

$$\textcircled{1} \quad G = 0.9 \text{ S} \quad r = 3r \quad G = \frac{1}{\rho L} \Rightarrow 0.9 = \frac{\pi (3r)^2}{\rho L} = 0.9 \times 9 = \frac{9\pi r^2}{\rho L}$$

$$\sqrt{G} = 3.15$$

$$\textcircled{2} \quad P = 640 \text{ W} \quad R = 10 \Omega \quad V = ? \quad P = \frac{\Delta V^2}{R} \Rightarrow 640 = \frac{\Delta V^2}{10} \Rightarrow \sqrt{\Delta V = 80 \text{ V}}$$

$$\textcircled{3} \quad q(t) = 5t^2 + 7t + 9 \quad I(t) = 10t + 7 \quad t = 2.5 \quad = 10(2.5) + 7 \quad \sqrt{I = 32 \text{ mA}}$$

$\textcircled{4}$ Potential difference increase $\rightarrow I$ increase
 R_X doesn't depend on V

$$\textcircled{5} \quad R_{eq} = 2 + 1 + 5 = 8 \Omega \quad V = 40 \text{ V} \quad \begin{cases} \Delta V = IR \\ I = \frac{\Delta V}{R} = \frac{40}{8} = 5 \text{ A} = I_3 \rightarrow \text{series} \end{cases}$$

$$\textcircled{6} \quad A_1 = A \quad A_2 = 3A \quad \text{same current} \quad I \propto \frac{1}{A} \quad \frac{I_1}{I_2} = \frac{A_2}{A_1} \Rightarrow \frac{I_1}{I_2} = \frac{3A}{A} \Rightarrow \frac{I_1}{I_2} = 3 \text{ or } \frac{I_2}{I_1} = \frac{1}{3} \quad \sqrt{I_1 = 3I_2 \text{ or } I_2 = \frac{1}{3} I_1}$$

$$\textcircled{7} \quad \sqrt{3.6 \text{ C} = 1 \times 10^{-3} \times 3600 = 1 \text{ mAh}} \quad \textcircled{8} \quad R_{eq} = \frac{R}{n} \quad \begin{cases} \Delta V = IR \\ \downarrow R = \frac{\Delta V}{I} \end{cases}$$

$$\frac{3.6}{10^{-3} \times 60 \times 60} = 1 \text{ mAh}$$

$$\textcircled{10} \quad R_2 = 3R_1 \quad R_1$$

$$V = 8 \text{ V}$$

$$I = 0.2 \text{ A}$$

$$R = \frac{\Delta V}{I} = \frac{8}{0.2} = 40 \Omega$$

$$40 = R_2 + R_1$$

$$40 = 3R_1 + R_1$$

$$40 = 4R_1$$

$$\sqrt{R_1 = \frac{40}{4} = 10 \Omega}$$

$\textcircled{9}$ نحل بافتراض قيم للـ R

$$\textcircled{11} \quad V_{emf} = i(R_1 + R) \quad 4 = i(0.3 + 1.7)$$

$$i = \frac{4}{0.3 + 1.7}$$

$$= 2 \text{ A}$$

$$\textcircled{13} \quad V = 12 \quad R = 2.4$$

$$\Delta V = IR$$

$$I = \frac{\Delta V}{R} = \frac{12}{2.4} = 5 \text{ A}$$

12

$$R_2 = 5 \Omega$$

$$R_1 = 3 \Omega$$

$$V_{\text{emf}} = 8 \text{ V}$$

$$R_A = 1 \Omega$$

$$R_{\text{eq}} = 5 + 3 + 1 = 9 \Omega$$

$$I = \frac{V}{R} = \frac{8}{9} = 0.89 \text{ A}$$

$$(1) 3 \text{ mAh} = 3 \times 10^{-3} \times 60 \times 60 \\ = 10.8 \text{ C}$$

$$(1) q = 5t^2 + 7t + 9 \quad \text{diff} \left(\begin{array}{l} \text{Charge} \\ \text{Current} \end{array} \right) \int \text{intg}$$

$$t = 2.5$$

$$I(t) = 10t + 7 \\ = 10(2.5) + 7 \\ \vec{I} = 32 \text{ mA}$$

$$(2) L = 32 \text{ m} \\ R = 0.2 \Omega \\ \rho = 2.82 \times 10^{-8} \\ r = ?$$

$$R = \rho \frac{L}{A} = \rho \frac{L}{\pi r^2} \\ 0.2 = (2.82 \times 10^{-8}) \times \frac{32}{\pi r^2} \\ r^2 = 1.436 \times 10^{-6} \\ \vec{r} = 1.198 \times 10^{-3} \text{ m}$$

$$(3) q = 5t^2 + 3t \\ \vec{I} = 10t + 3$$

(4) unit of current density equal to
Ampere per meter $\rightarrow$ it should be
Per meter square
 $J = \frac{i}{A} \Rightarrow \frac{\text{A}}{\text{m}^2} \checkmark$

$$(5) S = \frac{1}{R} \Rightarrow R = \frac{\Delta V}{I} \Rightarrow \frac{V}{A}, \text{ so } \vec{S} = \frac{A}{V}$$

$$(7) R_{eq} = \frac{R}{2} = \frac{R}{2}$$

$$\vec{R} = \frac{V}{2I} \Rightarrow \text{current became twice}$$

$$(6) P = 968 \text{ W} \\ V = 220 \text{ V}$$

$$P = \frac{\Delta V^2}{R} \Rightarrow 968 = \frac{220^2}{R} \\ \vec{R} = 50 \Omega$$

(9) Current flowing in R_C stays the same.

$$(8) R_{eq} = 6 \Omega$$

$$R_{eq} = \frac{R}{N} \Rightarrow 6 = \frac{R}{3}$$

$$\vec{R} = 6 \times 3 = 18 \Omega$$

(1) Ammeters should be connected in series, while voltmeters should be connected in parallel.

(2)	R	same	-
	R	opposite	+
	V	same	+
	V	opposite	-

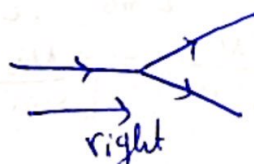
$$(3) R_{eq} = 3 + 5 + 1 = 9 \Omega$$

$$\vec{V} = IR \Rightarrow I = \frac{V}{R} = \frac{8}{9} = 0.89 \text{ A}$$

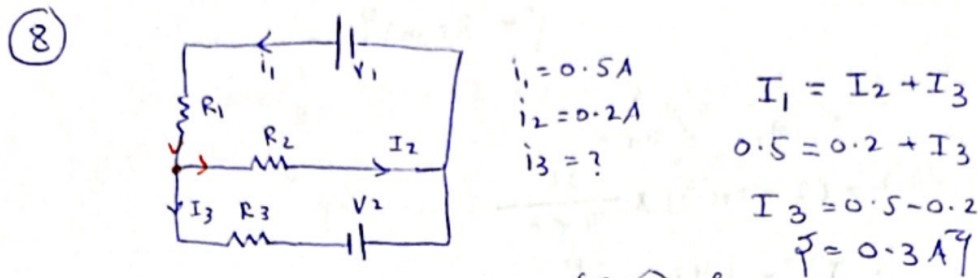
(4) ی، گمان مضیق اب
جواز عندها، طریقہ
طبی

$$(5) \frac{R}{4} \times \frac{24}{8} \Rightarrow 8R = 96 \Rightarrow \vec{R} = \frac{96}{8} = 12 \Omega$$

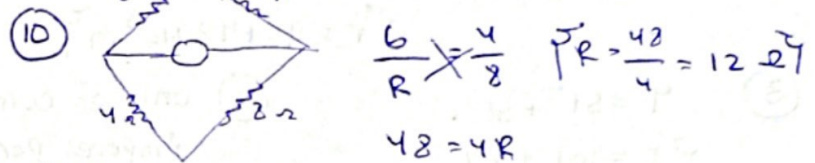
$$(6) I = 2.5 + 3.5 \\ = 6 \text{ A to the right}$$



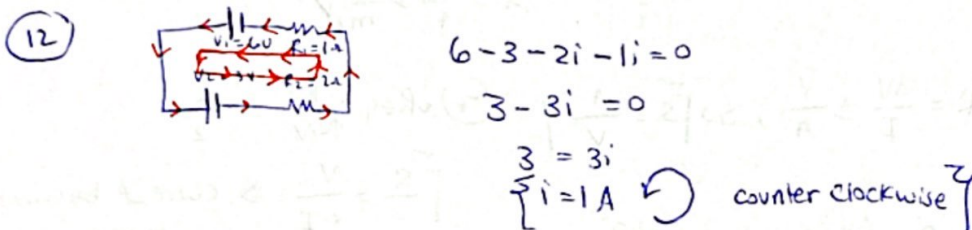
⑦ $q(t) = \frac{6 \times 10^{-4}}{1 - e^{-t/0.1}}$ $V = 12V$
 $Q_{max} = CV \Rightarrow 6 \times 10^{-4} = C(12) \Rightarrow C = \frac{6 \times 10^{-4}}{12} = 5 \times 10^{-5} F$



⑨ $\frac{1}{R_{eq}}$



⑪ Ammeter is connected in series with the circuit



① $A \rightarrow \text{North}$
 $B \rightarrow \text{South}$

② $1 \rightarrow \text{North}$
 $2 \rightarrow \text{South}$

③ $4 \rightarrow \text{North}$
 $3 \rightarrow \text{South}$

③ $F_B = qVB \Rightarrow B = \frac{F_B}{qV} = \frac{N}{C \cdot m/s} = \frac{N \cdot s}{C \cdot m} = \frac{Vs}{m \cdot m} = \frac{Vs}{m^2}$

④ $1 \rightarrow \text{electron or a negative particle}$
 $2 \rightarrow \text{Neutral}$
 $3 \rightarrow \text{Proton or a positive particle}$

⑤ $B \downarrow$ into the page

⑥ $F_B = qVB = C \cdot m/s \cdot T = \frac{CmT}{s}$

⑦ $\uparrow$ upward

⑦ $A \rightarrow \text{North}$ $C \rightarrow \text{North}$
 $B \rightarrow \text{South}$ $D \rightarrow \text{South}$
 The magnetic field is going out from them

⑧ $F_B = qVB$
 $= (1.6 \times 10^{-19})(3 \times 10^5)(0.83)$
 $= 3.984 \times 10^{-14} \approx 4 \times 10^{-14}$

⑩ F_B is minimum when $\theta = 0$ because the current and the magnetic field are parallel

⑪ $F_B = qVB \Rightarrow B = \frac{F_B}{qV} = \frac{N}{C \cdot m/s} = \frac{N \cdot s}{C \cdot m}$

or $F_B = iLB \Rightarrow B = \frac{F_B}{iL} = \frac{N}{C/s \cdot m} = \frac{N \cdot s}{C \cdot m}$

(12) $\vec{F}_B \uparrow$ $\vec{v} \rightarrow$ $\left\{ \begin{array}{l} \text{Toward y positive} \end{array} \right.$

(13) $F_B = qvB \Rightarrow = (3.2 \times 10^{-6})(520)(0.2) = 3.328 \times 10^{-4} = \boxed{332.8 \mu N}$

(14) $F_B = iLB \sin \theta \Rightarrow = (2.3)(1.5)(5.4 \times 10^{-2}) \sin 60 = \boxed{0.52 N}$

(15) $\frac{F_x}{F_y} = \frac{N_x}{N_y} = \frac{400}{900} = \frac{4}{9}$

(16) $\frac{r}{1} \times \frac{mv}{qB} \Rightarrow \frac{rqB}{r} = \frac{mv}{r}$

$B = \frac{mv}{qr} \rightarrow \text{radius}$

(17) when the $\theta = 0 \rightarrow \text{Parallel}$

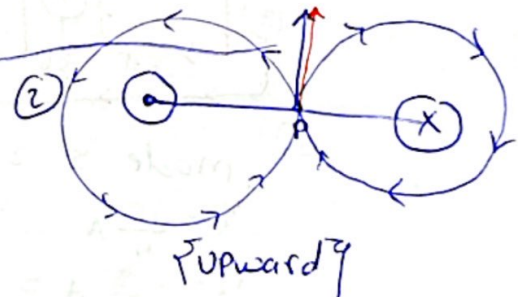
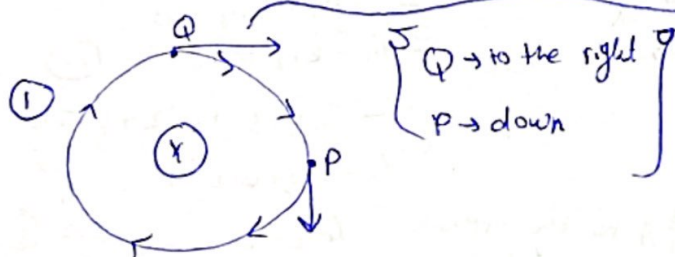
(18) $F_B = iLB \Rightarrow I = \frac{V}{R} = \frac{12}{4} = 3A$
 $\vec{F}_B = (3)(1)(0.2) = 0.6 N$

$\rightarrow$ الموجان الجزئية
 $\text{التي في المجال الى}$
 طولها 1m

(19) $\mu_0 =$ The magnetic permeability of free space / $\text{النفاذية المغناطيسية للفراغ}$

(20) perpendicular to the current element and to the radial direction.

(21)  $\vec{B} = \frac{\mu_0 i}{2\pi r} = \frac{(4\pi \times 10^{-7})(\frac{15}{125 \times 10^{-3}})}{2\pi (2.6)}$
 $\vec{B} = 7.69 \times 10^{-5} T$

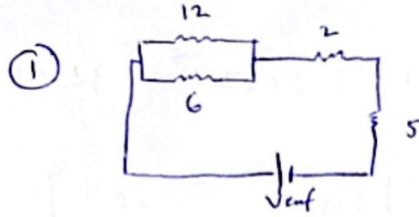


(3) $i \rightarrow +z$ $\left\{ \begin{array}{l} P_1 = +z = +y \\ P_2 = +y = -x \end{array} \right.$

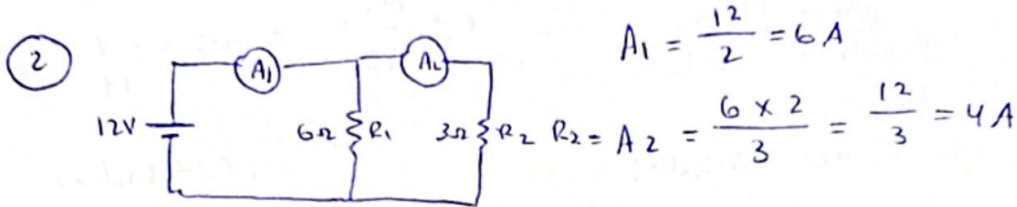
(4) the red end is the North because it is in the magnetic field's direction.



الجزء الكتابي



$$R_{eq} = 5 + 2 + \left(\frac{1}{6} + \frac{1}{12} \right)^{-1} = 11 \Omega$$



$$A_1 = \frac{12}{2} = 6A$$

$$R_2 = A_2 = \frac{6 \times 2}{3} = \frac{12}{3} = 4A$$

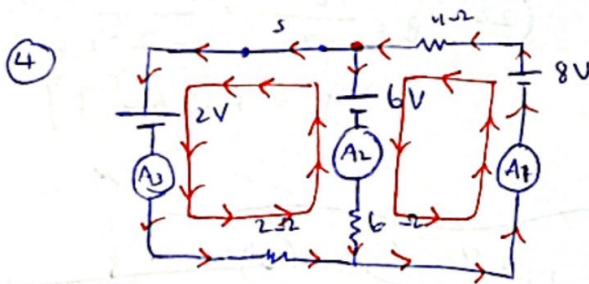
$$R_{eq} = \left(\frac{1}{6} + \frac{1}{3} \right)^{-1} = 2 \Omega$$

③

$$\text{Ampere} = \frac{C}{s} = \frac{N}{m \cdot T}$$

$$F_B = iLB$$

$$i = \frac{F_B}{LB}$$



① mode 5 2

$$i_1 = \frac{10}{11} A$$

$$i_2 = -\frac{3}{11} A = \frac{3}{11} A \text{ to the opposite direction}$$

$$i_3 = \frac{13}{11} A$$

$$I_1 = I_2 + I_3$$

$$\Rightarrow I_1 - I_2 - I_3 = 0 \text{ ---- (1)}$$

$$8 - 4i_1 - 6 - 6i_2 = 0$$

$$2 - 4i_1 - 6i_2 = 0$$

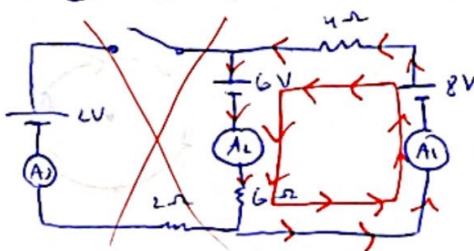
$$-4i_1 - 6i_2 = -2 \text{ ---- (2)}$$

$$-2 - 2i_3 + 6i_2 + 6 = 0$$

$$4 - 2i_3 + 6i_2 = 0$$

$$6i_2 - 2i_3 = -4 \text{ ---- (3)}$$

② لواء switch كان مفتوح



$$8 - 4i_1 - 6 - 6i_1 = 0$$

$$2 - 10i_1 = 0$$

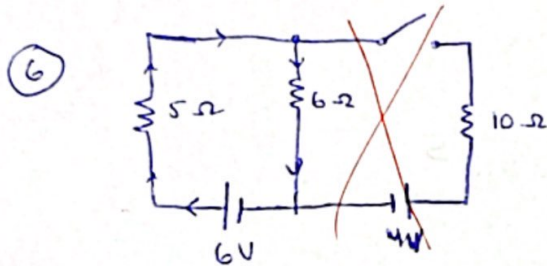
$$2 = 10i_1$$

$$A_1 = A_2 = i_1 = \frac{2}{10} = \frac{1}{5} = 0.2 A$$

$$A_3 = \text{No current}$$

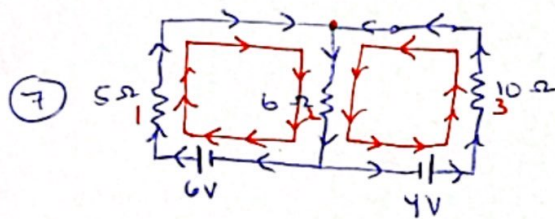
$$\begin{aligned} \textcircled{5} \quad F_B &= qVB \\ &= (1.6 \times 10^{-19}) (720 \times 2.4 \times 10^{10}) \\ &= 2.7648 \times 10^{-26} \text{ N} \end{aligned}$$

$$F = ma \Rightarrow a = \frac{F}{m} = \frac{2.7648 \times 10^{-26}}{9.11 \times 10^{-31}} = 303449.067 \text{ m/s}^2$$



$\textcircled{1}$ There is NO current flowing in $R = 10\Omega$ because the switch is opened

$$\begin{aligned} \textcircled{2} \quad R_{eq} &= 5 + 6 = 11\Omega \\ V &= IR \Rightarrow I = \frac{V}{R} = \frac{6}{11} = 0.54 \text{ A} \end{aligned}$$



node 5 2

$$\begin{aligned} i_1 &= 0.514 \text{ A} \\ i_2 &= 0.5714 \text{ A} \rightarrow R = 6\Omega \\ i_3 &= 0.05714 \text{ A} \rightarrow R = 10\Omega \end{aligned}$$

$$I_1 + I_3 = I_2$$

$$I_1 - I_2 + I_3 = 0 \quad \text{--- (1)}$$

$$4 - 6i_2 - 10i_3 = 0$$

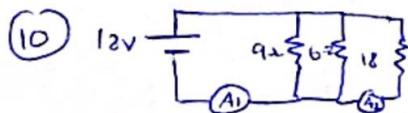
$$-6i_2 - 10i_3 = -4 \quad \text{--- (2)}$$

$$6 - 5i_1 - 6i_2 = 0$$

$$-5i_1 - 6i_2 = -6 \quad \text{--- (3)}$$

$$\textcircled{8} \quad F_B = qVB \Rightarrow B = \frac{F_B}{qV} = \frac{N}{\text{C m/s}} = \frac{Ns}{\text{Cm}}$$

$$\begin{aligned} \textcircled{9} \quad R_{eq} &= 150\Omega + 300 + \left(\frac{1}{2.5 \times 10^3} + \frac{1}{5 \times 10^3} \right)^{-1} \\ &= 2116.67 \Omega \end{aligned}$$

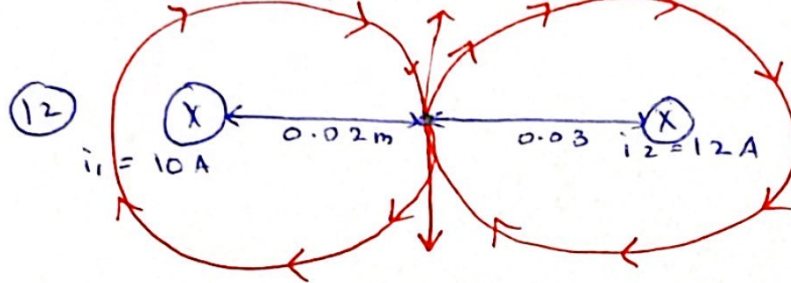


$$\begin{aligned} R_{eq} &= \left(\frac{1}{9} + \frac{1}{6} + \frac{1}{12} \right)^{-1} \\ &= 3\Omega \end{aligned}$$

$$A_1 = I = \frac{12}{3} = 4 \text{ A}$$

$$A_2 = I_3 = \frac{6 \times 3}{12} = 1.5 \text{ A}$$

⑪ $B = \frac{\mu_0 i}{2\pi r} = \frac{(4\pi \times 10^{-7})(5)}{2\pi(0.04)} = 2.5 \times 10^{-5} \text{ T } (\otimes) \text{ into the page}$



$B_1 = \frac{(4\pi \times 10^{-7})(10)}{2\pi(0.02)} = 1 \times 10^{-4} \text{ down}$

$B_2 = \frac{(4\pi \times 10^{-7})(12)}{2\pi(0.03)} = 8 \times 10^{-5} \text{ up}$

$B_{\text{net}} = B_1 - B_2 = 2 \times 10^{-5} \text{ T down}$

⑬ ① $B = \frac{\mu_0 i}{2\pi r} = \frac{(4\pi \times 10^{-7})i}{2\pi(0.1)} = 2 \times 10^{-5}$
 $i = 10 \text{ A}$

② $F_B = qvB$
 $= (1.6 \times 10^{-19})(3 \times 10^4)(2 \times 10^{-5})$
 $F = 9.6 \times 10^{-20} \text{ N}$