

Q1. JEE Main 2026 (21 January Shift 2)

Consider two identical metallic spheres of radius R each having charge Q and mass m . Their centers have an initial separation of $4R$. Both the spheres are given an initial speed of u towards each other. The minimum value of u , so that they can just touch each other is :

(Take $k = \frac{1}{4\pi\epsilon_0}$ and assume $kQ^2 > Gm^2$ where G is the Gravitational constant)

(1) $\sqrt{\frac{kQ^2}{2mR} \left(1 - \frac{Gm^2}{kQ^2}\right)}$

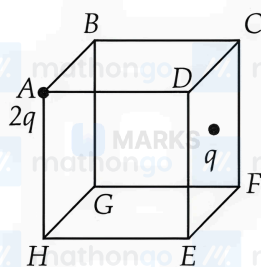
(2) $\sqrt{\frac{kQ^2}{4mR} \left(1 - \frac{Gm^2}{kQ^2}\right)}$

(3) $\sqrt{\frac{kQ^2}{2mR} \left(1 - \frac{Gm^2}{2kQ^2}\right)}$

(4) $\sqrt{\frac{kQ^2}{4mR} \left(1 + \frac{Gm^2}{kQ^2}\right)}$

Q2. JEE Main 2026 (23 January Shift 1)

Two point charges $2q$ and q are placed at vertex A and centre of face $CDEF$ of the cube as shown in figure. The electric flux passing through the cube is :



(1) $\frac{3q}{2\epsilon_0}$

(2) $\frac{3q}{4\epsilon_0}$

(3) $\frac{q}{\epsilon_0}$

(4) $\frac{3q}{\epsilon_0}$

Q3. JEE Main 2026 (28 January Shift 2)

Identify the correct statements :

- A. Electrostatic field lines form closed loops.
- B. The electric field lines point radially outward when charge is greater than zero.
- C. The Gauss - Law is valid only for inverse - square force.
- D. The workdone in moving a charged particle in a static electric field around a closed path is zero.
- E. The motion of a particle under Coulomb's force must take place in a plane.

Choose the correct answer from the options given below :

(1) A, B, D, E Only

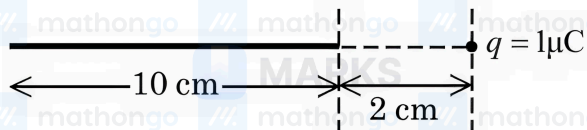
(2) A, C, E Only

(3) A, B, C, D Only

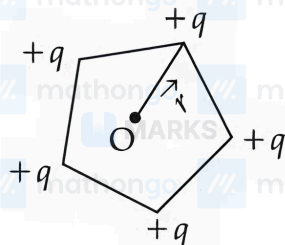
(4) B, C, D, E Only

Q4. JEE Main 2026 (24 January Shift 2)

A point charge $q = 1\mu\text{C}$ is located at a distance 2 cm from one end of a thin insulating wire of length 10 cm having a charge $Q = 24\mu\text{C}$, distributed uniformly along its length, as shown in figure. Force between q and wire is ____ N.
(Use : $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$)

**Q5. JEE Main 2026 (22 January Shift 2)**

Five positive charges each having charge q are placed at the vertices of a pentagon as shown in the figure. The electric potential (V) and the electric field ($\vec{E}$) at the center O of the pentagon due to these five positive charges are:



(1) $V = \frac{5q}{4\pi\epsilon_0 r}$ and $\vec{E} = \frac{5\sqrt{3}q}{8\pi\epsilon_0 r^2} \hat{r}$

(2) $V = \frac{5q}{4\pi\epsilon_0 r}$ and $\vec{E} = 0$

(3) $V = 0$ and $\vec{E} = 0$

(4) $V = \frac{5q}{4\pi\epsilon_0 r}$ and $\vec{E} = \frac{5q}{4\pi\epsilon_0 r^2} \hat{r}$

Q6. JEE Main 2026 (22 January Shift 2)

Three small identical bubbles of water having same charge on each coalesce to form a bigger bubble. Then the ratio of the potentials on one initial bubble and that on the resultant bigger bubble is :

(1) $3^{2/3} : 1$

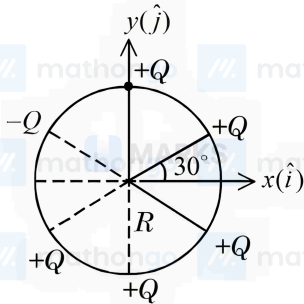
(2) $1 : 2^{2/3}$

(3) $1 : 3^{2/3}$

(4) $1 : 3^{1/3}$

Q7. JEE Main 2026 (22 January Shift 1)

Six point charges are kept 60° apart from each other on the circumference of a circle of radius R as shown in figure. The net electric field at the center of the circle is _____. (ϵ_0 is permittivity of free space)



- (1) $\frac{Q}{4\pi\epsilon_0 R^2}(\sqrt{3}\hat{i} - \hat{j})$ (2) $-\frac{5Q}{8\pi\epsilon_0 R^2}(\hat{i} + \sqrt{3}\hat{j})$
 (3) $-\left(\frac{5Q}{8\pi\epsilon_0 R^2}\right)(\hat{i} - 3\hat{j})$ (4) $-\frac{Q}{4\pi\epsilon_0 R^2}(\sqrt{3}\hat{i} - \hat{j})$

Q8. JEE Main 2026 (22 January Shift 1)

A simple pendulum has a bob with mass m and charge q . The pendulum string has negligible mass. When a uniform and horizontal electric field $\vec{E}$ is applied, the tension in the string changes. The final tension in the string, when pendulum attains an equilibrium position is _____. (g : acceleration due to gravity)

- (1) $\sqrt{m^2 g^2 + q^2 E^2}$ (2) $m g + qE$
 (3) $mg - qE$ (4) $\sqrt{m^2 g^2 - q^2 E^2}$

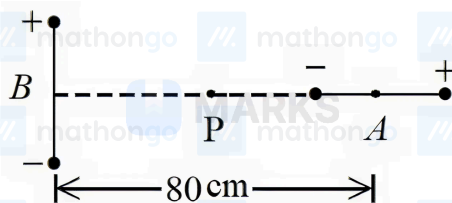
Q9. JEE Main 2026 (22 January Shift 1)

Electric field in a region is given by $\vec{E} = Ax\hat{i} + By\hat{j}$, where $A = 10 \text{ V/m}^2$ and $B = 5 \text{ V/m}^2$. If the electric potential at a point $(10, 20)$ is 500 V, then the electric potential at origin is ____ V.

- (1) 0 (2) 2000 (3) 500 (4) 1000

Q10. JEE Main 2026 (23 January Shift 2)

Two short dipoles (A, B), A having charges $\pm 2\mu\text{C}$ and length 1 cm and B having charges $\pm 4\mu\text{C}$ and length 1 cm are placed with their centres 80 cm apart as shown in the figure. The electric field at a point P , equi-distant from the centres of both dipoles is ____ N/C.



- (1) $\frac{9}{16}\sqrt{2} \times 10^4$ (2) $9\sqrt{2} \times 10^4$
 (3) $4.5\sqrt{2} \times 10^4$ (4) $\frac{9}{16}\sqrt{2} \times 10^5$

Q11. JEE Main 2026 (23 January Shift 2)

Two charges $7\mu\text{C}$ and $-2\mu\text{C}$ are placed at $(-9, 0, 0)\text{cm}$ and $(9, 0, 0)\text{cm}$ respectively in an external field $E = \frac{A}{r^2}\hat{r}$, where $A = 9 \times 10^5 \text{ N/C} \cdot \text{m}^2$. Considering the potential at infinity is 0, the electrostatic energy of the configuration is ____ J.

- (1) 49.3 (2) -90.7 (3) 24.3 (4) 1.4

Q12. JEE Main 2026 (21 January Shift 1)

A point charge of 10^{-8}C is placed at origin. The work done in moving a point charge $2\mu\text{C}$ from point $A(4, 4, 2)\text{m}$ to $B(2, 2, 1)\text{m}$ is ____ J. $\left(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ in SI units}\right)$

- (1) 45×10^{-6} (2) 15×10^{-6}
(3) 0 (4) 30×10^{-6}

Q13. JEE Main 2026 (28 January Shift 1)

Two point charges of 1 nC and 2 nC are placed at the two corners of equilateral triangle of side 3 cm. The work done in bringing a charge of 3 nC from infinity to the third corner of the triangle is ____ μJ .

- $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2$
(1) 27 (2) 5.4 (3) 2.7 (4) 3.3

Q14. JEE Main 2026 (24 January Shift 1)

There are three co-centric conducting spherical shells A, B and C of radii a, b and c respectively ($c > b > a$) and they are charged with charge q_1, q_2 and q_3 respectively. The potentials of the spheres A, B and C respectively, are :

- (1) $\frac{1}{4\pi\epsilon_0} \left(\frac{q_1+q_2+q_3}{a} \right), \frac{1}{4\pi\epsilon_0} \left(\frac{q_1+q_2+q_3}{b} \right), \frac{1}{4\pi\epsilon_0} \left(\frac{q_1+q_2+q_3}{c} \right)$
(2) $\frac{1}{4\pi\epsilon_0} \left(\frac{q_1}{a} + \frac{q_2}{b} + \frac{q_3}{c} \right), \frac{1}{4\pi\epsilon_0} \left(\frac{q_1+q_2+q_3}{b} \right), \frac{1}{4\pi\epsilon_0} \left(\frac{q_1+q_2+q_3}{c} \right)$
(3) $\frac{1}{4\pi\epsilon_0} \left(\frac{q_1}{a} + \frac{q_2}{b} + \frac{q_3}{c} \right), \frac{1}{4\pi\epsilon_0} \left(\frac{q_1+q_2}{b} + \frac{q_3}{c} \right), \frac{1}{4\pi\epsilon_0} \left(\frac{q_1+q_2+q_3}{c} \right)$
(4) $\frac{1}{4\pi\epsilon_0} \left(\frac{q_1+q_2+q_3}{a} \right), \frac{1}{4\pi\epsilon_0} \left(\frac{q_1+q_2}{b} + \frac{q_3}{c} \right), \frac{1}{4\pi\epsilon_0} \left(\frac{q_1}{a} + \frac{q_2}{b} + \frac{q_3}{c} \right)$

Q15. JEE Main 2026 (24 January Shift 1)

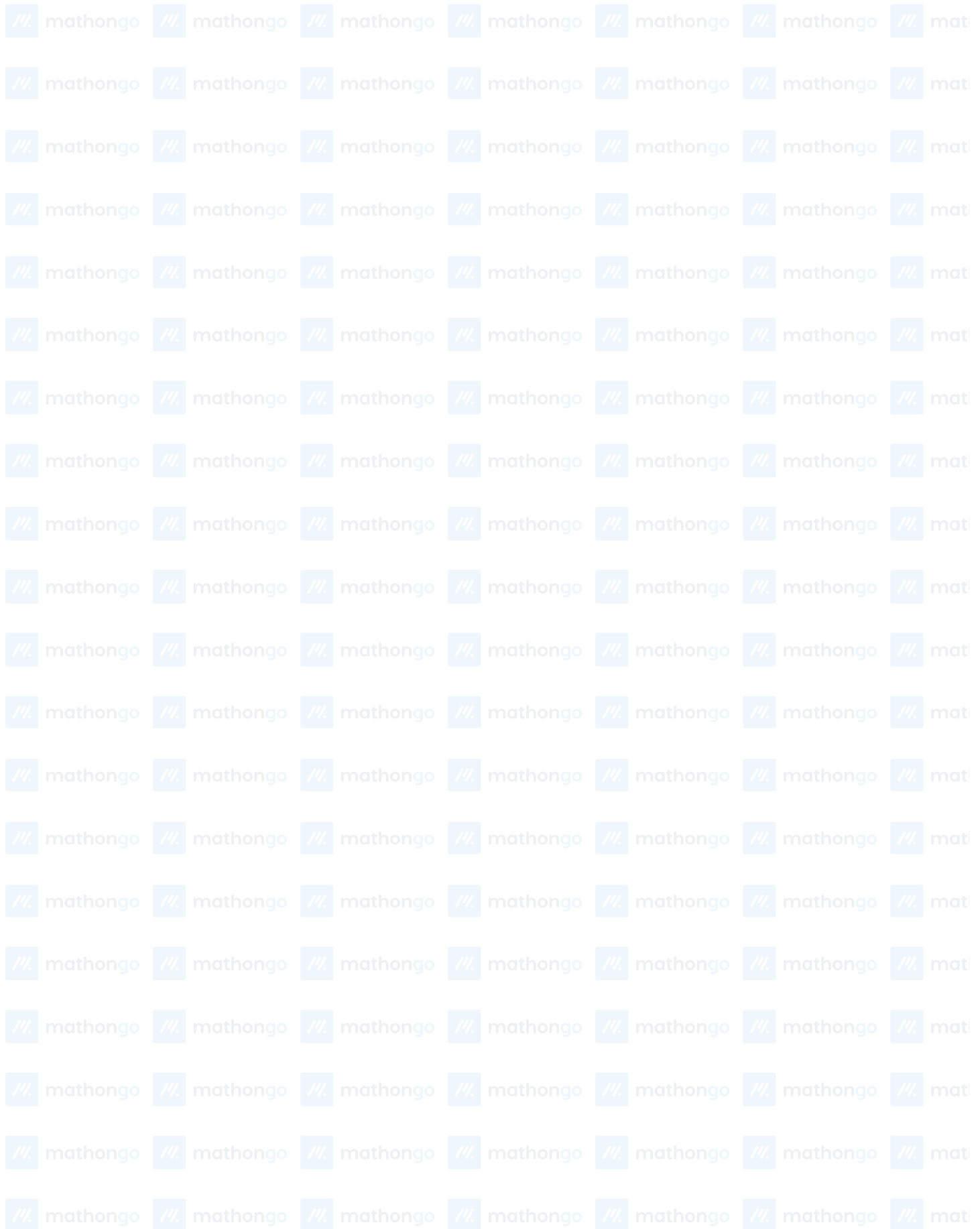
Three charges $+2q, +3q$ and $-4q$ are situated at $(0, -3a), (2a, 0)$ and $(-2a, 0)$ respectively in the xy plane. The resultant dipole moment about origin is ____.

- (1) $2qa(7\hat{i} - 3\hat{j})$ (2) $2qa(3\hat{j} - \hat{i})$
(3) $2qa(3\hat{i} - 7\hat{j})$ (4) $2qa(3\hat{j} - 7\hat{i})$

Q16. JEE Main 2026 (24 January Shift 1)

The electrostatic potential in a charged spherical region of radius r varies as $V = ar^3 + b$, where a and b are constants. The total charge in the sphere of unit radius is $\alpha \times \pi a \epsilon_0$. The value of α is ____.
(permittivity of vacuum is ϵ_0)

- (1) -9 (2) -12 (3) -8 (4) -6



ANSWERS AND SOLUTIONS

1. (2) 2. (2) 3. (4) 4. 90 5. (2) 6. (3) 7. (4) 8. (1)
 9. (2) 10. (1) 11. (1) 12. (4) 13. (3) 14. (3) 15. (1) 16. (2)

1. (2) Using energy conservation, the system's kinetic energy must overcome the increase in electrostatic potential energy as the spheres approach.

Initial state: separation $4R$, speed u each.

Final state: touching (separation $2R$), speed zero.

Change in potential energy: $\Delta U = k\frac{Q^2}{2R} - k\frac{Q^2}{4R} = k\frac{Q^2}{4R}$.

Initial kinetic energy: $KE_i = mu^2$.

Energy equation: $mu^2 = k\frac{Q^2}{4R} \left(1 - \frac{Gm^2}{kQ^2}\right)$.

Therefore, $u = \sqrt{\frac{kQ^2}{4mR} \left(1 - \frac{Gm^2}{kQ^2}\right)}$.

2. (2) Using Gauss's law:

$$\phi = \frac{Q_{in}}{\epsilon_0}$$

Charge $2q$ is at vertex A of the cube. A vertex is shared by 8 cubes, so the flux contribution from $2q$ through this cube is $\frac{2q}{8\epsilon_0} = \frac{q}{4\epsilon_0}$.

Charge q is at the centre of face CDEF. A face center is shared by 2 cubes, so the flux contribution from q through this cube is $\frac{q}{2\epsilon_0}$.

Total flux:

$$\phi = \frac{q/4 + q/2}{\epsilon_0} = \frac{3q}{4\epsilon_0}$$

3. (4) Statement A: Electrostatic field lines originate from positive charges and terminate on negative charges. They do not form closed loops because the electrostatic field is conservative. Thus, A is incorrect.

Statement B: For a positive point charge ($q > 0$), the electric field lines are directed radially outwards. Thus, B is correct.

Statement C: Gauss's Law is a consequence of the inverse-square nature of Coulomb's law ($F \propto 1/r^2$). If the force law were different, Gauss's Law would not hold in its standard form. Thus, C is correct.

Statement D: The electrostatic field is conservative, meaning the work done in moving a charge along any closed path is zero ($\oint \vec{E} \cdot d\vec{l} = 0$). Thus, D is correct.

Statement E: Coulomb's force is a central force. The motion of a particle under a central force always takes place in a plane because the torque about the center is zero, keeping angular momentum constant in direction. Thus, E is

correct.

Since B, C, D, and E are correct, the correct option is (4).

4. (90) Consider a small element of length dx on the wire at a distance x from the point charge q .

The linear charge density of the wire is $\lambda = \frac{Q}{L} = \frac{24 \times 10^{-6}}{0.1} = 240 \times 10^{-6} \text{ C/m}$.

The charge on the small element is $dQ = \lambda dx$.

The electrostatic force between the point charge q and the element dQ is $dF = \frac{kqdQ}{x^2} = \frac{kq\lambda dx}{x^2}$.

The total force F is obtained by integrating dF from $x = a$ to $x = a + L$, where $a = 2 \text{ cm}$ and $L = 10 \text{ cm}$.

$$F = \int_{0.02}^{0.12} \frac{kq\lambda}{x^2} dx = kq\lambda \left[-\frac{1}{x} \right]_{0.02}^{0.12}$$

$$F = kq\lambda \left(\frac{1}{0.02} - \frac{1}{0.12} \right) = kq\frac{Q}{L} \left(\frac{0.12 - 0.02}{0.02 \times 0.12} \right)$$

$$F = \frac{kqQ}{L} \frac{L}{a(a+L)} = \frac{kqQ}{a(a+L)}$$

Substituting the given values: $k = 9 \times 10^9 \text{ N.m}^2/\text{C}^2$, $q = 1 \times 10^{-6} \text{ C}$, $Q = 24 \times 10^{-6} \text{ C}$, $a = 0.02 \text{ m}$, and

$a + L = 0.12 \text{ m}$.

$$F = \frac{9 \times 10^9 \times 1 \times 10^{-6} \times 24 \times 10^{-6}}{0.02 \times 0.12}$$

$$F = \frac{9 \times 24 \times 10^{-3}}{0.0024} = \frac{216 \times 10^{-3}}{2.4 \times 10^{-3}}$$

$$F = \frac{216}{2.4} = 90 \text{ N}.$$

5. (2) The electric potential at center O is the scalar sum of contributions from all 5 charges.

Each charge is equidistant from center, so $V = 5 \times \frac{kq}{r} = \frac{5q}{4\pi\epsilon_0 r}$.

The electric field is a vector sum of field vectors from all 5 charges.

Due to 5-fold rotational symmetry of a regular pentagon, the 5 field vectors point radially outward from center, equally spaced at 72° angles.

The vector sum of 5 equally spaced unit vectors is zero, so $\vec{E} = 0$.

6. (3) For three identical conducting bubbles with charge q and radius r ,

Initial potential on each: $V_i = \frac{kq}{r}$

When three bubbles coalesce,

Total charge $Q = 3q$ and new radius from volume: $\frac{4}{3}\pi R^3 = 3 \times \frac{4}{3}\pi r^3$

So $R = 3^{1/3}r$

Final potential: $V_f = \frac{k(3q)}{3^{1/3}r} = \frac{3kq}{3^{1/3}r} = V_i \cdot 3^{2/3}$

Ratio: $V_i : V_f = 1 : 3^{2/3}$

7. (4) Six point charges equally spaced 60° apart on a circle of radius R , with alternating arrangement creating a dipole-like configuration.

Each charge creates an electric field at the center of magnitude $E_0 = \frac{Q}{4\pi\epsilon_0 R^2}$ pointing radially (outward for $+Q$, inward for $-Q$).

By vector addition of field contributions from all six charges with proper angle consideration:

The charges at specific positions create a net field with components that depend on their arrangement.

For the given symmetric configuration, the net electric field is: $\vec{E} = \frac{Q}{4\pi\epsilon_0 R^2}(\sqrt{3}\hat{i} - \hat{j})$

This corresponds to magnitude $2E_0$ at angle of -30° from the positive x-axis.

8. (1) The charged bob experiences two forces at equilibrium:

Gravitational force: $F_g = mg$ (downward)

Electric force: $F_E = qE$ (horizontal, in direction of field)

These forces are perpendicular to each other. The string tension must balance their resultant.

At equilibrium, the string makes angle θ with vertical such that:

Vertical: $T \cos \theta = mg$

Horizontal: $T \sin \theta = qE$

The net force from gravity and electric field is $\sqrt{(mg)^2 + (qE)^2}$

Therefore, the tension in the string is: $T = \sqrt{m^2 g^2 + q^2 E^2}$

9. (2) The electric field is related to potential by $\vec{E} = -\nabla V$.

Given: $\vec{E} = Ax\hat{i} + By\hat{j}$ with $A = 10 \text{ V/m}^2$ and $B = 5 \text{ V/m}^2$

This means:

$$\frac{\partial V}{\partial x} = -Ax \text{ and } \frac{\partial V}{\partial y} = -By$$

Integrating:

$$V(x, y) = -\frac{Ax^2}{2} - \frac{By^2}{2} + C = -5x^2 - \frac{5y^2}{2} + C$$

Using the boundary condition at $(10, 20)$ where $V = 500 \text{ V}$:

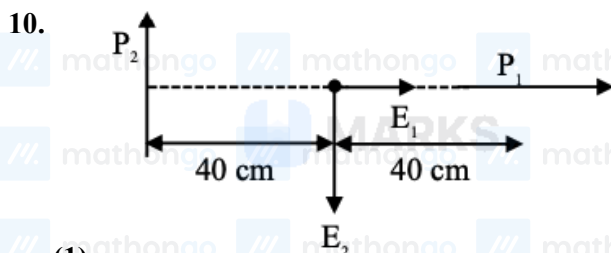
$$500 = -5(100) - \frac{5(400)}{2} + C$$

$$500 = -500 - 1000 + C$$

$$C = 2000 \text{ V}$$

At the origin $(0, 0)$:

$$V(0, 0) = -5(0) - \frac{5(0)}{2} + 2000 = 2000 \text{ V}$$



(1)

$$\vec{E}_2 = -\frac{KP_2}{r^3}; \vec{E}_1 = -\frac{2KP_1}{r^3}$$

$$P_1 = 2 \times 10^{-6} \times 10^{-2} = 2 \times 10^{-8}$$

$$P_2 = 4 \times 10^{-6} \times 10^{-2} = 4 \times 10^{-8}$$

$$\vec{E}_{net} = \frac{2 \times 9 \times 10^9 \times 2 \times 10^{-8}}{(0.4)^3} \hat{i} - \frac{9 \times 10^9 \times 4 \times 10^{-8}}{(0.4)^3} \hat{j}$$

$$\vec{E}_{net} = \frac{9 \times 10^9 \times 4 \times 10^{-8}}{(0.4)^3} [\hat{i} - \hat{j}]$$

$$|\vec{E}_{net}| = \frac{9 \times 10^4}{16} (\sqrt{2})$$

11. (1) The total electrostatic energy U of a system of two charges q_1 and q_2 in an external field is given by

$$U = q_1 V(r_1) + q_2 V(r_2) + \frac{kq_1 q_2}{r_{12}}.$$

Given external electric field $E = \frac{A}{r^2} \hat{r}$, the potential $V(r)$ is found by $V(r) = - \int_{\infty}^r E \cdot dr = - \int_{\infty}^r \frac{A}{r^2} dr = \frac{A}{r}$.

Parameters given:

$$q_1 = 7\mu C = 7 \times 10^{-6} C \text{ at } r_1 = 9cm = 0.09m.$$

$$q_2 = -2\mu C = -2 \times 10^{-6} C \text{ at } r_2 = 9cm = 0.09m.$$

$$\text{Distance between charges } r_{12} = 9 - (-9) = 18cm = 0.18m.$$

$$A = 9 \times 10^5 N/C \cdot m^2.$$

Calculating individual terms:

$$q_1 V(r_1) = q_1 \frac{A}{r_1} = (7 \times 10^{-6}) \frac{9 \times 10^5}{0.09} = 7 \times 10^{-6} \times 10^7 = 70J.$$

$$q_2 V(r_2) = q_2 \frac{A}{r_2} = (-2 \times 10^{-6}) \frac{9 \times 10^5}{0.09} = -2 \times 10^{-6} \times 10^7 = -20J.$$

$$\text{Interaction energy } \frac{kq_1 q_2}{r_{12}} = \frac{9 \times 10^9 \times (7 \times 10^{-6}) \times (-2 \times 10^{-6})}{0.18} = \frac{-126 \times 10^{-3}}{0.18} = -0.7J.$$

$$\text{Total energy } U = 70 - 20 - 0.7 = 49.3J.$$

12. (4) Distance from origin to A: $r_A = \sqrt{4^2 + 4^2 + 2^2} = 6 \text{ m}$

$$\text{Distance from origin to B: } r_B = \sqrt{2^2 + 2^2 + 1^2} = 3 \text{ m}$$

$$\text{Work done: } W = q_2 (V_B - V_A) = q_2 \times \frac{q_1}{4\pi\epsilon_0} \left(\frac{1}{r_B} - \frac{1}{r_A} \right)$$

$$= 2 \times 10^{-6} \times 9 \times 10^9 \times 10^{-8} \times \left(\frac{1}{3} - \frac{1}{6} \right)$$

$$= 18 \times 10^{-5} \times \frac{1}{6} = 30 \times 10^{-6} \text{ J}$$

13. (3) Two point charges of 1 nC and 2 nC are placed at two corners of an equilateral triangle with side 3 cm. The work done in bringing a 3 nC charge from infinity to the third corner equals the charge times the potential at that point.

Both source charges are at distance 0.03 m from the third corner.

$$\text{The potential due to the 1 nC charge is } V_1 = \frac{9 \times 10^9 \times 1 \times 10^{-9}}{0.03} = 300 \text{ V}$$

$$\text{and due to the 2 nC charge is } V_2 = \frac{9 \times 10^9 \times 2 \times 10^{-9}}{0.03} = 600 \text{ V.}$$

$$\text{Total potential: } V_{total} = 300 + 600 = 900 \text{ V}$$

$$\text{Work done: } W = 3 \times 10^{-9} \times 900 = 2.7 \times 10^{-6} \text{ J} = 2.7 \mu\text{J}$$

14. (3) The potential at any point due to a charged spherical shell of radius R and charge Q is $V = \frac{1}{4\pi\epsilon_0} \frac{Q}{R}$ for points inside or on the surface ($r \leq R$), and $V = \frac{1}{4\pi\epsilon_0} \frac{Q}{r}$ for points outside ($r > R$).

Let $k = \frac{1}{4\pi\epsilon_0}$. The potentials of the three shells A, B, C with radii $a < b < c$ and charges q_1, q_2, q_3 are calculated by superposition.

For shell A ($r = a$):

Shell A is on its own surface, while it is inside shells B and C .

$$V_A = k\frac{q_1}{a} + k\frac{q_2}{b} + k\frac{q_3}{c} = \frac{1}{4\pi\epsilon_0} \left(\frac{q_1}{a} + \frac{q_2}{b} + \frac{q_3}{c} \right)$$

For shell B ($r = b$):

Shell B is outside shell A , on its own surface, and inside shell C .

$$V_B = k\frac{q_1}{b} + k\frac{q_2}{b} + k\frac{q_3}{c} = \frac{1}{4\pi\epsilon_0} \left(\frac{q_1+q_2}{b} + \frac{q_3}{c} \right)$$

For shell C ($r = c$):

Shell C is outside shells A and B , and on its own surface.

$$V_C = k\frac{q_1}{c} + k\frac{q_2}{c} + k\frac{q_3}{c} = \frac{1}{4\pi\epsilon_0} \left(\frac{q_1+q_2+q_3}{c} \right)$$

Comparing these expressions with the given options, option (3) matches correctly.

15. (1) The dipole moment is given by:

$$\vec{p} = q_1\vec{r}_1 + q_2\vec{r}_2 + q_3\vec{r}_3$$

$$\vec{p} = (2q)(-3a)\hat{j} + (3q)(2a)\hat{i} + (-4q)(-2a)\hat{i}$$

$$\vec{p} = -6qa\hat{j} + 6qa\hat{i} + 8qa\hat{i}$$

$$\vec{p} = 14qa\hat{i} - 6qa\hat{j}$$

$$\vec{p} = 2qa(7\hat{i} - 3\hat{j})$$

16. (2) From $V = ar^3 + b$, the electric field is $E = -dV/dr = -3ar^2$.

By Gauss's law:

$$E(r) \cdot 4\pi r^2 = Q(r)/\epsilon_0, \text{ so } -3ar^2 \times 4\pi r^2 = Q(r)/\epsilon_0.$$

$$\text{This gives } Q(r) = -12\pi ar^4\epsilon_0.$$

$$\text{At } r = 1: Q(1) = -12\pi a\epsilon_0.$$

$$\text{Since } Q(1) = \alpha \times \pi a\epsilon_0, \text{ we have } \alpha = -12$$