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

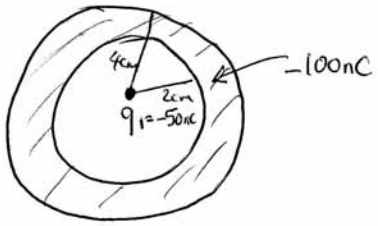
NAME: Key ID# SECTION#

A point charge q1 = –50 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 cm from the center of the shell

$$E = \frac{k|q_1|}{r^2} = \frac{9\times10^9 \times 50\times10^{-9}}{(0.01)^2}$$

$$= 4.5\times10^6 \text{ N/C} \quad \text{inward}.$$



(b) r = 3 cm from the center of the shell

inside the conductor $E = 0$

(c) r = 10 cm from the center of the shell

$$E = \frac{k|q_1|}{r^2} + \frac{k|q_2|}{r^2} = \frac{9\times10^9}{(0.1)^2}\left(50\times10^{-9} + 100\times10^{-9}\right)$$

$$= 1.35\times10^5 \text{ N/C} \quad \text{inward}.$$

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QUIZ #7- CHAPTER 23

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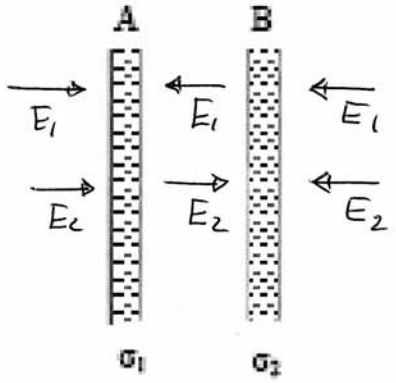
The figure shows portions of two large, parallel, **non-conducting** sheets, A and B. The surface charge densities are: $\sigma 1 = -4.5\ \mu C/m^2$ and $\sigma 2 = -6.5\ \mu C/m^2$. Find the magnitude and direction of the net electric field

(a) on the right of plate B

$$\vec{E}_{net} = -(E_1 + E_2)\,\hat{i}$$

$$= -\left(\frac{|\sigma_1|}{2\varepsilon_0} + \frac{|\sigma_2|}{2\varepsilon_0}\right)\hat{i}$$

$$\vec{E}_{net} = -6.2\times10^{11}\,\hat{i}\ N/C$$



(b) on the left of plate A

$$\vec{E}_{net} = (E_1 + E_2)\hat{i}$$

$$= +6.2\times10^{11}\,\hat{i}\ N/C$$

(c) between the plates

$$\vec{E}_{net} = (E_2 - E_1)\,\hat{i}$$

$$= \frac{|\sigma_2| - |\sigma_1|}{2\varepsilon_0}\,\hat{i} = 1.1\times10^{11}\,\hat{i}\ N/C$$

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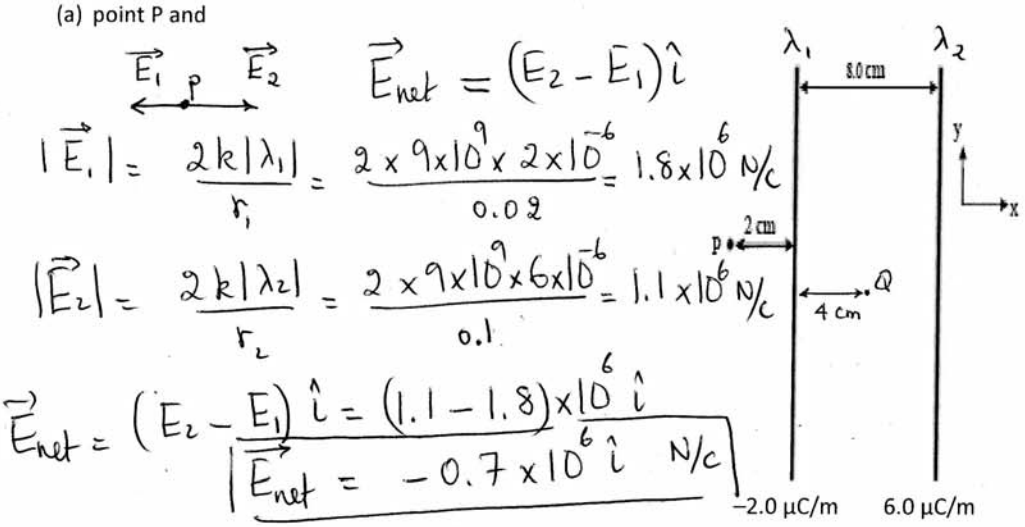
The Figure shows short sections of two very long parallel wires carrying uniform linear charge densities + 6.0 μC/m and −2.0 μC/m. Find the magnitude and direction of the net electric field at

(a) point P and



$\vec{E}_1$ P $\vec{E}_2$ $\quad \vec{E}_{net} = (E_2 - E_1)\hat{i}$

$$|\vec{E}_1| = \frac{2k|\lambda_1|}{r_1} = \frac{2\times 9\times10^{9}\times 2\times10^{-6}}{0.02} = 1.8\times10^{6}\ N/C$$

$$|\vec{E}_2| = \frac{2k|\lambda_2|}{r_2} = \frac{2\times 9\times10^{9}\times 6\times10^{-6}}{0.1} = 1.1\times10^{6}\ N/C$$

$$\vec{E}_{net} = (E_2 - E_1)\,\hat{i} = (1.1 - 1.8)\times10^{6}\,\hat{i}$$

$$\boxed{\vec{E}_{net} = -0.7\times10^{6}\,\hat{i}\ N/C}$$

(b) point Q.

$\vec{E}_1$ $\vec{E}_2$ Q

$$\vec{E}_{net} = -(E_1 + E_2)\,\hat{i}$$

$$E_1 = \frac{2k|\lambda_1|}{r_1} = \frac{2\times 9\times10^{9}\times 2\times10^{-6}}{0.04} = 0.9\times10^{5}\ N/C$$

$$E_2 = \frac{2k|\lambda_2|}{r_2} = \frac{2\times 9\times10^{9}\times 6\times10^{-6}}{0.04} = 2.7\times10^{6}\ N/C$$

$$\boxed{\vec{E}_{net} = -3.6\times10^{6}\,\hat{i}\ N/C}$$