

QUARTELY EXAM – 2023**XII-PHYSICS – IMPORTANT PROBLEM****DATE : 01.09.2023**

1. Calculate the number of electrons in one coulomb of negative charge
2. 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
3. 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.
4. 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° ?
5. 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
6. 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 Graff generator.
7. When two objects are rubbed with each other, approximately a charge of 50 nC can be produced in each object. Calculate the number of electrons that must be transferred to produce this charge.
8. Compute the current in the wire if a charge of 120 C is flowing through a copper wire in 1 minute.
9. If an electric field of magnitude 570 N C^{-1} , is applied in the copper wire, find the acceleration experienced by the electron.
10. A copper wire of cross-sectional area 0.5 mm^2 carries a current of 0.2 A. If the free electron density of copper is $8.4 \times 10^{28} \text{ m}^{-3}$ then compute the drift velocity of free electrons.
11. Determine the number of electrons flowing per second through a conductor, when a current of 32 A flows through it.
12. The resistance of a wire is 20Ω . What will be new resistance, if it is stretched uniformly 8 times its original length?

13. Resistance of a material at 200 C and 400 C are $45\ \Omega$ and $85\ \Omega$ respectively. Find its temperature coefficient of resistivity
14. Two electric bulbs marked 20 W – 220 V and 100 W – 220 V are connected in series to 440 V supply. Which bulb will get fused
15. A battery has an emf of 12 V and connected to a resistor of $3\ \Omega$. The current in the circuit is 3.93A. Calculate (a) terminal voltage and the internal resistance of the battery (b) power delivered by the battery and power delivered to the resistor

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