

Solutions

PHYS-203B

(Midterm Exam 01) Fall 2026

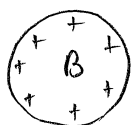
①

Problem 1

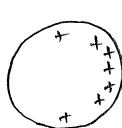
$$q_B = q$$

$$q_C = 0$$

before:



after



attract

Problem 2

$$a_e = \frac{q_e E}{m_e}$$

$$a_p = \frac{q_p E}{m_p}$$

$$v_e = 0 + a_e \Delta t$$

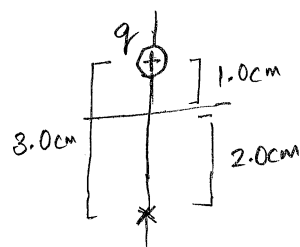
$$v_p = 0 + a_p \Delta t$$

Since $|q_e| = |q_p|$, $a_e > a_p$. Thus, $v_e > v_p$.

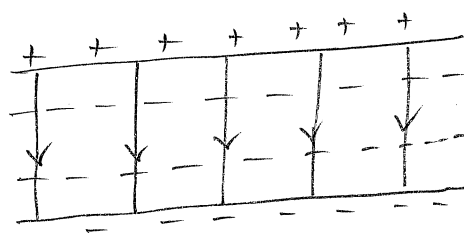
Problem 3

$$|\vec{E}| = \frac{kq}{r^2} = \frac{(9.0 \times 10^9)(1.0 \times 10^{-9})}{(3.0 \times 10^{-2})^2}$$

$$= 1.0 \times 10^4 \frac{\text{N}}{\text{C}}$$

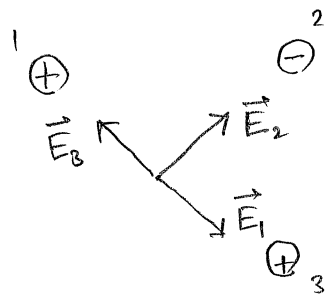


Problem 4



equipotential surface.

Problem 5



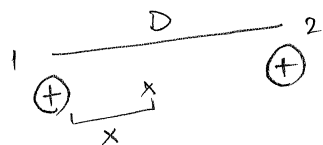
$$\begin{aligned}\vec{E} &= \vec{E}_1 + \vec{E}_3 + \vec{E}_2 \\ &= \vec{E}_2 + 0 \quad (\vec{E}_1 = -\vec{E}_3) \\ &= \frac{kq}{\left(\frac{L}{\sqrt{2}}\right)^2} (\cos 45^\circ \hat{i} + \sin 45^\circ \hat{j}) \\ &= \frac{kq}{L^2} 2 \left(\frac{1}{\sqrt{2}} \hat{i} + \frac{1}{\sqrt{2}} \hat{j}\right)\end{aligned}$$

$$\begin{aligned}\vec{E} &= \frac{(9.0 \times 10^9)(1.0 \times 10^{-9})}{(3.0 \times 10^{-2})^2} 2 [0.71 \hat{i} + 0.71 \hat{j}] \\ &= 2.0 \times 10^4 \frac{N}{C} [0.71 \hat{i} + 0.71 \hat{j}]\end{aligned}$$

magnitude: $2.0 \times 10^4 \frac{N}{C}$

direction: from center towards q_2 .

Problem 6



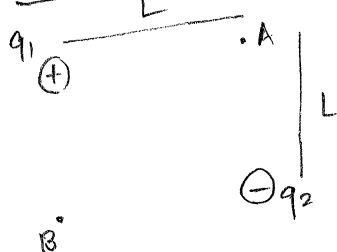
2.5 cm to right from q_1

$$\begin{aligned}E_1 &= E_2 \\ \frac{kq_1}{x^2} &= \frac{kq_2}{(D-x)^2} \\ \frac{1.0}{x^2} &= \frac{9.0}{(D-x)^2}\end{aligned}$$

$$D-x = 3.0x$$

$$\begin{aligned}x &= \frac{D}{4.0} \\ &= 2.5 \text{ cm}\end{aligned}$$

Problem 7



$$V_A = + \frac{k|q_1|}{L} - \frac{k|q_2|}{L} = - \frac{kq}{L}$$

$$V_B = + \frac{k|q_1|}{L} - \frac{k|q_2|}{L} = - \frac{kq}{L}$$

$$V_A - V_B = 0$$