

XII –PHYSICS IMPORTANT PROBLEM QUESTIONS -2023**UNIT : 1****PREPARED BY****Dr.G.THIRUMOORTHY,M.Sc,B.Ed,Ph.D (PHYSICS)****ASSISTANT PROFESSOR****GOVT ARTS COLLEGE (AUTONOMOUS)****SALEM- 636007****CELL: 8610560810,8883610465**

1.An electric dipole is placed at an alignment angle of 30^0 with an electric field of $2 \times 10^{-5} \text{ N C}^{-1}$. It experiences a torque equal to 8 N m. The charge on the dipole if the dipole length is 1 cm

2.Dielectric strength of air is $3 \times 10^6 \text{ V m}^{-1}$. Suppose the radius of a hollow sphere in the Van de Graff generator is $R = 0.5 \text{ m}$, calculate the maximum potential difference created by this Van de Graaff generator.

3.Two conducting spheres of radius $r_1 = 8 \text{ cm}$ and $r_2 = 2 \text{ cm}$ are separated by a distance much larger than 8 cm and are connected by a thin conducting wire as shown in the figure. A total charge of $Q = +100 \text{ nC}$ is placed on one of the spheres. After a fraction of a second, the charge Q is redistributed and both the spheres attain electrostatic equilibrium. r B 1 r₂ A -in conducting wire

(a) Calculate the charge and surface charge density on each sphere.



(b) Calculate the potential at the surface of each sphere.

4. A parallel plate capacitor filled with mica having $\epsilon_r = 5$ is connected to a 10 V battery. The area of each parallel plate is 6 cm^2 and separation distance is 6 mm.

(a) Find the capacitance and stored charge.

(b) After the capacitor is fully charged, the battery is disconnected and the dielectric is removed carefully. Calculate the new values of capacitance, stored energy and charge

5. A parallel plate capacitor has square plates of side 5 cm and separated by a distance of 1 mm.

(a) Calculate the capacitance of this capacitor.

(b) If a 10 V battery is connected to the capacitor, what is the charge stored in any one of the plates? (The value of $\epsilon_0 = 8.85 \times 10^{-12}$)

6. Calculate the electric flux through the rectangle of sides 5 cm and 10 cm kept in the region of a uniform electric field 100 NC^{-1} . The angle θ is 60° . If θ becomes zero, what is the electric flux?

7. A water molecule has an electric dipole moment of $6.3 \times 10^{-30} \text{ Cm}$. A sample contains 10^{22} water molecules, with all the dipole moments aligned parallel to the external electric field of magnitude $3 \times 10^5 \text{ NC}^{-1}$. How much work is required to rotate all the water molecules from $\theta = 0^\circ$ to 90° ?

8. Consider a point charge $+q$ placed at the origin and another point charge $-2q$ placed at a distance of 9 m from the charge $+q$. Determine the point between the two charges at which electric potential is zero.

9. A sample of HCl gas is placed in a uniform electric field of magnitude $3 \times 10^4 \text{ N C}^{-1}$. The dipole moment of each HCl molecule is $3.4 \times 10^{-30} \text{ Cm}$. Calculate the maximum torque experienced by each HCl molecule

10. Calculate the electrostatic force and gravitational force between the



proton and the electron in a hydrogen atom. They are separated by a distance of 5.3×10^{-11} m. The magnitude of charges on the electron and proton are 1.6×10^{-19} C. Mass of the electron is $m_e = 9.1 \times 10^{-31}$ kg and mass of proton is $m_p = 1.6 \times 10^{-27}$ kg.

11. Calculate the number of electrons in one coulomb of negative charge.

12. They are separated by a distance of 1m. Calculate the force experienced by the two charges for the following cases:

- (a) $q_1 = +2 \mu\text{C}$ and $q_2 = +3 \mu\text{C}$
- (b) $q_1 = +2 \mu\text{C}$ and $q_2 = -3 \mu\text{C}$

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