ST. LAWRENCE HIGH SCHOOL

A JESUIT CHRISTIAN MINORITY INSTITUTION

SOLUTION TO WORK SHEET 5

Subject : PHYSICS

CLASS : XII Date : 8.5.20

Chapter : Electrostatics

Topic : Torque on Dipole, Potential, Potential due to Dipole on Axial and Perpendicular bisector point.

Multiple Choice Question : **1 x 15 = 15**

1. A dipole of dipole moment $\vec{P}$ is placed in uniform electric field $\vec{E}$ then torque acting on it is given by :

   (a) $\vec{\tau} = \vec{P} \cdot \vec{E}$ (b) $\vec{\tau} = \vec{P} \times \vec{E}$

   (c) $\vec{\tau} = \vec{P} + \vec{E}$ (d) $\vec{\tau} = \vec{P} - \vec{E}$

   Ans. : (b) $\vec{\tau} = \vec{P} \times \vec{E}$

2. An electric dipole is placed at an angle of 30^0 with an electric field intensity 2×10^5 N C^{-1}. It experiences a torque equal to 4 N m. The charge on the dipole, if the dipole length is 2 cm, is

   (a) 8 mC (b) 2 mC (c) 5 mC (d) 7 μC

   Ans : (b) 2 mC

3. An electric dipole with dipole moment $\vec{P} = (2\hat{i} + 3\hat{j})$ cm is kept in electric field $\vec{E} = 4\hat{i}$ N/C. The torque acting on it is :

   (a) $-12\hat{k}$ (Nm) (b) $8\hat{k}$ (Nm) (c) $12\hat{k}$ (Nm) (d) $-8\hat{k}$ (Nm)

   Ans. : (b) $8\hat{k}$ (Nm)

4. Number of Statvolt corresponding to 1 volt is :

   (a) $\frac{1}{100}$ (b) 10^9 (c) $\frac{1}{300}$ (b) 300

   Ans. : (c) $\frac{1}{300}$

5. Four point changes each + q is placed on the circumference of a circle of diameter $2d$ in such a way that they form a square. The potential at the centre of the circle (in CGS) is :

   (a) 0 (b) $\frac{4q}{d}$ (c) $\frac{4d}{q}$ (d) $\frac{q}{4d}$

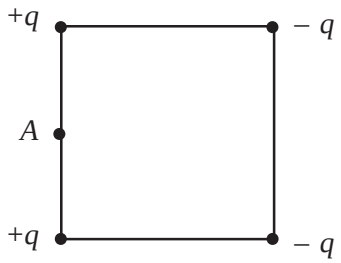
   Ans. : (b) $\frac{4q}{d}$

6. The radius of a soap bubble whose potential is 16 V is doubled. The new potential of the bubble is :

   (a) 2 V (b) 4 V (c) 8 V (d) 16 V

   Ans. : (c) 8 V

7. Four electric charges $+q$, $+q$, $-q$ are placed at the corners of a square of side $2L$. The electric potential at point A midway between the two charges $+q$ and $+q$ is :



(a) $\frac{1}{4\pi\epsilon_0}\frac{2q}{L}(1+\sqrt{5})$ (b) $\frac{1}{4\pi\epsilon_0}\frac{2q}{L}\left(1+\frac{1}{\sqrt{5}}\right)$ (c) $\frac{1}{4\pi\epsilon_0}\frac{2q}{L}\left(1-\frac{1}{\sqrt{5}}\right)$ (d) zero

Ans. : (c) $\frac{1}{4\pi\epsilon_0}\frac{2q}{L}\left(1-\frac{1}{\sqrt{5}}\right)$

8. The electric potential at a point on the axis of an electric dipole depends on the distance x of the point from the dipole as :

(a) $\propto x$ (b) $\propto \frac{1}{x}$ (c) $\propto \frac{1}{x^2}$ (d) $\propto \frac{1}{x^3}$

Ans. : (c) $\propto \frac{1}{x^2}$

9. The electric potential at the surface of an atomic nucleus (Z = 50) of radius of 9 x 10^{-15} m :

(a) 80V (b) 9V (c) 9 x 10^5V (d) 8 x 10^5V

Ans. : (d) 8 x 10^5V

10. Two charges – 10C and + 10C are placed 10 Cm apart. Potential at the centre of the line joining the two charges is

(a) zero (b) 2 V (c) –2 V (d) None of these

Ans. : (a) zero

11. Two charges each equal to q are placed at the corners of a square of side l. The electric potential at the centre of the square is :

(a) $\frac{1}{4\pi\varepsilon_0}\frac{4q}{l}$ (b) $\frac{1}{4\pi\varepsilon_0}\frac{4q}{\sqrt{2}l}$ (c) $\frac{1}{\pi\varepsilon_0}\frac{\sqrt{2}q}{l}$ (d) $\frac{1}{\pi\varepsilon_0}\frac{2q}{l}$

Ans. : (c) $\frac{1}{\pi\varepsilon_0}\frac{\sqrt{2}q}{l}$

12. Two concentric spheres of radii R and r have similar charges with equal surface densities (σ). What is the electric potential at their common centre?

(a) $\frac{\sigma}{\varepsilon_0}$ (b) $\frac{\sigma}{\varepsilon_0}(R-r)$ (c) $\frac{\sigma}{\varepsilon_0}(R+r)$ (d) None of the above.

Ans. : (c) $\frac{\sigma}{\varepsilon_0}(R+r)$

13. At a point *A*, there is an electric field of 500 V/m and potential of 3000 V. The distance between the point charge and *A* is :

(a) 6 m (b) 12 m (c) 36 m (d) 144 m

Ans. : (a) 6 m.

14. Potential at a point on the perpendicular bisector of a dipole is :

(a) zero (b) 1 (c) $\frac{q}{2l}$ (d) $\frac{l}{q}$

Ans. : (a) zero.

15. Potential at a distance r from the mid point of a dipole of length $2l$ on the axis of it is :

(a) zero (b) $\frac{1}{4\pi\epsilon_0} \cdot \frac{p}{r^2 - l^2}$ (c) $\frac{1}{4\pi\epsilon_0} \cdot \frac{2p}{r^2 - l^2}$ (d) $\frac{P}{r^2 - l^2}$

Ans. : (b) $\frac{1}{4\pi\epsilon_0} \cdot \frac{p}{r^2 - l^2}$

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