KING FAHD UNIVERSITY OF PERTOLEUM & MINERALS
PHYSICS DEPARTMENT
QUIZ #8- CHAPTER 24

NAME: Key ID# SECTION# 16

Over a certain region of space, the electric potential is give by: $V(x,y) = 2x^2 + 5y^2 - 2xy$.
Find the magnitude and direction of the electric field at points (2 m, 1 m).

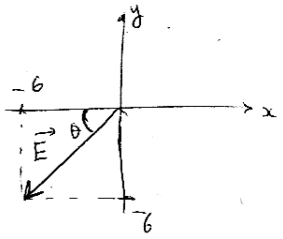
$$E_x = -\frac{\partial V}{\partial x} = -(4x - 2y)$$

$$E_y = -\frac{\partial V}{\partial y} = -(10y - 2x)$$

$x = 2m$ and $y = 1\,m$

$$E_x = -6\ N/C$$

$$E_y = -6\ N/C$$



magnitude $|\vec{E}| = 8.5\ N/C$

$$\theta = \tan^{-1}(1) = 45^\circ$$

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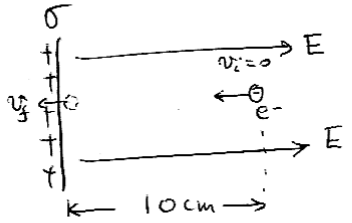
NAME: Key ID# SECTION# 17

An electron starts from rest at a point 10 cm from a positively charged conducting plate, with a surface charge density $\sigma = +1 \times 10^{-9}$ C/m^2. The electron is attracted to the plate until it collides with the plate. With what speed will the electron collide with the plate?



$$\Delta K + \Delta U = 0$$

$$\Delta U = q\,\Delta V = -qEd\cos 180^\circ = +qEd$$

$$\Delta K = -\Delta U \Rightarrow \Delta K = -qEd$$

$$\frac{1}{2}mv^2 - 0 = -qEd \qquad E = \frac{\sigma}{\varepsilon_0}$$

$$v = \sqrt{-\frac{2q\sigma d}{\varepsilon_0 m}}$$

$$= \sqrt{\frac{-2\times(-1.6\times10^{-19})\times 1\times10^{-9}\times 0.1}{8.85\times10^{-12}\times 9.1\times10^{-31}}}$$

$$\boxed{v = 2\times10^{6}\ \text{m/s}}$$

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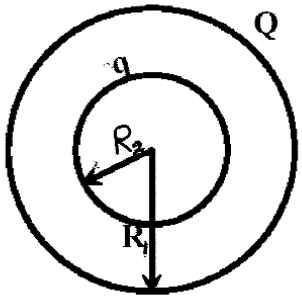
NAME: Key ID# SECTION# 18

Consider two concentric spherical shells. The first one has a charge Q = 20 nC and radius R1 = 20 cm the other has a charge q = −10 nC and radius R2 = 10 cm. Take the potential to be zero at infinity. Find the net potential at



(a) r = 25 cm

$$V = k\left(\frac{Q}{r} + \frac{q}{r}\right) = 360\,V$$

(b) r = 20 cm

$$V = k\left(\frac{Q}{R_1} + \frac{q}{R_1}\right) = 450\,V$$

(c) r = 15 cm

$$V = k\left(\frac{Q}{R_1} + \frac{q}{r}\right) = 300\,V$$

(d) r = 10 cm

$$V = k\left(\frac{Q}{R_1} + \frac{q}{R_2}\right) = 0$$

(e) r = 5 cm.

$$V = k\left(\frac{Q}{R_1} + \frac{q}{R_2}\right) = 0$$