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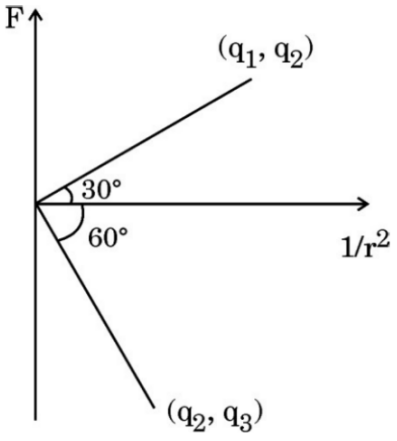
CLASS TEST - I (2025-26)

SUBJECT - PHYSICS

MM: 35 **CLASS-XII** **Time: 1:00 hours**

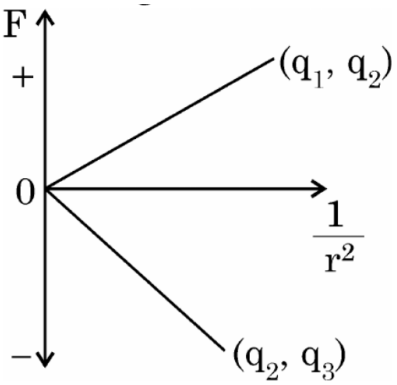
Section A - MCQ

Q 1. Coulomb force F versus $\frac{1}{r^2}$ graphs for two pairs of point charges (q_1 and q_2) and (q_2 and q_3) are shown in the fig. The ratio of charges $\left(\frac{q_1}{q_3}\right)$ [1]



A. $\sqrt{3}$ B. $\frac{1}{\sqrt{3}}$ C. 3 D. $\frac{1}{3}$

Q 2. The Coulomb force (F) versus $\left(\frac{1}{r^2}\right)$ graphs for two pairs of point charges (q_1 and q_2) (q_2 and q_3) are shown in the fig. The charge q_2 is positive and has least magnitude. Then [1]



A. $q_1 > q_2 > q_3$ C. $q_3 > q_2 > q_1$

B. $q_1 > q_3 > q_2$ D. $q_3 > q_1 > q_2$

Q 3. The magnitude of the electric field due to a point charge object at a distance of 4.0 m is 9 N/C. From the same charged object the electric field of magnitude, 16 N/C will be at a distance of [1]

A. 1 m B. 2 m C. 3 m D. 4 m

Q 4. An isolated point charge particle produces an electric field E at a point 3 m away from it. The distance of the point at which the field is $\frac{E}{4}$ will be [1]

A. 2 m B. 3 m C. 4 m D. 6 m

Q 5. A point charge q_0 is moving along a circular path of radius a, with a point charge $-Q$ at the centre of the circle. The kinetic energy of q_0 is [1]

A. $\frac{Qq_0}{4\pi\epsilon_0 a}$ B. $\frac{Qq_0}{8\pi\epsilon_0 a}$ C. $\frac{Qq_0}{4\pi\epsilon_0 a^2}$ D. $\frac{Qq_0}{8\pi\epsilon_0 a^2}$

Q 6. An electron experiences a force $(1.6 \times 10^{-16}\ N)\ \hat{i}$ in an electric field $\vec{E}$. The electric field $\vec{E}$ is : [1]

A. $\left(1.0 \times 10^3\ \frac{N}{C}\right)\hat{i}$ C. $\left(1.0 \times 10^{-3}\ \frac{N}{C}\right)\hat{i}$

B. $-\left(1.0 \times 10^3\ \frac{N}{C}\right)\hat{i}$ D. $-\left(1.0 \times 10^{-3}\ \frac{N}{C}\right)\hat{i}$

Q 7. A particle of mass m and charge $-q$ is moving with a uniform speed v in a circle of radius r, with another charge q at the centre of the circle. The value of r is : [1]

A. $\frac{1}{4\pi\epsilon_0 m}\left(\frac{q}{v}\right)$

B. $\frac{1}{4\pi\epsilon_0 m}\left(\frac{q}{v}\right)^2$

C. $\frac{m}{4\pi\epsilon_0}\left(\frac{q}{v}\right)^2$

D. $\frac{m}{4\pi\epsilon_0}\left(\frac{q}{v}\right)$

Q 8. The charge on a body is 8×10^{-12} C. It means that the body has: [1]

A. lost 8×10^{-12} electrons

B. gained 4×10^{10} electrons

C. gained 2×10^{8} electrons

D. lost 5×10^{7} electrons

Q 9. 10^9 electrons are transferred to a pith ball with charge 0.16 nC. Its charge now is : [1]

A. Zero

B. -3.2×10^{-10} C

C. -1.6×10^{-9} C

D. 3.2×10^{-10} C

Q 10. Two charged particles P and Q, having the same charge but different masses m_p and m_Q, start from rest and travel equal distances in a uniform electric field $\vec{E}$ in time t_P and t_Q respectively. Neglecting the effect of gravity, the ration $\left(\frac{t_P}{t_Q}\right)$ is : [1]

A. $\frac{m_P}{m_Q}$ B. $\frac{m_Q}{m_P}$ C. $\sqrt{\frac{m_P}{m_Q}}$ D. $\sqrt{\frac{m_Q}{m_P}}$

Q 11. Two identical small conducting balls B_1 and B_2 are given -7 pC and $+4$ pC charges respectively. They are brought in contact with a third identical ball B_3 and then separated. If the final charge on each ball is -2 pC, the initial charge on B_3 was [1]

A. -2 pC B. -3 pC C. -5 pC D. -15 pC

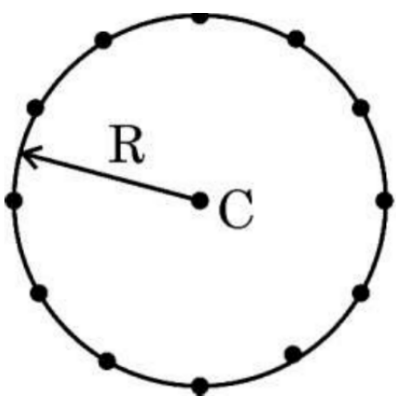
Q 12. When a glass rod is rubbed with a silk cloth, it acquires a positive charge of 4.8×10^{-17} C. In the process, the number of electrons and protons transferred are respectively : [1]

A. 0, 300 B. 0, 225 C. 150, 150 D. 300, 0

Section B - Short Answer Questions

Q 13. Consider two identical point charges located at points (0, 0) and (a, 0). Is there a point on the line joining them at which the electric field is zero ? Justify your answer. [2]

Q 14. Twelve negative charges of same magnitude are equally spaced and fixed on the circumference of a circle of radius R as shown in Fig. Find the electric field at the centre C of the circle. [2]



Section C - Long Answer Questions

Q 15. (a) Four point charges of 1 μC, -2 μC, 1 μC and -2 μC are placed at the corners A, B, C and D respectively, of a square of side 30 cm. Find the net force acting on a charge of 4 μC placed at the centre of the square. [3]

OR

(b) Three point charges, 1 pC each, are kept at the vertices of an equilateral triangle of side 10 cm. Find the net electric field at the centroid of triangle. [3]

Q 16. A small sphere S_1 with charge $-8q$ is 1.6 m away from another identical sphere S_2 with charge $+2q$. The two spheres are brought in contact with each other and then separated by a distance 1.6 m. Initially the force between the two spheres was 81×10^{-4} N. Based on the above facts, answer the following questions : [3]

(a) Which sphere will transfer the electrons to the other sphere after they were brought in contact ?

(b) How does the net electric field at the midpoint on the line joining the two spheres change after contact ?

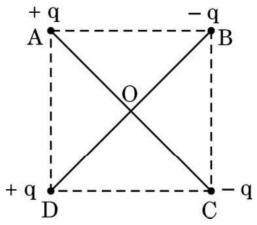
(c) What is the charge on spheres S_1 and S_2 after contact ?

Q 17. Explain what is meant by quantization of charge and conservation of charge? [3]

Q 18. (a) i. State Coulomb's law in electrostatics and write it in vector form, for two charges. [5]

ii. Two charges A (charge q) and B (charge 2q) are located at points (0, 0) and (a, a) respectively. Let $\hat{i}$ and $\hat{j}$ be the unit vectors along x-axis and y-axis respectively. Find the force exerted by A on B, in terms of $\hat{i}$ and $\hat{j}$.

iii. Four charges $+q$, $-q$, $-q$, and $+q$ are placed at the corners of a square ABCD of side $\sqrt{2}$ m as shown in the figure. Obtain the magnitude and direction of the net electric field at the centre (O) of the square.



OR

(b) i. Why do we use a small test charge to measure an electric field? [5]

ii. A small stationary positively charged particle is free to move in an electric field. In which direction will it begin to move?

iii. Two point charges Q_1 (40 μC) and Q_2 (-16 μC) are placed along x-axis at 0 cm and 24 cm from the origin respectively. Calculate the net force on a third charge Q_3 (-2.5 μC) placed at $x = 36$ cm from the origin.

HOMEWORK

Q 19. What is the amount of charge possessed by 1 kg of electrons [1]

A. 1.76×10^{11} C B. 1.76×10^{-9} C C. 1.76×10^{-7} C D. 1.76×10^{-5} C

Q 20. Two equal point charges A and B are R distance apart. A third point charge placed on the perpendicular bisector at a distance 'd' from the centre will experience maximum electrostatic force when [1]

A. $d = \frac{R}{2\sqrt{2}}$ B. $d = \frac{R}{\sqrt{2}}$ C. $d = R\sqrt{2}$ D. $d = 2\sqrt{2}R$

Q 21. Two equal positive charges Q are fixed at points $(a,\ 0)$ and $(-a,\ 0)$ on the x-axis. An opposite charge $-q$ at rest is released from point $(0,\ a)$ on the y-axis. the charge $-q$ will [1]

A. Move to infinity

B. Move to origin and rest there

C. Undergo SHM about the origin

D. Execute oscillatory periodic motion but not SHM

Q 22. Four charges each equal to Q are placed at the four corners of a square and a charge q is placed at the centre of the square. If the system is in equilibrium then the value of q is [1]

A. $\frac{Q}{2}(1+2\sqrt{2})$ B. $\frac{-Q}{4}(1+2\sqrt{2})$ C. $\frac{Q}{4}(1+2\sqrt{2})$ D. $\frac{-Q}{2}(1+2\sqrt{2})$

Q 23. A point charge q_1 exerts an electric force on a second point charge q_2. If third charge q_3 is brought near, the electric force of q_1 exerted on q_2 [1]

A. Decreases

B. Increases

C. Remains unchanged

D. Increases if q_3 is of same sign as q_1 and decreases if q_3 is of opposite sign

Q 24. Three charge $+4q$, Q and q are placed in a straight line of length l at points 0, $\frac{l}{2}$ and l distance away from one end respectively. What should be Q in order to make the net force on q to be zero? [1]

A. $-q$ B. $4q$ C. $-\frac{q}{2}$ D. $-2q$

Q 25. A particle of mass m are carrying charge $-q_1$ is moving around a charge $+q_2$ along a circular path of radius r. Find period of revolution of the charge $-q_1$ [1]

A. $\sqrt{\frac{16\pi^3\epsilon_0 mr^3}{q_1q_2}}$ B. $\sqrt{\frac{8\pi^3\epsilon_0 mr^3}{q_1q_2}}$ C. $\sqrt{\frac{q_1q_2}{16\pi^3\epsilon_0 mr^3}}$ D. Zero

Q 26. A charge Q is placed at the centre of a square. If electric field intensity due to the charge at the corners of the square is E_1 and the at the mid point of the side of square is E_2, then the ratio of $\frac{E_1}{E_2}$ will be [1]

A. $\frac{1}{2\sqrt{2}}$ B. $\sqrt{2}$ C. $\frac{1}{2}$ D. 2