University of Bahrain Ist Semester 2001-2002

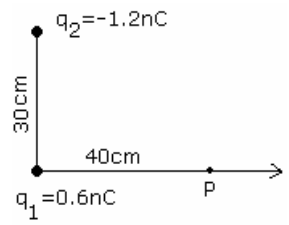
College of Science **Date : 23/10/01**
Department of Physics **Time: 11:00 – 12:00**

PHYCS 102
Test One

Name:……. .....ID#…… .Section:……

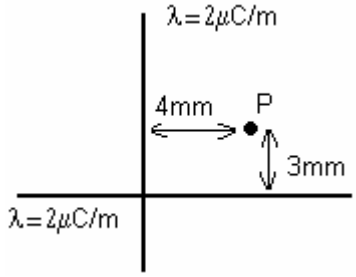
Q1. Two point charges having charges q_1 = 0.6 nC and q_2= -1.2 nC are fixed as shown in figure.

- **a.** Find the magnitude and direction of the net electric field at point "p".
- **b.** Find the magnitude and direction of electric force on charge q_3 = -2 nC intoduced to the point "p".



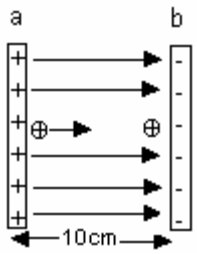
Q3. Two uniform positive line charges of infinite length are arranged as shown in the figure below.

a- Find the magnitude and direction of the total electric field at a point 'p' .
b- Find the magnitude and direction of the electric force on a point charge q = 2μC placed at the point "p".



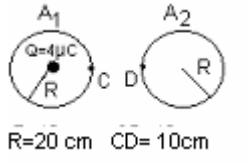
Q3. A positive point charge q = 2 μc of mass m= 2 x 10^{-3}g released from rest in a uniform electric field E= 5x10^3 N/C directed a long the x-axis as in figure. Find

- **a.** The electric force on the charge.
- **b.** The potential difference between the points *a* and *b*.
- **c.** The kinetic energy of the charge.



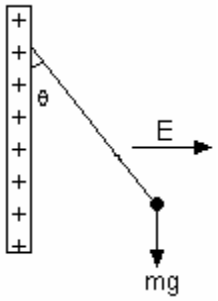
Q4. Consider two spherical gaussion surfaces A_1 and A_2 of radius R = 20 cm, as shown in the figure. The only charge present is the charge Q = 4μC at center of surface A_1.

- **a.** What is the flux through surface A_1?
- **b.** What is the flux through surface A_2?
- **c.** Find the electric potential field at point C .
- **d.** Find the electric potential field at point D.



Q6. A small nonconducting ball of mass m = 1 mg and charge $q = 2\text{x}10^{-8}C$ hangs from an insulating thread that makes an angle $\theta = 30^{o}$ with a vertical uniformaly charged large nonconducting sheet. Calculate:

- **a.** The magnitude of E – Field produced by the sheet.
- **b.** The surface charge density σ of the sheet.



Use the following terms:

$K = 9\text{x}10^{9}\ N.m^2/C^2$	$\varepsilon_o = 8.854 \text{ x } 10^{-12} C^2/N.m^2$,	$m_e = 9.1\text{x}10^{-31} Kg$
$m_p = 1.67\text{x}10^{-27} Kg$	$e = 1.602 \text{ x}10^{-19} C$	$g = 10 m/s^2$
	$\mu_o = 4\pi\ 10^{-7}$ T. m/A	$N_A = 6.022\text{x}10^{23}\ mol^{-1}$

Ist Semester 2001/2002 PHYCS 102
First Exam

Department of Physics **23/10/01**

Solutions for the First Exam:

Q1 a) $\vec{E_1} = \vec{i}\frac{Kq_1}{(0.4)^2} = 33.75\,\vec{i}\ N/C$, $\vec{E_2} = \frac{Kq_2}{(0.5)^2}\left(-\frac{4}{5}\vec{i}+\frac{3}{5}\vec{j}\right) = -34.56\vec{i}+25.92\vec{j}$

$\vec{E_p} = \vec{E_1}+\vec{E_2} = -0.81\,\vec{i}+25.92\,\vec{j}$, E_p=25.93N/C, α=91.7°

b) $\vec{F} = q\vec{E} = \left(1.62\vec{i} - 51.84\,\vec{j}\right) nN$, F=51.96N, α=271.7

Q2 a) $\vec{E_1} = \frac{2k\lambda}{0.003}\vec{j}$, $\vec{E_2} = \frac{2k\lambda}{0.004}\vec{i}$, $\vec{E_p} = \vec{E_1}+\vec{E_2} = \left(0.9\vec{i}+1.2\vec{j}\right)$ x $10^7\ N/C$

E_p=1.5E7 N/C, α=53.13°

b) $\vec{F} = q\vec{E_p} = \left(18\vec{i}+24\,\vec{j}\right)N$, F=30N , α=53.13°

Q3 $E = 5$ x $10^3\ N/C$, $F = qE = 0.01N$, $V_{ab} = E.d = 500V$, $E_k = qV_{ab} = 1mJ$

Q4 a) $\Phi = 4\mu C/\varepsilon_o = 0.452 . 10^6\ N.m^2/C$,

b) $E_C = K.Q/(0.2)^2 = 900kN/C$

c) $V_D = K.Q/(0.3) = 120kV$

Q5 $T\sin\theta = qE$

$T\cos\theta = mg$

$\therefore E = \frac{mg\tan\theta}{q} = 288.6\ N/C$

$E = \frac{\sigma}{2\varepsilon o}$, $\sigma = 2\varepsilon_o E = 5.1nC/m^2$