PHYSICS CLASS 12 BATCH

Electric Charges and Field

DPP-03

1. An electron is moving round the nucleus of a hydrogen atom in a circular orbit of radius r. The coulomb force $\vec{F}$ between the two is (Where $K = \frac{1}{4\pi\varepsilon_0}$);

(1) $-K\frac{e^1}{r^3}\hat{r}$ (2) $K\frac{e^1}{r^3}\vec{r}$

(3) $-K\frac{e^2}{r^3}\vec{r}$ (4) $K\frac{e^1}{r^2}\hat{r}$

2. Two small spheres each having the charge $+Q$ are suspended by insulating threads of length L from a hook. This arrangement is taken in space where there is no gravitational effect, then the angle between the two suspensions and the tension in each will be:

(1) $180°, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{(2L)^2}$

(2) $90°, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{L^2}$

(3) $180°, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{2L^2}$

(4) $180°, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{L^2}$

3. Charge q_2 of mass m revolves around a stationary charge q_1 in a circular orbit of radius r. The orbital periodic time of q_2 would be:

(1) $\left[\frac{4\pi^2 mr^3}{kq_1q_2}\right]^{1/2}$ (2) $\left[\frac{kq_1q_2}{4\pi^2 mr^3}\right]^{1/2}$

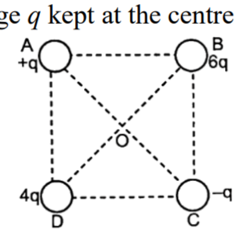
(3) $\left[\frac{4\pi^2 mr^4}{kq_1q_2}\right]^{1/2}$ (4) $\left[\frac{4\pi^2 mr^2}{kq_1q_2}\right]^{1/2}$

4. The ratio of electrostatic and gravitational forces acting between electron and proton separated by a distance 5×10^{-11} m will be (Charge on electron = 1.6×10^{-19} C, mass of electron = 9.1×10^{-31} kg, mass of proton = 1.6×10^{-27} kg, $G = 6.7 \times 10^{-11}$ Nm^2/kg^2):

(1) 2.36×10^{39} (2) 2.36×10^{40}

(3) 2.34×10^{41} (4) 2.34×10^{42}

5. Four charges are arranged at the corners of a square $ABCD$, as shown in the adjoining figure. The force on the charge q kept at the centre O is:



(1) zero
(2) along the diagonal AC
(3) along the diagonal BD
(4) perpendicular to side DC

6. A charge q_1 exerts some force on a second charge q_2. If third charge q_3 is brought near, the force that q_1 exerts on q_2 and net force on q_2 respectively

(1) decreases, increases
(2) increases, increases
(3) remains unchanged, may increase or decrease
(4) remains unchanged, remains unchanged

7. Two equal point charges each of 3μC are separated by a certain distance in metres. If they are located at $(\hat{i}+j+k)$ and $(2\hat{i}+3j+3k)$, then the electrostatic force between them is:

(1) $9 \times 10^3\ N$
(2) $9 \times 10^{-3}\ N$
(3) $3 \times 10^{-3}\ N$
(4) $9 \times 10^{-2}\ N$

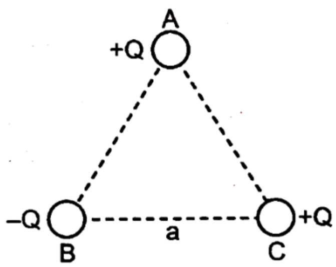
8. Three charges are placed at the vertices of an equilateral triangle of side 'a' as shown in the following figure. The force experienced by the charge placed at the vertex A in a direction normal to BC is:

(1) $Q^2/\left(4\pi\varepsilon_0 a^2\right)$

(2) $-Q^2/\left(4\pi\varepsilon_0 a^2\right)$

(3) zero

(4) $Q^2/\left(2\pi\varepsilon_0 a^2\right)$



9. Equal charges q are placed at the four corners A, B, C, D of a square of length a. The magnitude of the force on the charge at B will be:

(1) $\dfrac{3q^2}{4\pi\varepsilon_0 a^2}$

(2) $\dfrac{4q^2}{4\pi\varepsilon_0 a^2}$

(3) $\left(\dfrac{1+2\sqrt{2}}{2}\right)\dfrac{q^2}{4\pi\varepsilon_0 a^2}$

(4) $\left(2+\dfrac{1}{\sqrt{2}}\right)\dfrac{q^2}{4\pi\varepsilon_0 a^2}$

10. Four charges equal to $-Q$ are placed at the four corners of a square and a charge q is at its centre. If the system is in equilibrium the value of q is:

(1) $-\dfrac{Q}{4}\left(1+2\sqrt{2}\right)$

(2) $\dfrac{Q}{4}\left(1+2\sqrt{2}\right)$

(3) $-\dfrac{Q}{2}\left(1+2\sqrt{2}\right)$

(4) $\dfrac{Q}{2}\left(1+2\sqrt{2}\right)$

11. Three identical charges are placed at the corners of an equilateral triangle. If the force between any two charges is F, then the net force on each will be:

(1) $\sqrt{2}F$ (2) $2F$

(3) $\sqrt{3}F$ (4) $3F$

ANSWER KEY

1. (3)
2. (1)
3. (1)
4. (1)
5. (4)
6. (3)
7. (2)
8. (3)
9. (3)
10. (2)
11. (3)