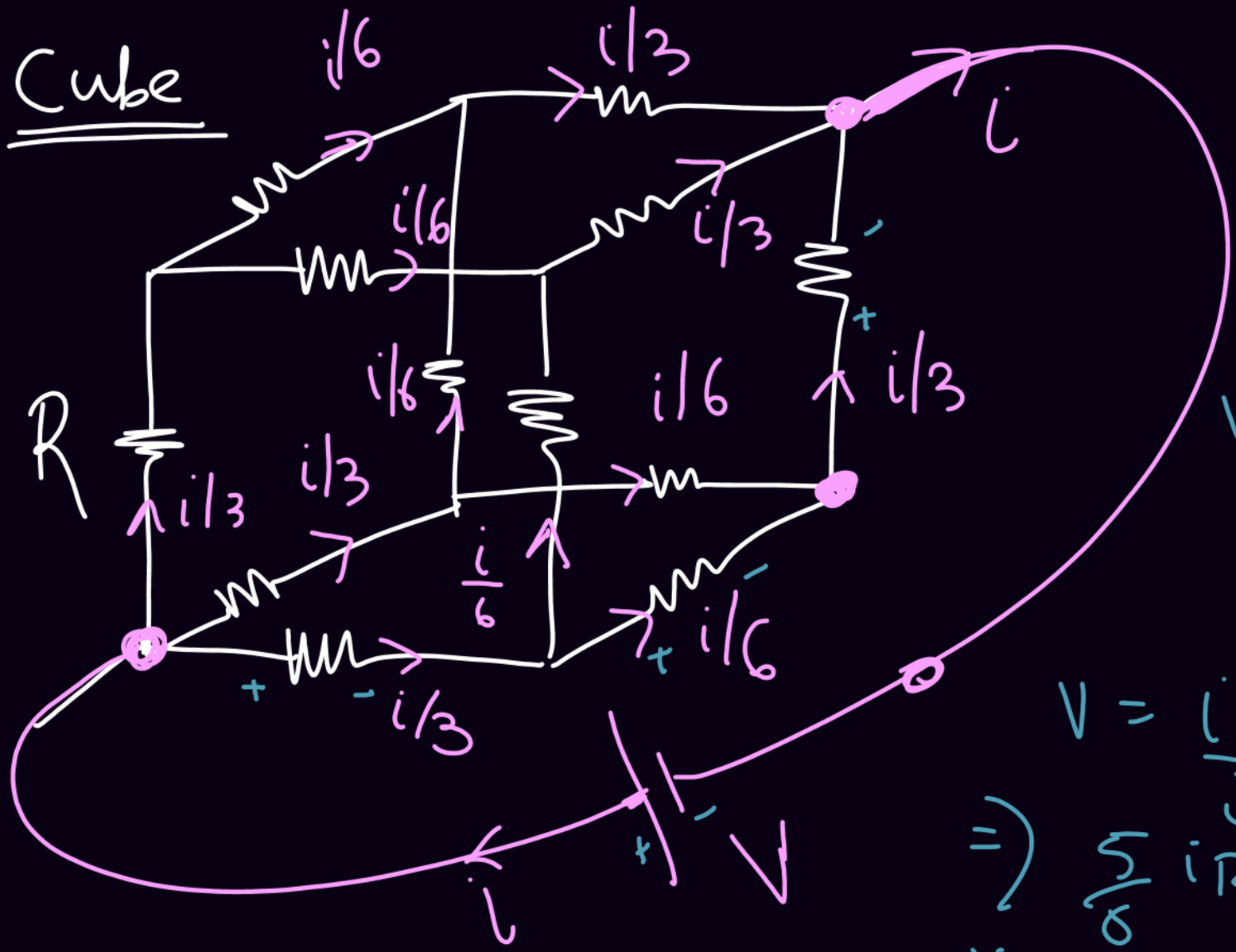
Electric Potential
&
Capacitanace
By Rohit Gupta

Today's Goal
Grouping of Capacitors
&
Resistors

Cube



$$R_{eq} = \frac{V}{i}$$

$$V - \frac{i}{3}R - \frac{i}{6}R$$

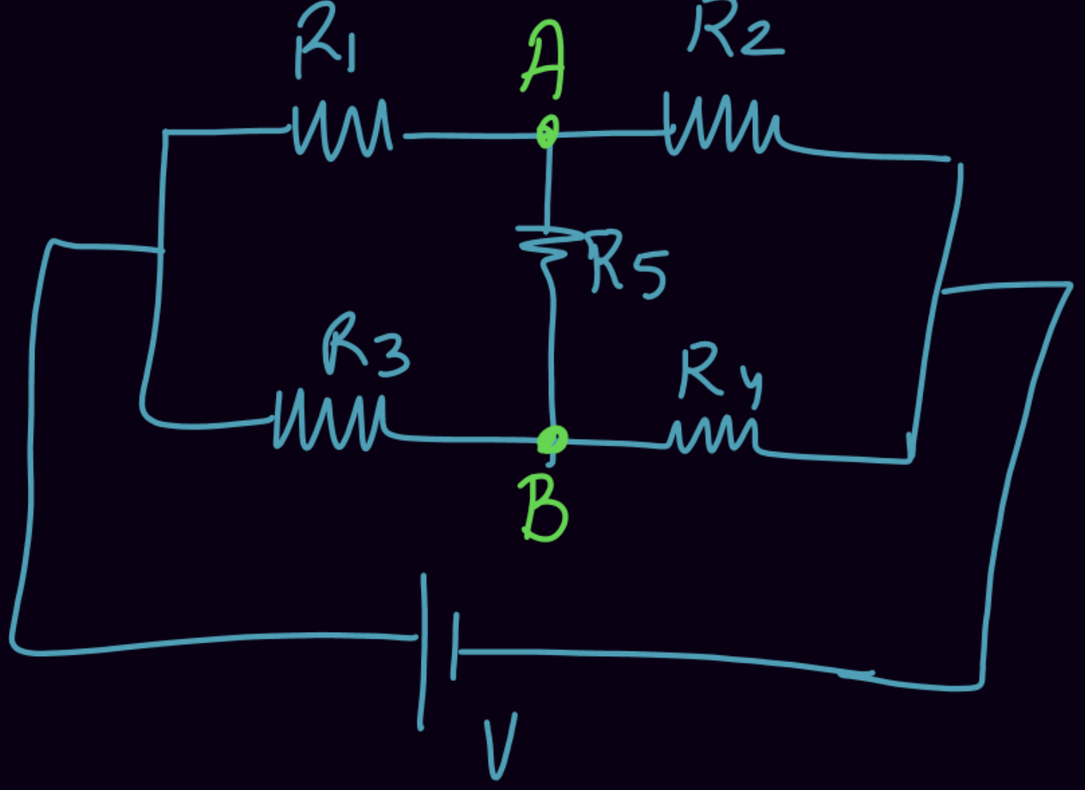
$$-\frac{i}{3}R = 0$$

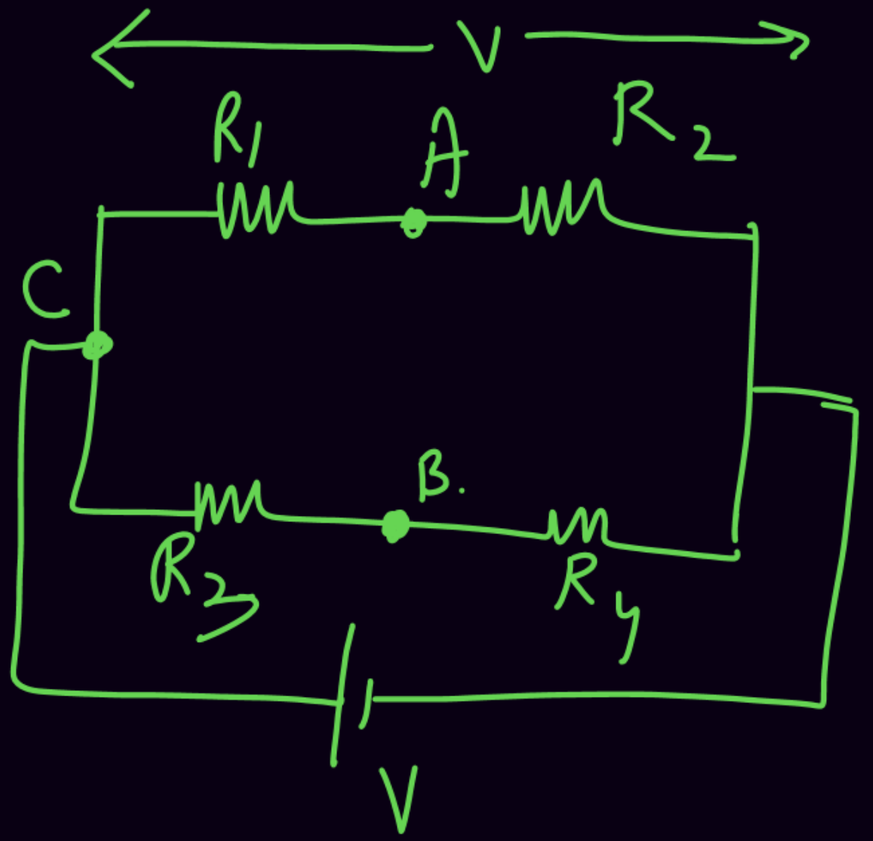
$$V = \frac{iR}{3}\left(1 + \frac{1}{2} + 1\right)$$

$$\Rightarrow \frac{5}{6}iR = V$$

$$\frac{V}{i} = \frac{5R}{6} = \frac{10R}{12}$$

Wheatstone bridge





$$V_C - V_A = \frac{R_1 V}{R_1 + R_2}$$

$$V_C - V_B = \frac{R_3 V}{R_3 + R_4}$$

If $V_A = V_B$ then

$$V_C - V_A = V_C - V_B$$

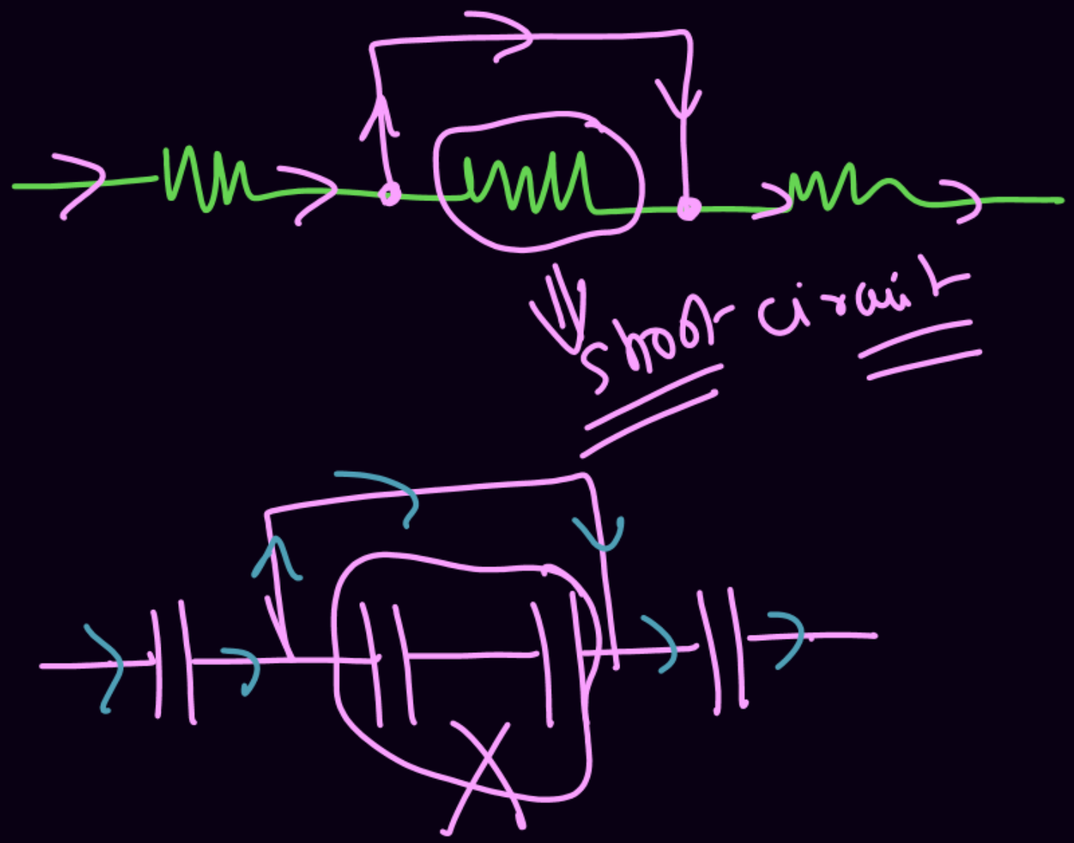
$$\frac{R_1 \cancel{V}}{R_1 + R_2} = \frac{R_3 \cancel{V}}{R_3 + R_4}$$

$$\frac{R_1 + R_2}{R_1} = \frac{R_3 + R_4}{R_3}$$

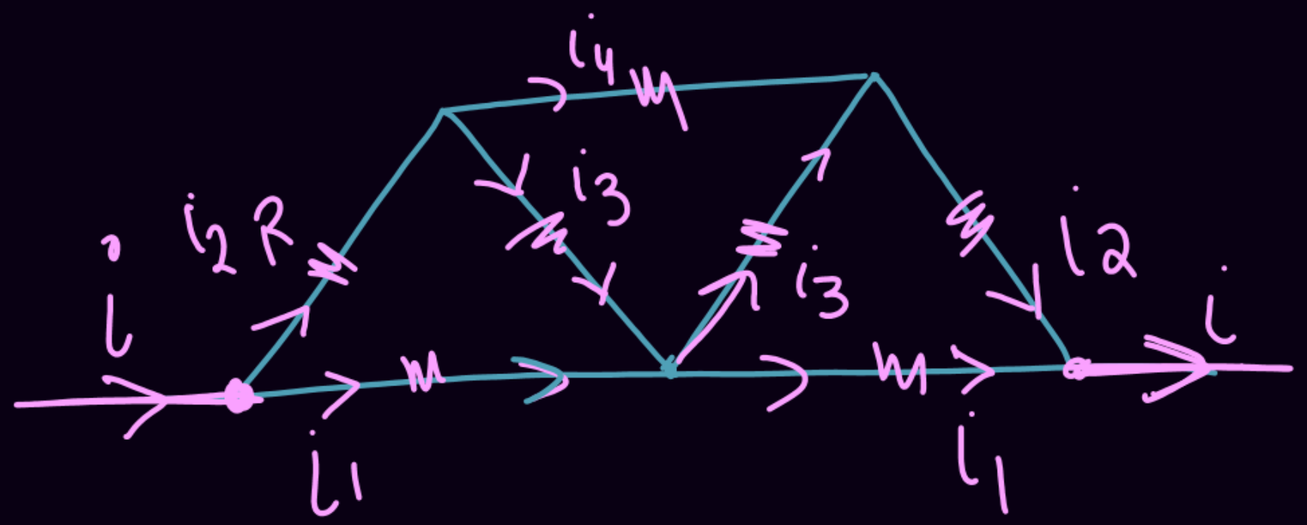
$$\cancel{1} + \frac{R_2}{R_1} = \cancel{1} + \frac{R_4}{R_3}$$

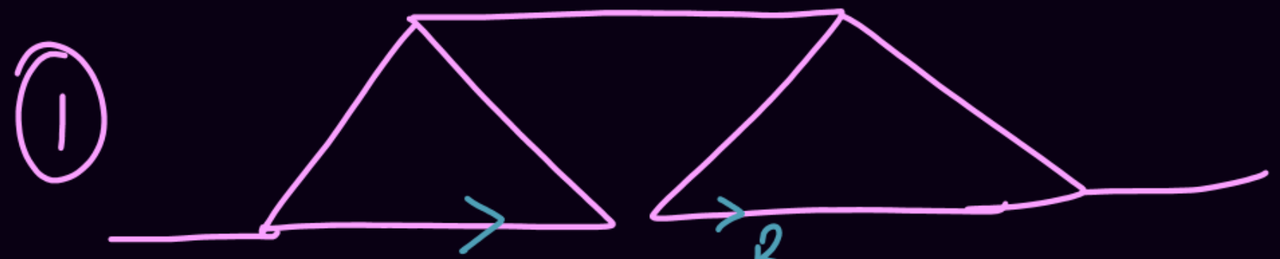
$$\boxed{\frac{R_1}{R_2} = \frac{R_3}{R_4}}$$

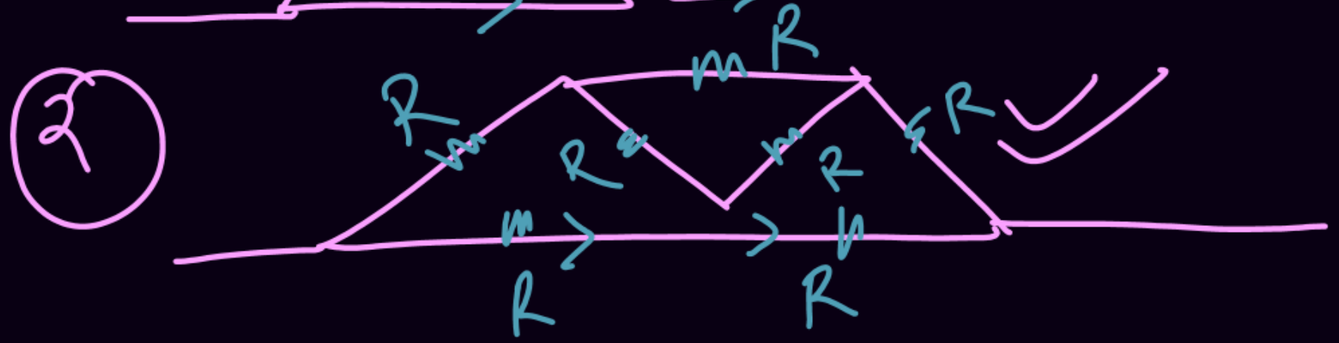
Short circuit



* Junction open





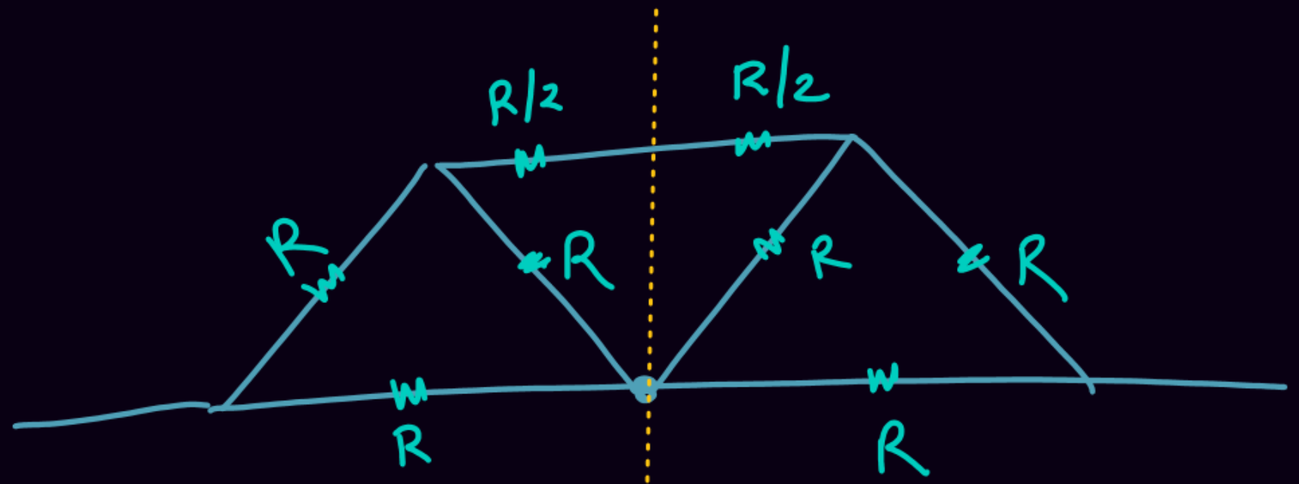


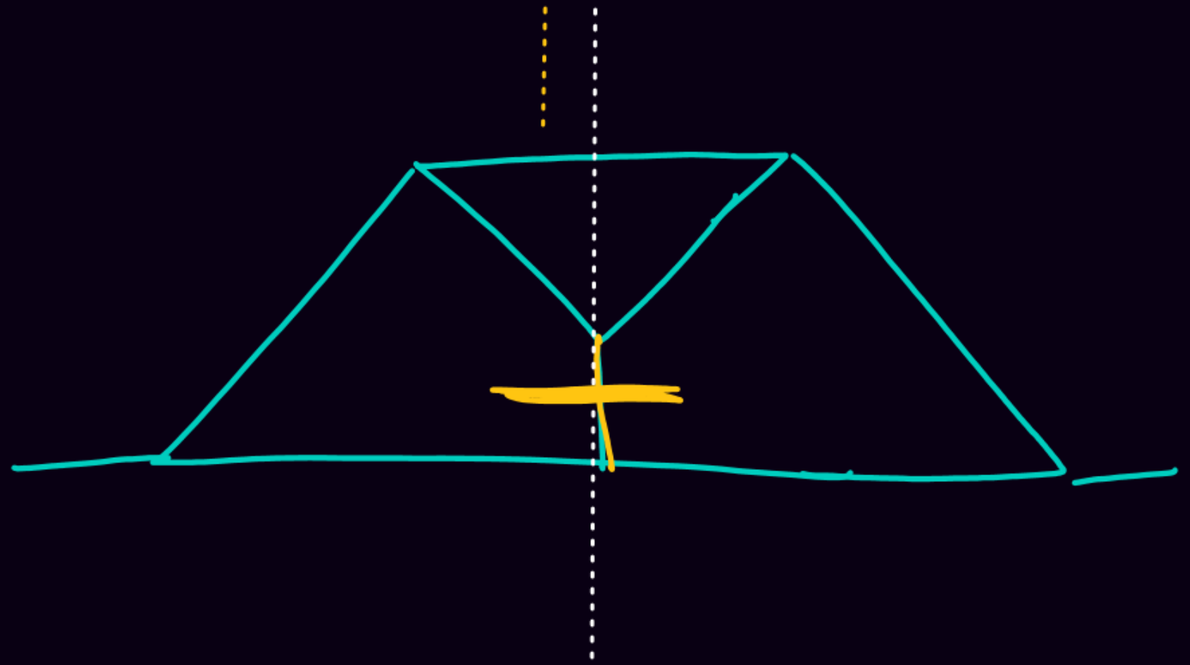
$$\left(\frac{2R}{3}+2R\right)\|2R.$$

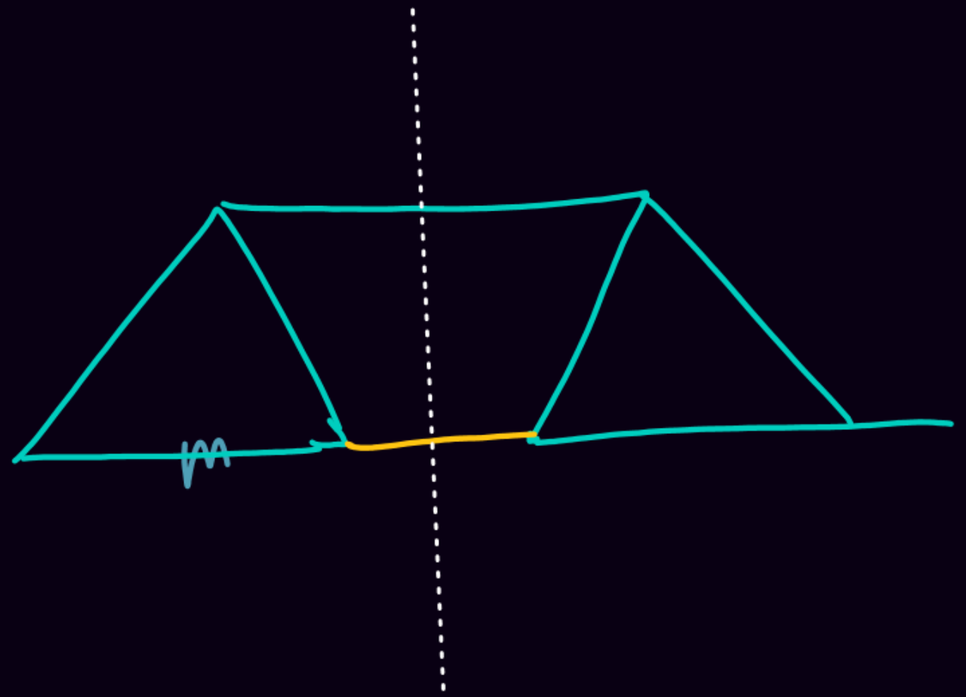
$$\frac{8R}{3}\|2R$$

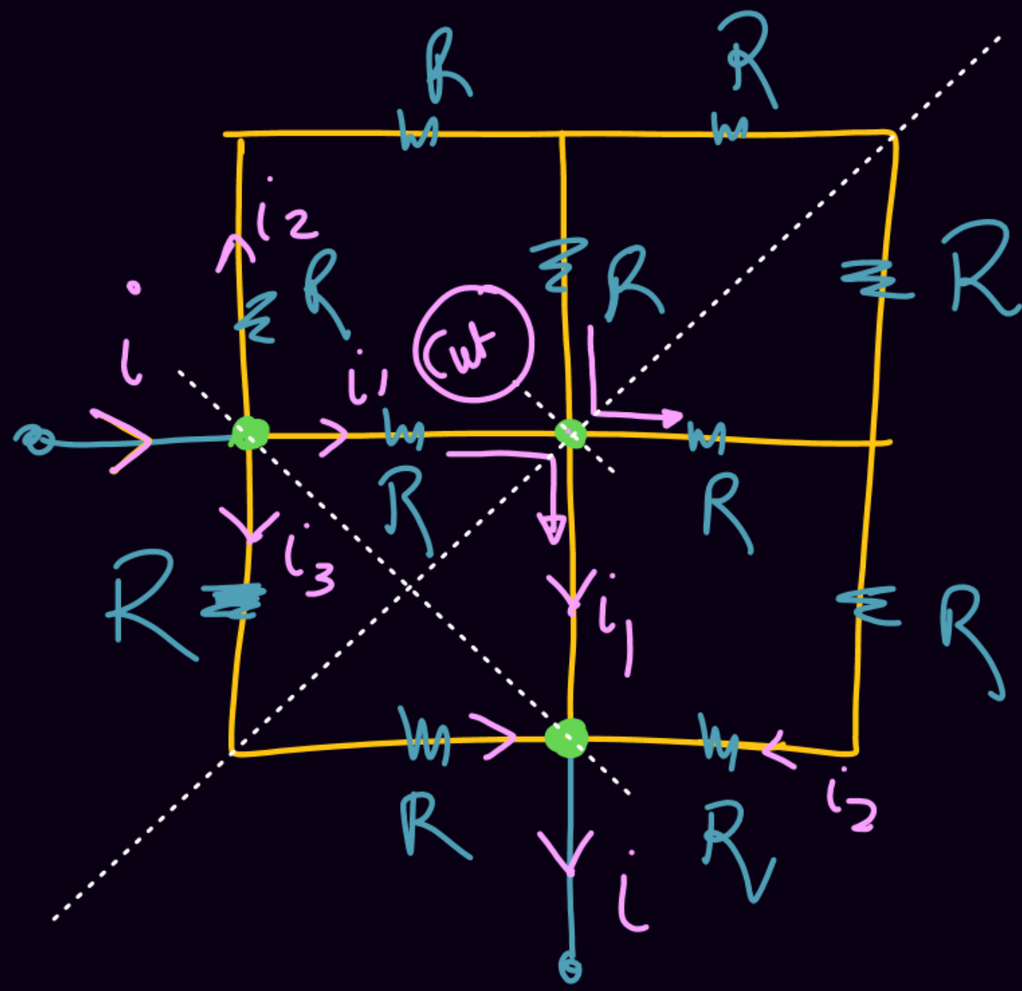
$$\frac{\frac{8R}{3}\times 2R}{\frac{8R}{3}+2R}$$

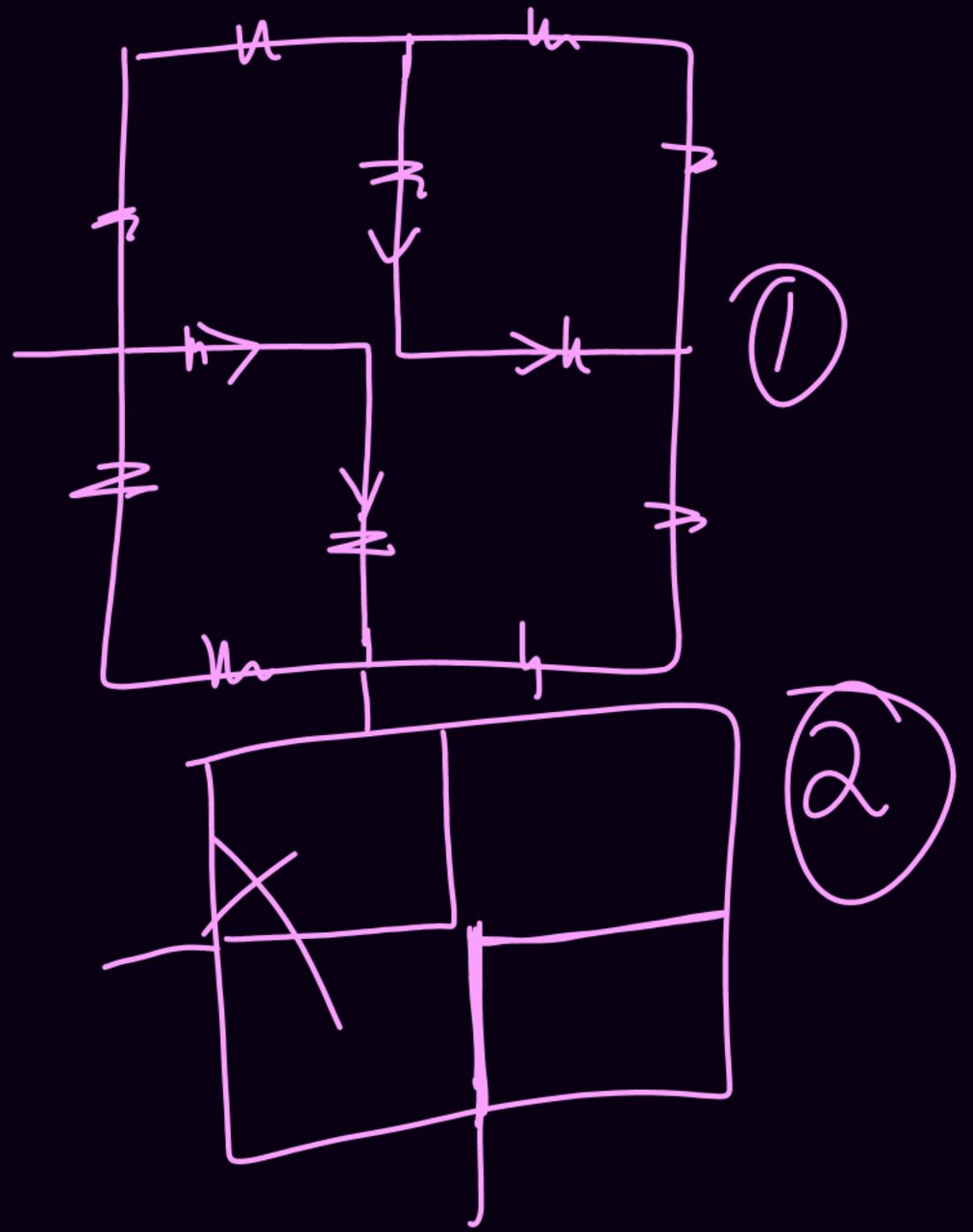
$$\Rightarrow \frac{16}{14}R = \frac{8R}{7}$$

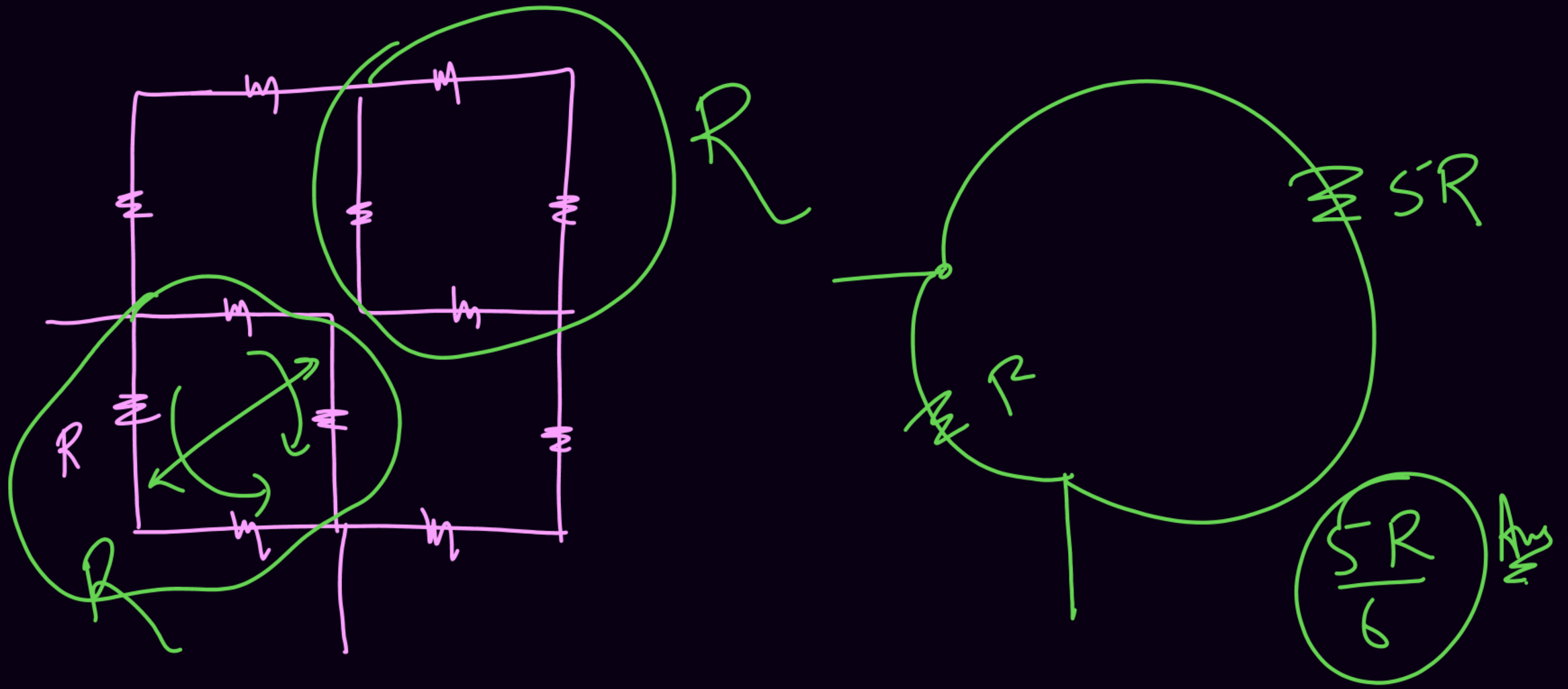

R/2
R/2
R
R
R
R
R
R

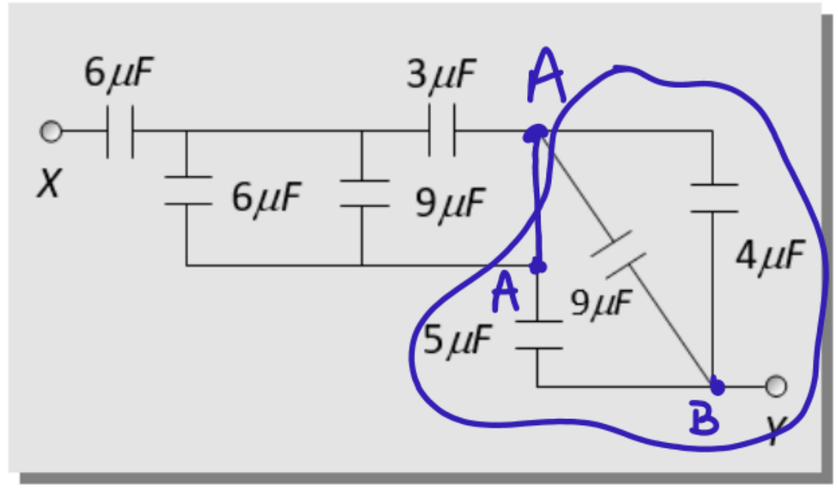





R
R
R
R
R
R
R
R
R
R
R
i
i1
i2
i3
i1
i2
i


①
②


R
R
R
5R
R
5R/6
Ans

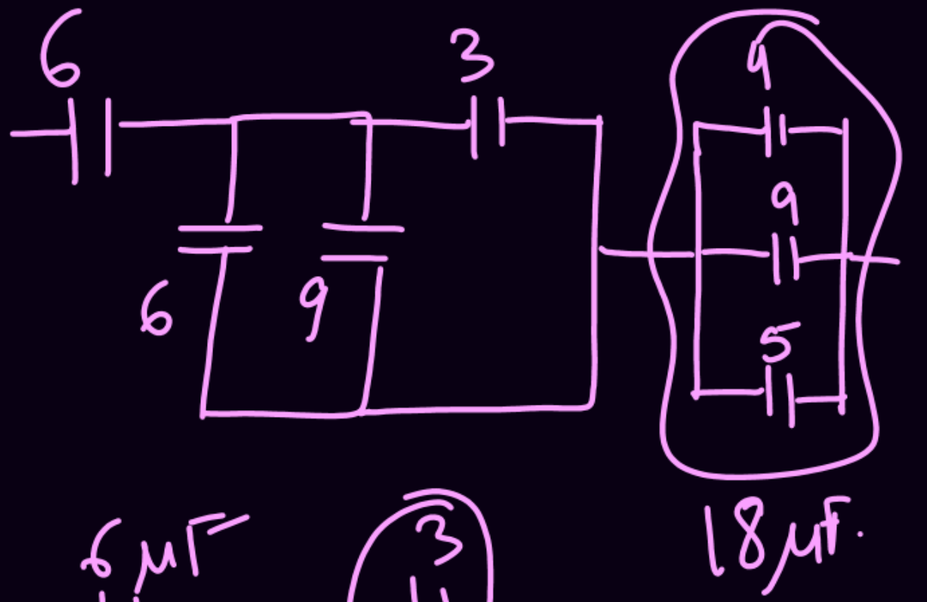


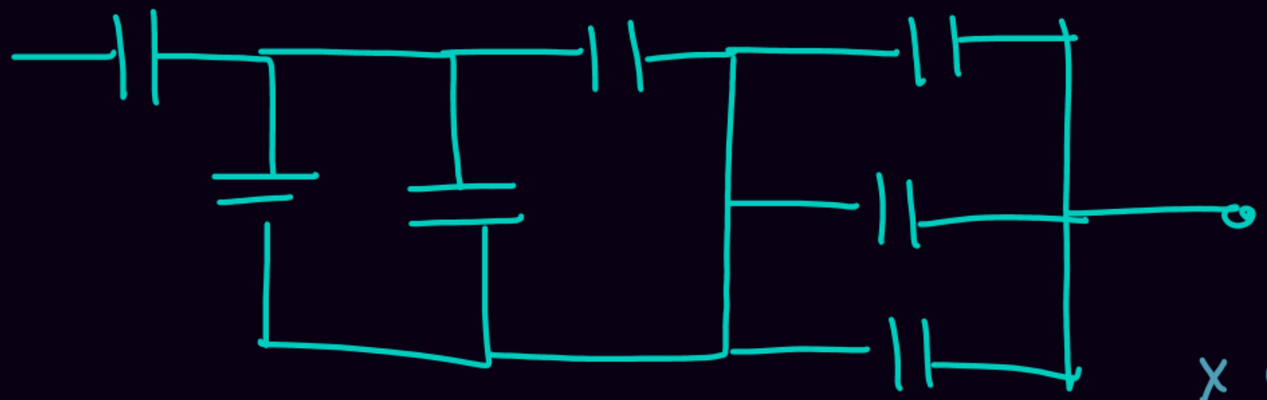
~~(a) 3.6 μF~~

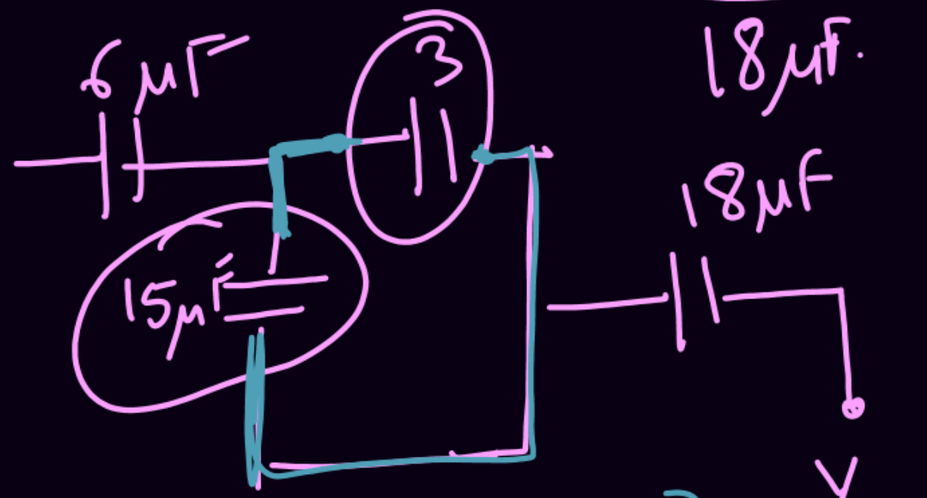
(b) 6 μF

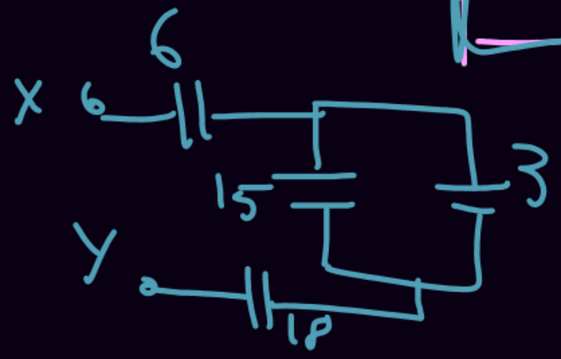
(c) 1.5 μF

(d) 9 μF

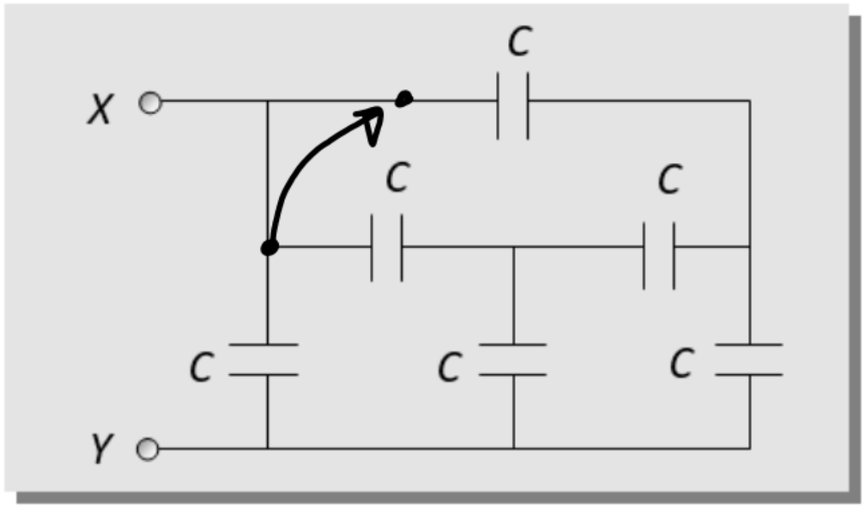








$\frac{9\times6^2}{5^{15}} = \frac{18}{5} = 3.6$

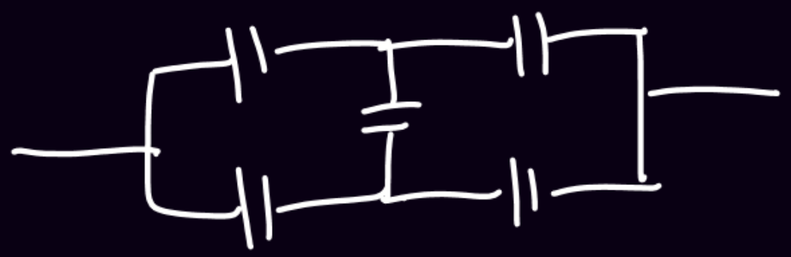


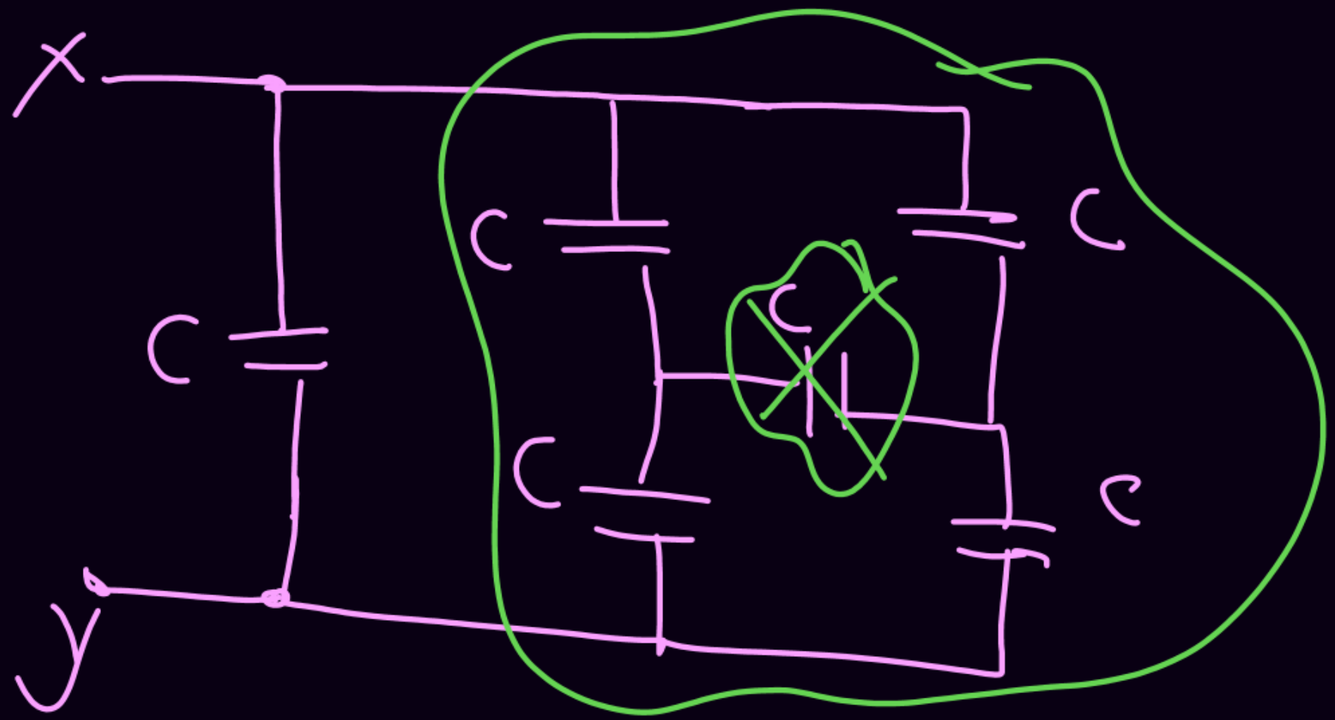
(a) $C/2$

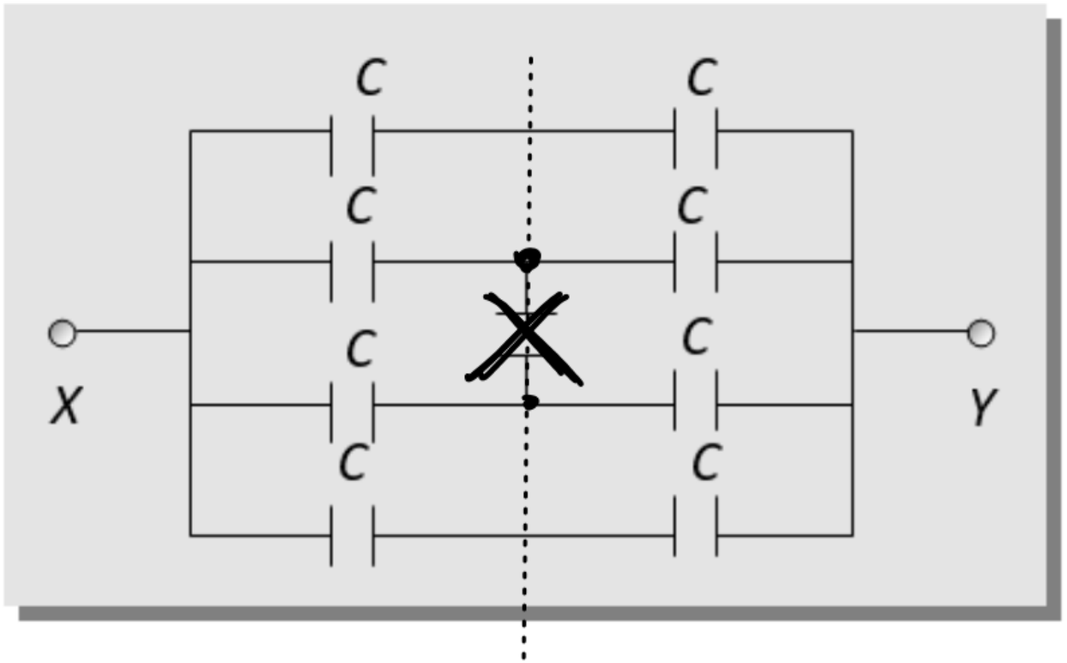
(b) C

~~(c)~~ $2C$

(d) $6C$





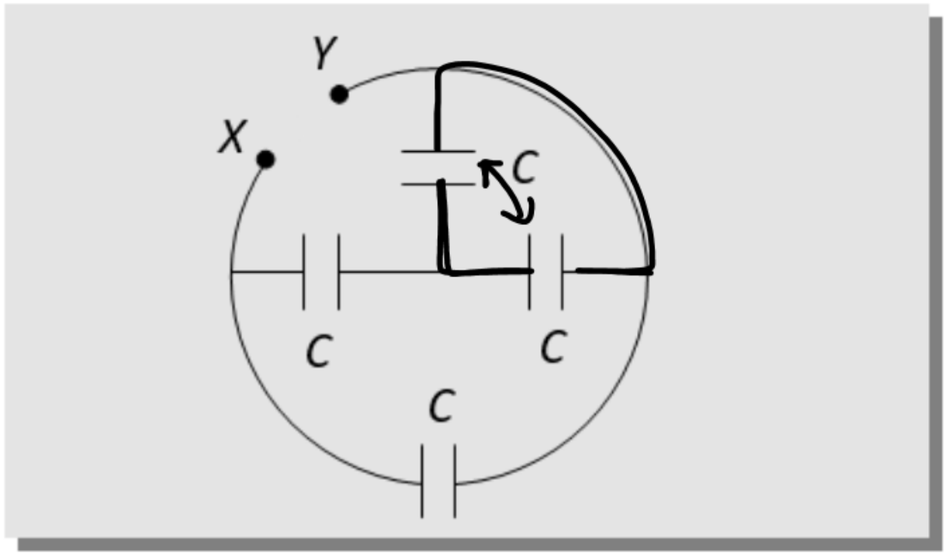


(a) C

(b) $C/2$

(c) $2C$

(d) $3C$

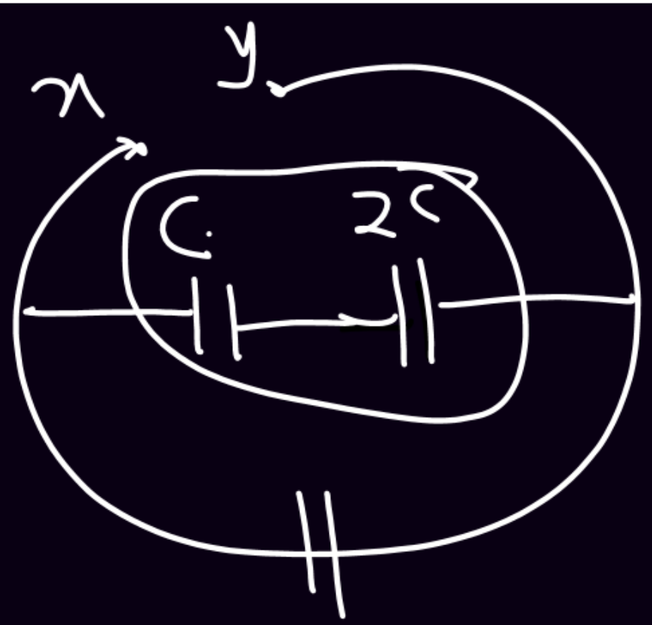


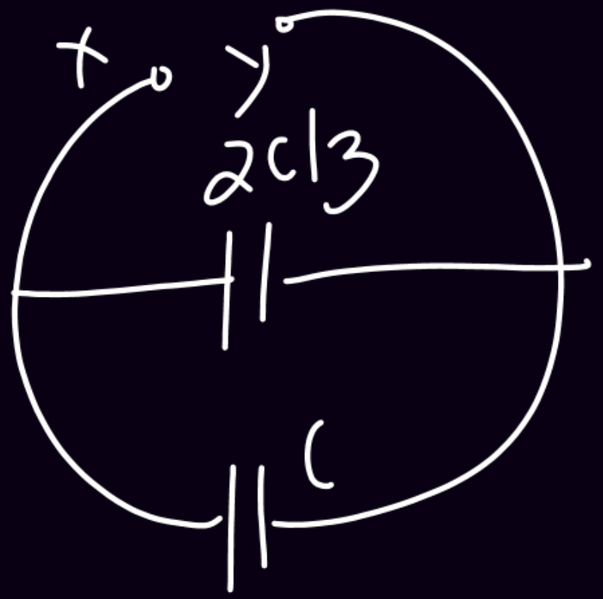
(a) $\frac{5}{3}C$

(b) $\frac{2}{3}C$

(c) C

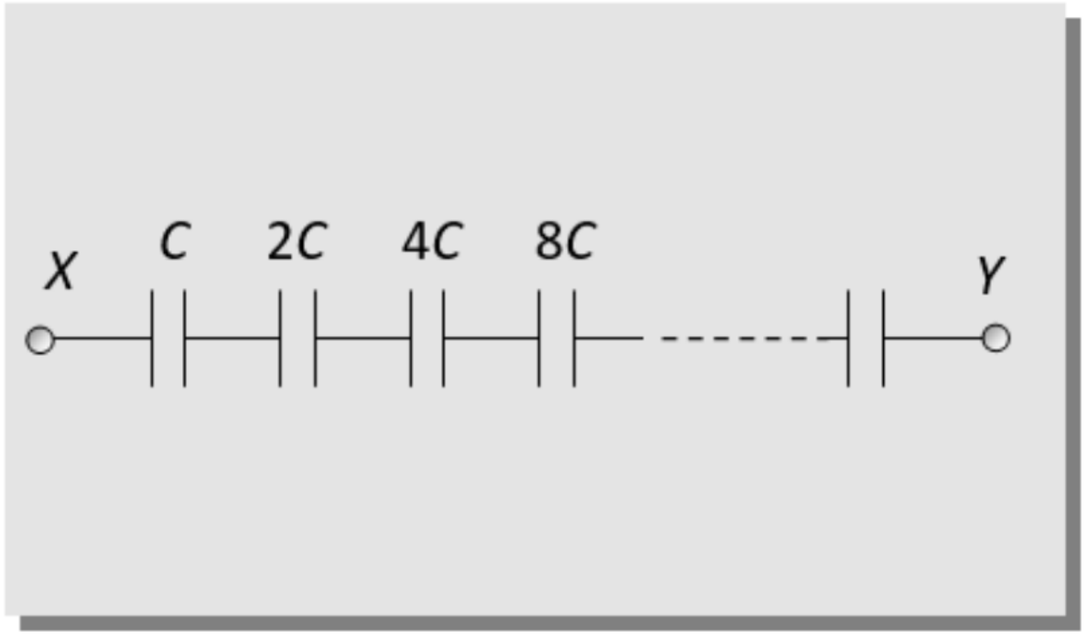
(d) $2C$





$\frac{2C}{3} + C$

$= \frac{5C}{3}$



(a) C

~~(b) $C/2$~~

(c) $2C$

(d) ∞

$$S_\infty = \frac{a}{1-r} \qquad a=1,\ r=\frac{1}{2}$$

$$= \frac{1}{1-\frac{1}{2}}$$

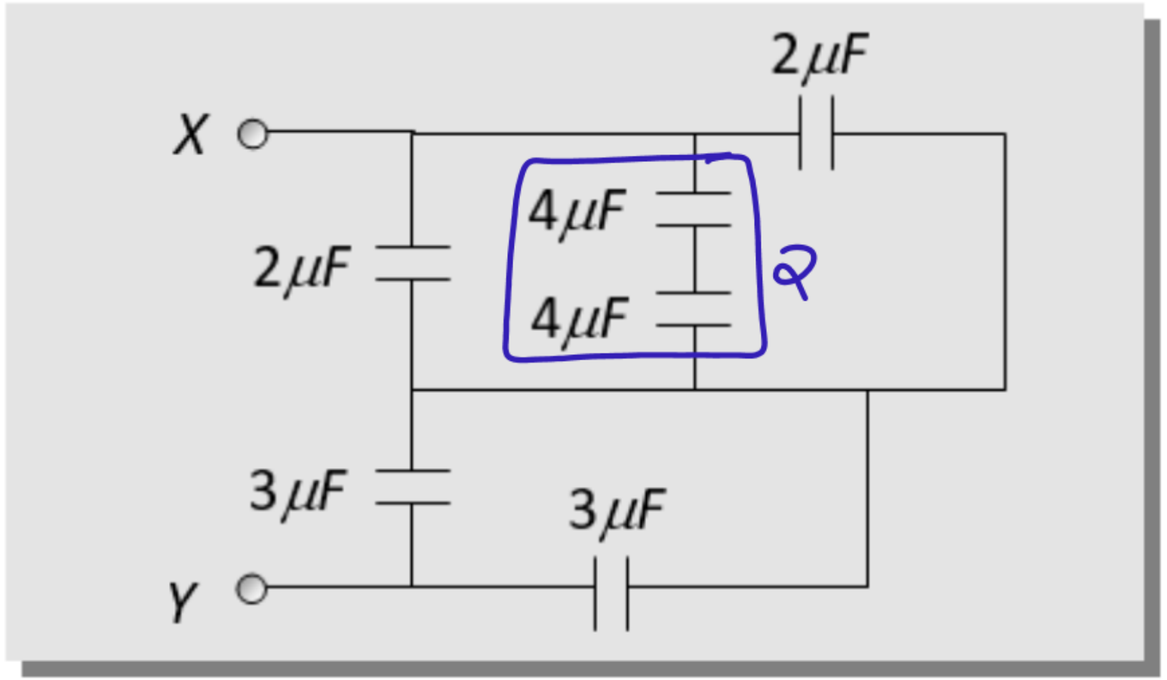
$$= \frac{2}{2-1}$$

$$= 2$$

$$\frac{1}{C_{eq}} = \frac{1}{C} + \frac{1}{2C} + \frac{1}{4C} + \frac{1}{8C} + \cdots \infty$$

$$\frac{1}{C}\left(1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots\right)$$

$$\frac{1}{C_{eq}} = \frac{2}{C} \Rightarrow C_{eq} = C/2$$

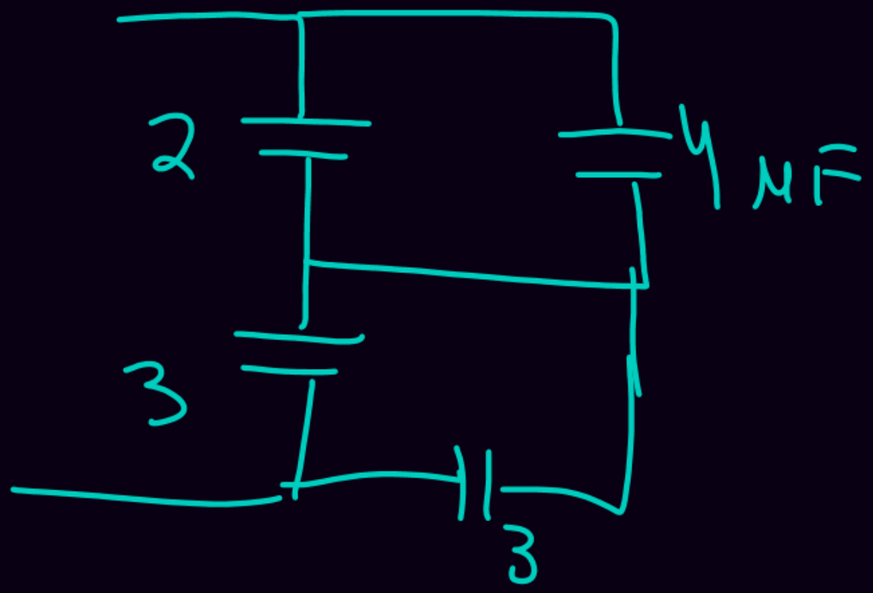


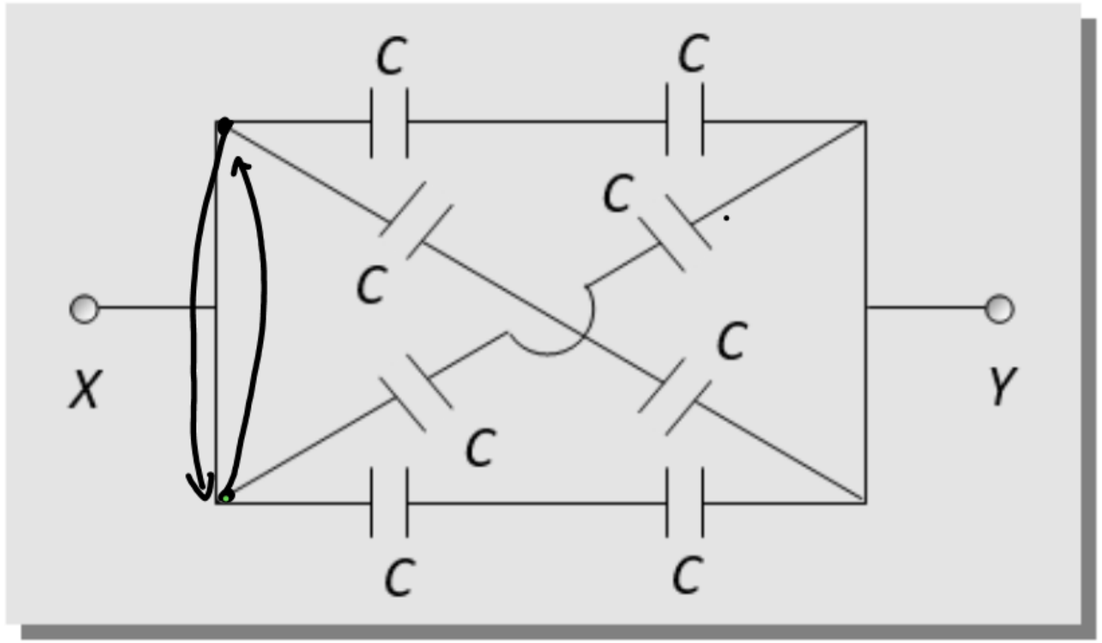
(a) $17/6\,\mu F$

(b) $12/17\,\mu F$

(c) $6/5\ \mu F$

~~(d)~~ $3\ \mu F$



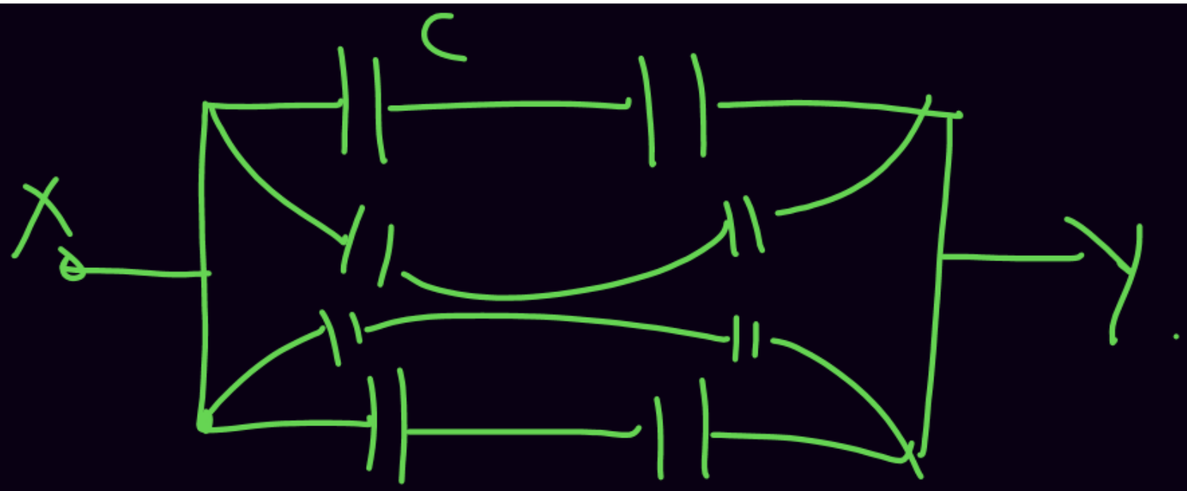


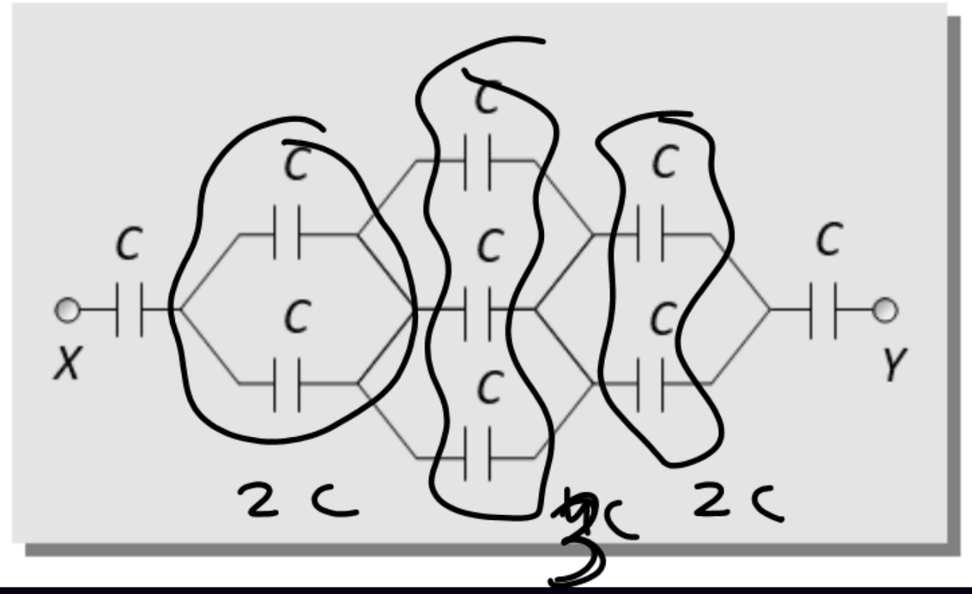
(a) C

(b) $2C$

(c) $3C$

(d) $4C$



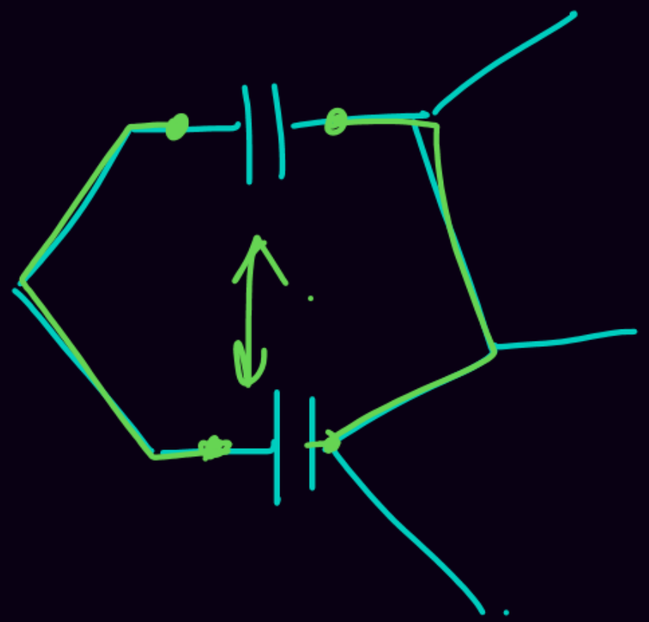


(a) $C/10$

(b) $10C/3$

(c) $3C/10$

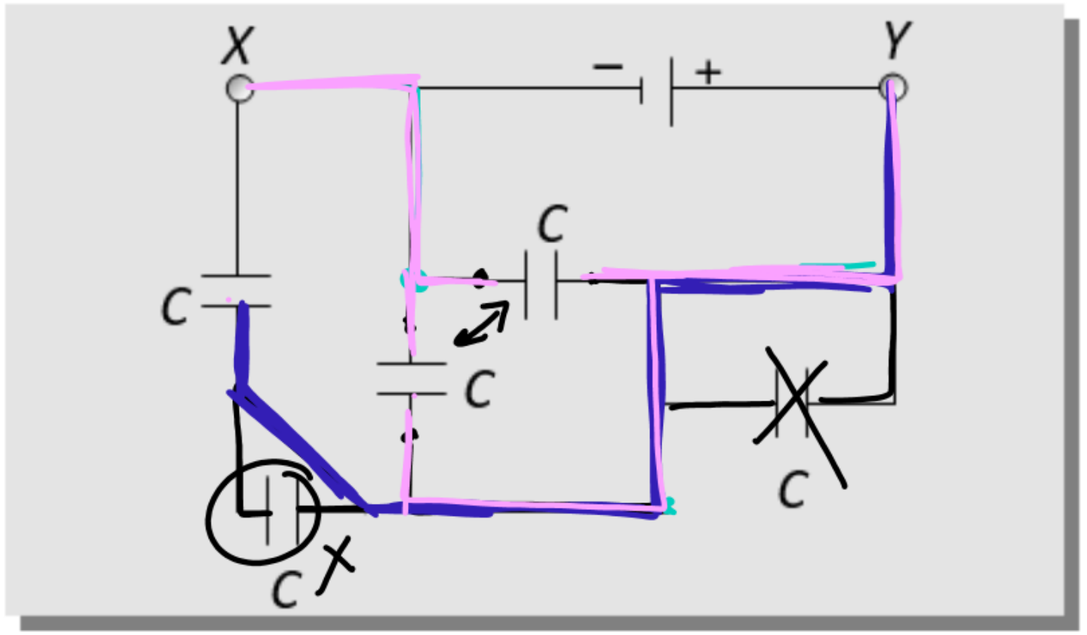
(d) $9C$



$$\frac{1}{C_{eq}} = \frac{1}{C} + \frac{1}{2C} + \frac{1}{3C} + \frac{1}{2C} + \frac{1}{C}$$

$$\frac{1}{C}\left(1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{2} + 1\right)$$

$$\frac{1}{C}\left(3 + \frac{1}{3}\right) \Rightarrow C_{eq} = \frac{3C}{10}$$

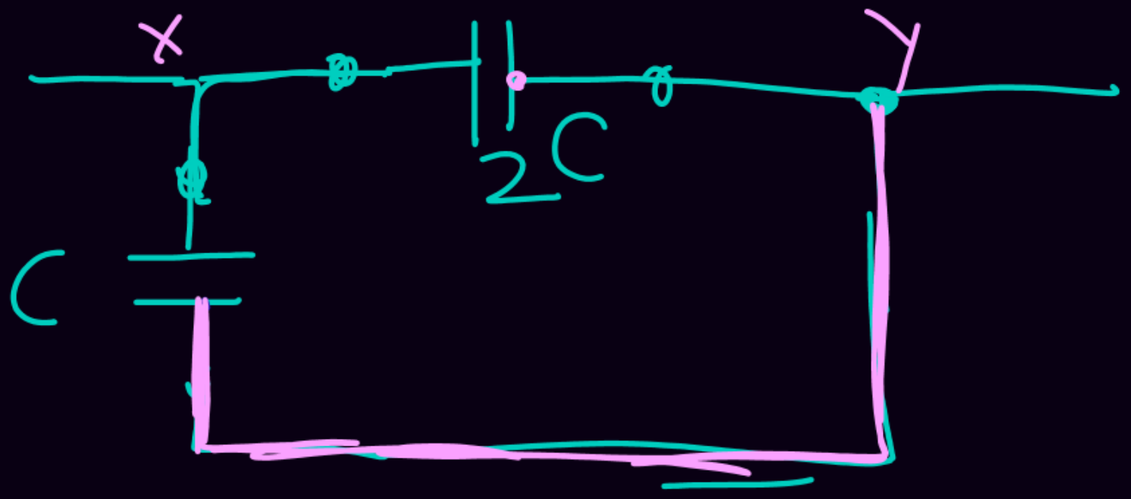


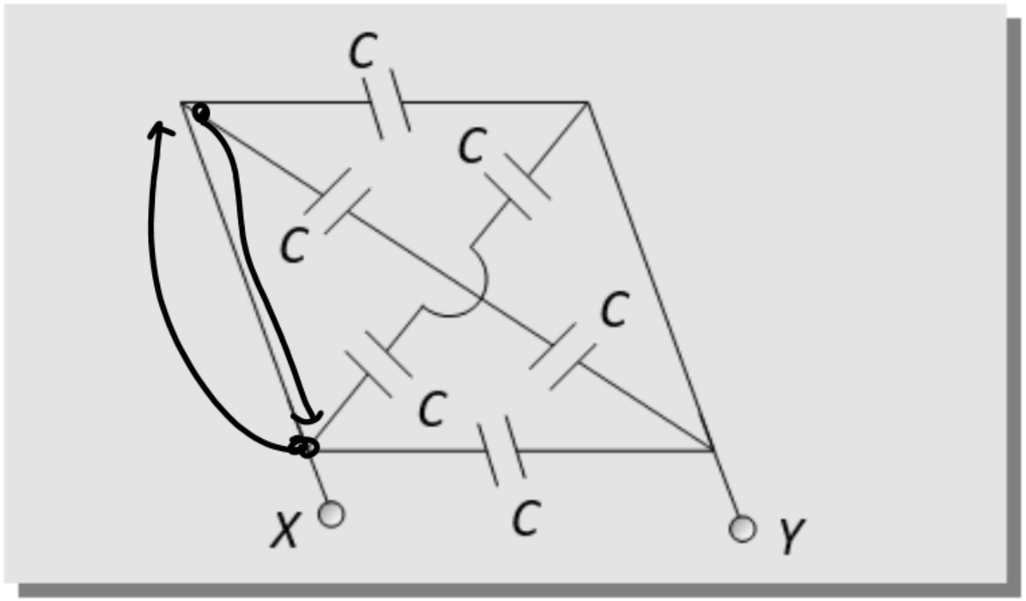
(a) C

(b) $5C$

(c) $2C$

~~(d)~~ $3C$



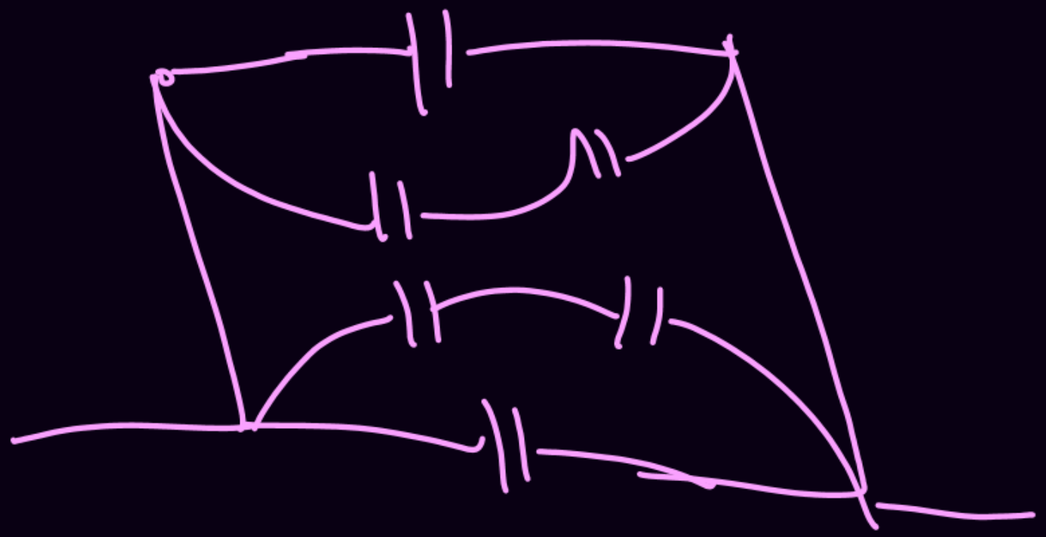


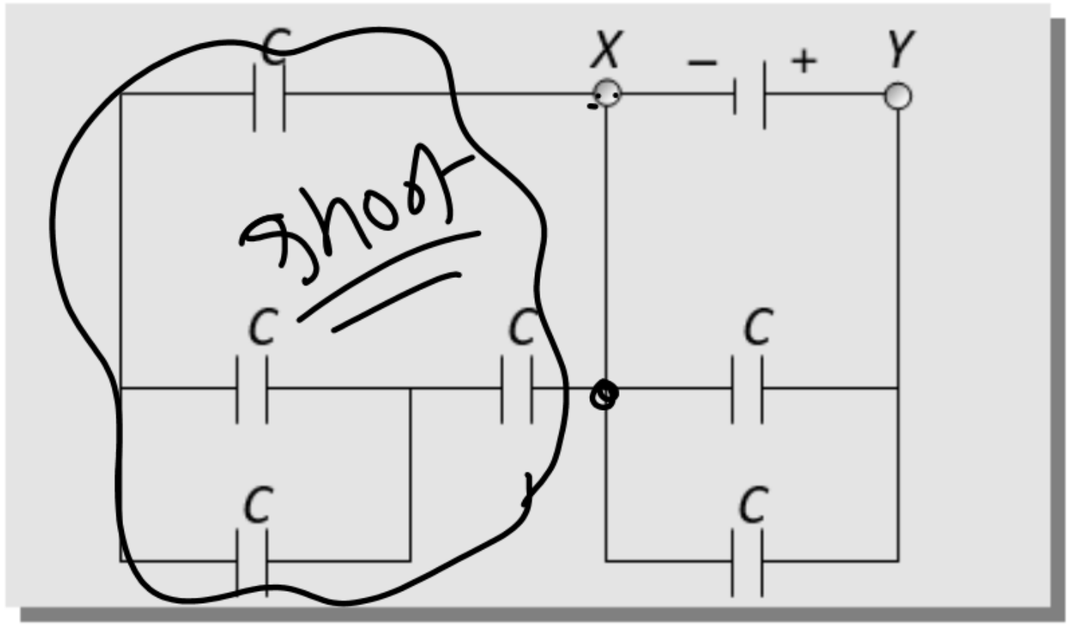
(a) C

(b) $2C$

(c) $3C$

(d) $4C$



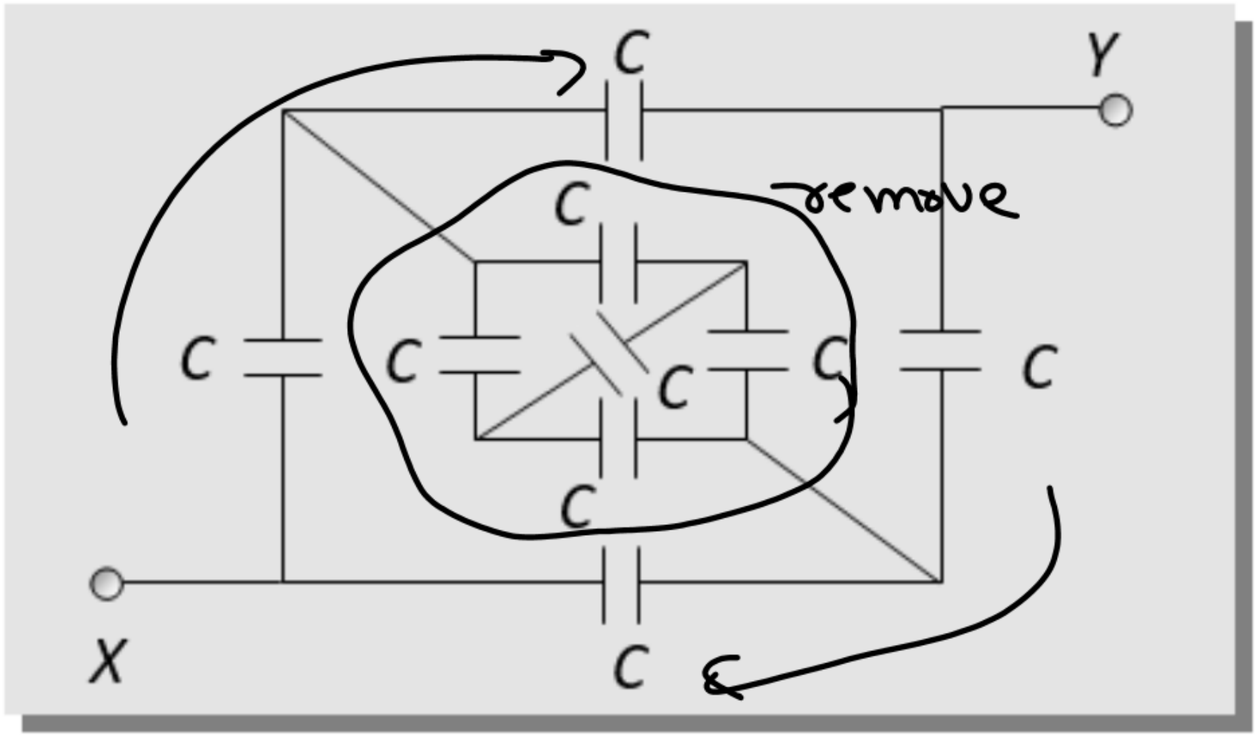


(a) $6C$

(b) $5C$

(c) $3C$

~~(d)~~ $2C$

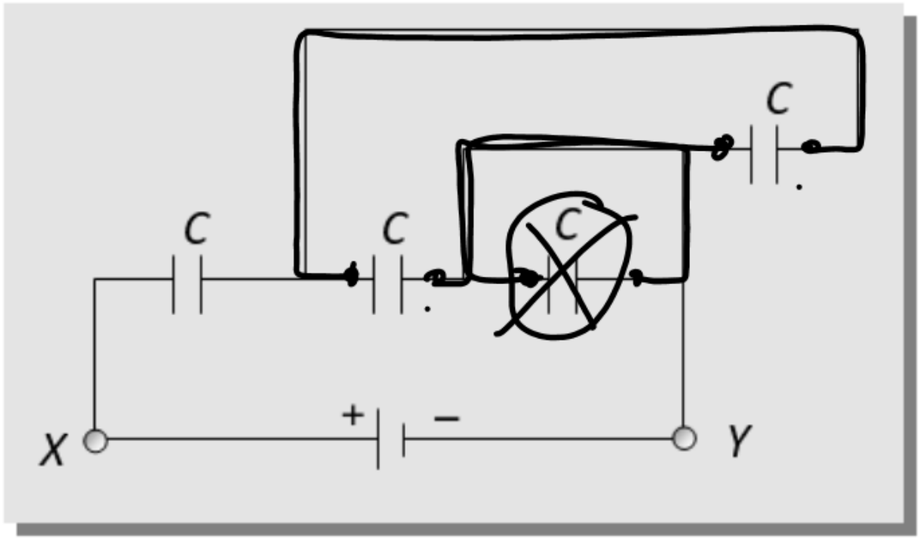


~~(a) C~~

(b) $4C$

(c) $6C$

(d) 0

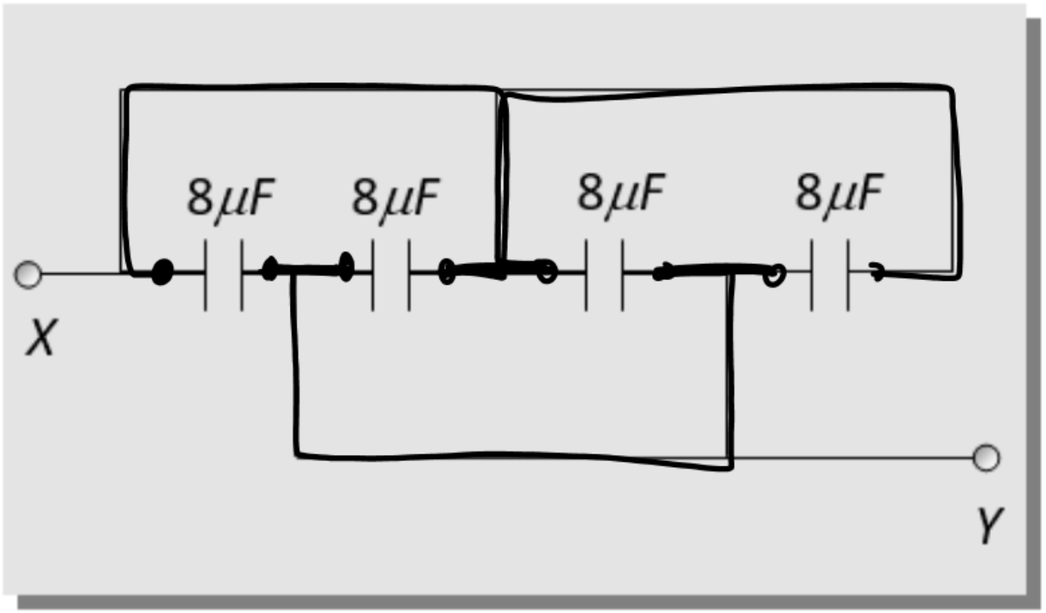


(a) C

(b) $2C$

(c) $3C$

(d) $2C/3$

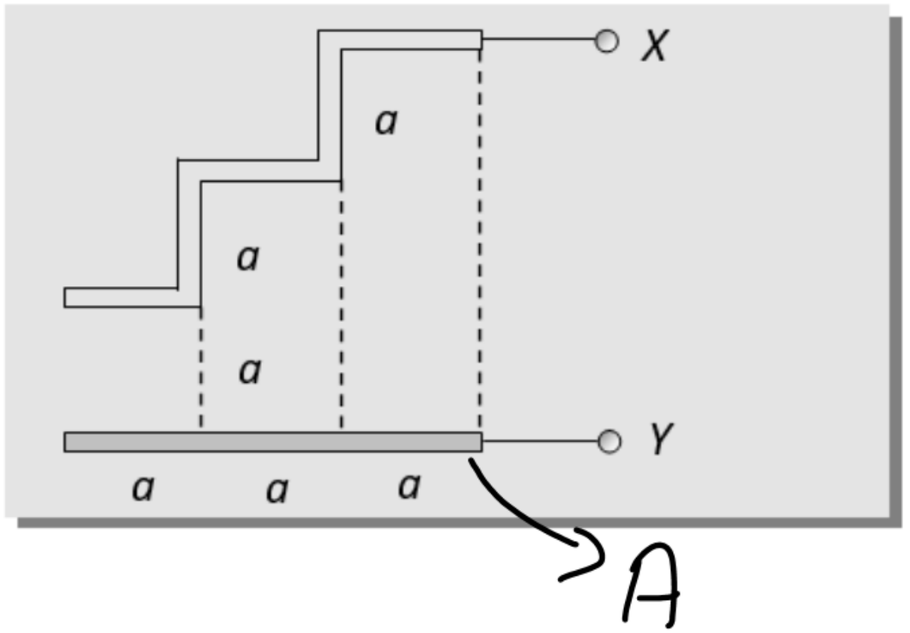


(a) 32 μF

(b) 2 μF

(c) 8 μF

(d) 16 μF

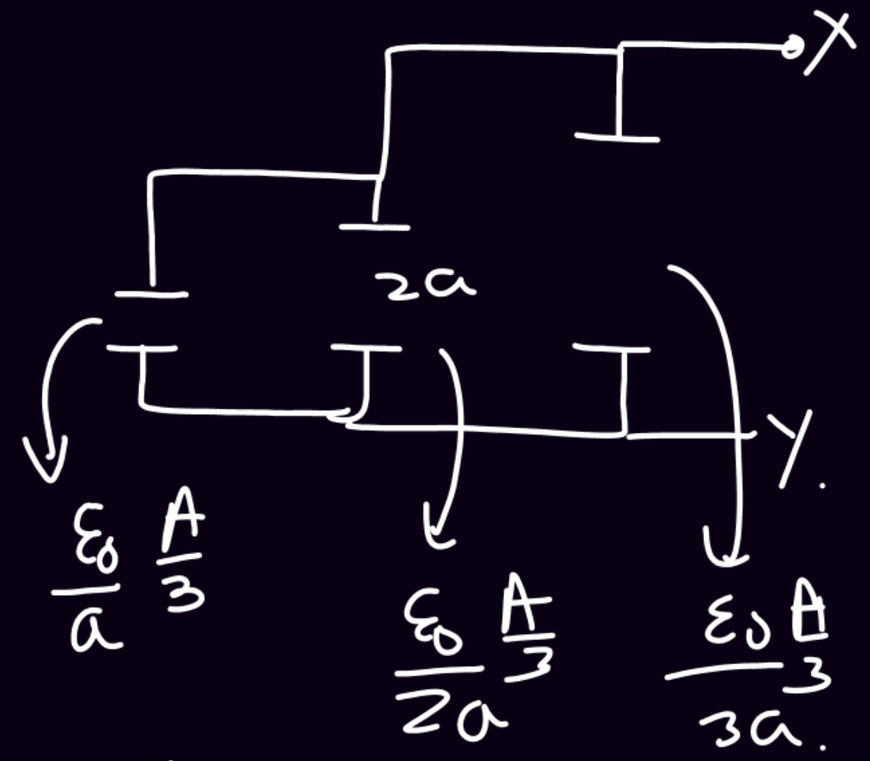


(a) $\frac{10\varepsilon_0 A}{5a}$

(b) $\frac{9\varepsilon_0 A}{7a}$

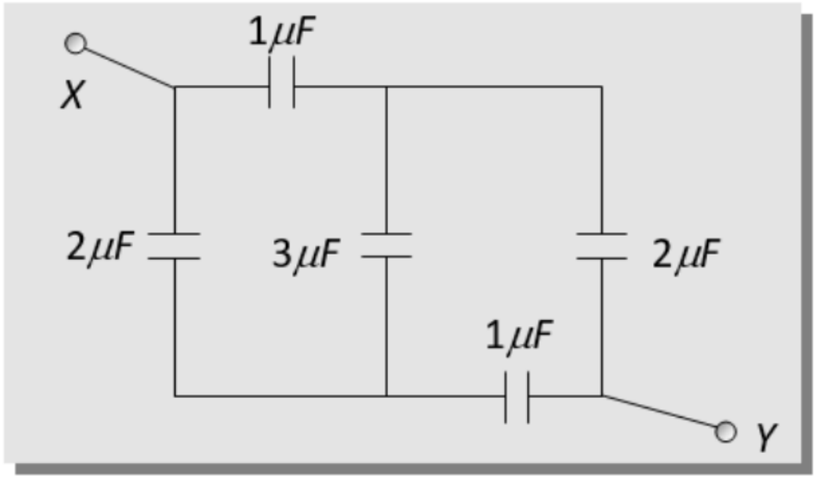
(c) $\frac{11\varepsilon_0 A}{18a}$

(d) $\frac{12\varepsilon_0 A}{18a}$



$$\frac{\varepsilon_0 A}{3a}\left(1+\frac{1}{2}+\frac{1}{3}\right)$$

$$\frac{\varepsilon_0 A\,(6+3+2)}{18a} = \frac{11}{18}\frac{\varepsilon_0 A}{a}$$

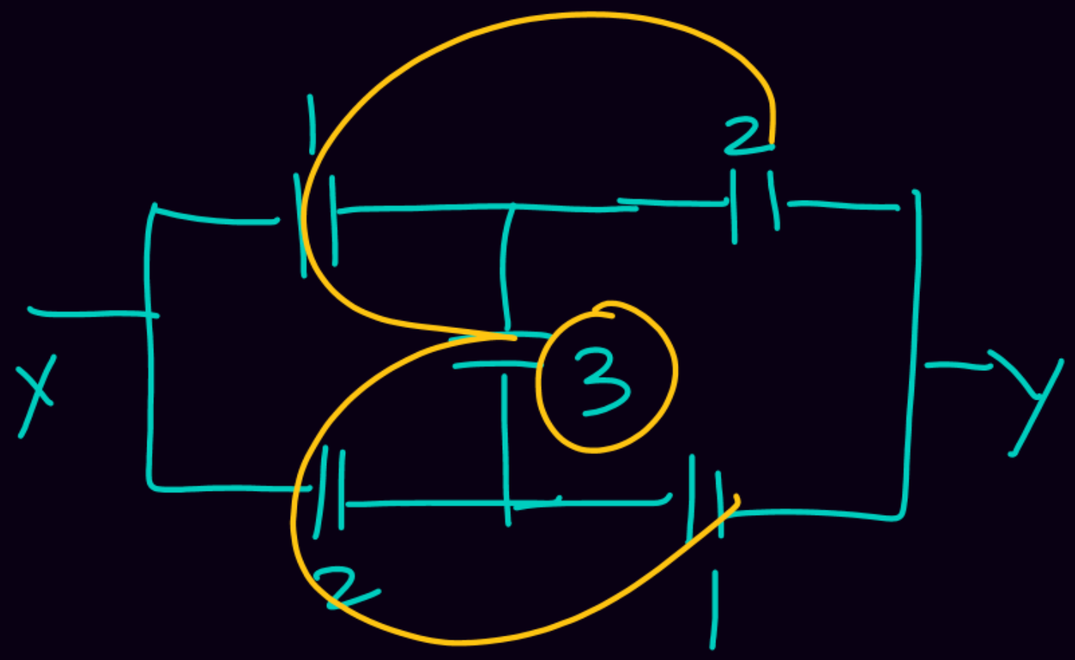


(a) $\frac{19}{56}\ \mu F$

(b) $\frac{64}{11}\ \mu F$

(c) $\frac{56}{11}\ \mu F$

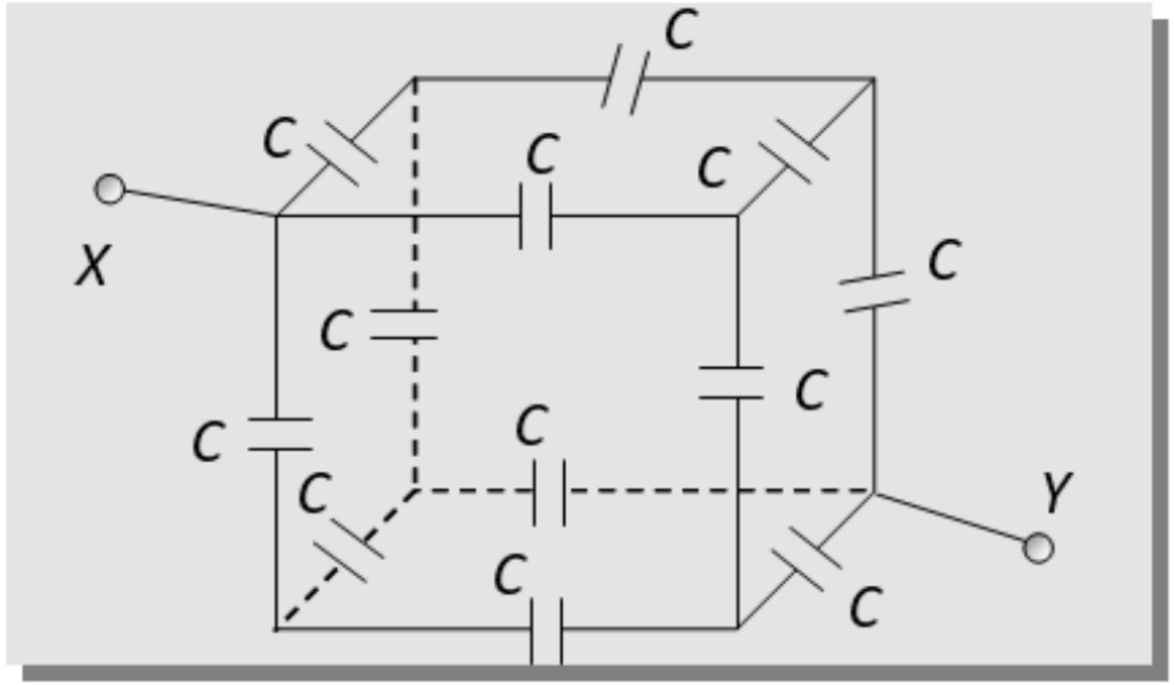
(d) $\frac{9}{37}\ \mu F$



$$C_{eq} = \frac{2\times1 + 1\times3 + 3\times2 + 2\times1}{1 + 2 + 2\times3}$$

$$= \frac{2 + 3 + 6 + 2}{1 + 2 + 6}$$

$$= \frac{13}{9}\ \mu F$$

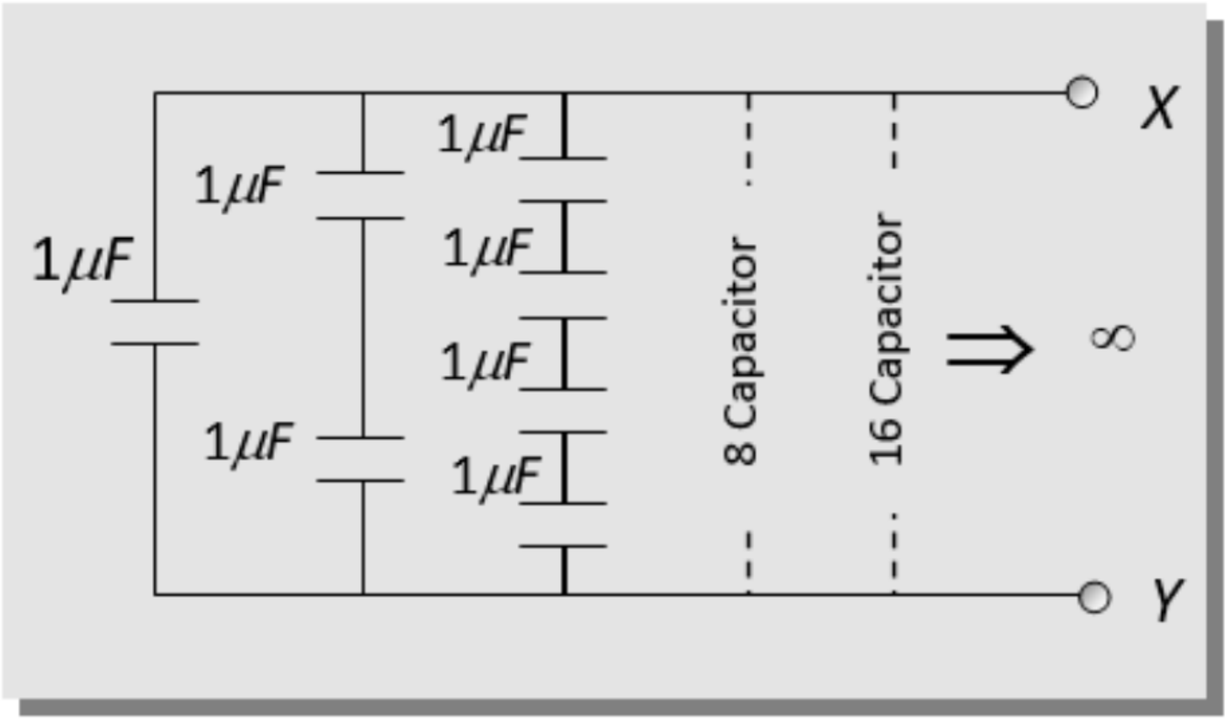


(a) $\frac{5}{6}C$

(b) $\frac{C}{6}$

(c) $\frac{C}{5}$

~~(d)~~ $\frac{6C}{5}$



(a) 1 μF

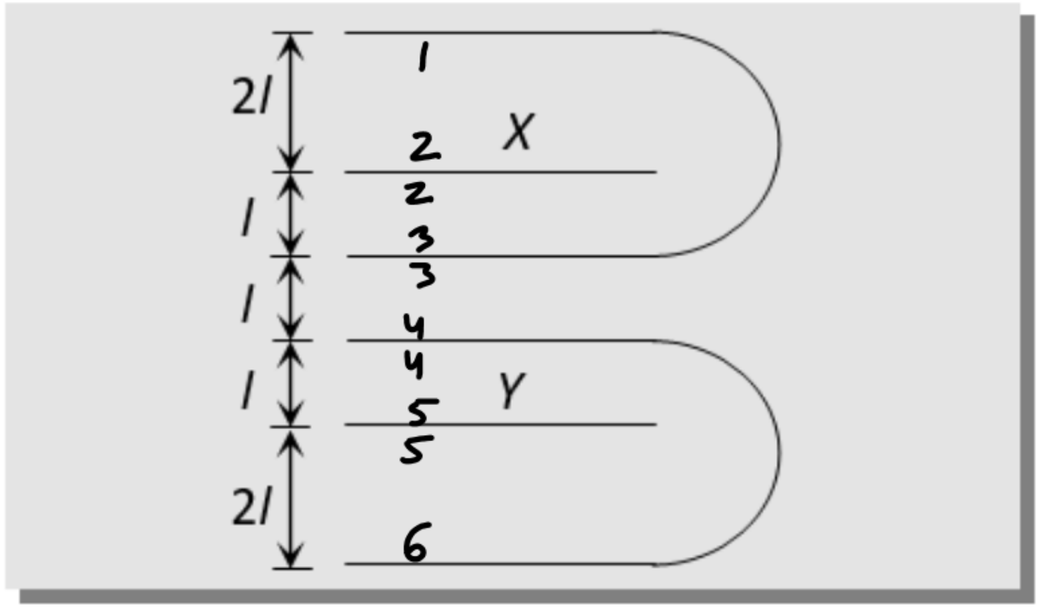
~~(b) 2 μF~~

(c) $\frac{1}{2}\,\mu F$

(d) ∞

$$C = 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \cdots$$

$$C = \frac{1}{1-\frac{1}{2}} = 2.$$



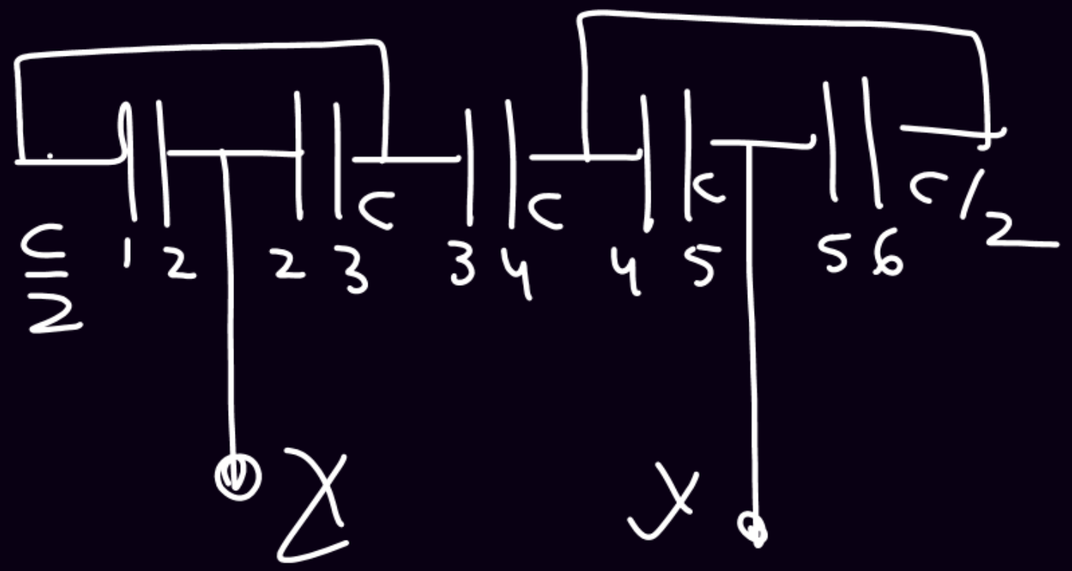
(a) $\frac{3C}{7}$

(b) $\frac{7C}{3}$

(c) $5C$

(d) $2C$

$C = \frac{\varepsilon_0 A}{L}$

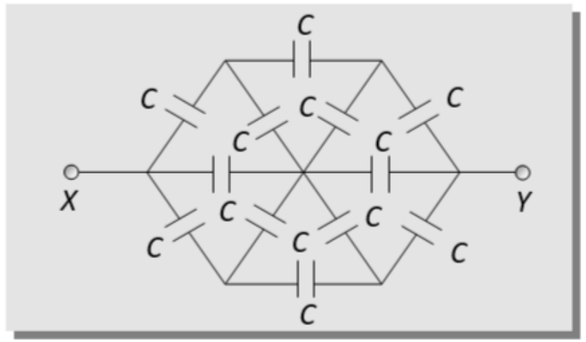


$\frac{C}{2} + C = \frac{3C}{2}$

$\frac{1}{C_{eq}} = \frac{2}{3C} + \frac{2}{3C} + \frac{1}{C}$

$= \frac{4}{3C} + \frac{1}{C} = \frac{4+3}{3C}$

$C_{eq} =$

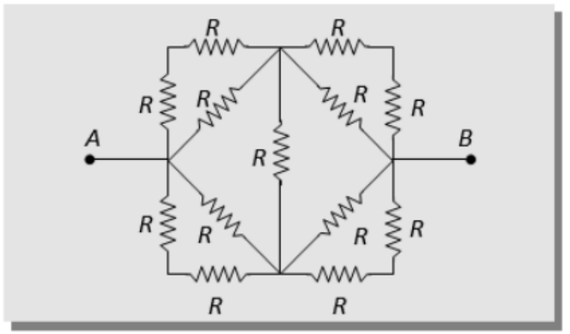


(a) $\frac{4C}{5}$

(b) $\frac{5C}{4}$

(c) 12 C

(d) $\frac{C}{12}$

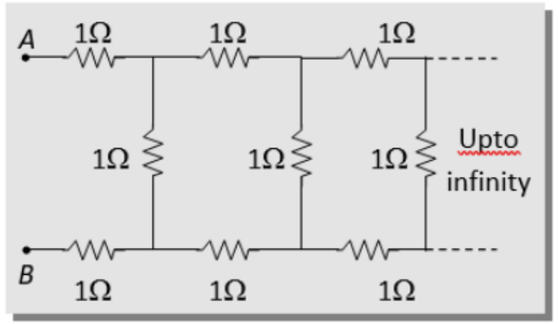


(a) $2R\Omega$

(b) $\frac{4R}{3}\Omega$

(c) $\frac{2R}{3}\Omega$

(d) $R\Omega$

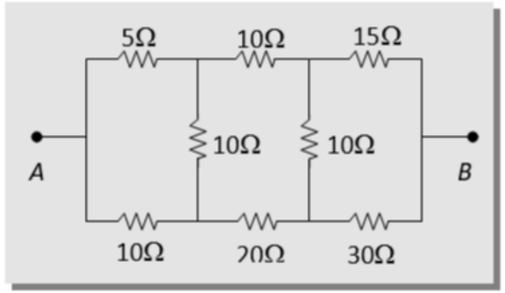


(a) $(\sqrt{3}-1)$

(b) $(1-\sqrt{3})$

(c) $(1+\sqrt{3})$

(d) $(2+\sqrt{3})$

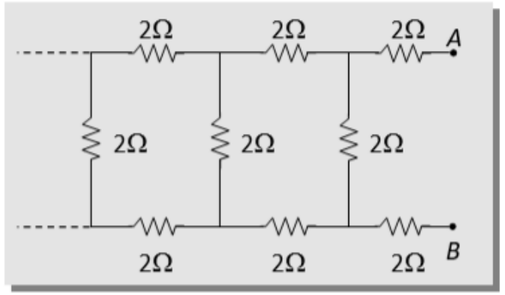


(a) 20 Ω

(b) 30 Ω

(c) 90 Ω

(d) 110 Ω

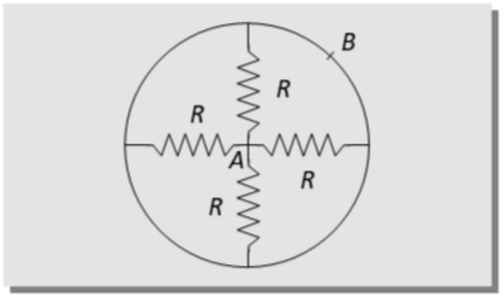


(a) Less than 4 Ω

(b) 4 Ω

(c) More than 4 Ω but less than 12 Ω

(d) 12 Ω

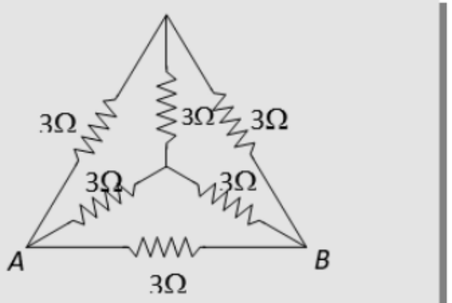


(a) $\frac{R}{4}$

(b) $4R$

(c) $\frac{3R}{4}$

(d) $\frac{4R}{3}$

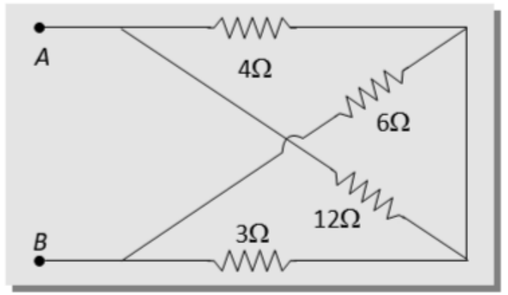


(a) 4 *ohms*

(b) 2 *ohms*

(c) 1 *ohm*

(d) $\frac{6}{4}$ *ohm*

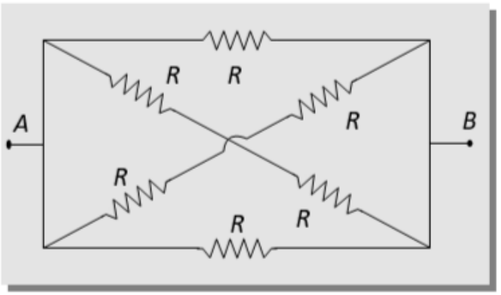


(a) 6 Ω

(b) 16 Ω

(c) 7 Ω

(d) 5 Ω

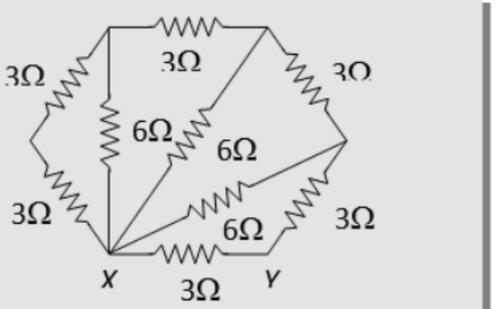


(a) R

(b) $\frac{R}{3}$

(c) $3R$

(d) $4R$

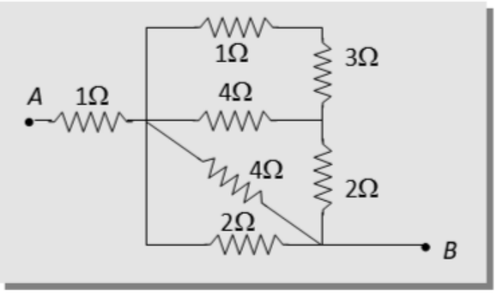


(a) 4 Ω

(b) 2 Ω

(c) 8 Ω

(d) 16 Ω

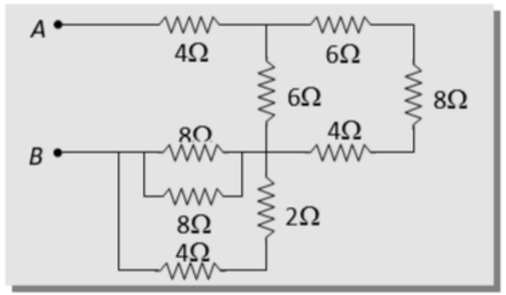


(a) 1 Ω

(b) 2 Ω

(c) 3 Ω

(d) 4 Ω

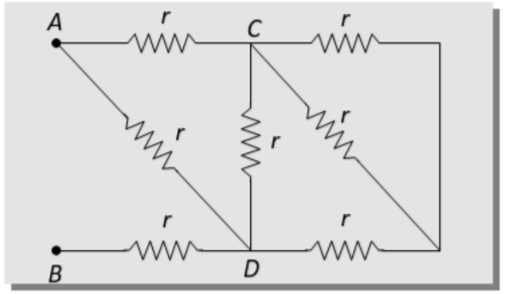


(a) 4 Ω

(b) 6 Ω

(c) 10.9 Ω

(d) 12.6 Ω

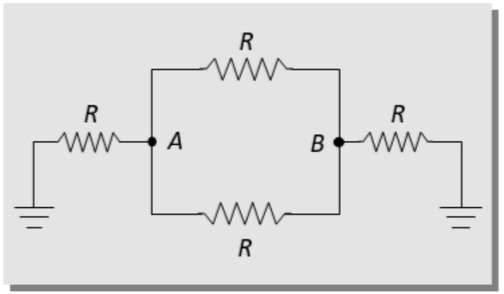


(a) $\frac{13}{9}r$

(b) $\frac{11}{5}r$

(c) $\frac{5}{12}r$

(d) $\frac{21}{13}r$

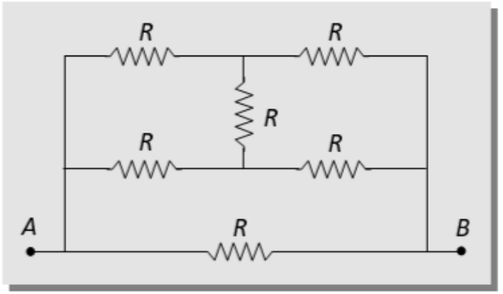


(a) $\frac{R}{2}$

(b) $\frac{2R}{5}$

(c) $\frac{3R}{5}$

(d) $\frac{R}{3}$

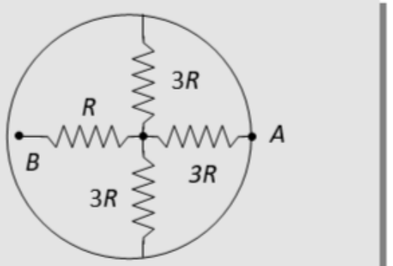


(a) $\frac{R}{2}$

(b) R

(c) $2R$

(d) $4R$

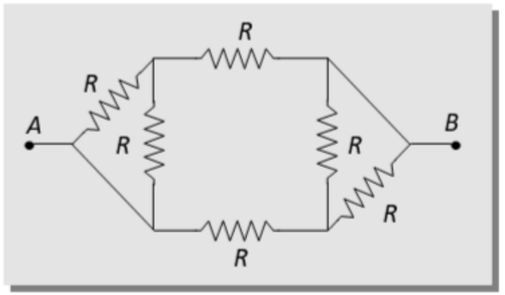


(a) $2R$

(b) $4R$

(c) $7R$

(d) $10R$

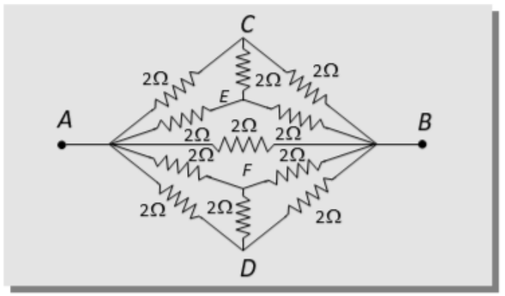


(a) $\frac{3}{4}R$

(b) $\frac{5}{3}R$

(c) $\frac{7}{5}R$

(d) R



(a) $2\ \Omega$

(b) $\frac{2}{3}\Omega$

(c) $\frac{3}{4}\Omega$

(d) $\frac{4}{3}\Omega$

Thank You