KAKUBHAI PARIKH SCHOOL

Name: **Worksheet** **Class: 12th Sc.**

Subject: Physics **Chapter: 1,2 &3**

1. An electric dipole of length 4 cm when placed with its axis making an angle of 60^0 with a uniform electric field, experience a torque of $4\sqrt{3}\,Nm$. Calculate the potential energy of the dipole if it has charge of ±8nC. **[ans. -4 J]**
2. Define the term electric dipole moment. Is it a scalar or vector? Deduce an expression for the electric field at a point on the equatorial plane of an electric dipole of length 2a.
3. Deduce the expression for the torque acting on a dipole of dipole moment **p** in the presence of a uniform electric field **E**.
4. Given a uniform electric field $2 \times 10^3 \hat{\imath}$ **N/C**, find the flux of this field through a square of side 20 cm, whose plane is parallel to the YZ-plane. What would be the flux through the same square if the plane makes an angle of 30^0 with the x-axis? **[ans. 40 Nm^2C^{-1}]**
5. State **Gauss'** law. Using this law derive an expression for the electric field due to a long straight wire of linear charge density **λ C/m .**
6. Find out the expression for the potential energy of a system of three charges q_1, q_2 and q_3 located at r_1, r_2 and r_3 with respect to the common origin O.
7. A point charge **Q** is placed at point P at a distance **R** from the centre of a metallic spherical shell of inner radius **2R** and outer radius **2.5R**. Find the electric potential at the centre of the shell. $\left[Ans: \frac{1}{4\pi\varepsilon_0}\left(\frac{9Q}{10R}\right)\right]$
8. Five point charges , each equal to **+q,** are placed at five vertices of a regular hexagon of side **L**. Find the magnitude of the force on a point charge **–q** placed at the centre of the hexagon.

   $\left[Ans: \frac{q^2}{4\pi\varepsilon_0 L^2}\right]$
9. Four equal charges **Q** are placed at the four corners of a square of side **'a'**. Find the work done in removing a charge **–Q** from the centre of the square to infinity. $\left[Ans: \frac{2Q^2}{\pi\varepsilon_0 a}\right]$
10. A capacitor of capacitance **5 μF** is fully charged by a **120 V** battery. The battery is disconnected. If an additional charge of **+200 μC** is given to the positive plate, then find the potential differences between the capacitor plates. **[Ans: 140 V]**
11. If the charge on a capacitor is increased by **2 C**, then the energy stored in it increases by **21%**. Find the original charge on the capacitor. **[Ans: 20 C]**
12. An electric field of **200 Vm^{-1}** exist in the region between the plates of a parallel plate capacitor of plate separation **5 cm**. Find the potential difference between the plates when a slab of dielectric constant **4** and thickness **1 cm** is inserted between the plates**. [Ans: 8.5 V]**
13. Derive an expression for capacitance of a parallel plate capacitor. Also derive the formula for energy stored in the parallel plate capacitor.
14. If the potential difference between the plates of a capacitor is increased by **20%**, the find the percentage increased in energy stored in the capacitor. **[Ans: 44%]**

15. A parallel plate capacitor of plate area **A** and plate separation **d** is charged by a battery of voltage **V**. The battery is then disconnected. Find the work done needed to pull the plates to a separation **2d.**
$\left[\boldsymbol{Ans}: \frac{\boldsymbol{AV^2\varepsilon_o}}{\boldsymbol{2d}}\right]$
16. A potential difference of **0.8 V** is maintained between the ends of a metal wire of length **1 m**. The number density of free electrons in the metal **is 8×10^{28} per m^3** and the electrical conductivity of the metal is $\boldsymbol{6.4 \times 10^7\ \Omega^{-1}m^{-1}}$. Find the drift speed of electrons.
[Ans. 4×10^{-3} ms^{-1}]
17. A wire is stretched to make it 0.1% longer. What is the percentage change in the resistance? **[Ans. 0.2%]**
18. A wire of resistance 0.1 Ω/cm is bent to form a square ABCD of side 10 cm. A similar wire is connected between corners B and D to form the diagonal BD. Find the effective resistance between the corners A and C. **[Ans. 1Ω]**
19. When a cell is connected to a resistance R_1, the rate at which heat is generated in it is the same as when the cell is connected to a resistance $R_2(<R_1)$.Find the internal resistance of the cell.
$\left[\boldsymbol{Ans}.\sqrt{\boldsymbol{R_1R_2}}\right]$
20. An electric bulb has rating **500 W, 100 V**. It is used in a circuit having at **200 V** supply. What resistance must be connected in series with the bulb so that it delivers **500 W**? **[Ans. 20Ω]**
21. Three equal resistors, connected in series with a battery , dissipate **P watts** of power. What will be the power dissipated if the same resistances are connected in parallel across the same battery? **[Ans. 9P]**