

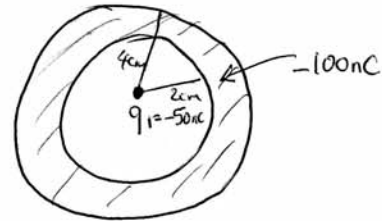
KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
PHYSICS DEPARTMENT
QUIZ #7- CHAPTER 24

NAME: Key ID# _____ SECTION# _____

A point charge $q_1 = -50 \text{ nC}$ lies at the center of a hollow spherical metal shell that has a net charge of -100 nC and inner radius 2 cm and outer radius 4 cm . Find the magnitude and direction of the electric field at

(a) $r = 1 \text{ cm}$ from the center of the shell

$$E = \frac{k|q_1|}{r^2} = \frac{9 \times 10^9 \times 50 \times 10^{-9}}{(0.01)^2} \\ = 4.5 \times 10^6 \text{ N/C} \quad \text{inward.}$$



(b) $r = 3 \text{ cm}$ from the center of the shell

inside the conductor $E = 0$

(c) $r = 10 \text{ cm}$ from the center of the shell

$$E = \frac{k|q_1|}{r^2} + \frac{k|q_2|}{r^2} = \frac{9 \times 10^9}{(0.1)^2} (50 \times 10^{-9} + 100 \times 10^{-9}) \\ = 1.35 \times 10^5 \text{ N/C} \quad \text{inward.}$$

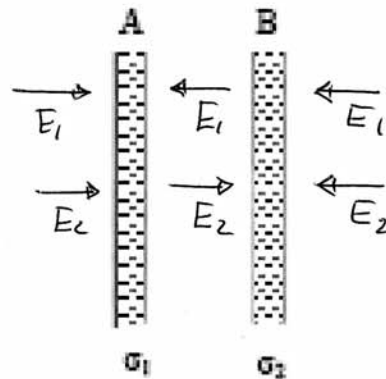
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QUIZ #7- CHAPTER 23

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The figure shows portions of two large, parallel, **non-conducting** sheets, A and B. The surface charge densities are: $\sigma_1 = -4.5 \mu\text{C}/\text{m}^2$ and $\sigma_2 = -6.5 \mu\text{C}/\text{m}^2$. Find the magnitude and direction of the net electric field

(a) on the right of plate B

$$\begin{aligned}\vec{E}_{\text{net}} &= - (E_1 + E_2) \hat{i} \\ &= - \left(\frac{|\sigma_1|}{2\epsilon_0} + \frac{|\sigma_2|}{2\epsilon_0} \right) \hat{i} \\ \vec{E}_{\text{net}} &= - 6.2 \times 10^{11} \hat{i} \text{ N/C}\end{aligned}$$



(b) on the left of plate A

$$\begin{aligned}\vec{E}_{\text{net}} &= (E_1 + E_2) \hat{i} \\ &= + 6.2 \times 10^{11} \hat{i} \text{ N/C}\end{aligned}$$

(c) between the plates

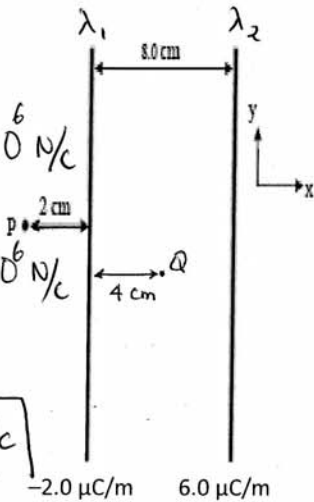
$$\begin{aligned}\vec{E}_{\text{net}} &= (E_2 - E_1) \hat{i} \\ &= \frac{|\sigma_2| - |\sigma_1|}{2\epsilon_0} \hat{i} = 1.1 \times 10^{11} \hat{i} \text{ N/C}\end{aligned}$$

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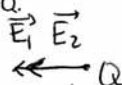
The Figure shows short sections of two very long parallel wires carrying uniform linear charge densities $+6.0 \mu\text{C/m}$ and $-2.0 \mu\text{C/m}$. Find the magnitude and direction of the net electric field at

(a) point P and



\vec{E}_1 \vec{E}_2 $\vec{E}_{\text{net}} = (E_2 - E_1)\hat{i}$
 $|\vec{E}_1| = \frac{2k|\lambda_1|}{r_1} = \frac{2 \times 9 \times 10^9 \times 2 \times 10^{-6}}{0.02} = 1.8 \times 10^6 \text{ N/C}$
 $|\vec{E}_2| = \frac{2k|\lambda_2|}{r_2} = \frac{2 \times 9 \times 10^9 \times 6 \times 10^{-6}}{0.1} = 1.1 \times 10^6 \text{ N/C}$
 $\vec{E}_{\text{net}} = (E_2 - E_1)\hat{i} = (1.1 - 1.8) \times 10^6 \hat{i}$
 $|\vec{E}_{\text{net}}| = -0.7 \times 10^6 \hat{i} \text{ N/C}$

(b) point Q.



\vec{E}_1 \vec{E}_2
 $\vec{E}_{\text{net}} = -(E_1 + E_2)\hat{i}$
 $E_1 = \frac{2k|\lambda_1|}{r_1} = \frac{2 \times 9 \times 10^9 \times 2 \times 10^{-6}}{0.04} = 0.9 \times 10^6 \text{ N/C}$
 $E_2 = \frac{2k|\lambda_2|}{r_2} = \frac{2 \times 9 \times 10^9 \times 6 \times 10^{-6}}{0.04} = 2.7 \times 10^6 \text{ N/C}$
 $|\vec{E}_{\text{net}}| = -3.6 \times 10^6 \hat{i} \text{ N/C}$