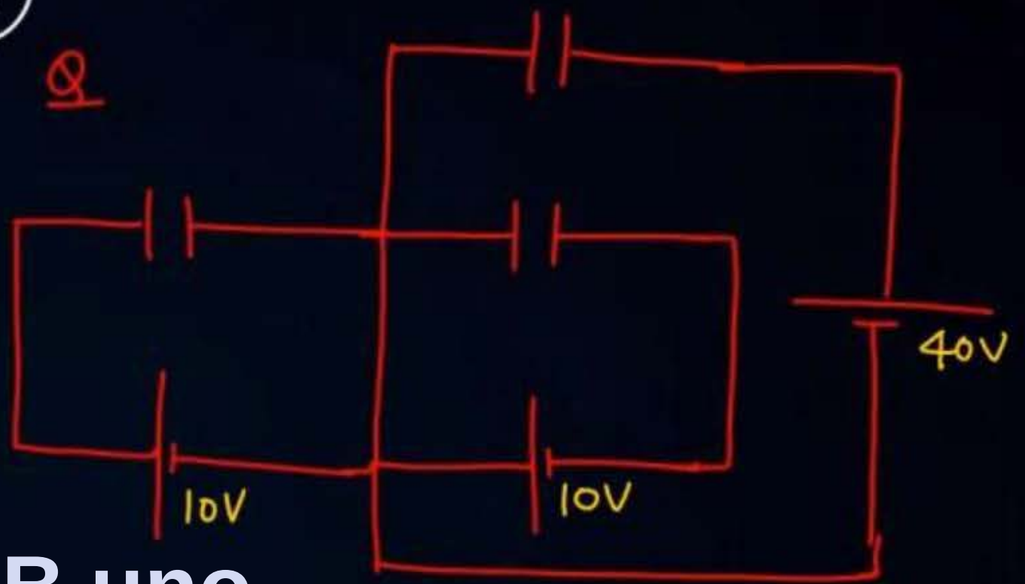
7

Q



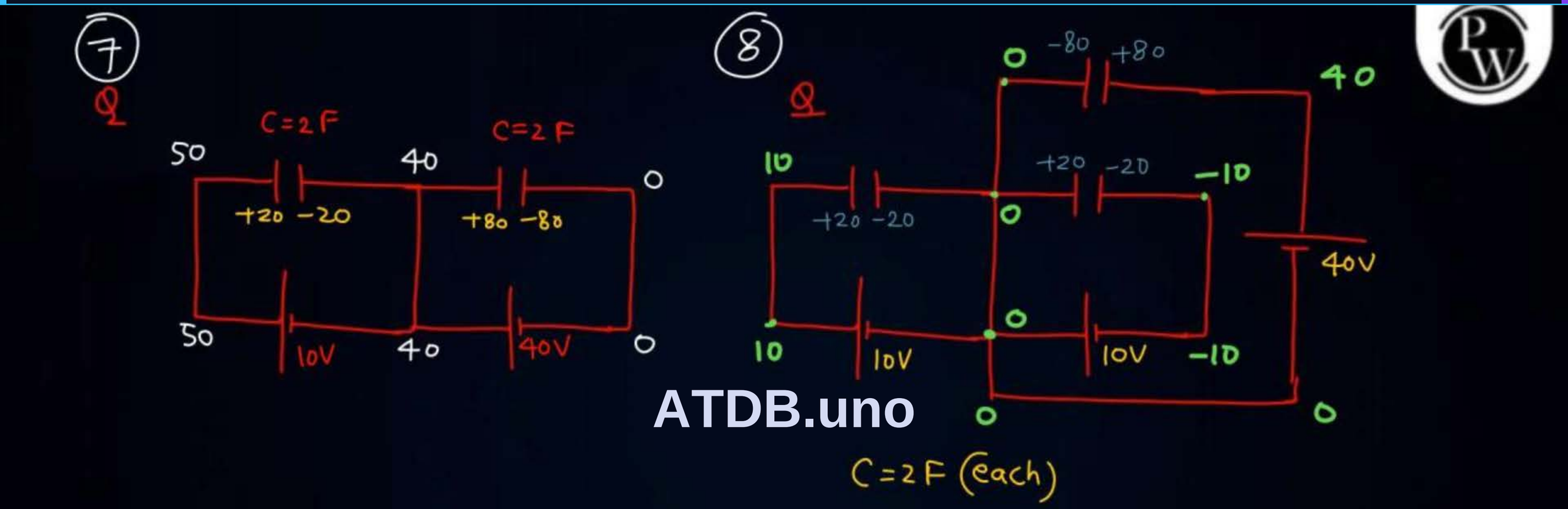

8

Q





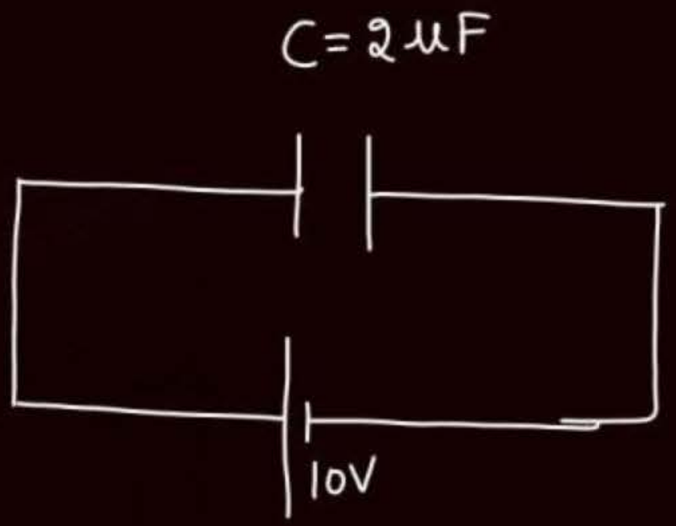

C = 2 F (each)





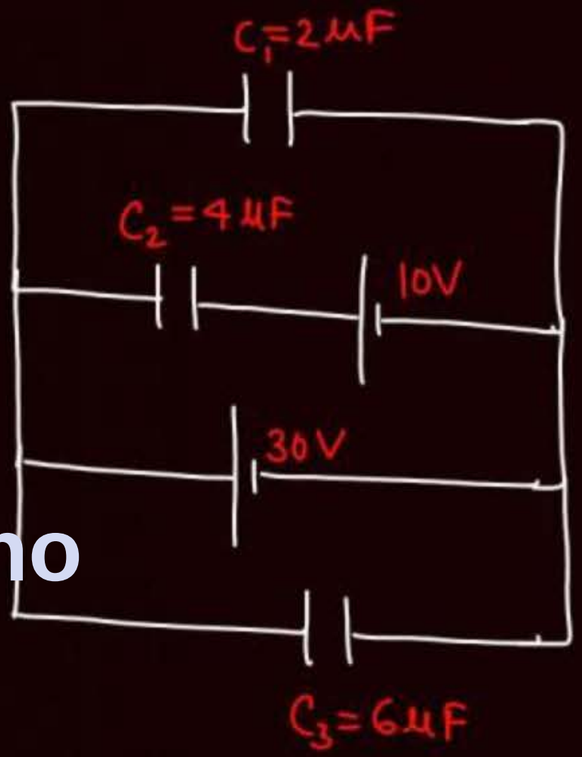

C=2 F (each)

(9)

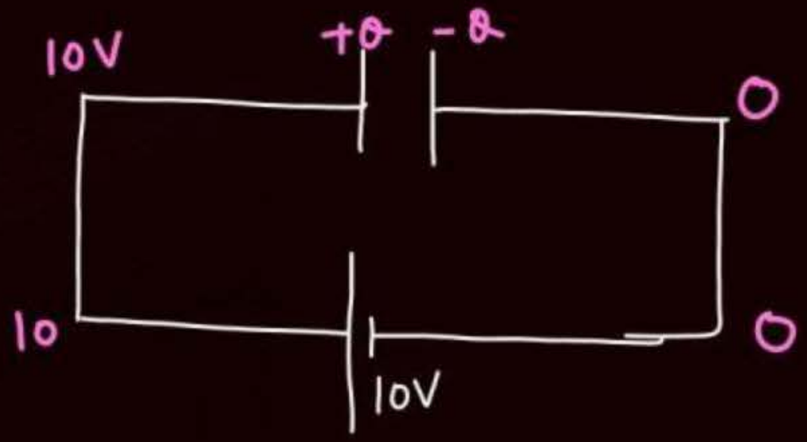



$C = 2\mu F = 2 \times 10^{-6} F$

(10)



(9)



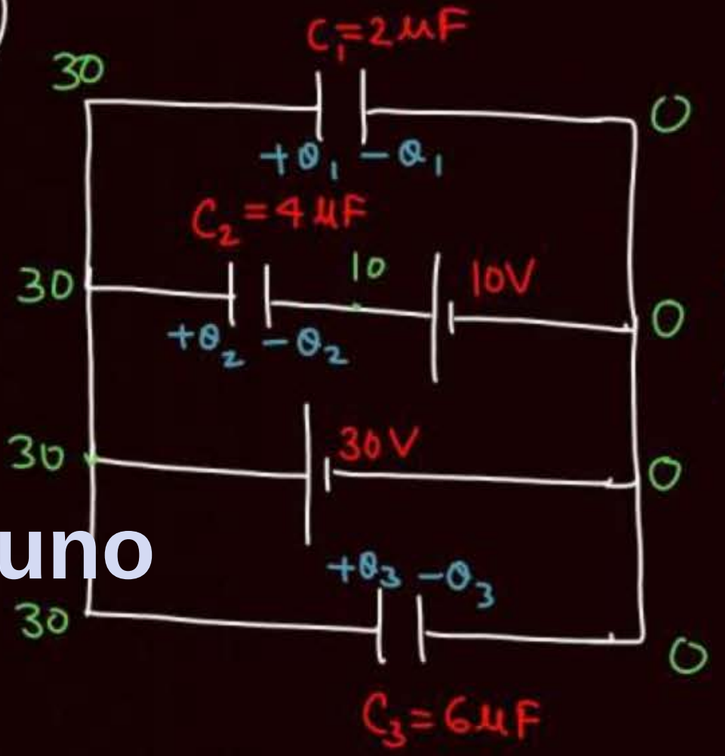

$C = 2\mu F = 2 \times 10^{-6} F$

$Q = CV = 2 \times 10^{-6} \times 10$

$= 20 \times 10^{-6}$ Coulomb

$= 20\ \mu C$

(10)

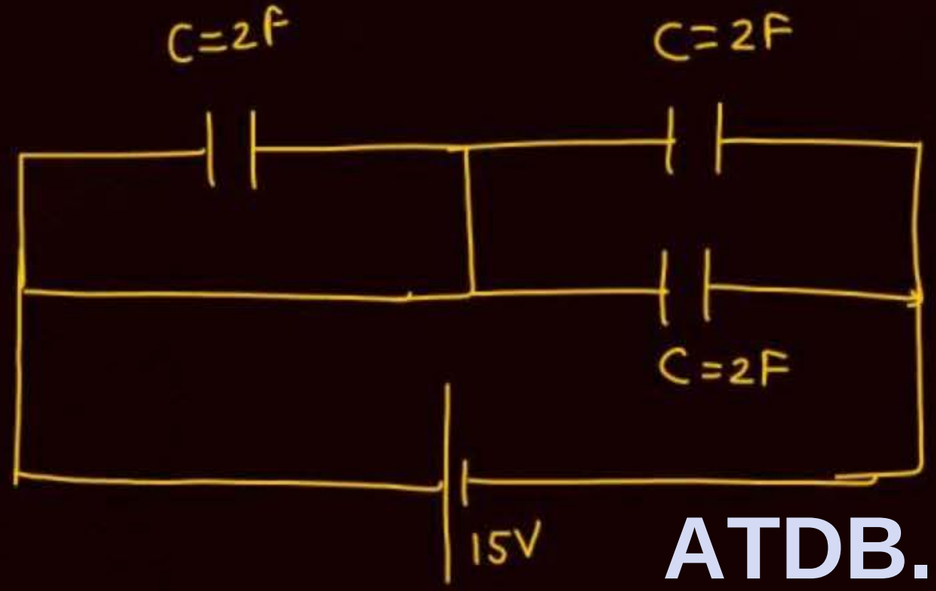


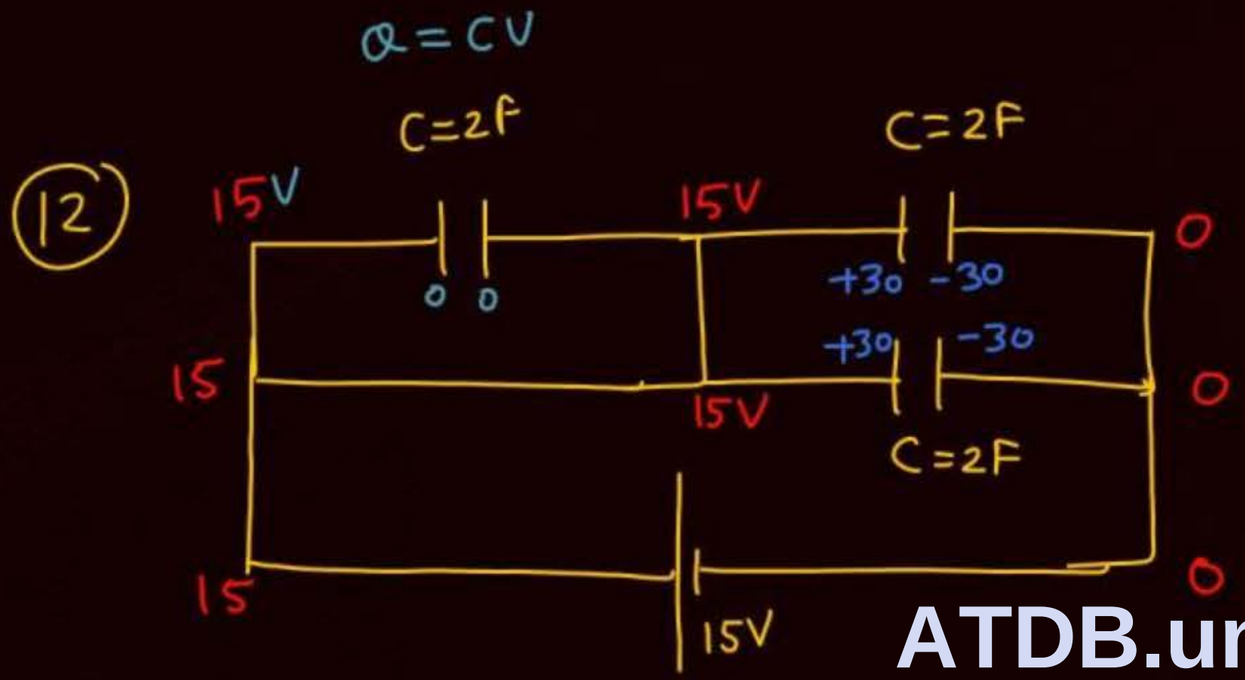

$Q_1 = 2 \times 30 = 60\ \mu C$

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

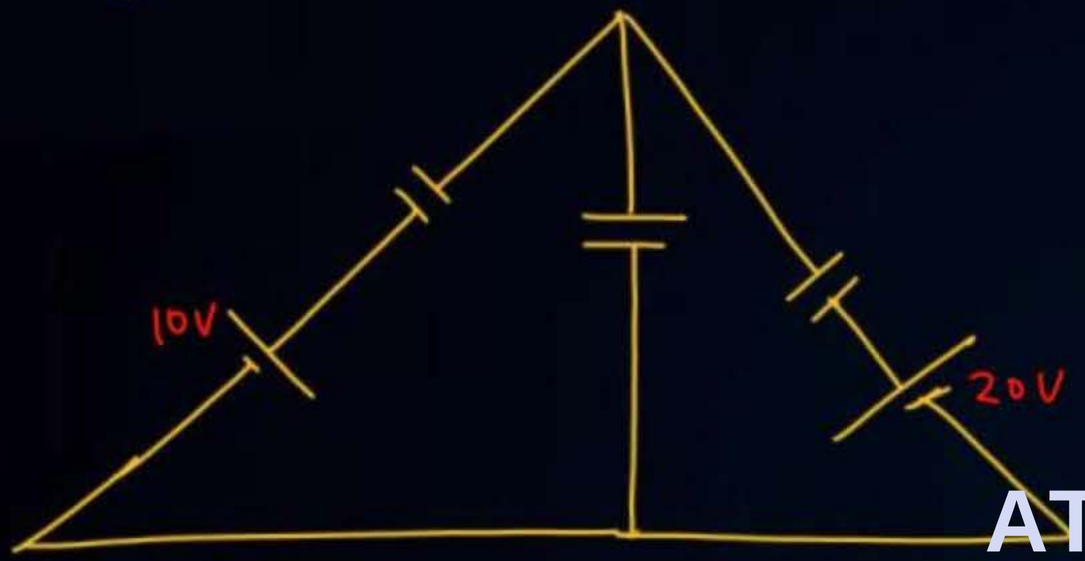
$Q_3 = 6 \times 30 = 180\ \mu C$

(12)





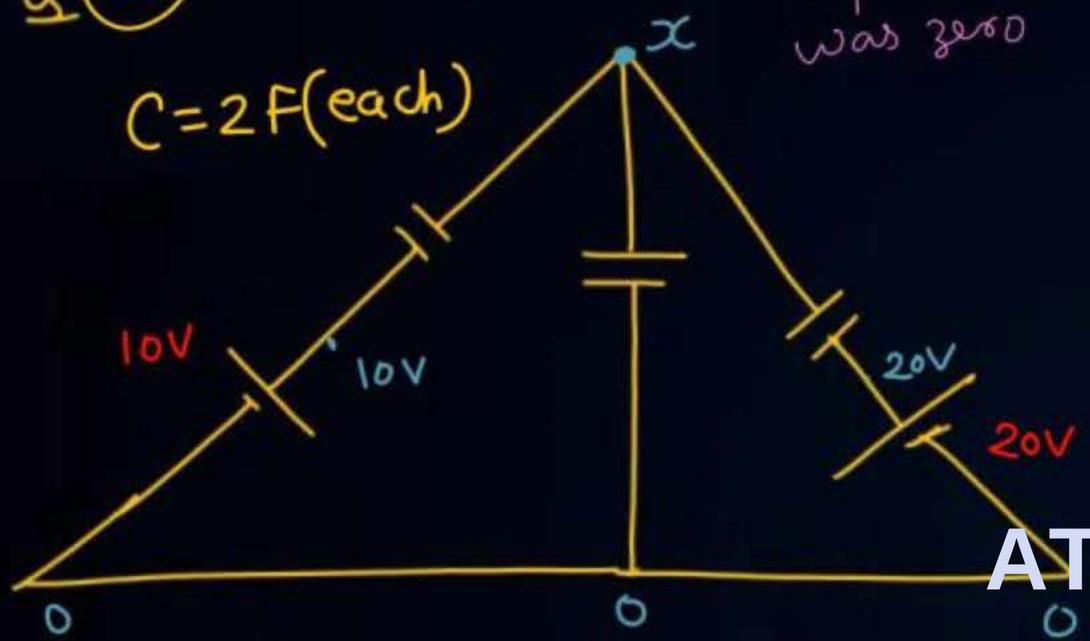
Q 13



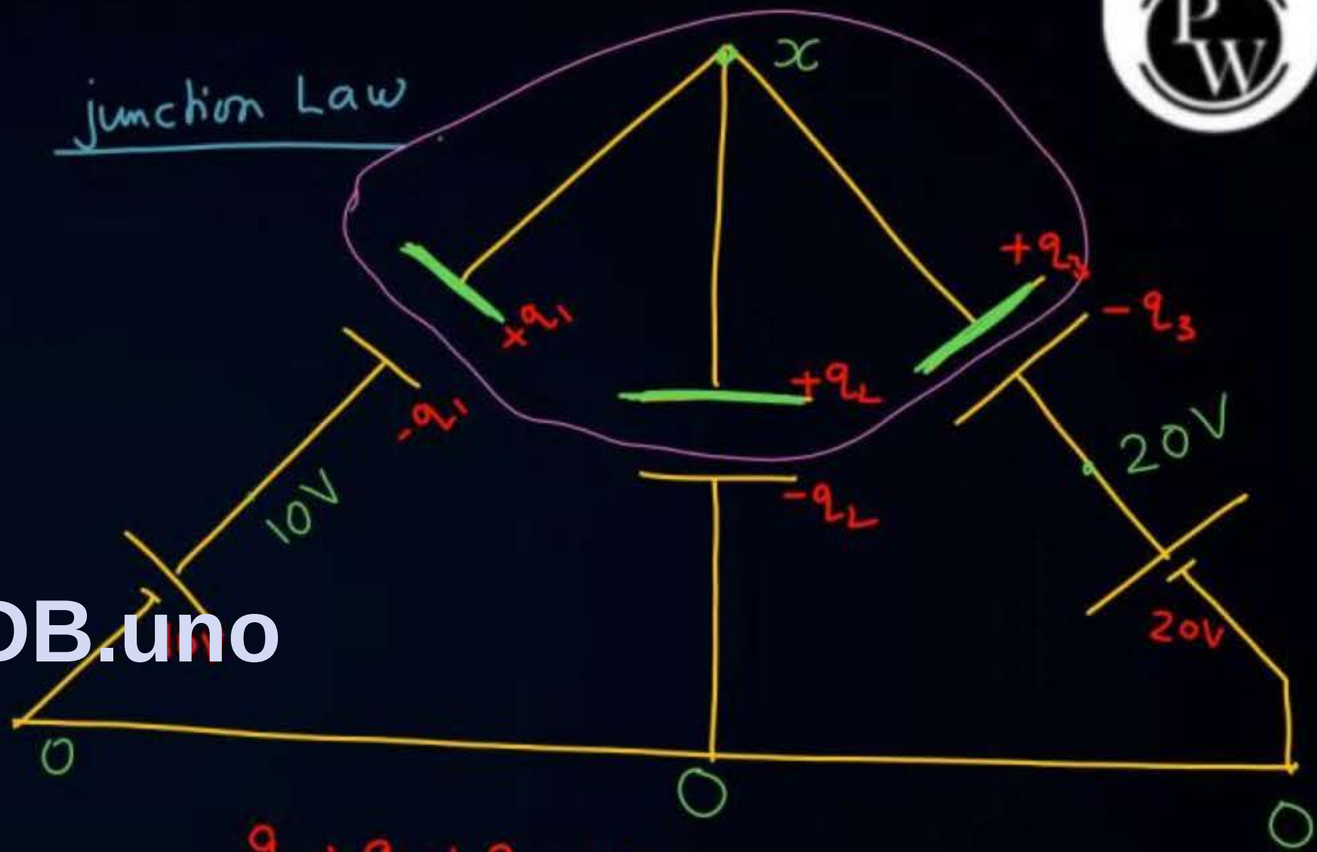
Q 13

Assume initially chage on all capacitors was zero

C = 2 F (each)




Junction Law




$q_1 = 2 \times 0 = 0$

$q_2 = 2 \times 10 = 20$

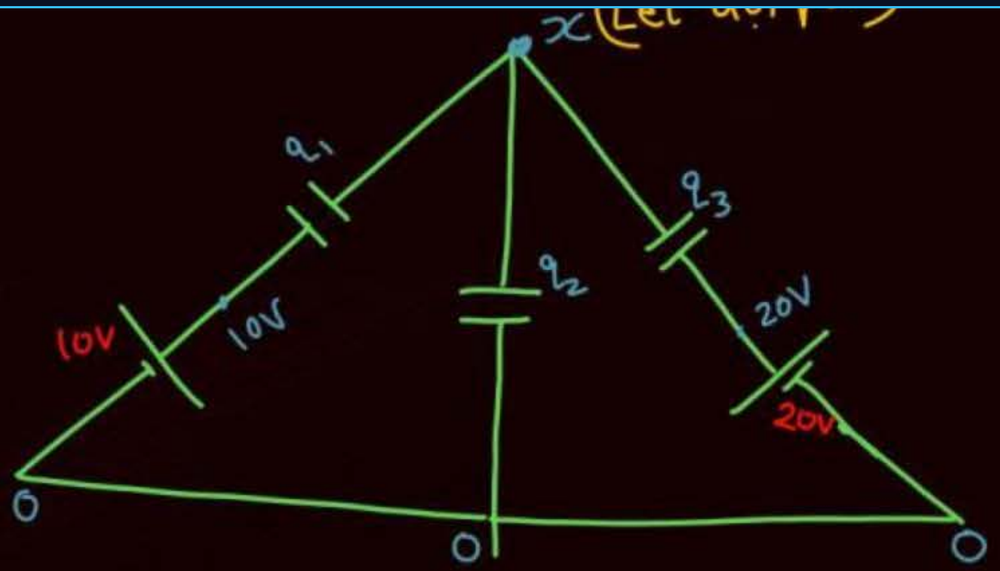
$q_3 =$

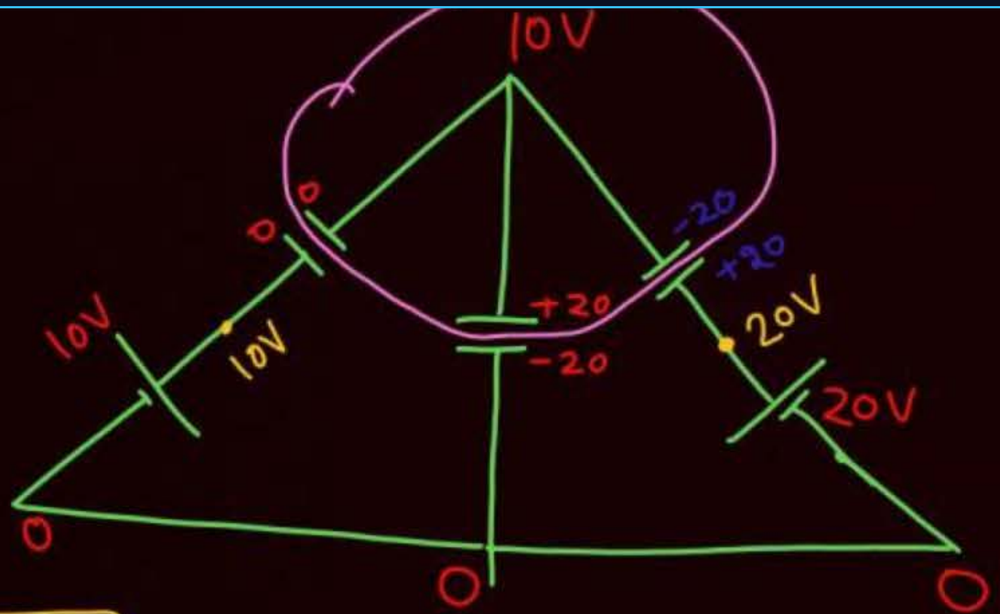
$q_1 + q_2 + q_3 = 0$

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

$6x - 20 - 40 = 0$

$x = 10$




$C = 2\ F\ (each)$

$q = CV + C$



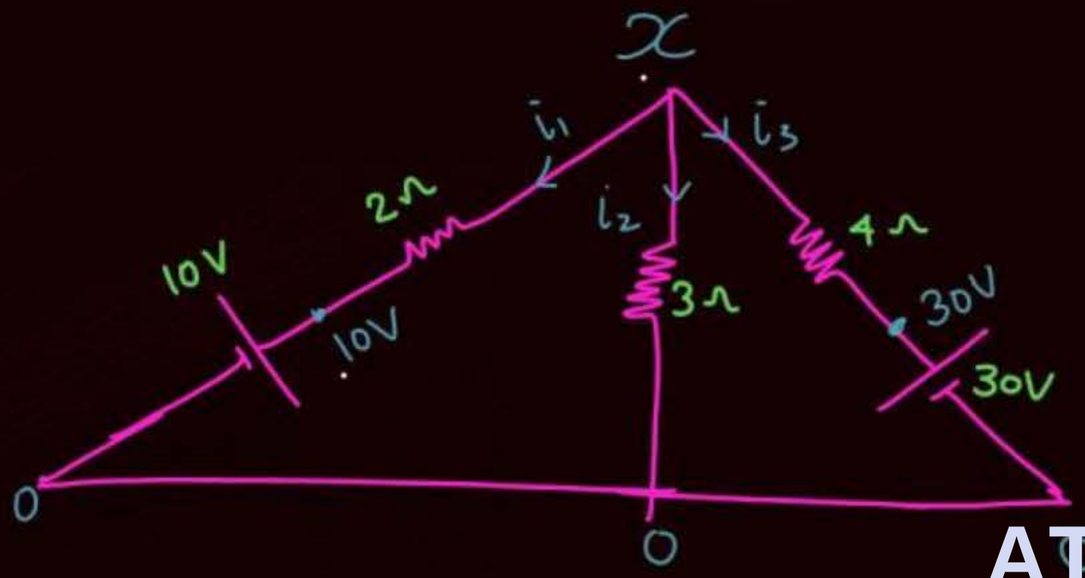
$$q_1 + q_2 + q_3 = 0$$

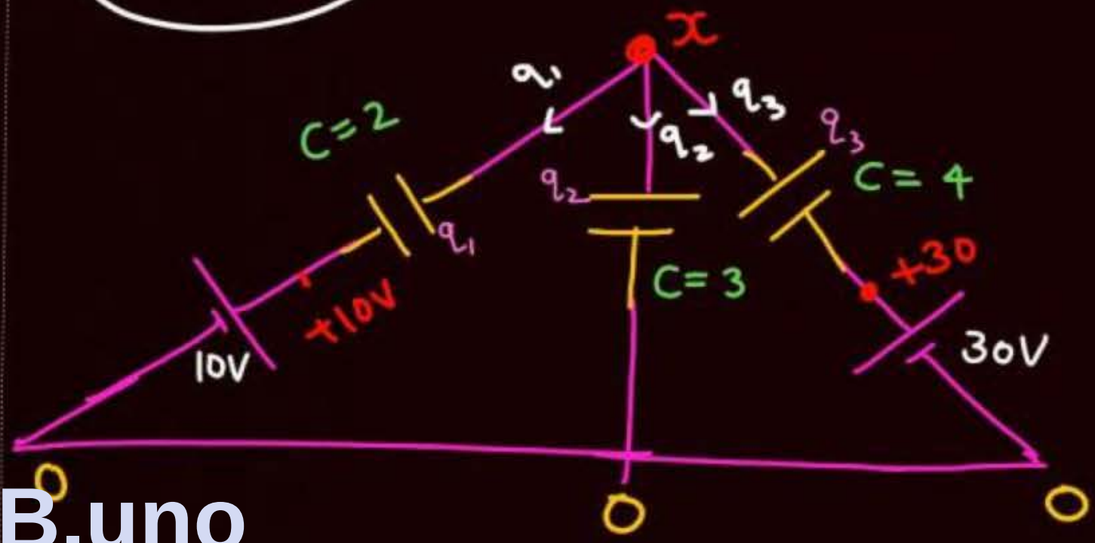
$$(x-10) \times 2 + (x-0) \times 2 + (x-20) \times 2 = 0$$

$$6x = 60$$

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

$q = VC$






$$i_1 + i_2 + i_3 = 0$$

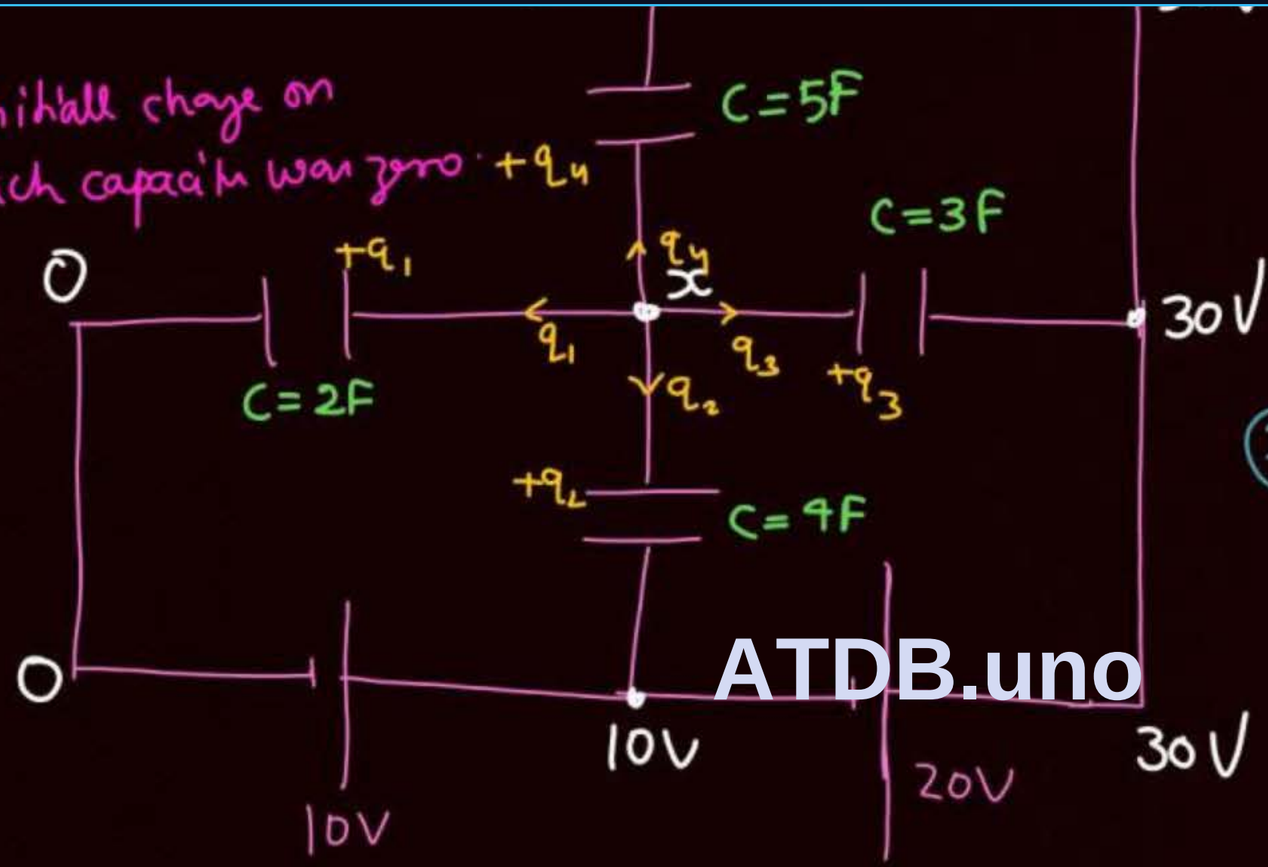
$$\frac{x-10}{2} + \frac{x-0}{3} + \frac{x-30}{4} = 0$$

$$q_1 + q_2 + q_3 = 0$$

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

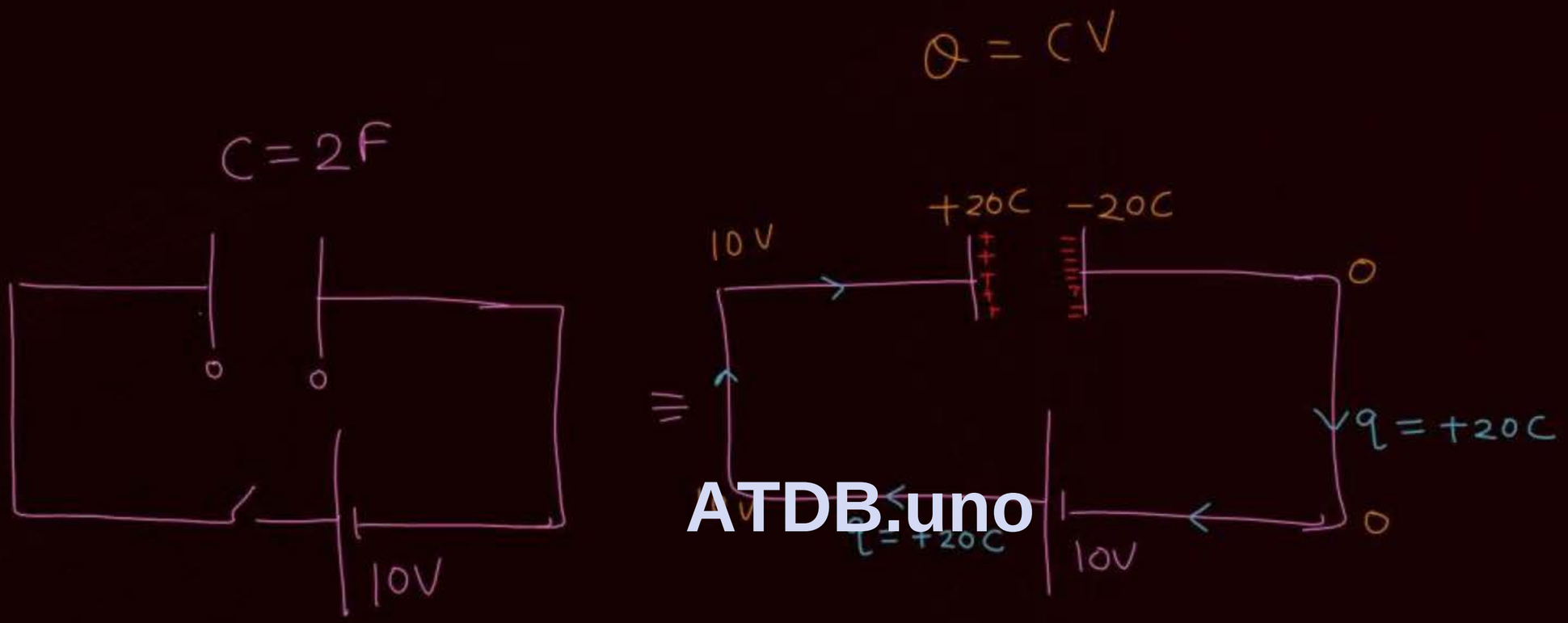
Q

Initial chaye on each capacitor was zero



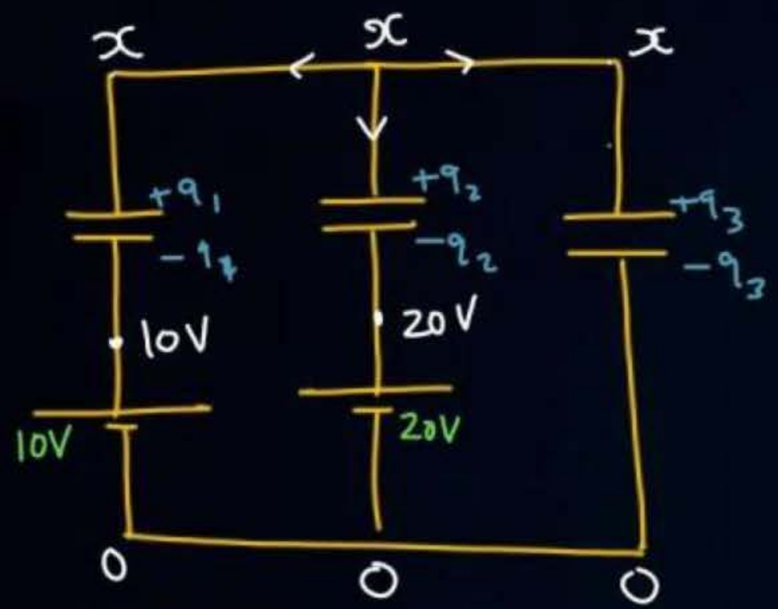

$$q_1 + q_2 + q_3 + q_4 = 0$$

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



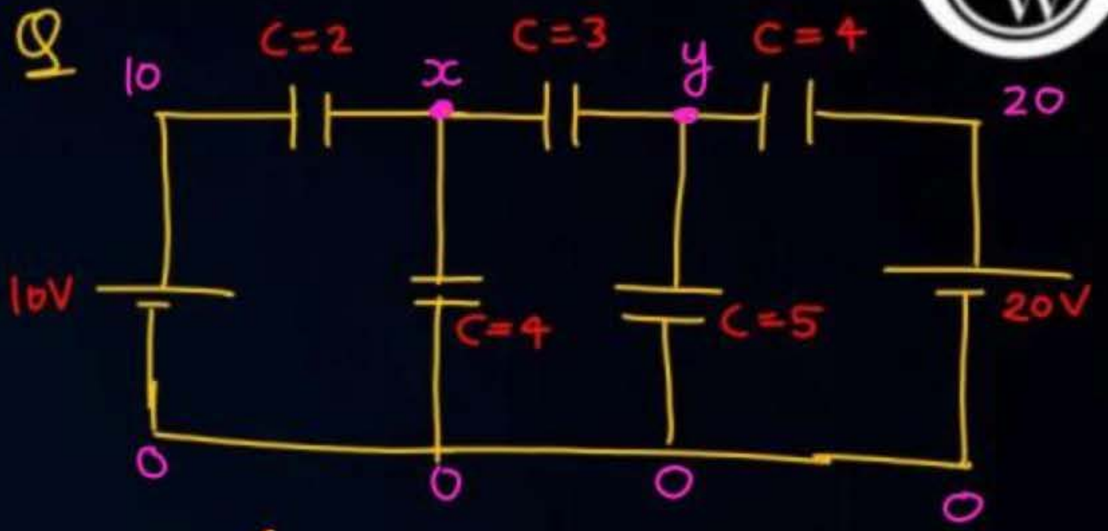
Q 14

$C = 2F$ (each)




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

Q 15

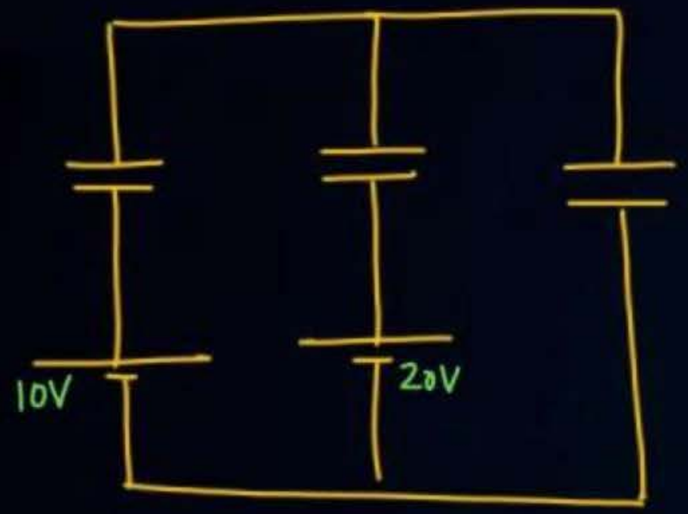



$$(x-10)2 + (x-0)4 + (x-y)\times 3 = 0$$

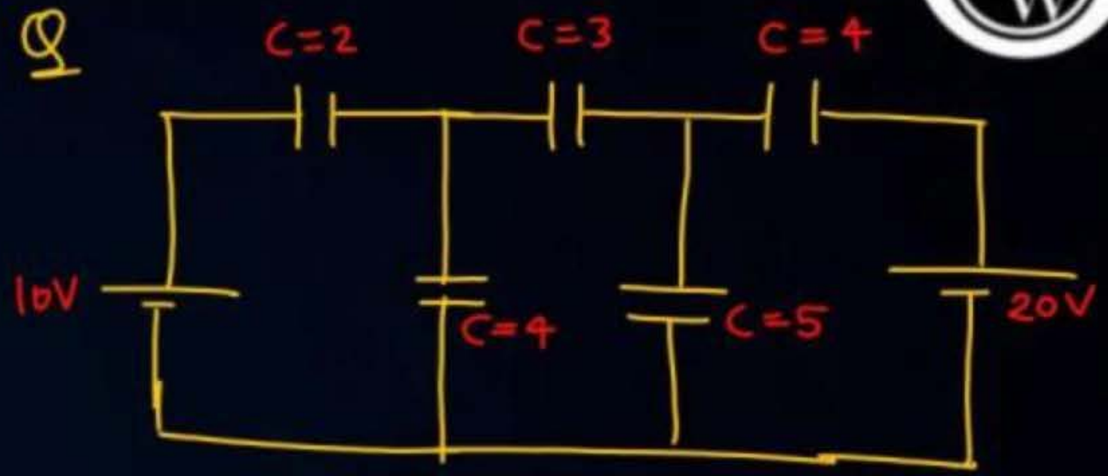
$$(y-x)\times 3 + (y-0)\times 5 + (y-20)\times 4 = 0$$

Q 14

C = 2F (each)




Q 15

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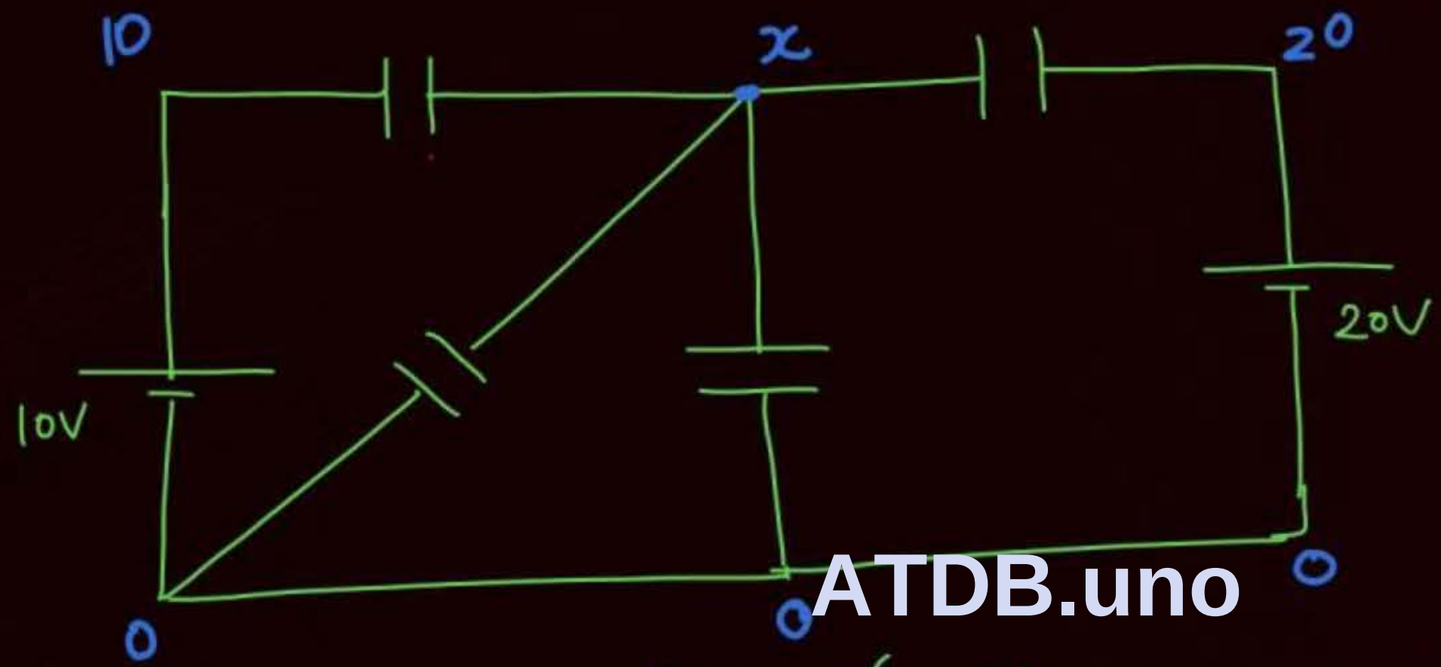
(16)

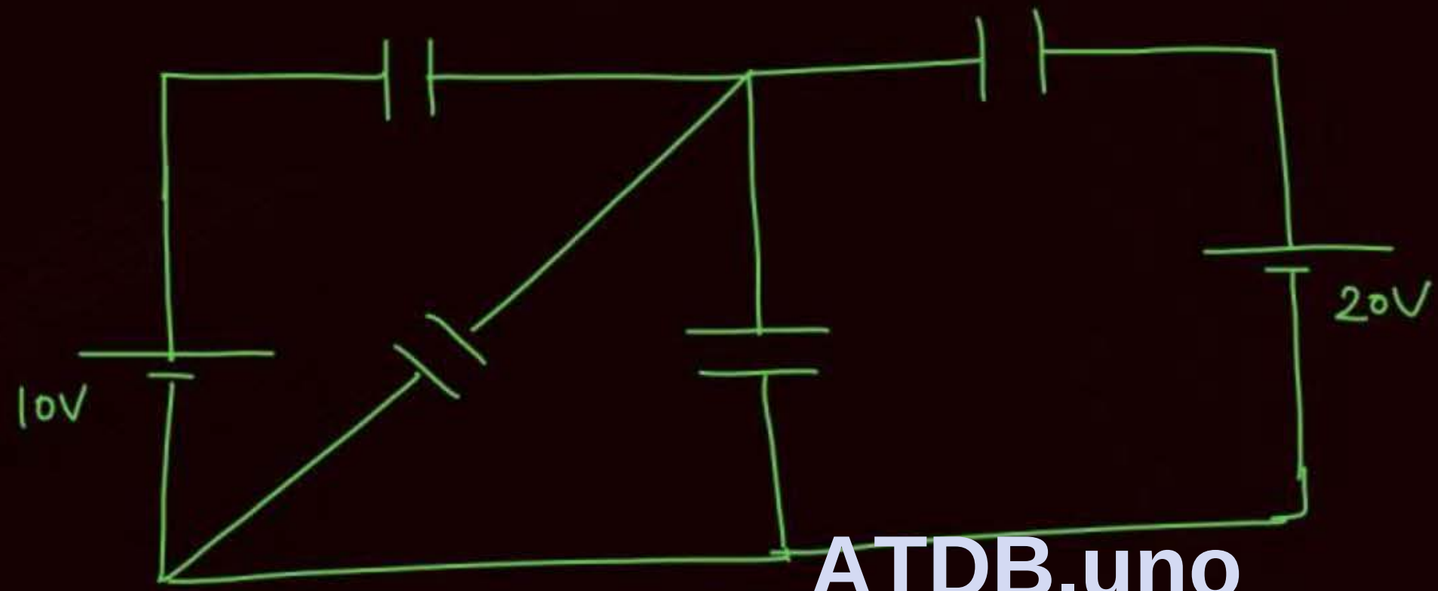





$C = 2\ \mu F$ (each)

$$(x-10)2 + (x-0)\times 2 + (x-0)\times 2 + (5 \quad 20)\times 2 = 0$$

16






$C = 2\ \mu F$ (each)

# Home work

- P40 (CE) module