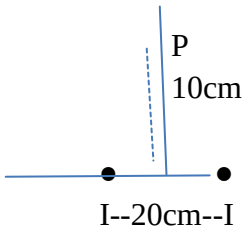
## Assignment-4 Optional/Practice Problem Sheet-4 :

## Contents: Electric Field : Spring 2023

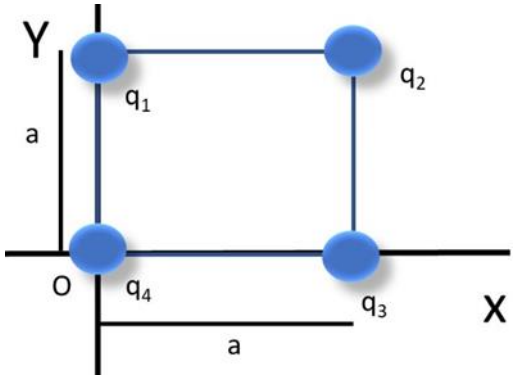
Course Code: PHY 2105/PHY 105

1. Four charges +2q, +4q, +2q and –2q are placed at the corners of a square. (i) Draw the arrangement of the charges (ii) Calculate the magnitude and direction of electric field at the intersection of the diagonals of the square of side 10 cm if q =$57\times10^{-9}$C.
2. Two equal charges q=$12\times10^{-7}$C are placed at the two corners an equilateral triangle of side r =10cm. Draw the triangle with charges. Find the resultant electric field and it's direction at third corner of the triangle.
3. A charge of -1.0 μC is located at the coordinates (0,2) while a second charge of +1.0 μC is located at the coordinates (1,0). Draw the charge arrangement and determine the value of the following quantities at the origin: (i) the magnitude of the electric field E, (ii) the direction of the electric field.
4. Two point charges +4q and +q are placed 30 cm apart. At what point on the line joining them the electric field is zero?
5. A dipole is placed in a uniform electric field with its axis parallel to the field. What is the Torque on it?
6. Two charges $10 \times 10^{-9}$ C and $20 \times 10^{-9}$C are placed at the two corners of a equilateral triangles. The length of the arms is 0.03 m. Calculate the electric field out the third corner of the triangles.
7. Two equal charges of $10 \times 10^{-5}$ C are shown in fig below; each produces an electric field at point *P* on Y axis. (a) What is the magnitudes of the fields at *P*? (b) what is direction of field? (c) Find the X and Y components of the field vector and (d) What is the direction of the net field?



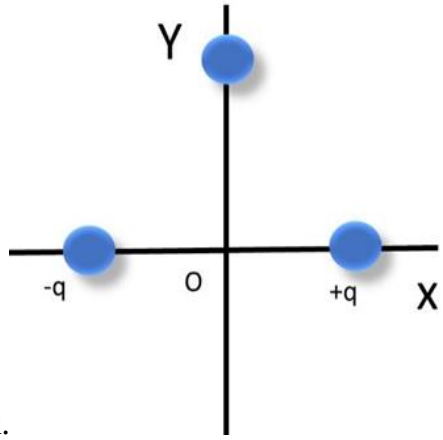

8. A charged particle produces an electric field with a magnitude of 5.0 N/C at a point that is 60 cm away from the particle. What is the magnitude of the particle's charge?
9. An electric dipole consists of charge + 2e and -2e separated by 0.75nm. It is in an electric field of strength $5.4\times10^{-8}$ N/C. Calculate the magnitude of the torque on the dipole when the dipole moment is (a) parallel to (b) perpendicular to the electric field.
10. How much work is required to turn an electric dipole $180^0$ in a uniform electric field of magnitude E = 56.0 N/C if the dipole moment has a magnitude of p = $3.2\times10^{-24}$ C and the initial angle $65^0$.

11. In the figure, the four particles form a square of edge length a=5.00 cm and have charges $q_1$ = +10.00 nC, $q_2$ = -20.0 nC, $q_3$ = +20.0 nC and $q_4$ = -10.0 nC. In unit vector notation, what net electric field




do the particle produces at the square's center? Also find out the net electric potential produces at the square's center.

12. The electric potential difference between the ground and a cloud in a particular thunderstorm is $1.2 \times 10^9$ V. In the unit of electron-volts, what is the magnitude of the charge in the electric potential energy of an electron that moves between the ground and the cloud?
13. In figure, two charged particles on an x-axis: $-q = -4.8 \times 10^{-19}$ C is at x = -3.00 m and $q = 4.80 \times 10^{-19}$ C is at x = 3.00 m. What are the (a) magnitude and (b) direction of the net electric field produced at point P in the Y axis at y = 4.00 m. (c) if –q=0 C and at O position (0,0) +2q charge is inserted then also find out




the direction and magnitude of the net electric field.

14. Fair weather atmospheric electricity 100 N/C is acting downward 100 km high in the ionosphere. What is the ionosphere voltage required?
15. Calculate the Electric Field due to a proton at the location of the electron in the H atom. The radius of the electron orbit is $0.5 \times 10^{-10}$m.
16. Water ($H_2O$) is a molecule that has a permanent dipole moment is $6.2 \times 10^{-30}$ C m. What is the dipole distance of water molecule? If the molecule is placed in an electric field of $1.5 \times 10^4$ N/C, what maximum torque can the field exert on it?
17. The ammonia molecule $NH_3$ has a permanent electric dipole moment equal to 1.47 D, where 1D= 1 Debye unit = $3.34 \times 10^{-30}$ Cm. Calculate the electric potential due to an ammonia molecule at a point 52.0 nm away along the axis of the dipole. (Set V= 0 at infinity)