Class XII
Electric charges and Fields.

Q1) How much total negative charge is carried by 100 g of water?

Q2) A particle of mass m and carrying charge $-q_1$ is moving around a charge $+q_2$ along a circular path of radius r. Prove that the period of revolution of the charge $-q_1$ about $+q_2$ is given by

$$T = \sqrt{\frac{16\pi^3 \epsilon_0 m r^3}{q_1 q_2}}$$

Q3) A charge Q is to be divided on two objects. What should be the values of the charges on the two objects so that the force between the objects can be maximum.

Q4) The sum of two point charges is 7 μC. They repel each other with a force of 1 N when kept 30 cm apart in free space. Calculate the value of each charge.

Q5) Two point electric charges of values q and 2q are kept at a distance d apart from each other in air. A third charge Q is to be kept along the same line in such a way that the net force acting on q and 2q is zero. Calculate the position of charge Q in terms of q and d.

Q6) An infinite number of charges each equal to 4 μC are placed along x axis at $x = 1m$, $x = 2m$, $x = 4m$, $x = 8m$ and so on. Find the total force on a charge of 1C placed at the origin.

Q7) Three point charges +q each are kept at the vertices of an equilateral triangle of side 'l'. Determine the magnitude and sign of the charge to be kept at its centroid so that the charges at the vertices remain in equilibrium.

Q8) Three point charges of +2 μC, −3 μC and −3 μC are kept at the vertices A, B and C respectively of an equilateral triangle of side 20 cm as shown in figure. What should be the magnitude and sign of the charge to be placed at the mid point (M) of side BC so that the charge at A remains in equilibrium.

Q9) Four charges $+q$, $+q$, $-q$ and $-q$ are placed respectively at the four corners A, B, C and D of a square of side a. Calculate the force on a charge Q placed at the centre of the square.

Q10) Give a comparision of electrostatic and gravitational field.

Q11) How many electrons should be removed from a coin of mass 1.6 g, so that it may just float in an electric field of intensity $10^9\ NC^{-1}$, directed upward?

Q12) An electron moves a distance of 6 cm when accelerated from rest by an electric field of strength $2\times10^4\ NC^{-1}$. Calculate the time of travel.

Q13) A charged particle, of charge $+2\mu C$ and mass 10 milli gram., moving with a velocity of 1000 m/sec enters a uniform electric field of strength $10^3\ NC^{-1}$ directed perpendicular to its direction of motion. find the velocity and displacement of the particle after 10S.

Q14) Two point charges of $+5\times10^{-19}C$ and $20\times10^{-19}C$ are separated by a distance of 2m. find the point on the line joining them at which electric field intensity is zero.

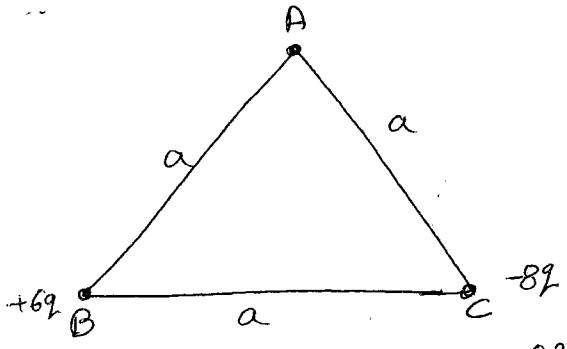
Q15) Two point charges $q_1 = +0.2C$ and $q_2 = +0.4C$ are placed 0.1 m apart. Calculate the electric field at

(a) the midpoint between the charges

(b) a point on the line joining q_1 and q_2 such that it is 0.05 m away from q_2 and 0.15 m away from q_1.

Q16) Four charges $+q$, $+q$, $-q$ and $-q$ are placed respectively at the four corners A, B, C and D of a square of side 'a'. Calculate the electric field at the centre of the square.

Q17) Two point charges $+6q$ and $-8q$ are placed at the vertices 'B' and 'C' of an equilateral triangle ABC of side 'a' as shown figure. obtain the expression for (i) the magnitude (ii) direction of the resultant electric field at the vertex A due to these two charges.



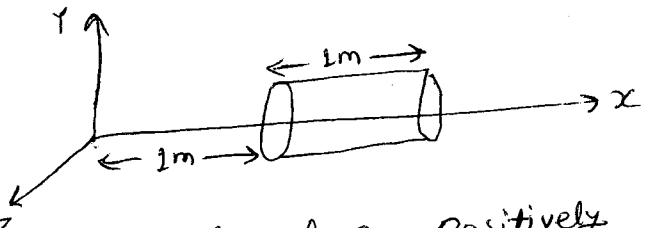
Q18) Sixty four drops of radius 0.02 m and each carrying a charge of 5 μC are combined to form a bigger drop. Find how the surface density of electrification will change if no charge is lost.

Q19) A charge is distributed uniformly over a ring of radius 'a'. obtain an expression for the electric intensity E at a point on the axis of the ring. Hence show that for points at large distances from the ring, it behaves like a point charge.

Q20) The force experienced by a unit charge when placed at a distance of 0.1 m from the middle of an electric dipole on its axial line is 0.025 N and when it is placed at a distance of 0.2 m, the force is reduced to 0.002 N. calculate the dipole length.

Q21) Deduce Coulomb's law from Gauss's theorem.

Q22) A hollow cylindrical box of length 1m and area of cross section 25 cm^2 is placed in a three dimensional coordinate system as shown in figure. The electric field in the region is given by $\vec{E} = 50x\hat{i}$, where E is in N C^{-1} and x is in metres.



Q23) (a) An infinitely long positively charged wire has a linear charge density λ C m^{-1}. An electron is revolving around the wire as its centre with a constant velocity in a circular plane perpendicular to the wire. Deduce the expression for its kinetic energy.

(b) Plot a graph of the kinetic energy as a function of linear

charge density λ.

(24) A spherical conducting shell of inner radius r_1 and outer radius r_2 has a charge '$\otimes$'. A charge 'q' is placed at the centre of the shell.

(a) What is the surface charge density on the inner surface & outer surface of the shell?

(b) Write the expression for the electric field at a point $x > r_2$ from the centre of the shell.

(25) An infinite number of charges, each equal to q are placed along X axis at $x=1$, $x=2$, $x=4$, $x=8$ ---- and so on.

(i) Find the electric field at the point $x=0$ due to this set up of charges.

(ii) What will be the electric field, if in the above set up the consecutive charges have opposite signs.