Q1) $P = 30$ Watt

$V = 120$ V

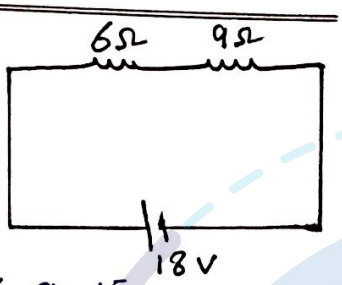
$t = 1\,min = 60\,s$

$P = IV$

$I = \frac{P}{V} = \frac{30}{120} = 0.25$

$I = \frac{Q}{\Delta t} \Rightarrow Q = I\,\Delta t = 0.25 \times 60 = \underline{15\ C}$

Q2)



$R_T = 6 + 9 = 15\ \Omega$

$\therefore I_T = \frac{18}{15} = 1.2$

$P_T = I^2 R_1 + I^2 R_2$

$= (1.2)^2(6) + (1.2)^2(9)$

$= 21.6$

$V_{6\Omega} = V_{9\Omega} = 18$

$\therefore P_T = \frac{V^2}{R_{9\Omega}} + \frac{V^2}{R_{6\Omega}}$

$P_T = \frac{(18)^2}{6} + \frac{(18)^2}{9} = 90$

$P = IV$

$= \frac{V}{R} \cdot V$

$P = \frac{V^2}{R}$

$\therefore P_{max}$ ستكون في حالة التوازي لأن الجهد لا يتوزع على المقاومتين (متساوي في المقاومتين).

Q3) $I = \frac{Q}{\Delta t} = \frac{Ne}{\Delta t}$

$= \frac{5 \times 10^{21} \times 1.6 \times 10^{-19}}{10 \times 60} = 1.33$

$\therefore V = IR = 1.33 \times 20 = 26.66 \cong 27$

Q4) $R = \frac{\rho L}{A}$

$\frac{RA}{L} = \rho$

$\rho = \frac{0.45 \times (\pi\,(0.5 \times 10^{-3})^2)}{2} = 1.8 \times 10^{-7}\ \Omega \cdot m$

Q5) $137 = \frac{\rho}{\pi\left(\frac{D_{24}}{2}\right)^2}$ ~①

$220 = \frac{\rho}{\pi\left(\frac{D_{26}}{2}\right)^2}$ ~②

① بقسمة ②

$\sqrt{\frac{137}{220}} = \sqrt{\frac{(D_{26})^2}{(D_{24})^2}}$

$0.789 = \frac{D_{26}}{D_{24}} \Rightarrow \frac{D_{24}}{D_{26}} = \frac{1}{0.789} = 1.3$

Q6) حجم الموصل يجب أن يبقى ثابت ، لذلك عند زيادة الطول تقل المساحة بحيث نحافظ على ثبات الحجم

$\because V_{Volume} = A\,L$ ↑ ↓

$\because L_2 = 4L_1$

$\therefore A_2 = \frac{1}{4}A_1$

$\Rightarrow R_2 = \frac{\rho L_2}{A_2} = \frac{\rho\, 4L_1}{\frac{1}{4}A_1} = 16\left(\frac{RL_1}{A_1}\right)$

R_1

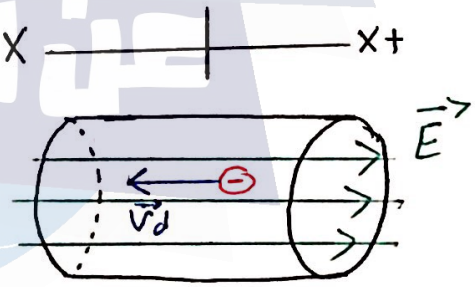
Q9) $I = n e v_d A$

$|\vec{v}_d| = \frac{I}{n e A}$

$|v_d| = \frac{1}{8.49\times10^{28} \times 1.6\times10^{-19} \times 0.4}$

$= 1.84\times10^{-10}$

$\vec{v}_d = -1.84\times10^{-10}$



Q10) $R_{S_1} = 10 + 10 + 10 = 30\ \Omega$

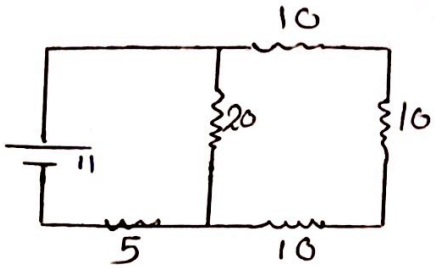
$R_p = \frac{30 \times 20}{(30 + 20)} = 12\ \Omega$

$R_{S_2} = 5 + 12 = 17$

$I_T = \frac{11}{17} = 0.65\ A$

$V_{5\Omega} = 0.65 \times 5 = 3.24$

$\therefore V_{20} = 11 - 3.24 = 7.8$



Q11) $R_{P_1} = \frac{10 \times 10}{10 + 10} = 5\ \Omega$

$R_{S_1} = 5 + 5 = 10\ \Omega$

$R_{P_2} = \frac{10 \times 10}{10 + 10} = 5\ \Omega$

$R_{S_2} = 5 + 10 = 15\ \Omega$

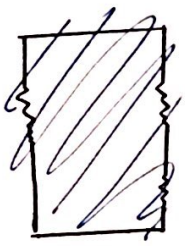
$I_T = \frac{24}{15} = 1.6$

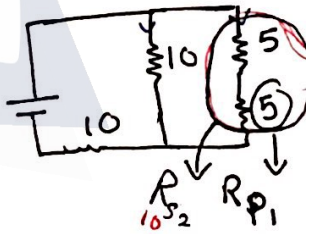
$V_{10\Omega} = 10 \times 1.6\ V$

$V_{10\Omega} = 8\ V$ (في التوازي)

$I_{5\Omega} = \frac{1.6}{2} = 0.8$

$\therefore P_{5\Omega} = (0.8)^2 \times 5 = 3.2\ Watt$





هما أن المقاومتين متساويات
إذا التيار سيتوزع بالتساوي
على ~~المقاومة~~ في التوازي

Q12) $R_S = R_1 + R_2$

$R_{Total} = \frac{V_T}{I_T} = \frac{20}{2} = 10\ \Omega$

$10 = R_1 + R_2 \Rightarrow R_1 = 10 - R_2$ ---①

$R_P = \frac{R_1 R_2}{R_1 + R_2}$

$R_T = \frac{20}{10} = 2\ \Omega$

$\therefore 2 = \frac{R_1 R_2}{R_1 + R_2}$

$2R_1 + 2R_2 = R_1 R_2$ ---②

بالتعويض في ② عن R_1

$2(10 - R_2) + 2R_2 = (10 - R_2)R_2$

$20 - 2R_2 + 2R_2 = 10R_2 - R_2^2$

$R_2^2 - 10R_2 + 20 = 0$

$R_2 = 7.23$ ✓

$R_1 = 2.8$

(Q13) $R_T = \frac{20}{2} = 10\ \Omega$

$\because R_T < 15$

$\therefore$ التوصيل Parallel

$10 : \frac{15R}{(15+R)}$

$15 + R : 1.5R$

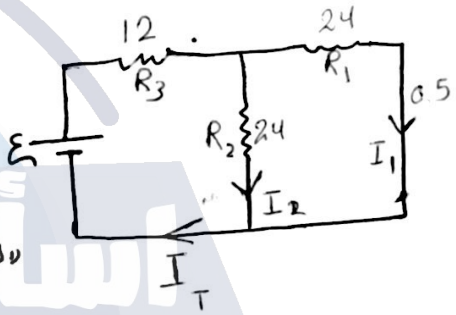
$15 : 0.5R$

$\therefore R : 30\ \Omega$

(Q14) $\because R_1 : R_2$

$\therefore I_{R_1} : I_{R_2} = 0.5$

$\therefore I_T = 0.5 + 0.5 = 1\ A$



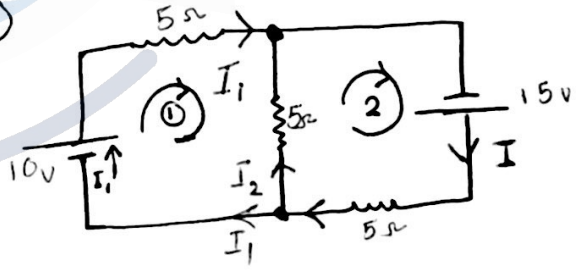
$V_{R_1} = V_{R_2}$ لأن التوصيل توازي

$\therefore \boxed{V_{R_1} = 0.5 \times 24 = 12\ V} = V_{R_2}$

$\boxed{V_{R_3} = 1 \times 12 = 12\ V}$

$\therefore \mathcal{E} = 12 + 12 = 24\ V$

(Q15) $I = I_1 + I_2 \Rightarrow \boxed{I - I_1 - I_2 = 0}$ ③



$10 - 5I_1 + 5I_2 = 0$

$\boxed{5I_1 - 5I_2 = 10}$ ①

$15 - 5I - 5I_2 = 0$

$\boxed{5I + 5I_2 = 15}$ ②

بحل المعادلات ③، ②، ① ينتج

$I = 2.66$

$\boxed{I_1 = 2.33}$

$I_2 = 0.33$

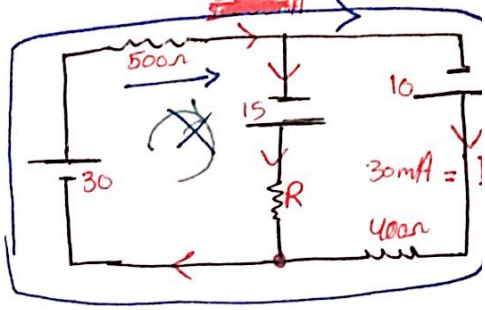
Q16) $30 - 500I + 10 - 400 \times 30\times10^{-3} = 0$

$40 - 500I - 12 = 0$

$28 - 500I = 0$

$I = 0.056 = 56\ mA$

from left to right



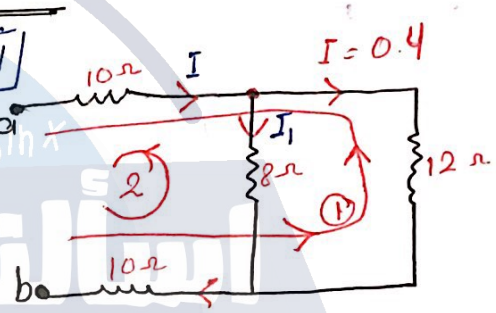
Q17) $20 - 20\times1.5 - 12 = V_B - V_A$

$V_B - V_a = -22$

Q18) $-30 - 6 + 12 - 10 + 4 = V_a - V_b$

$V_a - V_B = -30$

Q19) $I = 0.4 + I_1 \Rightarrow$ $\boxed{I_1 = I - 0.4}$



$10I + (0.4\times12) + 10I = V_a - V_b$

$20I + 4.8 = (V_a - V_b)$

$\boxed{20I - (V_a - V_b) = -4.8}$ ... ①

$10I + 8I_1 + 10I = (V_a - V_b)$

$20I + 8(I - 0.4) = (V_a - V_b)$

$20I + 8I - 3.2 = (V_a - V_b)$

$\boxed{28I - (V_a - V_b) = 3.2}$ ... ②

بحل ① ، ② بنتج:

$I = 1$

$(V_a - V_b) = 24.8 \approx 25\ V$

Q20) $Q = Q_f (1 - e^{-\frac{t}{\tau}})$

$\frac{Q}{C} = \frac{Q_f}{C} (1 - e^{-t/\tau})$

$\mathcal{E} = \mathcal{E}_f (1 - e^{-t/\tau})$

$0.8\mathcal{E}_f = \mathcal{E}_f (1 - e^{-t/\tau})$

$\ln 0.2 = \ln e^{-t/\tau}$ "ln الطرفين"

$-1.6 = -\frac{t}{\tau}$

$t = 1.6\tau$

Q21) $U = \frac{1}{2} C V_0^2$ ⟸ الأصل

$\frac{0.45}{\text{المتبقية}} U = \frac{1}{2} C V^2$

$0.45 (\frac{1}{2} C V_0^2) = \frac{1}{2} C V^2$

$0.45 V_0^2 = V^2$

$\sqrt{\frac{V^2}{V_0^2}} = \sqrt{0.45}$

$\boxed{\frac{V}{V_0} = 0.67}$ ①

$V = V_0 e^{-\frac{t}{\tau}}$

$\boxed{\frac{V}{V_0} = e^{-\frac{t}{\tau}}}$ ②

$0.67 = e^{-\frac{t}{\tau}}$ "ln الطرفين"

$-0.40 = -\frac{t}{\tau}$

$\boxed{t = 0.4\tau}$

حل آخر

باستخدام القانون $U = U_0 e^{-\frac{2t}{\tau}}$

$0.45 U_0 = U_0 e^{-\frac{2t}{\tau}}$

$\ln 0.45 = \ln e^{-\frac{2t}{\tau}}$

$-0.8 = -\frac{2t}{\tau}$

$t = \frac{0.8}{2}\tau \Rightarrow \boxed{t = 0.4\tau}$

Q22) $Q_f = 30 \times 30 = 900\,\mu C$

$Q = Q_f (1 - e^{-t/\tau})$

$\boxed{Q = 900 (1 - e^{-t/\tau})}$ ~ (1)

$\tau = (5 \times 10^{+3})(30 \times 10^{-6}) = 0.15$

$I_{max} = \frac{30}{5 \times 10^3} = 6 \times 10^{-3}\,A = 6\,mA$

$I = I_{max}\, e^{-t/\tau}$

$2 = 6\, e^{-t/0.15}$

$\frac{1}{3} = e^{-t/0.15}$ « ln الطرفين »

$-1.1 = \frac{-t}{0.15}$

$\boxed{t = 0.165\ s}$

$\therefore Q = 900(1 - e^{-\frac{0.165}{0.15}})$

$Q = 600\,\mu C$

$V_{capacitor} = \frac{600 \times 10^{-6}}{30 \times 10^{-6}} = 20\ V$

$\therefore P_{(rate)} = I V$

$= (2 \times 10^{-3})(20) = 40 \times 10^{-3}\,Watt = 40\ m\,Watt$

Q23) $Q_f = 40 \times 50 = 2000\ \mu C$

$\tau = (40 \times 10^{-6})(5 \times 10^{3}) = 0.2$

$I_{max} = \frac{50}{5 \times 10^{+3}} = 10 \times 10^{-3} = 10\ mA$

$I = I_{max}\, e^{-t/\tau}$

$2 = 10\, e^{-t/0.2}$

$\frac{1}{5} = e^{-t/0.2}$

$1.61 = \frac{t}{0.2}$

$\boxed{t = 0.32}$

$Q = 2000\,(1 - e^{\frac{-0.32}{0.2}})$

$= 1596.21\ \mu C$

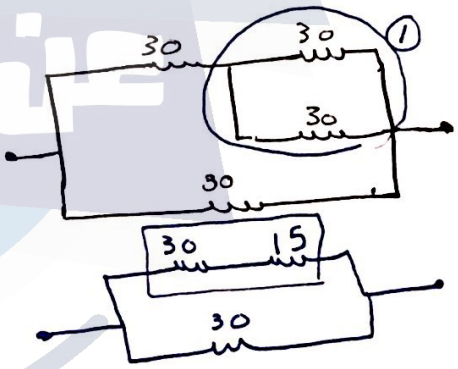
$U = \frac{1}{2}\frac{Q^2}{C}$

$= \frac{1}{2} \times \frac{(1596.21 \times 10^{-6})^2}{40 \times 10^{-6}} = 0.032\ J = 32\ mJ$

Q24) $R_{P_1} = \frac{30 \times 30}{30 + 30} = 15$

$R_{S_1} = 30 + 15 = 45$

$R_{P_2} = \frac{30 \times 45}{30 + 45} = 18$



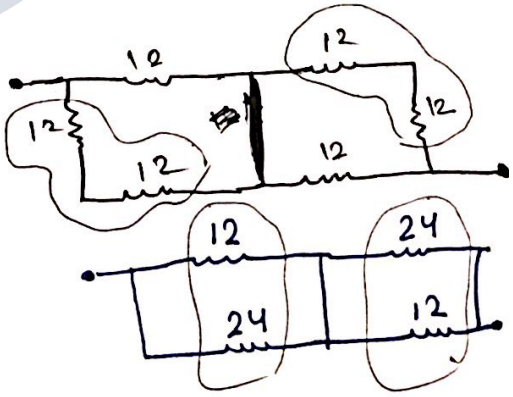
Q25) $R_{S_1} = 12 \# 12 = 24$

$R_{S_2} = 12 + 12 = 24$

$R_{P_1} = \frac{24 \times 12}{24 + 12} = 8$

$R_{P_2} = \frac{24 \times 12}{24 + 12} = 8$

$R_{S_3} = 8 + 8 = 16$



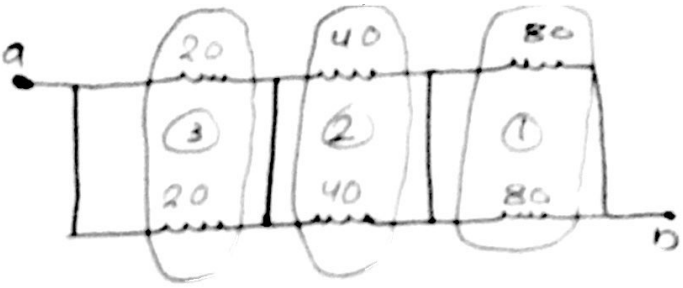
(Q24) $R_{P_1} = \frac{80 \times 80}{80 + 80} = 40\,\Omega$

$R_{P_2} = \frac{40 \times 40}{40 + 40} = 20\,\Omega$

$R_{P_3} = \frac{20 \times 20}{20 + 20} = 10\,\Omega$

$R_S = 10 + 20 + 30$

$= 70\,\Omega$



Ch 27

1) $|\vec{B}| = \sqrt{2^2 + 3^2 + (-4)^2} = 5.4\ mT$

$\vec{F}_B = q\vec{v} \times \vec{B}$

$= q v B \sin\theta$

$= (5\times10^{-9})(5\times10^{3})(5.4\times10^{-3}) \sin 120$

$= 1.17\times10^{-7}\ N$

$F = ma$

$1.17\times10^{-7} = 3\times10^{(-9)} \times a$ → $\mu g = 10^{-6}\ g$

$a = 38.9 \approx 39\ m/s$ → $= 10^{-9}\ Kg$

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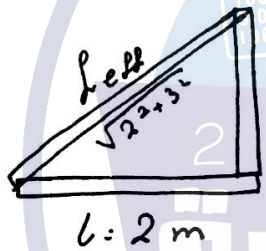
4)



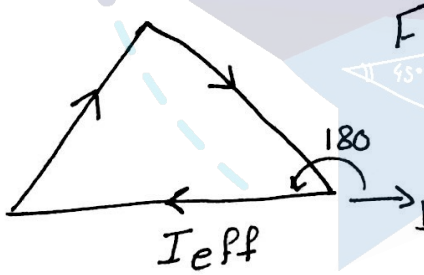
$\vec{F}_B = I\vec{l}_{eff} \times \vec{B}$

$= 25 \times \sqrt{2^2+3^2} \times (40\times10^{-3}) \sin 90$

$= 3.60\ N$

---

6)



$\vec{F} = I\vec{l}_{eff} \times \vec{B}$

$= I \times l \times B \sin 180$

$= Zero$

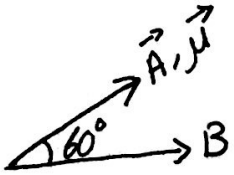
---

7) $\vec{\mu} = I\vec{A}$

$\mu = NIA$

$= 80 \times (8) \times (0.4 \times 0.3)$

$= 76.8$



$\tau = \vec{\mu} \times \vec{B}$

$= \mu B \sin\theta$

$= 76.8 \times (40\times10^{-3}) \sin 60$

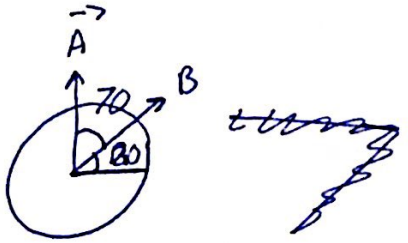
$= 2.66 \approx 2.7\ N.m$

8) $80 = 2\pi r$

$r = 12.7\ cm = 0.127\ m$

$A = \pi (0.127)^2$

$= 0.051\ m^2$



$\tau = \vec{\mu} \times \vec{B}$

$\tau = I \vec{A} \times \vec{B}$

$= I A B \sin\theta$

$= 4 \times 0.051 \times 2 \times \sin 70 = 0.38\ N.m$

---

9) $\tau = \vec{\mu} \times \vec{B}$

$= I \vec{A} \times \vec{B}$

$\vec{A} = A \hat{n}$ ($\hat{n}$: normal vector)

$= (\pi (0.5)^2) \dfrac{(2\hat{i} - \hat{j} + 2\hat{k})}{3}$

$= 0.26 (2i - j + 2k)$

$\vec{A} = 0.52i - 0.26j + 0.52k$

$\vec{A} \times \vec{B}$

$$\begin{matrix} & i & j & k \\ \vec{A} & 0.52 & -0.26 & 0.52 \\ \vec{B} & 2 & -6 & 0 \end{matrix}$$

ما بي داي نوجدهم

$\vec{A} \times \vec{B} = \begin{bmatrix} -0.26 & 0.52 \\ -1 & 0 \end{bmatrix} \hat{i} - [\quad] j - [\quad] k$

$= (-0.26 \times 0 - (-6 \times 0.52))\, i$

$\vec{A} \times \vec{B}_x = 3.12$

$\tau_x = I \vec{A} \times \vec{B}_x$

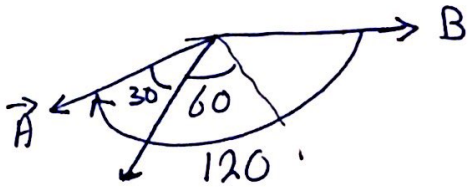
$= 3 \times 3.12$

$= 9.36 \approx 9.4$

10) $\vec{\mu} = I\vec{A}$

$= NI\vec{A}$

$= 50 \times 0.5 \times (0.2)^2 = 1$



$\tau = \vec{\mu} \times \vec{B}$

$= \mu B \sin\theta$

$= 1 \times 0.4 \sin \begin{matrix}60\\120\end{matrix} = 0.35$

---

11) $\tau = IN\vec{A} \times \vec{B}$ (θ: 90)

$\tau = INAB \sin\theta$

$0.080 = I \times 200 \times (0.2 \times 0.8) \times 0.3$

$0.080 = 9.6\, I$

$I = 8.3 \times 10^{-3} A = 8.3\, mA$

---

12) $\rho = V_{//} \times T$

$\rho = V_{//} \times \frac{2\pi}{\omega}$

$\rho = V_{//} \times \frac{2\pi r}{V_\perp}$

$r = \frac{m V_\perp}{Bq}$

$V_\perp = \frac{Bqr}{m}$

$V_\perp = \frac{(80 \times 10^{-6})(1.6 \times 10^{-19})(2 \times 10^{-3})}{(9.11 \times 10^{-31})}$

$V_\perp = 28.1\ Km/s$

$V_{//} = \frac{\rho}{T} = \frac{(9 \times 10^{-3})}{\frac{2\pi(2 \times 10^{-3})}{28.1 \times 10^3}} = 20.1\ Km/s$

$V = \sqrt{V_{//}^2 + V_\perp^2}$

$= \sqrt{(28.1)^2 + (20.1)^2}$

$= 34.5 \approx 35\ Km/s$

---

13) $F_B = F_C$

$qv_1B = \frac{mv_1^2}{r}$

$\omega = \frac{qB}{m} \Rightarrow T = \frac{2\pi}{\omega} \Rightarrow \boxed{T = \frac{2\pi m}{qB}}$

$T = \frac{2\pi (1.67\times10^{-27})}{(1.6\times10^{-19})(0.5)}$

$= 1.3\times10^{-7}\ s$

$p = v_{//}\, T$

$p = v\cos\theta\, T$

$5\times10^{-3} = (60\times10^{3})\cos\theta \times 1.3\times10^{-7}$

$5\times10^{-3} = 8\times10^{-3}\cos\theta$

$\cos\theta = \frac{5}{8} \Rightarrow \boxed{\theta = 51^\circ}$

---

14) $p = v_{//} \times \frac{2\pi r}{v_\perp}$

$p = \frac{v\cos\theta \times 2\pi r}{v\sin\theta} \Rightarrow p = \frac{2\pi r}{\tan\theta}$

$\tan\theta = \frac{2\pi(4\times10^{-2})}{(8\times10^{-2})}$

$\tan\theta = \frac{\pi}{2}$

$\boxed{\theta = 72^\circ}$

$p = \tan\theta \times 2\pi r$

$\frac{8\times10^{-2}}{2\pi(4\times10^{-2})} = \tan\theta$

15) $\vec{B}$ uniform, V isn't $\perp$ B $\Rightarrow$ helical

$$r = \frac{mv}{qB} = \frac{3\times10^{-9}\times40}{5\times10^{-6}\times60\times10^{-3}} = 0.4\,m = 40\,cm$$

$$p = 30 \times \frac{2\pi\times0.4}{60} = 1.3\,m$$

---

16) $KE = U_e$

$$\frac{1}{2}mv^2 = eV$$

$$\boxed{v = \sqrt{\frac{2eV}{m}}}$$

$$r = \frac{mv}{qB}$$

خواص

$$\frac{r_1}{r_2} = \frac{V_1}{V_2}$$

$$\frac{r_1}{r_2} = \frac{\sqrt{\frac{2eV_1}{m}}}{\sqrt{\frac{2eV_2}{m}}}$$

$$\frac{r_1}{r_2} = \frac{\sqrt{500}}{\sqrt{300}} = 1.29 \approx 1.3$$

---

17) $r = \frac{mv}{qB}$

$$2\times10^{-3} = \frac{(1.67\times10^{-27})v}{(1.6\times10^{-19})(0.25)}$$

$$v = 48\times10^3\ m/s = \underline{48\,Km/s}$$

$$\therefore d = 48\times1 = 48\,Km$$

---

18)

$$r_2 - r_1 = (2.5 \times 10^{-2})$$

$$\frac{m_2 v}{qB} - \frac{m_1 v}{qB} = (2.5 \times 10^{-2})$$

$$\frac{v}{qB}(m_2 - m_1) = (2.5 \times 10^{-2})$$

$$(m_2 - m_1) = \frac{(2.5 \times 10^{-2}) qB}{v}$$

$$(m_2 - m_1) = \frac{(2.5 \times 10^{-2})(1.6 \times 10^{-19})(0.4)}{5000 \times 10^3} = 3.2 \times 10^{-28}\ Kg$$

---

19) $F_B = F_e$

$$qvB = qE$$

$$v = \frac{E}{B} \Rightarrow v = \frac{4 \times 10^{-3}}{8 \times 10^{-3}} = 500 \times 10^3$$

$$KE = \frac{1}{2} m v^2$$

$$= \frac{1}{2}(9.11 \times 10^{-31})(500 \times 10^3)$$

$$= 1.14 \times 10^{-19}\ J$$

$$= \frac{1.14 \times 10^{-19}}{1.6 \times 10^{-19}}$$

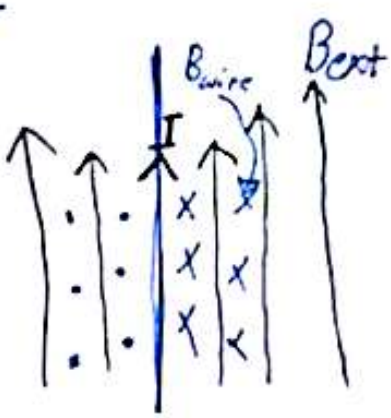
$$= 0.71\ eV$$

للتحويل من J إلى eV نقسم على شحنة الإلكترون 1.6×10^{-19}

Q9) $B_{wire} = \frac{\mu_0 \times 40}{2\pi(0.2)} = 4\times10^{-5} \Rightarrow 40\mu T$

$B_{ext} = 30\mu T$

$B_{total} = \sqrt{(40)^2 + (30)^2} = 50\mu T$



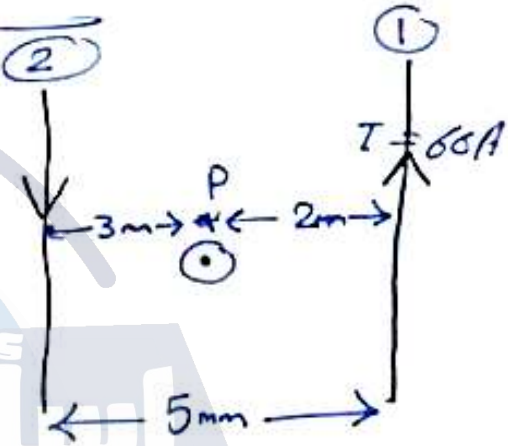
اسلاك متعامدين

Q8) $B_1 = \frac{\mu_0 \times 60}{2\pi(2\times10^{-3})} = 6\times10^{-3}$ ⊙

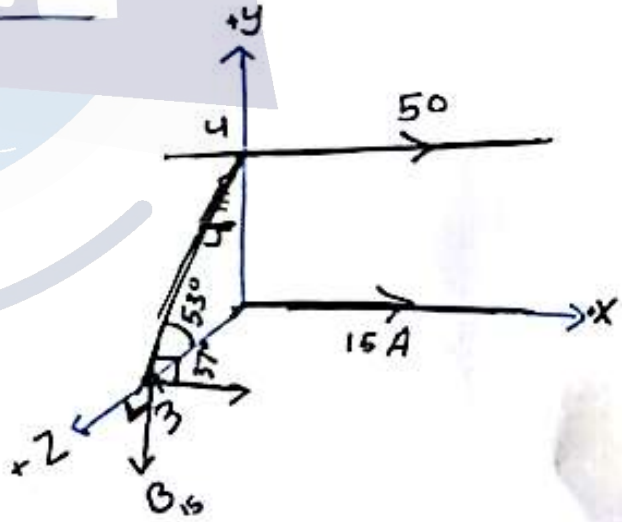
$B_2 = \frac{\mu_0 (60)}{2\pi(3\times10^{-3})} = 4\times10^{-3}$ ⊙

$B_{at\ p} = (6+4)\times10^{-3} = 10\times10^{-3}$

$= 10\ mT$



Q6)



Q12) $\theta = 90 \times \frac{\pi}{180} = \boxed{\frac{\pi}{2}}$

13 نفس فكرة

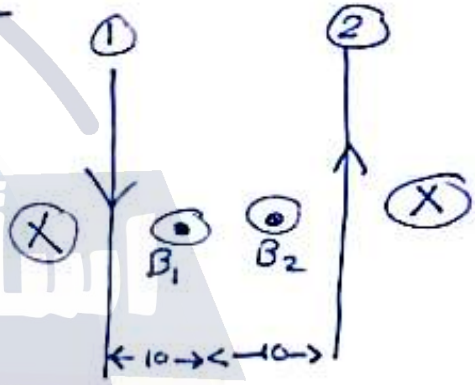
Q11) $L = (2\pi r) N$

$2 = 2\pi r \times 5$

$r = 0.064\ m$

$B = \frac{\mu_0 \times 5 \times 1.2}{2 \times 0.064} = 5.9 \times 10^{-5} = 59\ \mu T$

Q10) $\frac{I_1}{I_2} = \frac{3}{1} \Rightarrow \boxed{I_1 = 3 I_2}$



$B_{Total} = B_1 + B_2$

$4 \times 10^{-6} = \frac{\mu_0 (I_1)}{2\pi(0.1)} + \frac{\mu_0 I_2}{2\pi(0.1)}$

$4 \times 10^{-6} = \frac{\mu_0}{2\pi(0.1)} [3 I_2 + I_2]$

$4 \times 10^{-6} = \frac{\mu_0 \times 4 I_2}{2\pi(0.1)}$

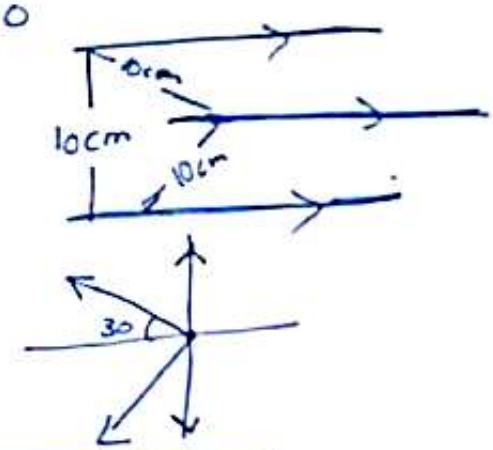
$I_2 = 0.5\ A$

$I_1 = 3 \times 0.5 = 1.5\ A$ the largest

Q15)

$$\Sigma F = 2 \times \frac{\mu_0 \times 10^2 \times (0.2) \times \cos 30}{2\pi (0.1)}$$

$$= 69\,\mu N$$



Q14) $B_a = \dfrac{\mu_0 I}{4\pi a}$ ⊙ $\longrightarrow \dfrac{270 \times \pi}{180} = \boxed{\dfrac{3\pi}{2}}$

$$B_a = \frac{\mu_0 I \left(\frac{3\pi}{2}\right)}{4\pi R} = \boxed{\frac{3\mu_0 I}{8R}} \odot$$

$$B_b = \frac{\mu_0 I \left(\frac{3\pi}{2}\right)}{4\pi (2R)} = \boxed{\frac{3\mu_0 I}{16R}} \otimes$$

$$B = \frac{3\mu_0 I}{8R} - \frac{3\mu_0 I}{16R} = \boxed{\frac{3\mu_0 I}{16R}}$$

Q13) $B_a = \dfrac{\mu_0 \times 5 \times 2\pi}{4\pi (0.02)} = 1.57 \times 10^{-4}$ ⊗ $\quad \boxed{\theta = 360 \times \frac{\pi}{180} = 2\pi}$

$$B_b = 6.98 \times 10^{-5} \odot$$

$$B = 1.57 \times 10^{-4} - 6.98 \times 10^{-5} = 8.7 \times 10^{-5} \otimes$$

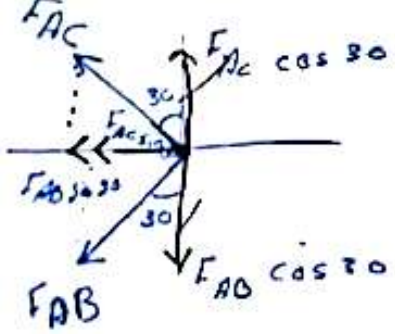
$$87\,\mu T$$

Q18) $F_{result} = F_{AC}\sin 30 + F_{AD}\sin 30$

$= (0.032 \sin 30) \times 2$

$= 0.032$

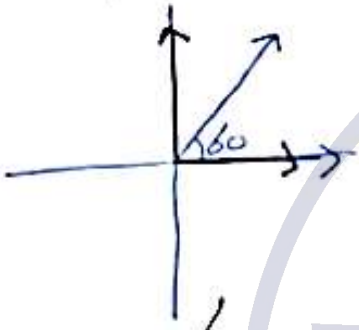
$= 32\ mN$



$F_{AC} = \frac{\mu_0 (20)^2 (2)}{2\pi (5\times10^{-3})}$

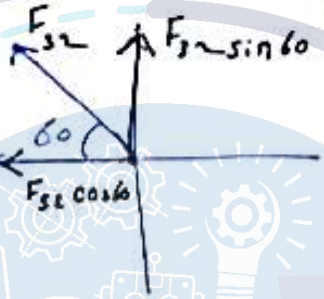
$= 0.032\ N = F_{AD}$

Q17)



نفس الفكرة

or

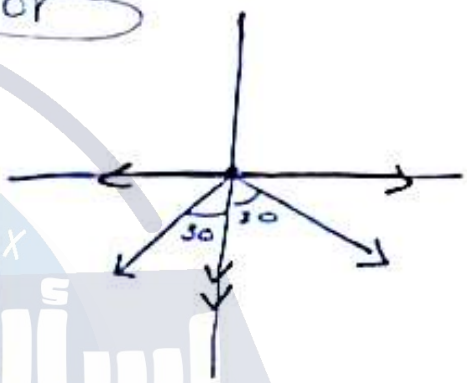


$F_x = F_{21} + F_{32}\cos 60$

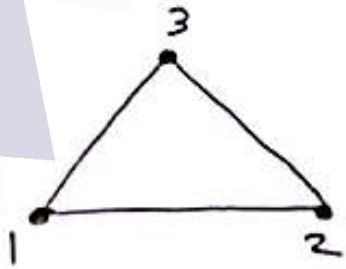
$F_y = F_{32}\sin 60$

$\Sigma F = \sqrt{F_x^2 + F_y^2}$

or



$F \cdot 2 \cancel{\cos} F\cos(30)$



Q16) $I_1 = 3I_2$

$F = \frac{\mu_0 I_1 I_2 L}{2\pi r}$

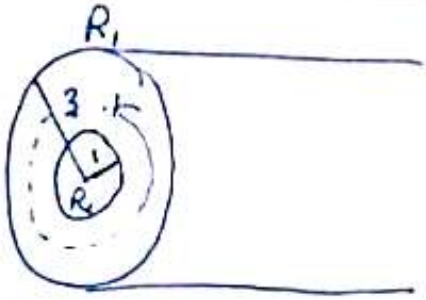
$60\times10^{-6} = \frac{\mu_0 (3I_2) I_2 (2)}{2\pi (0.02)}$

$I_2^2 = 1 \Rightarrow I_2 = 1A$

$\therefore I_1 = 3A$ the greatest

Q21) الإشتقاق في سؤال 23

$$B = \frac{\mu_0 I (r^2 - R_2^2)}{(2\pi r)(R_1^2 - R_2^2)}$$



$$= \frac{\mu_0 \times 80 \times \left((2\times10^{-3})^2 - (1\times10^{-3})^2\right)}{2\pi (2\times10^{-3})\left((3\times10^{-3})^2 - (1\times10^{-3})^2\right)}$$

$$= 3m\,T$$

Q20) $r > 1mm$

$$B = \frac{\mu_0 I}{2\pi r}$$ ← تعويض مباشر

Q18) $F_x = F_{BC} + F_{AC}\cos 60$ ← كفيف السيال

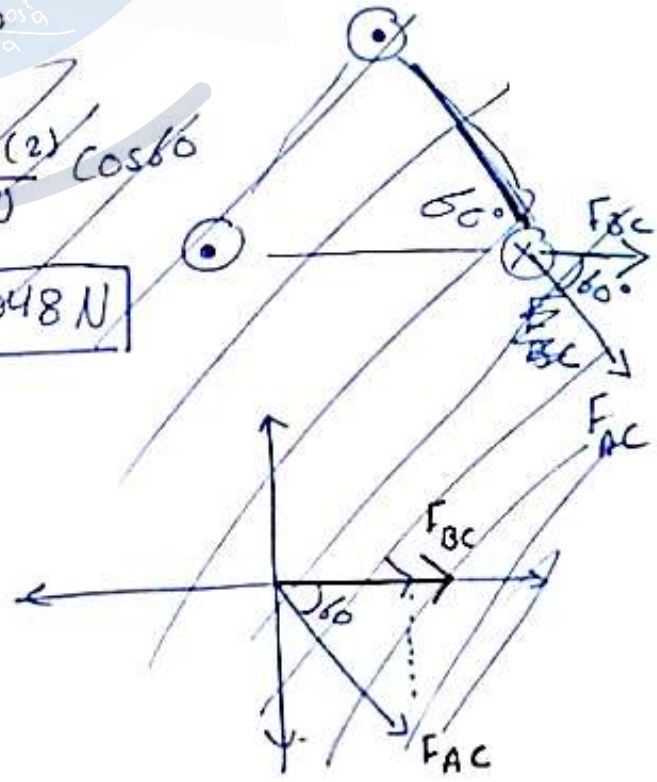
$$= \frac{\mu_0 (20)^2 \times 2}{2\pi (5\times10^{-3})} + \frac{\mu_0 (20)^2 (2)}{2\pi (5\times10^{-3})}\cos 60$$

$$= 0.032 + 0.016 = \boxed{0.048\ N}$$

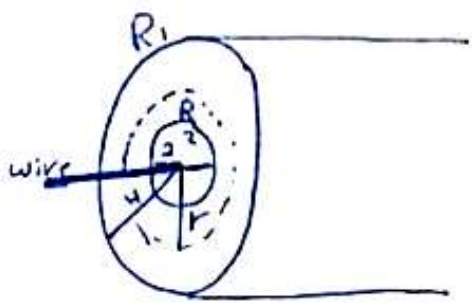
$$F_y = F_{AC}\sin 60$$

$$= \boxed{0.028\ N}$$

$$F = \sqrt{(0.028)^2 + (0.048)^2}$$



Q 23)



$B(2\pi r) = \mu_0 I_{inc}$

$B(2\pi r) = \mu_0 \frac{I \, A_{\text{الطلوب}}}{A_{\text{الكلي}}}$

$B(2\pi r) = \mu_0 \frac{I \, \pi(r^2 - R_2^2)}{\pi(R_1^2 - R_2^2)}$

$J = \frac{I}{A_{\text{الكلي}}}$

$A = \pi R_2^2 - \pi R_1^2$

$B_{\text{cylindrical conductor}} = \frac{\mu_0 I (r^2 - R_2^2)}{(2\pi r)(R_1^2 - R_2^2)}$

$= \frac{\mu_0 \times 24 \times ((3\times10^{-3})^2 - (2\times10^{-3})^2)}{2\pi(3\times10^{-3})((4\times10^{-3})^2 - (2\times10^{-3})^2)}$

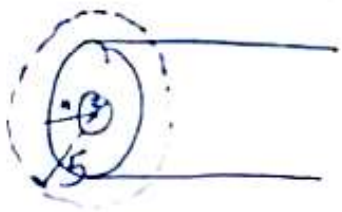
$= 6.67\times10^{-4} \Rightarrow \boxed{0.667 \text{ mT}}$

$B_{wire} = \frac{\mu_0 \times 24}{2\pi(3\times10^{-3})} = 1.6\times10^{-3} = \boxed{1.6 \text{ mT}}$

$|B_{result}| = 1.6 - 0.667 = 0.93 \text{ mT}$

Q 22) $B(2\pi r) = \mu_0 I_{inc}$

$B = \frac{\mu_0 I}{2\pi r}$



$= \frac{\mu_0 (24)}{2\pi(5\times10^{-3})} = 9.6\times10^{-4} \text{ T}$

$= 0.96 \text{ mT}$

Q27) $F_{\text{on wire}} = B_{\text{Solenoid}} \; I_{\text{wire}} \; L$

$F = (\mu_0 n I_{sol}) I L$

$= (\mu_0 \times 800 \times 50\times10^{-3})(12)(0.02)$

$= 1.2\times10^{-5}\ N = 12\ \mu N$

Q26) $n = \frac{8000}{2} = 2000$

$B = \mu_0 \times 2000 \times 5 = 0.0125\ T$

$\Phi = \vec{B}.\vec{A}$

$\Phi = (0.0125)(\pi (0.02)^2)\cos 0$

$= 1.6\times10^{-5}\ Wb = 16\ \mu Wb$

Q25) $B_{sol} = \mu_0 (900)(30\times10^{-3}) = 3.4\times10^{-5}$

$B_{wire} = \frac{\mu_0 (3)}{2\pi (0.02)} = 3\times10^{-5}$

$B_{result} = \sqrt{(3\times10^{-5})^2 + (3.4\times10^{-5})^2}$

$= 4.5\times10^{-5}\ T = 45\ mT$

Q 37)

$$B = \frac{\mu_0 N I}{2\pi r}$$

$$= \frac{(4\pi \times 10^{-7})(2000)(30)}{2\pi(0.11)} = 0.109\ T$$

Q 30) $\oint B \cdot ds = \mu_0 I_{inc}$

$= \mu_0 J A_{\text{المطلوبة}}$ ⟹ $(1.5\times10^{-2})^2 = 2.25\times10^{-4}$

$= \mu_0 I A_{\text{المطلوبة}}$

$A_{\text{الأصلية}}$ ⟹ $(3\times10^{-2})^2 = 9\times10^{-4}$

$$= \frac{(4\pi\times10^{-7})(60)(2.25\times10^{-4})}{(9\times10^{-4})}$$

$$= 11.9\times10^{-5}\ T = 19\ \mu T$$

Q 28) $B_{sol} = \mu_0 n I$

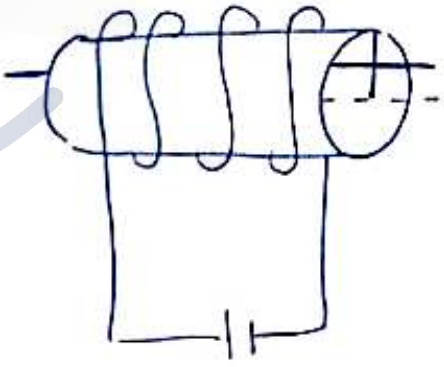
$= \mu_0 (1200)(0.3) = 4.5\times10^{-4}$

$$B_{wire} = \frac{\mu_0 (20)}{2\pi(0.01)} = 4\times10^{-4}$$

$$B_{result} = \sqrt{(4\times10^{-4})^2 + (4.5\times10^{-4})^2}$$

$$= 6.0\times10^{-4}\ T$$

$$= 0.60\ mT$$



المجال الناشئ في الـ solenoid باتجاهه بـ $\pm X$

+ المجال الناشئ عن الـ wire $\pm Z$ (خارج وداخل الصفحة)

∴ المجالين متعامدين
