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National University of Computer and Emerging Sciences

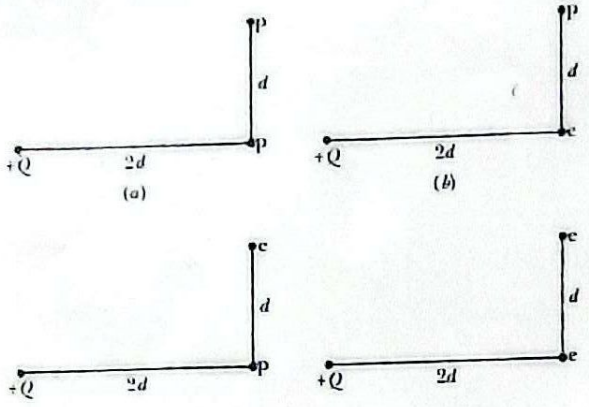
Department of Computer Science **Chiniot-Faisalabad Campus**

QUIZ 4

Name..... **Roll no.** ..... **Date** .....

Semester ..... **Class** ..... **Section**.....

Q1: Figure shows four arrangements of charged particles. Rank the arrangements according to the magnitude of the net electrostatic force on the particle with charge +Q, greatest first. [4Marks]



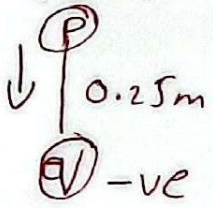
(a)
(d)
(b)
(c)

$a = d > b = c$

Q2: A particle has charge -5.00 nC. (a) Find the magnitude and direction of the electric field due to this particle at a point 0.250 m directly above it. (b) At what distance from this particle does its electric field have a magnitude of 12.0 N/C? [6Marks]

Sol:- $q = -5 \times 10^{-9}\ C$

(a) $r = 0.250\ m$



$$E = \frac{k|q|}{r^2} = \frac{(9 \times 10^9)(5 \times 10^{-9})}{(0.250)^2}$$

$$= 720\ N/C$$

$$\vec{E} = -720\ N/C\ \hat{j}$$

(b) $E = 12.0$

$$12.0 = \frac{|k|q|}{r^2}$$

$$12 = \frac{(9 \times 10^9)(5 \times 10^{-9})}{r^2}$$

$$\sqrt{r^2} = \sqrt{\frac{45}{12}}$$

$$r = 1.93\ m$$

Version ○

Q1:-

Ans: $3 > 1 > 2 > 4$

Q2

Sol: $q_1 = 2 \times 10^{-6}\ C$ at $x = 1.00\ m$

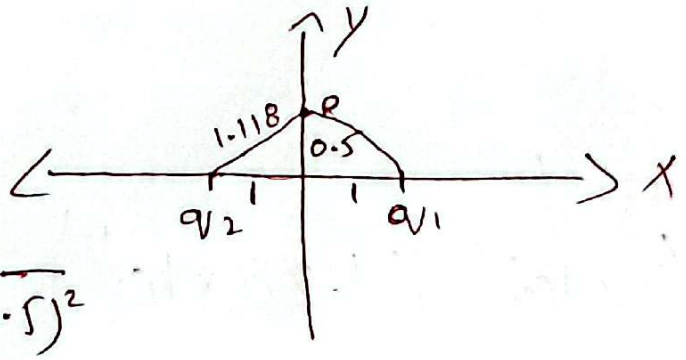
$q_2 = 2 \times 10^{-6}\ C$ at $x = -1.00\ m$

(a) $\vec{E}$ at $y = 0.5\ m$

(b) $q_3 = -3 \times 10^{-6}\ C$ at $y = 0.5\ m$. $\vec{F}_3 = ?$

~~Sol.~~

(a)



$$d = \sqrt{(1)^2 + (0.5)^2}$$

$$= \sqrt{1 + 0.25}$$

$$= \sqrt{1.25}$$

$$= 1.118\ m$$

$$E_x = E_{1x} + E_{2x} \Rightarrow E_{1x} - E_{1x} \Rightarrow 0$$

$$E_y = E_{1y} + E_{2y}$$

$$= \frac{k\,(|q_1|)}{(1.18)^2} \sin\theta + \frac{k\,|q_2|}{(1.18)^2} \sin\theta$$

$q_1 = q_2 = q$

$$E_y = \frac{2k|q|}{(1.118)^2}\sin\theta$$

$\because \sin\theta = \frac{P}{H} = \frac{0.5}{1.118}$

$$E_y = \frac{2k|q|}{(1.118)^2}\left(\frac{0.5}{1.118}\right)$$

$$= \frac{2(9\times10^9)(2\times10^{-6})\,0.5}{(1.118)^3}$$

$$= 1.28\times10^4\ N/C\ \hat{j} \quad \text{(outwards)}$$

(b)

as we know

$$F = qE$$

$$F = (3\times10^{-6})(1.28\times10^4)$$

$$F = 0.0386\ N(-\hat{j})$$ ~~Inward~~.

~~As charge~~ _____