

PHYSICS

NEET

CRASH COURSE

ELECTROSTATICS

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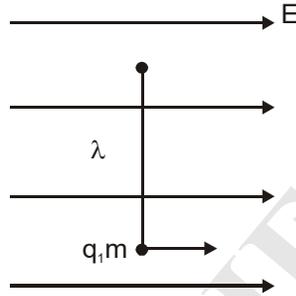
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ELECTROSTATICS

- Q.1 Two parallel charged plates have a charge density $+\sigma$ and $-\sigma$. The resultant force on the proton located outside the plates at some distance will be -
 (1) $2\sigma e / \epsilon_0$ (2) $\sigma e / \epsilon_0$ (3) $\sigma e / 2 \epsilon_0$ (4) zero

- Q.2 A simple pendulum has a length $2\sqrt{2}l$, mass of bob m . The bob is given a charge q coulomb. The pendulum is suspended in a uniform horizontal electric field of strength E as shown in figure, then calculate the time period of oscillation when the bob is slightly displaced from its mean position is :



- (1) $2\pi \sqrt{\frac{\lambda}{g}}$ (2) $2\pi \sqrt{\frac{\lambda}{g + \frac{qE}{m}}}$ (3) $2\pi \sqrt{\frac{\lambda}{g - \frac{qE}{m}}}$ (4) $2\pi \sqrt{\frac{\lambda}{g^2 + \left(\frac{qE}{m}\right)^2}}$

- Q.3 Charge $2Q$ and $-Q$ are placed as shown in figure. The point at which electric field intensity is zero will be:



- (1) Somewhere between $-Q$ and $2Q$
 (2) Somewhere on the left of $-Q$
 (3) Somewhere on the right of $2Q$
 (4) Somewhere on the right bisector of line joining $-Q$ and $2Q$
- Q.4 A charged particle of charge q and mass m is released from rest in an uniform electric field E . Neglecting the effect of gravity, the kinetic energy of the charged particle after time 't' seconds is
 (1) $\frac{Eqm}{t}$ (2) $\frac{E^2q^2t^2}{2m}$ (3) $\frac{2E^2t^2}{mq}$ (4) $\frac{Eq^2m}{2t^2}$

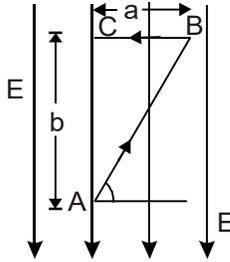
- Q.5 The distance between two plates is 2 cm, when an electric potential of 10 volt is applied to both the plates, then the value of electric field will be -
 (1) 20 N/C (2) 500 N/C (3) 5 N/C (4) 250 N/C

- Q.6 The dimensions of potential difference are -
 (1) $ML^2T^{-2}Q^{-1}$ (2) $MLT^{-2}Q^{-1}$ (3) $MT^{-2}Q^{-2}$ (4) $ML^2T^{-1}Q^{-1}$

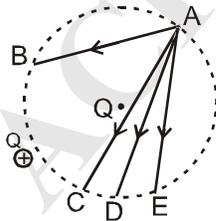
- Q.7 The potential on the conducting spheres of radii r_1 and r_2 is same, the ratio of their charge densities will be -
 (1) r_1/r_2 (2) r_2/r_1 (3) r_1^2/r_2^2 (4) r_2^2/r_1^2

- Q.8 A semicircular ring of radius 0.5 m is uniformly charged with a total charge of 1.5×10^{-9} coul. The electric potential at the centre of this ring is :
 (1) 27 V (2) 13.5 V (3) 54 V (4) 45.5 V

- Q.9 The potential difference between points A and B in the given uniform electric field is :



- (1) Ea (2) $E\sqrt{(a^2 + b^2)}$ (3) Eb (4) $(Eb/\sqrt{2})$
- Q.10 In the electric field of charge Q, another charge is carried from A to B. A to C, A to D and A to E, then work done will be -

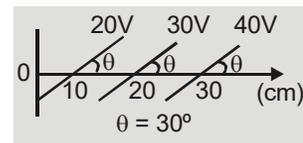


- (1) minimum along path AB. (2) minimum along path AD.
 (3) minimum along path AE. (4) zero along all the paths.
- Q.11 You are given an arrangement of three point charges q , $2q$ and xq separated by equal finite distances so that electric potential energy of the system is zero. Then the value of x is :
 (1) $-\frac{2}{3}$ (2) $-\frac{1}{3}$ (3) $\frac{2}{3}$ (4) $\frac{3}{2}$

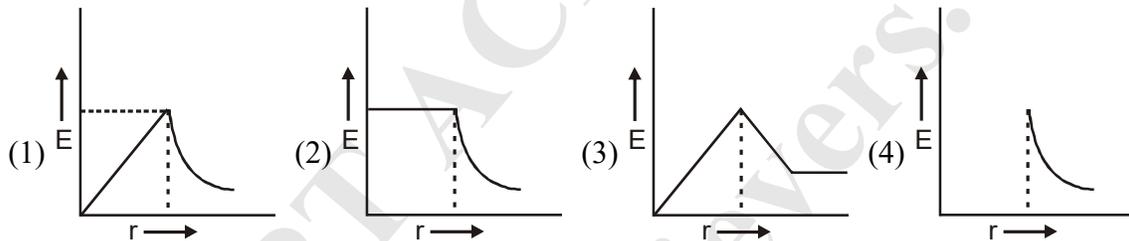
- Q.12 A sphere of radius 1 cm has potential of 8000 V. The energy density near the surface of sphere will be:
 (1) $64 \times 10^5 \text{ J/m}^3$ (2) $8 \times 10^3 \text{ J/m}^3$ (3) 32 J/m^3 (4) 2.83 J/m^3

- Q.13 If 'n' identical water drops assumed spherical each charged to a potential energy U coalesce to a single drop, the potential energy of the single drop is (Assume that drops are uniformly charged):
 (1) $n^{1/3} U$ (2) $n^{2/3} U$ (3) $n^{4/3} U$ (4) $n^{5/3} U$

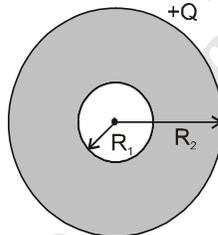
- Q.14 Some equipotential surfaces are shown in the figure. The magnitude and direction of the electric field is-
 (1) 100 V/m making angle 120° with the x-axis
 (2) 100 V/m making angle 60° with the x-axis
 (3) 200 V/m making angle 120° with the x-axis
 (4) none of the above



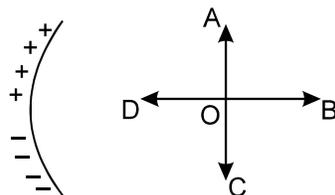
- Q.15 The electric field in a region is directed outward and is proportional to the distance r from the origin. Taking the electric potential at the origin to be zero, the electric potential at a distance r :
- (1) is uniform in the region (2) is proportional to r
 (3) is proportional to r^2 (4) increases as one goes away from the origin.
- Q.16 An electric dipole is made up of two equal and opposite charges of 2×10^{-6} coulomb at a distance of 3 cm. This is kept in an electric field of 2×10^5 N/C, then the maximum torque acting on the dipole -
- (1) 12×10^{-1} Nm (2) 12×10^{-3} Nm (3) 24×10^{-3} Nm (4) 24×10^{-1} Nm
- Q.17 A dipole of electric dipole moment P is placed in a uniform electric field of strength E . If θ is the angle between positive directions of P and E , then the potential energy of the electric dipole is largest when θ is:
- (1) zero (2) $\pi/2$ (3) π (4) $\pi/4$
- Q.18 A closed cylinder of radius R and length L is placed in a uniform electric field E , parallel to the axis of the cylinder. Then the electric flux through the cylinder must be -
- (1) $2\pi R^2 E$ (2) $(2\pi R^2 + 2\pi RL)E$ (3) $2\pi RLE$ (4) zero
- Q.19 Which of the following represents the correct graph for electric field intensity and the distance r from the centre of a hollow charged metal sphere or solid metallic conductor of radius R :



- Q.20 Figure shows a thick metallic sphere. If it is given a charge $+Q$, then electric field will be present in the region

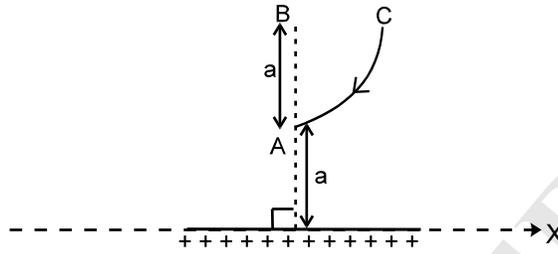


- (1) $r < R_1$ only (2) $r > R_1$ and $R_1 < r < R_2$
 (3) $r \geq R_2$ only (4) $r \leq R_2$ only
- Q.21 The linear charge density on upper half of a segment of ring is λ and at lower half, it is $-\lambda$. The direction of electric field at centre O of ring is :



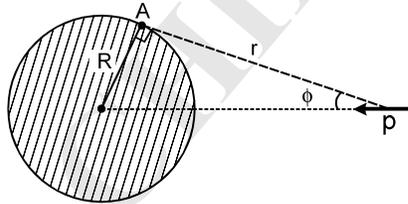
- (1) along OA (2) along OB (3) along OC (4) along OD

- Q.22 For an infinite line of charge having charge density λ lying along x-axis, the work required in moving charge q from C to A along arc CA is :



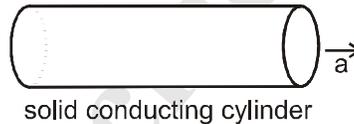
- (1) $\frac{q\lambda}{\pi\epsilon_0} \log_e \sqrt{2}$ (2) $\frac{q\lambda}{4\pi\epsilon_0} \log_e \sqrt{2}$ (3) $\frac{q\lambda}{4\pi\epsilon_0} \log_e 2$ (4) $\frac{q\lambda}{2\pi\epsilon_0} \log_e \frac{1}{2}$

- Q.23 A dipole having dipole moment p is placed in front of a solid uncharged conducting sphere as shown in the diagram. The net potential at point A lying on the surface of the sphere is :



- (1) $\frac{kpc \cos \phi}{r^2}$ (2) $\frac{kpc \cos^2 \phi}{r^2}$ (3) zero (4) $\frac{2kp \cos^2 \phi}{r^2}$

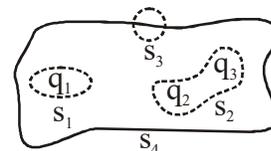
- Q.24 STATEMENT-1 : A solid uncharged conducting cylinder moves with acceleration a (w.r.t ground). As a result of acceleration of cylinder, an electric field is produced within cylinder.



STATEMENT-2 : When a solid conductor moves with acceleration a , then from frame of conductor a pseudoforce (of magnitude ma ; where m is mass of electron) will act on free electrons in the conductor. As a result some portion of the surface of conductor acquires negative charge and remaining portion of surface of conductor acquires positive charge.

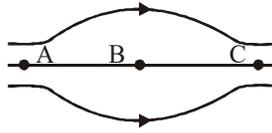
- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Both Statement-1 and Statement-2 are False
- Q.25 STATEMENT 1 : Electric current will not flow between two charged bodies when connected if their charges are same.
 STATEMENT 2 : Current flow from higher charge to lower charge.
 (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Both Statement-1 and Statement-2 are False

- Q.26 STATEMENT 1 : At a point in space, the electric field points towards north. In theregion, surrounding this point the rate of change of potential will be zero along the east and west.
STATEMENT 2 : Rate of change of electric potential is along the direction of electric field.
(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Both Statement-1 and Statement-2 are False
- Q.27 STATEMENT 1 : The surface of a conductor is an equipotential surface.
STATEMENT 2 : Conductor allows the flow of charge.
(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Both Statement-1 and Statement-2 are False
- Q.28 STATEMENT 1 : An applied electric field will polarize the polar dielectric material.
STATEMENT 2 : In polar dielectrics, each molecule has a permanent dipole moment but these are randomly oriented in the absence of an externally applied electric field.
(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Both Statement-1 and Statement-2 are False
- Q.29 Which one of the following statement regarding electrostatics is wrong ?
(1) Charge is quantized
(2) Charge is conserved
(3) There is an electric field near an isolated charge at rest
(4) A stationary charge produces both electric and magnetic fields
- Q.30 A pendulum bob of mass 80mg and carrying a charge of 2×10^{-8} Coulomb is at rest in a horizontal uniform electric field of $20,000 \text{ V m}^{-1}$. Find the tension in the thread of pendulum -
(1) $8.8 \times 10^{-2} \text{ N}$ (2) $8.8 \times 10^{-3} \text{ N}$ (3) $8.8 \times 10^{-4} \text{ N}$ (4) $8.8 \times 10^{-5} \text{ N}$
- Q.31 Two free positive charges $4q$ and q are a distance l apart. What charge Q is needed to achieve equilibrium for the entire system and where should it be placed form charge q ?
(1) $Q = \frac{4}{9} q$ (negative) at $\frac{l}{3}$ (2) $Q = \frac{4}{9} q$ (positive) at $\frac{l}{3}$
(3) $Q = q$ (positive) at $\frac{l}{3}$ (4) $Q = q$ (negative) at $\frac{l}{3}$
- Q.32 Three charges $q_1 = 1 \mu\text{C}$, $q_2 = 2 \mu\text{C}$ and $q_3 = -3 \mu\text{C}$ and four surfaces S_1, S_2, S_3 and S_4 are shown. The flux emerging through surface S_2 in $\text{N}\cdot\text{m}^2 / \text{C}$ is -
(1) $36 \pi \times 10^3$
(2) $-36 \pi \times 10^3$
(3) $36 \pi \times 10^9$
(4) $-36 \pi \times 10^9$



- Q.33 The electric flux from a cube of edge $2\sqrt{21}$ is ϕ . What will be its value if edge of cube is made $2\sqrt{21}$ and charge enclosed is halved -
 (1) $\phi/2$ (2) 2ϕ (3) 4ϕ (4) ϕ

- Q.34 Figure shows some of the electric field lines corresponding to an electric field. The figure suggests that



- (1) $E_A > E_B > E_C$ (2) $E_A = E_B = E_C$ (3) $E_A = E_C > E_B$ (4) $E_A = E_C < E_B$
- Q.35 A rectangular surface of sides 10 cm and 15 cm is placed inside a uniform electric field of 25 V/m, such that the surface makes an angle of 30° with the direction of electric field. Find the flux of the electric field through the rectangular surface :
 (1) $0.1675 \text{ N/m}^2\text{C}$ (2) $0.1875 \text{ Nm}^2/\text{C}$ (3) Zero (4) $0.1075 \text{ Nm}^2/\text{C}$

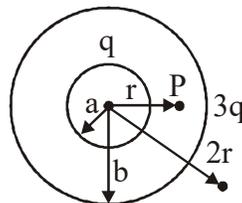
- Q.36 Charges of $+\left(\frac{10}{3}\right) \times 10^{-9}$ are placed at each of the four corners of a square of side 8cm. The potential at the intersection of the diagonals is
 (1) $150 \sqrt{2}$ Volt (2) $1500 \sqrt{2}$ Volt (3) $900 \sqrt{2}$ Volt (4) 900 Volt

- Q.37 The electric potential (V) as a function of distance (x) [in meters] is given by $V = (5x^2 + 10x - 9)$ Volt. The value of electric field at $x = 1\text{m}$ would be -
 (1) 20 Volt/m (2) 6 Volt/m (3) 11 Volt/m (4) -23 Volt/m

- Q.38 A α - particle moves towards a rest nucleus, if kinetic energy of α -particle is 10 MeV and atomic number of nucleus is 50. The closest approach will be -
 (1) 1.44×10^{-14} m (2) 2.88×10^{-14} m (3) 1.44×10^{-10} m (4) 2.88×10^{-10} m

- Q.39 A hollow conducting sphere of radius R has charge (+Q) on its surface. The electric potential within the sphere at a distance $r = \frac{R}{3}$ from the centre is -
 (1) Zero (2) $\frac{1}{4\pi\epsilon_0} \frac{Q}{r}$ (3) $\frac{1}{4\pi\epsilon_0} \frac{Q}{R}$ (4) $\frac{1}{4\pi\epsilon_0} \frac{Q}{r^2}$

- Q.40 The electric field intensity at P and Q, in the shown arrangement, are in the ratio :



- (1) 1 : 2 (2) 2 : 1 (3) 1 : 1 (4) 4 : 1

Q.41 Two charges of $+25 \times 10^{-9}$ coulomb and -25×10^{-9} coulomb are placed 6 m apart. Find the electric field intensity ratio at points 4 m from the centre of the electric dipole (i) on axial line (ii) on equatorial line:

- (1) $\frac{1000}{49}$ (2) $\frac{49}{1000}$ (3) $\frac{500}{49}$ (4) $\frac{49}{500}$

Q.42 An electric dipole of length 2 cm is placed with its axis making an angle of 30° to a uniform electric field 10^5 N/C. If it experiences a torque of $10\sqrt{3}$ Nm, then potential energy of the dipole :

- (1) - 10 J (2) - 20 J (3) - 30 J (4) - 40 J

Q.43 Two parallel large thin metal sheets have equal surface charge densities ($\sigma = 26.4 \times 10^{-12}$ C/m²) of opposite signs. The electric field between these plates is :

- (1) 1.5 N/C (2) 1.5×10^{-10} N/C (3) 3 N/C (4) 3×10^{-10} N/C

Q.44 At any point (x,0,0) the electric potential V is $\left(\frac{1000}{x} + \frac{1500}{x^2} + \frac{500}{x^3}\right)$ volt, then electric field at x = 1 m -

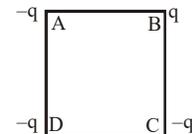
- (1) $5500(\hat{j} + \hat{k})$ V/m (2) $5500 \hat{i}$ V/m (3) $\frac{5500}{\sqrt{2}}(\hat{j} + \hat{k})$ V/m (4) $\frac{5500}{\sqrt{2}}(\hat{i} + \hat{k})$ V/m

Q.45 Two similar rings P and Q (radius = 0.1 mt) are placed co-axially at a distance 0.5 mt.apart .The charge on P and Q is $2\mu\text{C}$ and $4\mu\text{C}$ respectively. Work done to move a $5\mu\text{C}$ charge from centre of P to the center of Q is-

- (1) 1.28 J (2) 0.72 J (3) 0.144 J (4) 1.44 J

Q.46 Charges are placed on the vertices of a square as shown. Let \vec{E} be the electric field and V the potential at the centre. If the charges on A and B are interchanged with those on D and C respectively, then

- (1) \vec{E} remains unchanged, V changes
 (2) Both \vec{E} and V change
 (3) \vec{E} and V remain unchanged
 (4) \vec{E} changes, V remains unchanged



Q.47 The electric potential at a point (x, y, z) is given by

$$V = -x^2 y - xz^3 + 4$$

The electric field E at that point is

- (1) $E = i(2xy + z^3) + jx^2 + k3xz^2$ (2) $E = i2xy + j(x^2 + y^2) + k(3xz - y^2)$
 (3) $E = iz^3 + jxyz + kz^2$ (4) $E = i(2xy - z^3) + jxy^2 + k3z^2$

Direction for following questions :

- A. Both Assertion and Reason are true, and Reason is the correct explanation of Assertion.
 B. Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
 C. Assertion is true but Reason is false.
 D. Assertion and Reason both are false.

- Q.48 **Assertion:** If a conducting medium is placed between two charges, then electric force between them becomes zero.
Reason Reduction in a force due to introduced conductor is proportional to its dielectric constant.
 (1) A (2) B (3) C (4) D
- Q.49 **Assertion** Three equal charges are situated on a circle of radius r such that they form an equilateral triangle, then the electric field intensity at the centre is zero.
Reason: The force on unit positive charge at the centre, due to the three equal charges are represented by the three sides of a triangle taken in the same order. Therefore, electric field intensity at the centre is zero.
 (1) A (2) B (3) C (4) D
- Q.50 **Assertion** If a point charge q is placed in front of an infinite grounded conducting plane surface, the point charge will experience a force.
Reason: The force is due to the induced charge on the conducting surface which is at zero potential.
 (1) A (2) B (3) C (4) D
- Q.51 **Assertion:** No work is done in taking a positive charge from one point to other inside a positively charged metallic sphere while outside the sphere work is done in taking the charge towards the sphere.
Reason: Inside the sphere electric potential is same at each point, but outside it is different on different point.
 (1) A (2) B (3) C (4) D

ANSWER KEY

Q.1	4	Q.2	4	Q.3	2	Q.4	2	Q.5	2
Q.6	1	Q.7	2	Q.8	1	Q.9	3	Q.10	4
Q.11	1	Q.12	4	Q.13	4	Q.14	3	Q.15	3
Q.16	2	Q.17	3	Q.18	4	Q.19	4	Q.20	3
Q.21	3	Q.22	1	Q.23	2	Q.24	1	Q.25	4
Q.26	1	Q.27	1	Q.28	2	Q.29	4	Q.30	3
Q.31	1	Q.32	2	Q.33	1	Q.34	3	Q.35	2
Q.36	2	Q.37	1	Q.38	1	Q.39	3	Q.40	3
Q.41	1	Q.42	3	Q.43	3	Q.44	2	Q.45	2
Q.46	4	Q.47	1	Q.48	1	Q.49	1	Q.50	1
Q.51	1,4								