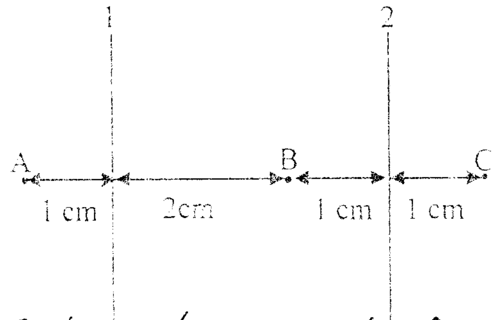
PHYS102-13
Quiz#7
Chapter 23

Name: Key id#

Consider two infinitely long parallel wires carrying charge density $\lambda 1 = -3\ \mu C/m$ and $\lambda 2 = 5\ \mu C/m$. Find the net electric field at points A, B and C.



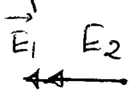
- At point A

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

$$= 2k\left(\frac{|\lambda_1|}{r_1} - \frac{|\lambda_2|}{r_2}\right)\hat{i} = 2 \times 9\times10^{9}\left(\frac{3\times10^{-6}}{0.01} - \frac{5\times10^{-6}}{0.04}\right)\hat{i}$$

$$\boxed{\vec{E}_{net} = 3.15\times10^{6}\,\hat{i}}\ \left(\frac{N}{C}\right)$$

- At point B

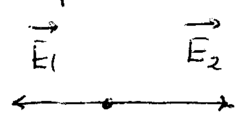


$$\vec{E}_{net} = -(E_1 + E_2)\,\hat{i} = -2k\left(\frac{|\lambda_1|}{r_1} + \frac{|\lambda_2|}{r_2}\right)\hat{i}$$

$$= -2 \times 9\times10^{9}\left(\frac{3\times10^{-6}}{0.02} + \frac{5\times10^{-6}}{0.01}\right)\hat{i}$$

$$\boxed{\vec{E}_{net} = -11.7\times10^{6}\,\hat{i}}\ (N/C)$$

- At point C



$$\vec{E}_{net} = (E_2 - E_1)\,\hat{i} = 2k\left(\frac{|\lambda_2|}{r_2} - \frac{|\lambda_1|}{r_1}\right)$$

$$= 2 \times 9\times10^{9}\left(\frac{5\times10^{-6}}{0.01} - \frac{3\times10^{-6}}{0.04}\right)$$

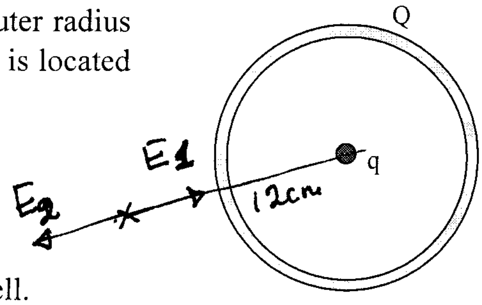
$$\boxed{\vec{E}_{net} = 7.65\times10^{6}\,\hat{i}}\ (N/C)$$

Physics 102.14
Quiz#7
Chapter 23

Instructor: Dr. A. Mekki

Name: Key Id:

Consider a metallic spherical shell of inner radius 8 cm and outer radius 10 cm carrying a charge Q = 10 μC. A point charge q = -5 μC is located at the center of shell as shown in the figure.



Find the electric field at

(a) r = 2 cm from the center of the shell
(b) r = 9 cm from the center of the shell
(c) r = 12 cm from the center of the shell
(d) what are the inner and outer charges on the spherical shell.

2 (a) $r = 2cm$ $\quad E = \frac{k|q|}{r^2} = \frac{9\times10^{9} \times 5\times10^{-6}}{(0.02)^2} = 11.25\times10^{7}\ \frac{N}{C}$ (outward)

2 (b) $r = 9\,cm$ (inside the conductor) $\quad E = 0$

2 (c) $r = 12cm$

$$E = -E_1 + E_2$$

$$E = -\frac{k|q|}{r^2} + \frac{k|Q|}{r^2} = -\frac{9\times10^{+9}\times5\times10^{-6}}{(0.12)^2} + \frac{9\times10^{9}\times10\times10^{-6}}{(0.12)^2}$$

$$E = +3.125\times10^{6}\ \frac{N}{C}$$

(+ ↑ outward)

4 (d) $q_{in} = -q = +5\times10^{-6}\ C$

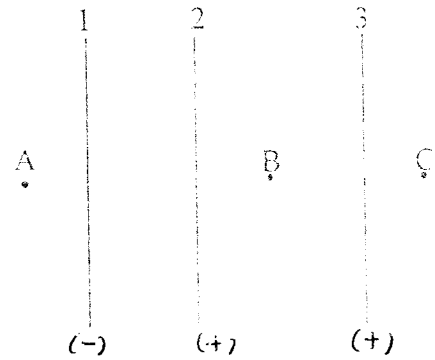
$q_{out} = +5\times10^{-6} C$

Note: $q_{in} + q_{out} = Q = 10\times10^{-6} C$.

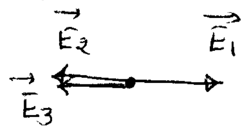
PHYS102-15
Quiz#7
Chapter 23

Name: Key Id#

Consider three large non-conducting parallel plates carrying charge density $\sigma1 = -3\ \mu C/m^2$, $\sigma2 = 3\ \mu C/m^2$ and $\sigma3 = 2\ \mu C/m^2$. Find the net electric field at points A, B and C.



- At point A

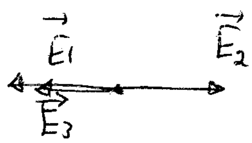


$$\vec{E}_{net} = (E_1 - E_2 - E_3)\,\hat{i}$$

$$= \left[\frac{|\sigma_1|}{2\varepsilon_0} - \frac{|\sigma_2|}{2\varepsilon_0} - \frac{|\sigma_3|}{2\varepsilon_0}\right]\hat{i} = \frac{1}{2\times 8.85\times 10^{-12}}\left(3\times 10^{-6} - 3\times 10^{-6} - 2\times 10^{-6}\right)\hat{i}$$

$$\boxed{\vec{E}_{net} = -1.13\times 10^{5}\ \hat{i}}\ (N/C)$$

- At point B

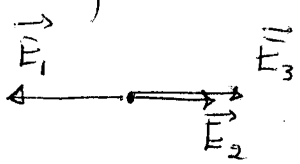


$$\vec{E}_{net} = (E_2 - E_1 - E_3)\,\hat{i}$$

$$= \frac{1}{2\times 8.85\times 10^{-12}}\left(3\times 10^{-6} - 3\times 10^{-6} - 2\times 10^{-6}\right)\hat{i}$$

$$\boxed{\vec{E}_{net} = -1.13\times 10^{5}\ \hat{i}}\ (N/C)$$

- At point C



$$\vec{E}_{net} = (E_2 + E_3 - E_1)\,\hat{i}$$

$$= \frac{1}{2\times 8.85\times 10^{-12}}\left(3\times 10^{-6} + 2\times 10^{-6} - 3\times 10^{-6}\right)\hat{i}$$

$$\boxed{\vec{E}_{net} = 1.13\times 10^{5}\ \hat{i}}\ (N/C)$$