CLASS- XII
PHYSICS ASSIGNMENT

Unit I : Electrostatics

Q1. Consider three charged rods A, B and C. A and B attract each other while B and C repel each other. What will be the nature of force between A and C?

Q2. Why it is possible to ignore the quantization of electric charge when dealing with macroscopic charges?

Q3. Give two points of distinction between charge and mass.

Q4. In coulombs Law $F = \frac{Kq_1q_2}{r^2}$, what are the factors on which proportionality constant K depends?

Q5. What is the dimensional formula for permittivity constant $\in_o$?

Q6. Give a practical example to show that the electrostatics force is much stronger than the gravitational force.

Q7. How is force b/w two charges affected when dielectric constant of the medium in which they are held increases?

Q8. Name the theorem which enables us to calculate electrostatic forces in a collection of point charges.

Q9. In a medium the force of attraction between 2 point electric charges, distance 'd' apart is F. what distance apart should they be kept in the same medium so that the force between them become 3F.

Q10. When can one ignore the quantization of electric charges?

Q11. Why the test charge should be extremely small when measuring the electric field at a point?

Q12. At what points, dipole field intensity is parallel to the line joining the charges?

Q13. Can any amount of charge be placed on a capacitor? Justify your answer.

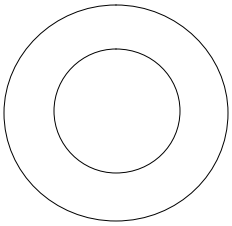
Q14. Where does the energy of a capacitor reside?

Q15. Show the surface of a conductor is an equipotential surface.

Q16. Show that the energy density. In parallel plate capacitor is $\frac{1}{2} \in_0 E^2$ where E is the electric field.

Q17. A sphere S_1 of radius r_1 encloses a charge Q. If there is another concentric sphere of radius r_2 ($r_2 > r_1$) and there is no additional charges between S1 and S2, find the ratio of the electric flux through S_1 and S_2.

Q18. S1 and S2 are two hollow concentric spheres enclosing charges Q and 2Q resp. as shown in fig



(i) What is the ratio of the electric flux through S_1 and S_2?

(ii) How will the electric flux through the sphere S1 changes, if a medium of dielectric constant 5 is introduced in the sphere inside S1 in place of air?

Ans (i) 1 : 3 (ii) become 1/5 that is air

Q19. Show that the direction of electric field is always perpendicular to the equipotential surface.

Q20. Draw equipotential surfaces for (i) positive point charges & (ii) uniform electric field . Can two equipotential surfaces interest? Why ?

Q21. Electric potential of the earth is taken to be zero why?

Q22. Obtain an expression for the electric field intensity at a distance 'r' from a point charge q.

Q23. How many electrons are present in one coulomb of charge?

Q24. A spark passes in air, when the potential gradient at a surface of a charged conductor is $3x10^6$ v/m what must be the radius of an insulated metal sphere, which can be raised to a potential of $3x10^6$ V, before sparking into the air? What will be the energy stored immediately before sparking occurs?

Ans. 500 J

Q25. A slab of material of dielectric constant K has the same area as the plates of a parallel plate capacitor but has a thickness (3/4) d ; where 'd' is the separation of the plate. How is the capacitance, changed when the slab is inserted b/w the plates?

Q26. A polythene piece rubbed with wool is found to have a negative charge of 3.2×10^{-7} C.

(a) Estimate the no. of electrons transferred (from which to which) ?

(b) Is there a transfer of mass from wool to polythene?

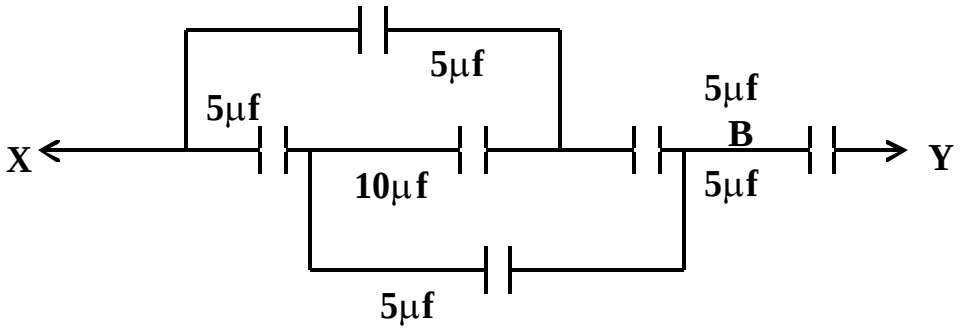
Q27. An infinite line charge produces a field of 9×10^4 N/C at a distance of 2 cm. Calculate the linear charge density.

Q28. What is the need to enclose Vande Graff generator inside an earth connected enclosure filled with air under pressure?

Q29. How do you justify the infinite value of dielectric constant of a conductor?

Q30. Using Gauss's theorem, derive an expression for electric field intensity at a point due to an infinite sheet of charge.

Q31. Find the resultant capacitance between the point X and Y of combination of capacitors as shown.



Q32. **Two spheres of copper of the same radii. One hollow and the other solid are charged to the same potential on which sphere there is more charge?**

Q33. **State the principle of working of Vande Graff generator, give its one main application.**

Q34. **Explain the principle of a capacitor.**

Q35. **Discuss the construction and working of Vande Graaff generator alongwith well labelled diagram.**

Q36. **Derive an expression for the torque experienced by an electric dipole placed in a uniform electric field. What is the net force acting on this, electric dipole?**

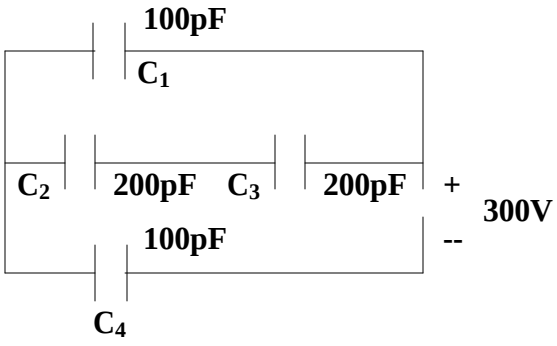
Q37. **Find the electrostatic potential energy of the configuration of four charges +q, -q, +q and –q placed at the four corners A, B, C and D of a square of side r.**

Ans. $\dfrac{1q^2(\sqrt{2}-4)}{4\pi\in_0 r}$

Q38. **Two isolated metallic solid spheres of radii R and 2R are charged, such that both of these have same charge density σ . The spheres are located far away from each other and connected by a thin conducting wire. Find the new charge density on the bigger sphere.**

Ans : (5σ/6)

Q39. **Obtain the equivalent capacitance of the network in given figure for a 300V supply, determine the charge and voltage across each capacitor.**



Ans. Equivalent capacitance = $\frac{200\ pF}{3}$

$q_1 = 10^{-8}C$; $V_1 = 100V$; $10^{-8}C = q_1 = q_3$

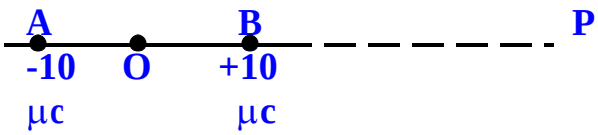
$V_2 = 50V$ $V_4 = 200V$

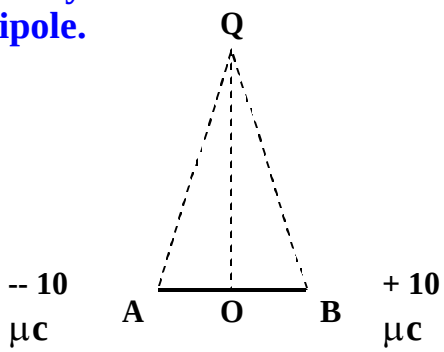
$q_4 = 2 \times 10^{-8}C$

Q40. A cube of side b has a charge q at each of its vertices. Determine the potential and electric field due to this charge away at the centre of the cube.

Ans. E=0 due to symmetry $V = \frac{4q}{\sqrt{3}\pi\in_o b}$.

Q41. Two charges $\pm$ 10μc are placed 5.0 mm apart determine the electric field at (a) a point P on the axis of the dipole 15cm away from its centre O in the side of the positive charge (b) a point Q 15cm away from O on a line passing through O and normal to the anis of the dipole.





Q42. State gauss's theorem in electrostatics. Apply this theorem to calculate the electric field due to a spherical shell of charge at a point (a) outside the shell, (b) on the shell and (C) inside the shell.

Q43. Prove that for a short dipole, the intensity at a point on the axis line is twice that on the equatorial line.

Q44. What is meant by potential energy of in electric dipole, when placed in an external electric field. Show that the potential energy U of an electric dipole of dipole moment $\bar{p}$ in a uniform field $\bar{E}$ is given by

$U = -\ \bar{p}\ .\ \bar{E}$

Q45. Two identical balls each of mass m and charge q are suspended with threads of length l. If Q is the angle. Which each thread make with vertical in equilibrium prove that separation (x) to given by

Assume Q to be small

$$X = \left[\frac{q^2 l}{2\pi\in_o mg}\right]^{1/3}$$