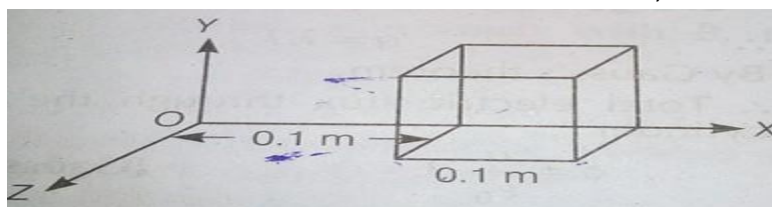


Important numerical of electrostatics (Top 12)

This assignment contain top 12 important numerical of electrostatics , chapter 1 and 2 (unit-1). Students preparing for 12th board examination included all states and ICSE board (even students preparing for JEE/NEET) must solve these numerical.

1. (i) Two point charges $4Q$ and Q are separated by 1m in air at what point on the line joining the two charges the electric field intensity is zero. (ii) Two identical metallic sphere A and B having charges $+4Q$ and $-10Q$ are kept at a certain distance apart . A third identical uncharged sphere C is first placed in contact with sphere A and then with sphere B . Spheres A and B are then brought in contact and then separated . Find the charges on the sphere A and B .

2. (i) Calculate the amount of work done in turning an electric dipole of dipole moment $3 \times 10^8 \text{ C}\cdot\text{m}$ from its position of unstable equilibrium to stable equilibrium, in a uniform electric field of intensity 10^3 N/C . (ii) The electric field components due to a charge inside the cube of side 0.1m are shown below $E_x = \alpha x$, where $\alpha = 500 \text{ N/C}\cdot\text{m}$ $E_y = 0, E_z = 0$



Calculate (a) The flux through the cube (b) the charge inside the cube

3.(a) A uniformly charged conducting sphere of 2.5 m in diameter has a surface charge density of $100 \mu\text{C}/\text{m}^2$. Calculate the (a) charge on the surface and (b) Total electric flux through the surface. (b) Two large, thin metal plates are parallel and close to each other. On their inner faces, the plates have surface charges densities of opposite signs and of magnitude $17.0 \times 10^{-22} \text{ C}/\text{m}^2$. What is electric field strength E : (a) in the outer region of the first plate, (b) in the outer region of the second plate, and (c) between the plates?

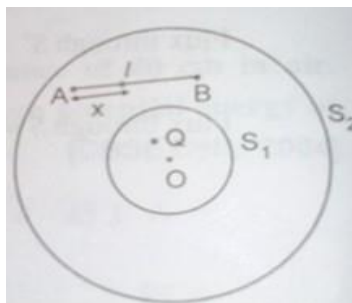
4. (a) Two insulated charged copper spheres A and B have their centres separated by a distance of 50 cm . What is the mutual force of electrostatic repulsion if the charge on each is $6.5 \times 10^{-7} \text{ C}$? The radii of A and B are negligible compared to the distance of separation. (b) What is the force of repulsion if each sphere is charged double the above amount, and the distance between them is halved?

5. (i) A spherical conductor of radius 12 cm has a charge of $1.6 \times 10^{-7} \text{ C}$ distributed uniformly on its surface . What is the electric field (a) inside the sphere (b) on the surface of the sphere and (c) at a point 18 cm from the centre of the sphere ?

(ii) A tiny particle of mass $10 \mu\text{g}$ is kept over a large horizontal sheet of charge density $4 \times 10^{-6} \text{ C}/\text{m}$. What charge should be given to the particle so that if released it doesn't fall down ?

6. (i) Two protons placed in vacuum, a certain distance apart exert a force F on each other. What will be the force between two alpha particles placed at same distance? Calculate the ratio of accelerations produced by the corresponding forces in proton and alpha particle. (ii) Two identical metal plates shown carry equal charge. Will the charge density have equal values at P_1 and P_2 ? Justify your answer. Also it is Given $V = x^2y + yz$ Calculate (i) X - component of electric field at point $(1, 3, 1)$. (ii) Magnitude of E at $(1, 3, 1)$.

7.(A) In the fig. shown , calculate the total flux of the electrostatic field through the spheres S_1 and S_2 . The wire shown here has a linier charge density λ given by $\lambda = kx$ where x is the distance measured along the wire , from the end A



(B) A spherical conducting shell of inner radius r_1 and other radius r_2 has a charge ' Q '. A charge ' q ' is placed at the centre of the shell.(a) What is the surface charge density on the (i) inner surface (ii) outer surface of the shell?(b) Wright expression for the electric field at a point $x > r_2$ from the center of the shell.

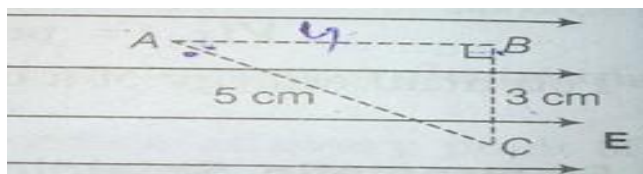
8. (a) Calculate the equivalent capacitance between points A and B in the circuit below. If a battery of 10 V is connected across A and B, calculate the charge drawn from the battery by the circuit.(b) A capacitor of unknown capacitance is connected across the battery of V votes. The charge stored in it is $360 \mu\text{C}$. When potential across the capacitor is reduced by 120 V, the charge stored in it becomes $120 \mu\text{C}$. Calculate:(i) The potential V and the unknown capacitance C .(ii) What will be the charge stored in the capacitor, if the voltage applied had increased by 120 V?

9. (i) A 600 pF capacitor is charged by a 200 V supply. It is then disconnected from the supply and is connected to another uncharged 600 pF capacitor. How much electrostatic energy is lost in the process? (ii) Three capacitors of capacitances 2 pF, 3 pF and 4 pF are connected in parallel (a) What is the total capacitance of the combination?(b) Determine the charge on the each capacitor if the combination is connected to 100 V supply.

10. (a) A parallel plate capacitor (C_1) having charge Q is connected, to an identical uncharged capacitor C_2 in series. What would be the charge accumulated on the capacitor C_2 ? (b)

Three identical capacitors each of capacitance $3\ \mu\text{F}$ are connected, in turn, in series and in parallel combination to the common source of the V volt. Find out the ratio of the energies stored in two configurations. (c) A $4\ \mu\text{F}$ capacitor is charged by a $200\ \text{V}$ supply. It is then disconnected from the supply and is connected to another unchanged $2\ \mu\text{F}$ capacitor. How much electrostatic energy of the first capacitor is lost in the form of heat and electromagnetic radiation?

11. (a) Two point charges $q_1 = 10 \times 10^{-8}\text{C}$ and $q_2 = -2 \times 10^{-8}\text{C}$ are separated by a distance of $60\ \text{cm}$ in air. (i) what a distance from the first charge q_1 would the electric potential be zero? (ii) Also calculate the electrostatic potential energy of the system. (b) A test charge q is moved without acceleration from A to B and then from B to C along the path from A to B and then from B to C in electric field E as shown in fig. (i) calculate the potential difference between A and C. (ii) at which point is the electric potential more and why?



12. (a) Two parallel plate capacitors X and Y have the same area of plates and same separation between them. X has air between the plates and Y contains a dielectric medium between the plates and both are connected in series with a battery of emf 12V .

(i) Calculate the capacitance of each capacitor if equivalent capacitance of the combination is $4\ \mu\text{F}$.

(ii) Calculate the potential difference between the plates of X and Y.

(iii) Estimate the ratio of electrostatic energy stored in X and Y.

(b) An electric dipole of length $10\ \text{cm}$ having charges $6 \times 10^{-3}\text{C}$, placed at 30° with respect to uniform electric field, experience a torque of magnitude $6\sqrt{3}\text{Nm}$. Calculate (i) magnitude of electric field and (ii) potential energy of electric dipole.