

Solutions

PHYS-203B

(Midterm Exam 02)

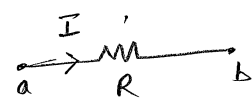
Fall 2025

①

Problem 1

$$I = \frac{V_a - V_b}{R} = \frac{(6.0) - (1.5)}{1.5 \times 10^3} = 3.0 \text{ mA}$$

$V_a > V_b$

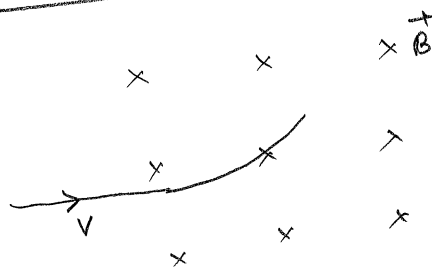


Problem 2

$$1 \text{ kWh} = 10^3 \frac{\text{J}}{\text{s}} (60 \times 60 \text{ s}) = 3.6 \times 10^6 \text{ J}$$

$$\begin{aligned} \text{Energy} &= 50.00 \text{ USD} \frac{\text{kWh}}{0.15 \text{ USD}} = 333 \text{ kWh} \\ &= 333 (3.6 \times 10^6 \text{ J}) \\ &= 1.2 \times 10^9 \text{ J} \end{aligned}$$

Problem 3

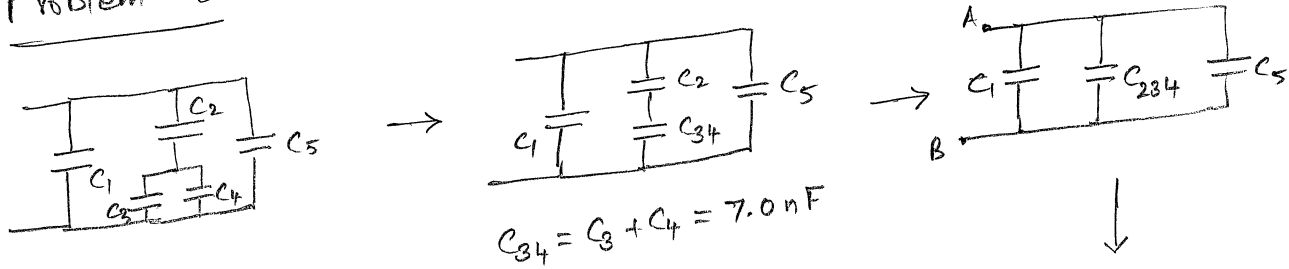


Positive charge.

Problem 4

The north pole of a bar magnet points in the direction of magnetic south (close to geographic north).

Problem 5



$$\frac{1}{C_{234}} = \frac{1}{C_2} + \frac{1}{C_{34}}$$

$$= \frac{1}{2.0} + \frac{1}{7.0}$$

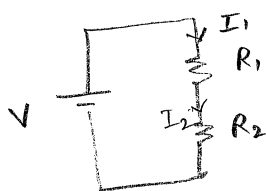
$$C_{234} = \frac{14}{9.0} \text{ nF} = 1.6 \text{ nF}$$

$$C_{eq} = C_1 + C_{234} + C_5$$

$$= 1.0 + \frac{14}{9.0} + 5.0$$

$$= \frac{68}{9.0} \text{ nF} = 7.6 \text{ nF}$$

Problem 6



$$I = I_1 = I_2$$

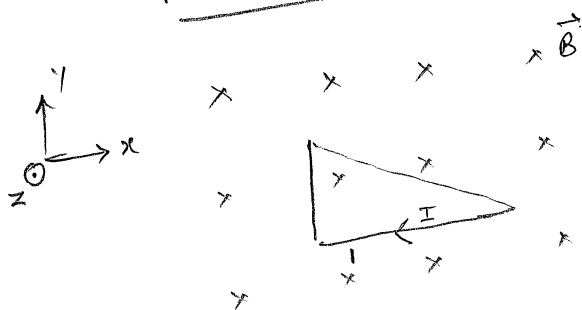
$$P_1 = I_1^2 R_1$$

$$P_2 = I_2^2 R_2$$

$$\frac{P_2}{P_1} = \frac{\frac{I_2^2 R_2}{I_1^2 R_1}}{\frac{I_1^2 R_1}{I_1^2 R_1}}$$

$$= \frac{R_2}{R_1} = 3.0$$

Problem 7



$$\vec{F} = I \vec{L} \times \vec{B}$$

$$= -\hat{j} I a B \sin 90$$

$$= -\hat{j} (2.0)(3.0 \times 10^{-2})(0.30)(1)$$

$$= -\hat{j} 18 \text{ mN}$$

$$\text{magnitude} = 18 \text{ mN}$$

$$\text{direction} = -\hat{j} \text{ (downwards)}$$