

Solutions

PHYS-205B-002

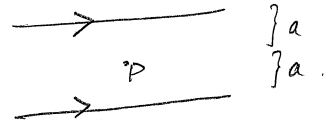
(Midterm Exam 03)

Spring 2024

①

Problem 1

$$B = \frac{\mu_0 I}{2\pi a} - \frac{\mu_0 I}{2\pi a} = 0$$



Zero.

Problem 2

$$V = L \frac{dI}{dt} = 0$$

(because I is constant)

Problem 3

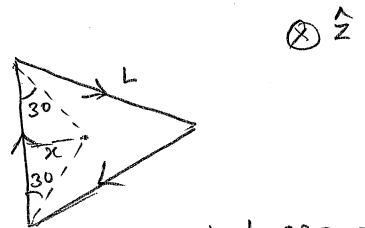
Yes.

Problem 4

$$\lambda = \frac{c}{f} = \frac{3.00 \times 10^8 \frac{\text{m}}{\text{s}}}{2.45 \times 10^9 \frac{1}{\text{s}}} = 1.23 \times 10^{-1} \text{ m} = 12.3 \text{ cm}$$

Problem 5

$$\begin{aligned} \vec{B}_{\text{tot}} &= 3 \vec{B}_1 \\ &= 3 \hat{z} \frac{\mu_0}{4\pi} \frac{I}{x} (\sin 60 + \sin 60) \\ &= \hat{z} \frac{\mu_0}{4\pi} \frac{I}{L} (2\sqrt{3}) 3 \left(\frac{\sqrt{3}}{2} + \frac{\sqrt{3}}{2} \right) \\ &= \hat{z} \frac{\mu_0}{4\pi} \frac{I}{L} 18 \end{aligned}$$



$$x = \frac{L}{2} \tan 30 = \frac{L}{2\sqrt{3}}$$

Thus, $a = 18$

Problem 6

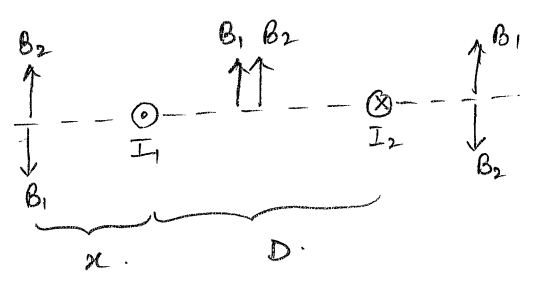
$$\frac{\mu_0 I_1}{2\pi x} = \frac{\mu_0 I_2}{2\pi (D+x)}$$

$$(D+x) I_1 = x I_2$$

$$D I_1 = x (I_2 - I_1)$$

$$x = D \left(\frac{I_1}{I_2 - I_1} \right) = 3.0 \text{ cm} \left(\frac{1.0}{4.0 - 1.0} \right) = 1.0 \text{ cm}$$

$\vec{B} = 0$ on the left of wire I_1 , $x = 1.0 \text{ cm}$.



Problem 7

- (a) decreasing
- (b) counter clock wise.

$$(c) \quad I = \frac{BLV}{R} = \frac{(1.2)(0.100)(5.0)}{(0.40)} = 1.5 \text{ V}$$

