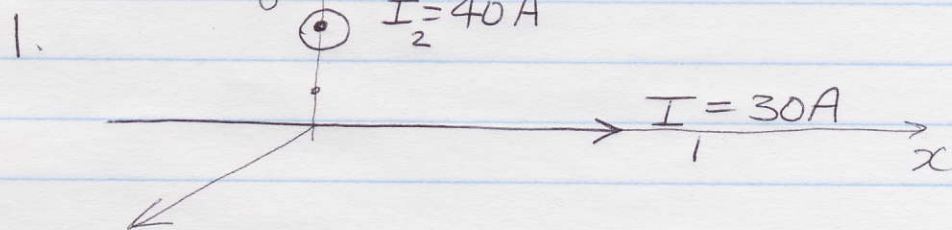


Physics 210 - Solutions to Multiple Choice - Week 9



$$\vec{B}_1 = \frac{\mu_0 (30A)}{2\pi (2m)} \hat{k} \quad \vec{B}_2 = \frac{\mu_0 (40A)}{2\pi (2m)} (-\hat{i})$$

$$B_{\text{net}} = \sqrt{B_1^2 + B_2^2} = 5.0 \mu\text{T}$$

$$2. \quad B = \frac{\mu_0 I}{2\pi(3)} - \frac{\mu_0 4I}{2\pi(2)} - \frac{\mu_0 3I}{2\pi(1)} = 19 \mu\text{T}$$

$$3. \quad B = \frac{\mu_0 I \theta}{4\pi R} = \frac{\mu_0 I}{4\pi} \left[\frac{\pi/2}{2\text{cm}} + \frac{3\pi/2}{4\text{cm}} \right]$$

$$= 39 \mu\text{T}$$

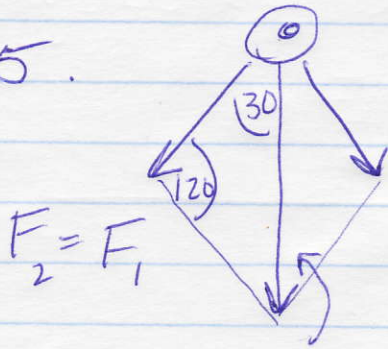
$$4. \quad F = \frac{\mu_0 I_1 I_2 L}{2\pi R} = \frac{4\pi \times 10^{-7} \cdot I \cdot 2I \cdot L}{2\pi (6\text{mm})} = 8 \mu\text{N}$$

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

$$2I = 0.4\text{A}$$

(2)

5.



$$F_1 = \frac{\mu_0 I_1 I_2 L}{2\pi R} = \frac{\mu_0 5 \cdot 5 \cdot 2}{(6\text{mm})}$$

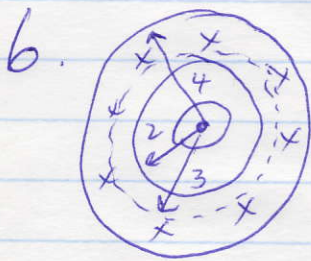
$$= 1.67 \times 10^{-3} \text{ N}$$

$$F_2 = F_1$$

$$F_{\text{net}}^2 = F_1^2 + F_2^2 - 2F_1 F_2 \cos 120^\circ$$

$$= 2F_1^2 (1 - \cos 120^\circ)$$

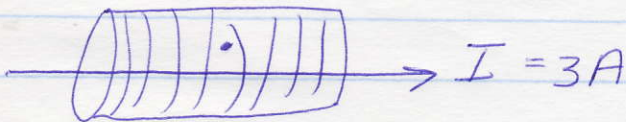
$$F_{\text{net}} = \sqrt{2(1 - \cos 120^\circ)}^{1/2} \cdot F_1 = 2.9 \text{ mN}$$



$$B = \frac{\mu_0}{2\pi(3\text{mm})} \left[24\text{A} - 24\text{A} \frac{(3^2 - 2^2)}{(4^2 - 2^2)} \right]$$

$$= 0.93 \text{ mT}$$

7.



$$B_{\text{solenoid}} = \mu_0 I n$$

$$= 3.39 \times 10^{-5} \text{ T}$$

$$B_{\text{wire}} = \frac{\mu_0 I}{2\pi(2\text{cm})}$$

$$= 3 \times 10^{-5} \text{ T}$$

$$B_{\text{net}} = \sqrt{B_{\text{sol}}^2 + B_{\text{wire}}^2} = 45 \mu\text{T}$$

$$8. \quad \Phi_B = B_{sol} \cdot A = \mu_0 n I \cdot \pi r^2$$

$$= \mu_0 \left(\frac{8000}{4} \right) \cdot 5 \cdot \pi (0.02)^2 = 16 \mu Wb$$

$$9. \quad \oint B \cdot ds = \mu_0 I_{in} = \mu_0 40 \cdot \frac{(5^2 - 3^2)}{(6^2 - 3^2)}$$

$$= 30 \mu T \cdot m$$

$$10. \quad B \propto \frac{N}{L} \quad B_{new} \propto \frac{2N}{2L} = \frac{N}{L} = B$$