1. **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.
2. **An α-particle placed a certain distance apart from another α-particle experiences a Columbic repulsion producing an acceleration of X m/s^2. If the particle is replaced by a proton, what will be the acceleration produced in it.**
3. **Draw electric field lines between the plates of a parallel plate capacitor. Show the modified filed lines when a**
   (i) **dielectric**
   (ii) **conducting slab is introduced between the plates of the capacitor.**
4. **Define electrostatic potential.**
   Represent graphically the variation of potential due to
   (a) **point charge with distance**
   (b) **a small electric dipole at a far off point on its (*i*) axial (*ii*) equatorial line.**
5. **Two large, thin metal plates are parallel and close to each other. On their inner faces the plates have surface charge densities of opposite signs and of magnitude 1.7 x 10^{-12} Cm^{-2}. What is the intensity of the electrostatic field**
   (a) **in outer region of first plate**
   (b) **in outer region of second plate**
   (c) **between the plates?**
6. **Obtain dimensional formula for ε_0.**
7. **Calculate the total number of electric field lines starting from a proton.**
8. **Describe a method to distinguish between a conductor and an insulator.**
9. **A charge *q* when placed at the mid point of the line joining two equal charges of magnitude Q each brings the system in equilibrium. Obtain a relation between *q* and Q.**
10. **Three capacitors of capacitance C_1, C_2 and C_3 are connected**
    (i) **in series**
    (ii) **in parallel**
    Obtain an expression for their effective capacitance in each case. Show that the two combinations store equal energy when connected to source of potential difference 'V' volts.
11. **Derive an expression for the magnitude of electric field intensity at any point along the equatorial line of a short electric dipole. Give the direction of the electric field intensity at that point.**
12. **An electric dipole is held in a uniform electric field**
    (a) **Show that no translatory force acts on it.**
    (b) **Derive an expression for the torque acting on it.**
    (c) **The dipole tends to align itself parallel to the field.**
    Calculate the work done in rotating it through 180^0.
13. **Two conductors A and B carry equal amount of charge. If the two are interconnected by a copper wire, will there be any transfer of electric charge between them.**
    If yes, state the parameter which governs the direction of flow of charge.
14. **Two point charges, *q* units each placed 2*m* apart exert a force of 20 N on each other. What will be the force between them if a third charge -*q* units is placed at mid point of the line joining the two charges.**
15. **Two charges *q* μC each are placed a certain distance apart. What is the ratio of the forces experienced by the two charges.**
16. **Give the principle of working of a Van de Graff generator. With the help of a labelled diagram, describe its construction and working.**
    How is the leakage of charge from the generator minimised?
17. **Represent graphically the variation of charge '*q*' stored in a parallel plate capacitor with the potential difference 'V' applied across its ends. Using the graph obtain an expression for the energy stored in the capacitor. What is the energy density in the parallel plate capacitor?**
18. **State Gauss theorem. Using the theorem obtain an expression for force acting between two point charges placed a certain distance apart in vacuum.**

19. **Using Gauss theorem, obtain an expression for the electric field intensity at a point due to a long line of charge with uniform linear chare density λ Cm^{-1}. Represent the variation of electric field intensity with distance from the line graphically.**

Hint : Deduce $\vec{E} = \frac{\lambda}{2\pi\varepsilon_0 r}\hat{r}$.

20. **A point charge A of 10 μC is placed at the centre of a metallic sphere of radium 5 cm with another charge B of 20 μC at a distance of 10 cm from A. What is the magnitude of the force exerted due to**

(i) **A on B.**

(ii) **B on A.**

Does the observation violate Newton's third law?

21. **Two point charges q_1 and q_2 are placed a distance 'r' apart. Represent graphically the variation of force F on q_2 with**

(i) **magnitude of q_2**

(ii) **distance r from q_1**

(iii) **$1/r^2$**

22. **Represent electric field lines due to an infinitely large flat sheet of charge wit uniform positive density.**

23. **The distance between the plates of a parallel plate capacitor of capacitance 'C' is doubled and the space between them is filled with a substance of dielectric constant 5. What will be the value of the capacitance?**

24. **Two identical capacitors are joined**

(i) **in series**

(ii) **in parallel**

to two different sources of potential difference V_1 and V_2 respectively. If the capacitors are found to store equal energy calculate V_1/V_2.

25. **Two capacitors with capacitance x μF and y μF can be connected to get a net capacitance of**

(a) **3 μF**

(b) **16 μF.**

How are the capacitors joined in the two cases ? Calculate x and y.

26. **AOB is diameter of a circle of radius R. A point charge Q in placed at mid point of OA and another charge 'q' is moves from A to B. Calculate the work done.**

27. **Two point charges of magnitude 8n C and - 3n C are placed in XOY plane at point A (0,3, cm) and B (4cm 0). Calculate the force exerted by B on A. If a third charges of 9nC chare due to the two given charges?**

28. **Two charges of magnitude q each are placed 4 m apart. Represent variation of electrostatic potential at P as x increases from 0 cm to 4 cm. At what position will the potential become minimum?**

29. **Represent variation of electrostatic potential energy between two point charges as separation between them is increased.**

30. **Calculate the work required to be done to reduce the separation between two identical charges of 50 μC each from 20 cm to 5 cm.**

31. **A charge of 8 mC is located at the origin. Calculate the work done to move a point charge of -2 x 10^{-9} C from P(0, 0, 3 cm) to P' (0, 3 cm, 0) through (3 cm, 0, 0).**

32. **In a hydrogen atom, the electron and proton are bound at a distance of 0.53 Å.**

(*a*) Estimate the work done to move the electron to an infinite separation from the proton if it already possesses a kinetic energy of half the magnitude of its potential energy at the given distance.

33. **In the adjoining figure; two large flat parallel sheets have uniform surface charge density + σ and - σ respectively. Represent the variation of electric field as we move from O to A.**

34. **In the above question, how will the graph vary if both the plates carry equal and positive chare densities σ C m^{-2} each.**

35. **Two identical balls carry charge 2Q and - Q placed a certain distance apart exert a force F on each other. The balls are connected by a copper wire which is later removed. Calculate the force between the balls.**

36. **A capacitor of 6 μF is charged to 100 V and connected to an uncharged capacitor of 14 μF.**

Calculate ratio of

(i) charges on the two capacitors

(ii) energy stored in the capacitors.

37. Given V = $x^2y + yz$
Calculate (*i*) component of electric field at point (1, 3, 1)
(*ii*) magnitude of E at (1, 3,1).

38. A photographic flash operated by a charged capacitor delivers 1000 W for 0.040 sc. If the capacitor has been charged by a 1000 V source, calculate capacitance of the capacitor.

39. An infinitely large flat sheet has a uniform surface charge density σ Cm^{-2}. Draw the electrostatic field lines due to the sheet.

40. *n* identical capacitors when joined in series given an effective capacitance of C units. What will be the capacitance if the capacitors are now placed in parallel combination?

41. Eight capacitors of capacitance 'C' each connected in parallel to a source store a total energy of 64 units. How much energy will be stored if the capacitors are now joined in series to the same source.

42. Represent the variation of electric field E due to a point charge with

(i) $1/r^2$

(ii) *r* graphically.

43. A uniformly charged rod with linear charge density λ Cm^{-1} of length '*l*' is inserted in the cube with constant velocity '*v*' and moves out of the opposite face. Represent graphically the variation of electric flux through the cube with time.

44. A dielectric slab is introduced in the space between the plates of a parallel plate capacitor so that it just fills the space. The capacitor is charged and the disconnected from the source. Plot the variation of

(i) charge

(ii) capacitance

(iii) potential difference across the plates and the length of the dielectric slab pulled out.
Justify your answer.

45. In the above situation, represent graphically the variation of charge, capacitance and potential difference if the source remains connected. Justify your answer.

46. Calculate the work done to assemble the system of four charges *q* each at the corners of a square of each side '*a*'.

47. Derive an expression for the energy stored in a parallel plate capacitor with air as medium between its plates.
A parallel plate capacitor is charged by connecting it to a source of potential difference 'V'. A dielectric medium of dielectric constant K is introduced between the plates. How does it effect the total energy of the capacitor if

(i) the capacitor remains connected to the source.

(ii) the source is disconnected before introducing the dielectric?

48. Calculate the area of the plates required to design a 1 F capacitor with separation between the plates being 0.5 cm. Why do capacitors generally have capacitance of the order of microfarads?

Hint : We have $A = \frac{Cd}{\varepsilon 0}$
By calculation A = 3.6 x 10^7 sq. m
As the area of plates is practically much smaller in actual practice, the capacitance is of the order of a few microfarads.