Physicsaholics

DPP – 5 (Electrostatics)

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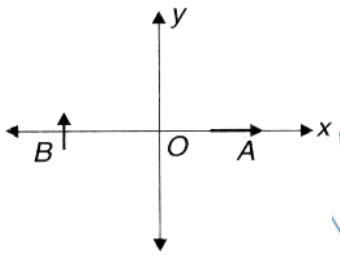
Q 1. Two dipoles of dipole moments p each are placed on points A (a, 0) and B (-a, 0) as shown in figure. How much work is done in rotating both the dipoles with 90° angle in clockwise direction?



(a) PE (b) $-\frac{KP}{r^4}$ (c)Zero (d) $-\frac{KP}{r^4}$

Q 2. Two small electric dipoles each of dipole moment p (along x axis) are situated at (0, 0, 0) and (r, 0, 0). The electric potential at a point $\left(\frac{r}{2}, \frac{\sqrt{3}r}{2}, 0\right)$ is:

(a) $\frac{P}{4\pi\epsilon_0 r^2}$ (b) 0 (c) $\frac{P}{2\pi\epsilon_0 r^2}$ (d) $\frac{P}{8\pi\epsilon_0 r^2}$

Q 3. A thin ring of radius R metres is placed in x-y plane such that its centre lies on origin. The half ring in region x< 0 carries uniform linear charge density +l C/m and the remaining half ring in region x> 0 carries uniform linear charge density–l C/m.

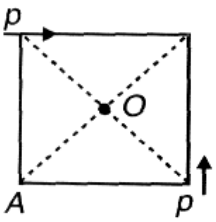
(a) Then the direction of electric field at point P whose coordinates are (0m, $+\frac{R}{2}$m) is along positive x-direction

(b) Then the electric potential (in volts) at point P whose coordinates are (0m, $+\frac{R}{2}$m) is 0

(c) Then the dipole moment of the ring in C–m is $(4R^2 l)\hat{\imath}$

(d) Then the dipole moment of the ring in C–m is $(2R^2 l)\hat{\imath}$

Q 4. Two short dipoles of dipole moment p are placed at two corners of square as shown in figure. What is the ratio of magnitude of electric field at two points O & A?



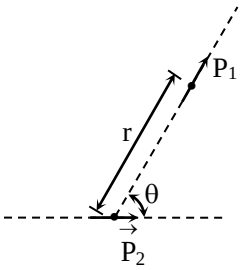
(a) 2 (b) $2\sqrt{2}$ (c) 1 (d) $\sqrt{2}$

Q 5. An electric dipole is made up of two particles having charges +1μC, mass 1 kg and other with charge -1 μc and mass 1 kg separated by distance 1 m. It is in equilibrium in a uniform electric

field of 20×10^3V/m. If the dipole is deflected through angle 2°, time taken by it come again in equilibrium is

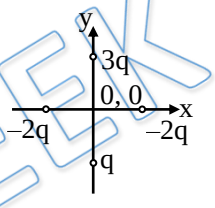
(a) 2.5 πs (b) 2.5 s (c) 5 πs (d) 4 π

Q 6. Two short electric dipoles are placed as shown. The energy of electric interaction between these dipoles will be –



(a) $\frac{2kp_1p_2Cos\,\theta}{r^3}$ (b) $-\frac{2kp_1p_2Cos\,\theta}{r^3}$ (c) $-\frac{2kp_1p_2Sin\,\theta}{r^3}$ (d) $-\frac{4kp_1p_2Cos\,\theta}{r^3}$

Q 7. 4 charges are placed each at a distance 'a' from origin. The dipole moment of configuration is-

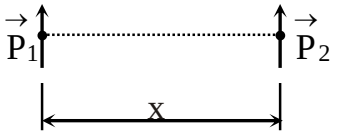


(a) 2qa
(b) $2\sqrt{2}$ qa
(c) $2\sqrt{5}$ qa
(d) None of these

Q 8. The magnitude of electric field intensity at point B (2, 0, 0) due to a dipole of dipole moment, $\vec{p} = \hat{\imath} + \sqrt{3}\,\hat{\jmath}$ kept at origin is (assume that the point B is at large distance from the dipole)

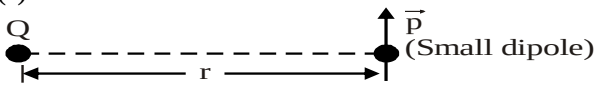
(a) $\frac{\sqrt{13}}{8}\,k$ (b) $\frac{\sqrt{13}}{4}\,k$ (c) $\frac{\sqrt{7}}{8}\,k$ (d) $\frac{\sqrt{7}}{4}\,k$

Q 9. Figure shows two short dipole moments parallel to each other and placed at a distance x apart is, then –



(a) they will repel each other
(b) they will attract each other
(c) force of interaction is of magnitude of $\frac{3P_1P_2}{4\pi\varepsilon_0x^4}$
(d) force of interaction is of magnitude of $\frac{6P_1P_2}{4\pi\varepsilon_0x^4}$

Q 10. For the situation shown in the figure below (assume r >> length of dipole) mark out the correct statement(s).



(a) Force acting on the dipole is zero.

(b) Force acting on the dipole is approximately $\frac{pQ}{4\pi\varepsilon_0 r^3}$ and is acting upward

(c) Torque acting on the dipole is $\frac{pQ}{4\pi\varepsilon_0 r^2}$ in clockwise direction.

(d) Torque acting on the dipole is $\frac{pQ}{4\pi\varepsilon_0 r^2}$ in anti-clockwise direction

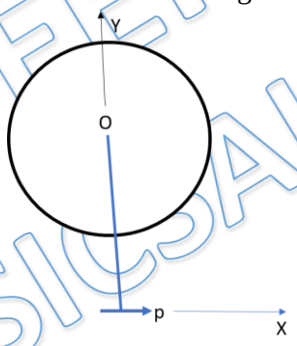
Q 11. Two point charges +4q and –q are placed on x axis at separation l_0 . Number of points on x axis where a dipole will experience zero force is (do not count x = $\pm\infty$)

(a) 2 (b) 1 (c) 3 (d) 4

Q 12. A short dipole of dipole moment p is placed on the axis of uniformly charged ring of radius R and charge Q . Distance of dipole from centre of ring is r = $\frac{R}{\sqrt{2}}$ and it is placed along axis. Force on dipole is

(a) $\frac{2KpQ}{R^3}$ (b) $\frac{KpQ}{3\sqrt{3}R^3}$ (c) $\frac{2\sqrt{2}KpQ}{R^3}$ (d) Zero

Q 13. In given figure circle is in xy plane and dipole is along x axis . O is centre of circle and R is radius of circle. If there are 4 points on circle where electric field is perpendicular to dipole moment, possible values of distance of O from origin is/are



(a) R (b) 2R (c) 1.5 R (d) 3R

Answer Key

Q.1 c	**Q.2 b**	**Q.3 a, b, c**	**Q.4 b**	**Q.5 a**
Q.6 b	**Q.7 a**	**Q.8 c**	**Q.9 a, c**	**Q.10 b, c**
Q.11 a	**Q.12 d**	**Q.13 a, c**		