PART 1

OLYMPIAD WALLAH

ADVANCED PHYSICS

FOR JEE & OLYMPIAD 2025

FOR 12th STANDARD STUDENTS

Ultimate Resource for NSEP Preparation

CONTENTS

EXERCISE-1

1. Mid way between the two equal and similar charges, we placed the third equal and similar charge. Which of the following statements is correct, concerned to the equilibrium along the line joining the charges?

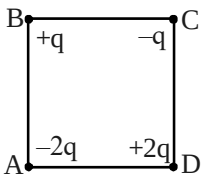
(A) The third charge experienced a net force inclined to the line joining the charges

(B) The third charge is in stable equilibrium

(C) The third charge is in unstable equilibrium

(D) The third charge experiences a net force perpendicular to the line joining the charges

2. Four charges are arranged at the corners of a square ABCD, as shown. The force on a +ve charge kept at the centre of the square is



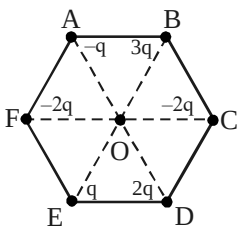
(A) zero

(B) along the diagonal AC

(C) along diagonal BD

(D) perpendicular to the side AB

3. Six charges are placed at the corner of a regular hexagon as shown. If an electron is placed at its centre O, force on it will be:



(A) Zero

(B) Along OF

(C) Along OC

(D) None of these

4. Two equal negative charges are fixed at the points [0, a] and [0, –a] on the y-axis. A positive charge Q is released from rest at the points [2a, 0] on the x-axis. The charge Q will

(A) move to the origin and stop there

(B) move to the origin, cross the origin and then move to infinitely.

(C) execute simple harmonic motion about the origin.

(D) execute oscillatory but not simple harmonic motion.

5. 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?

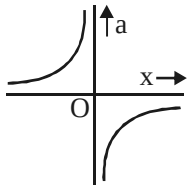
(A) $Q=-\frac{4q}{9}$ in between 4q and q at $\frac{\ell}{3}$ from 4q

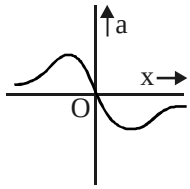
(B) $Q=-\frac{4q}{9}$ in between 4q and q at $\frac{2\ell}{3}$ from 4q

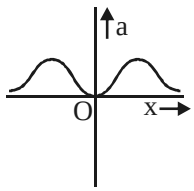
(C) $Q=\frac{4q}{9}$ in between 4q and q at $\frac{\ell}{3}$ from 4q

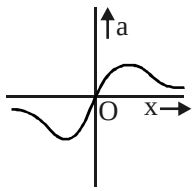
(D) $Q=\frac{4q}{9}$ in between 4q and q at $\frac{2\ell}{3}$ from 4q

6. Two identical positive charges are fixed on the y-axis, at equal distances from the origin O. A particle with a negative charge starts on the x-axis at a large distance from O, moves along the + x-axis, passes through O and moves far away from O. Its acceleration a is taken as positive in the positive x-direction. The particle's acceleration a is plotted against its x-coordinate. Which of the following best represents the plot?

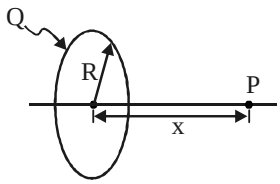
(A) 

(B) 

(C) 

(D) 

7. A small particle of mass m and charge –q is placed at point P on the axis of uniformly charged ring and released. If R >> x, the particle will undergo oscillations along the axis of symmetry with an angular frequency that is equal to



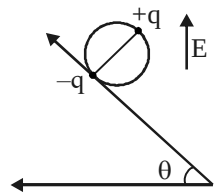
(A) $\sqrt{\dfrac{qQ}{4\pi\varepsilon_0 mR^3}}$

(B) $\sqrt{\dfrac{qQx}{4\pi\varepsilon_0 mR^4}}$

(C) $\dfrac{qQ}{4\pi\varepsilon_0 mR^3}$

(D) $\dfrac{qQx}{4\pi\varepsilon_0 mR^4}$

8. A wheel having mass m has charges +q and –q on diametrically opposite points. It remains in equilibrium on a rough inclined plane in the presence of uniform vertical electric field E =



(A) $\dfrac{mg}{q}$

(B) $\dfrac{mg}{2q}$

(C) $\dfrac{mg\tan\theta}{2q}$

(D) None of these

9. A point charge 50 μC is located in the XY plane at the point of position vector $\vec{r}_0 = 2\hat{i}+3\hat{j}$. What is the electric field at the point of position vector $\vec{r} = 8\hat{i}-5\hat{j}$

(A) 1200 V/m (B) 0.04 V/m

(C) 900 V/m (D) 4500 V/m

10. A point charge q is placed at origin. Let $\vec{E}_A, \vec{E}_B$ and $\vec{E}_C$ be the electric field at three points A (1, 2, 3), B (1, 1, –1) and C(2, 2, 2) due to charge q. Consider the following statements and choose correct alternative.

(i) $\vec{E}_A \perp \vec{E}_B$ (ii) $|\vec{E}_B| = 4|\vec{E}_C|$

(A) only (i) is correct

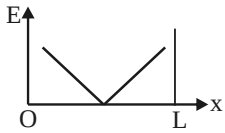
(B) only (ii) is correct

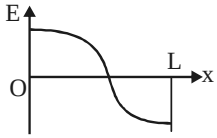
(C) both (i) and (ii) are correct

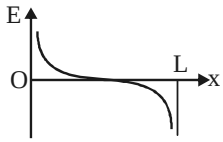
(D) both (i) and (ii) are wrong

11. Two identical point charges are placed at a separation of L. P is a point on the line joining the charges, at a distance x from any one charge. The field at P is E. E is plotted against x for values of x from close to zero to slightly less than L. Which of the following best represents the resulting curve?

(A) 

(B) 

(C) 

(D) 

12. A nonconducting ring of radius R has uniformly distributed positive charge Q. A small part of the ring, of length d, is removed (d << R). The electric field at the centre of the ring will now be

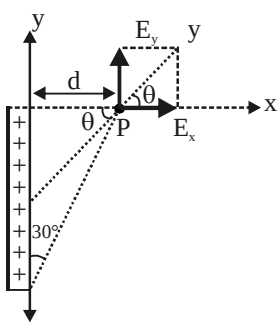
(A) directed towards the gap, inversely proportional to R^3.

(B) directed towards the gap, inversely proportional to R^2.

(C) directed away from the gap, inversely proportional to R^3.

(D) directed away from the gap, inversely proportional to R^2.

13. In the given figure the direction (θ) of $\vec{E}$ at point P due to uniformly charged finite thin rod will be



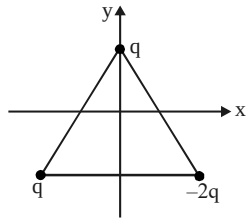
(A) at an angle of 30° from x-axis

(B) at an angle of 45° from x -axis

(C) at an angle of 60° from x -axis

(D) None of these

14. An equilateral triangle wire frame of side L having 3 point charges at its vertices is kept in x-y plane as shown. Centroid of the triangle conicides with the origin. Component of electric field due to the configuration in z direction at (0, 0, L) is



(A) $\frac{9\sqrt{3}kq}{8L^2}$ (B) $\frac{9kq}{8L^2}$

(C) zero (D) None of these

15. A charged particle having some mass is resting in equilibrium at a height H above the centre of a uniformly charged non-conducting horizontal ring of radius R. The force of gravity acts downwards. The equilibrium of the particle will be stable

(A) for all values of H

(B) only if $H > \frac{R}{\sqrt{2}}$

(C) only if $H < \frac{R}{\sqrt{2}}$

(D) only if $H = \frac{R}{\sqrt{2}}$

16. Select the correct statement: (Only force on a particle is due to electric field)

(A) A charged particle always moves along the electric line of force.

(B) A charged particle may move along the line of force

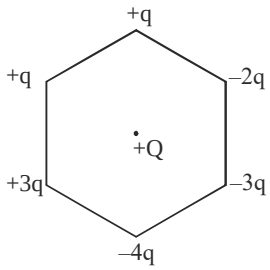
(C) A charge particle never moves along the line of force

(D) A charged particle moves along the line of force only if released from rest.

EXERCISE-2

1. Two particles of charges –2q and q are fixed at points A and B, ℓ distance apart. Where should a positive test charge be placed on the line connecting the charges for it to be in equilibrium? What is the nature of the equilibrium for small disturbances along the line joining the charges.

2. Six charges are kept at the vertices of a regular hexagon as shown in the figure. If magnitude of force applied by +Q on +q charge is F, then net electric force on the +Q is nF. Find the value of n.



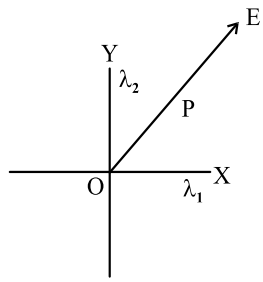
3. Three charges 4q, Q and q are in a straight line in the position of 0, *l*/2 and *l* respectively. The resultant force on q will be zero, if Q =

4. Draw E-x graph for $0 < x < x_0$, for a system of two point charges A and B. Charge A is kept at the origin and B at $(x_0, 0)$, when
(i) both are positive.
(ii) both are negative.
(iii) A is positive and B is negative.
(iv) A is negative and B is positive.

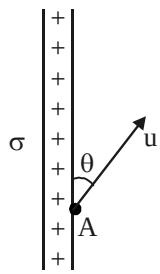
5. A clock face has negative charges –q, –2q, –3q, ..., –12q fixed at the positions of the corresponding numerals on the dial. Assume that the clock hands do not disturb the net field due to point charges. At what time does the hour hand point in the same direction is electric field at the centre of the dial.

6. A charge $+10^{-9}$ C is located at the origin in free space and another charge Q at (2, 0, 0). If the X-component of the electric field at (3, 1, 1) is zero, calculate the value of Q. Is the Y-component zero at (3, 1, 1)?

7. Two mutually perpendicular infinite wires along x-axis and y-axis carry charge densities λ_1 and λ_2. The electric line of force at P is along the line $y = \frac{1}{\sqrt{3}}x$, where P is also a point lying on the same line then find λ_1/λ_2



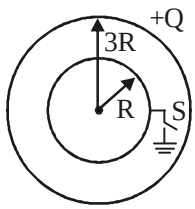
8. A particle of mass m and negative charge q is thrown in a gravity free space with speed u from the point A on the large charged sheet of uniform surface charge density σ, as shown in figure. Find the maximum distance from A on sheet where the particle can strike.



9. Calculate the magnitude of electrostatic force on a charge placed at a vertex of a triangular pyramid (4 vertices, 4 faces), if 4 equal charges are placed at all four vertices of pyramid of side 'a'.

27. A particle of mass m and charge – q moves along a diameter of a uniformly charged sphere of radius R and carrying a total charge + Q. Find the frequency of SHM of the particle if the amplitude does not exceed R.

28. Two thin conducting shells of radii R and 3R are shown in figure. The outer shell carries a charge +Q and the inner shell is neutral. The inner shell is earthed with the help of switch S. Find the charge attained by the inner shell.



29. Consider two concentric conducting spheres of radii a & b (b > a). Inside sphere has a positive charge q_1. What charge should be given to the outer sphere so that potential of the inner sphere becomes zero? How does the potential vary between the two spheres & outside?

30. Consider three identical metal spheres A, B and C. Spheres A carries charge + 6q and sphere B carries charge – 3q. Sphere C carries no charge. Spheres A and B are touched together and then separated. Sphere C is then touched to sphere A and separated from it. Finally the sphere C is touched to sphere B and separated from it. Find the final charge on the sphere C.

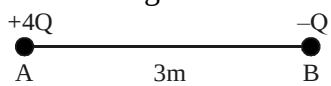
EXERCISE-3

1. There are four concentric metallic shells A, B, C and D of radii a, 2a, 3a and 4a respectively. Shells B and D are given charges +q and –q respectively. Shell C is now earthed. The potential difference $V_A - V_C$ is

(A) $\frac{Kq}{2a}$ (B) $\frac{Kq}{3a}$

(C) $\frac{Kq}{4a}$ (D) $\frac{Kq}{6a}$

2. Two fixed charges 4Q (positive) and Q (negative) are located at A and B, the distance AB being 3 m.



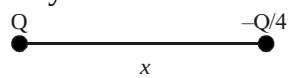
(A) The point P where the resultant field due to both is zero is on AB outside AB.

(B) The point P where the resultant field due to both is zero is on AB inside AB.

(C) If a positive charge is placed at P and displaced slightly along AB it will execute oscillations.

(D) If a negative charge is placed at P and displaced slightly along AB it will execute oscillations.

3. Two point charges Q and – Q/4 are separated by a distance x. Then



(A) potential is zero at a point on the axis which is x/3 on the right side of the charge – Q/4

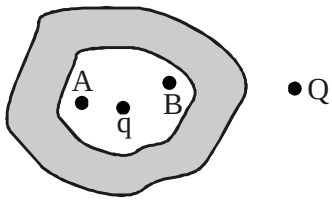
(B) potential is zero at a point on the axis which is x/5 on the left side of the charge – Q/4

(C) electric field is zero at a point on the axis which is at a distance x on the right side of the charge – Q/4

(D) there exist two points on the axis where electric field is zero.

39. **Statement-1:** A point charge q is placed inside a cavity of conductor as shown. Another point charge Q is placed outside the conductor as shown. Now as the point charge Q is pushed away from conductor, the potential difference (V_A–V_B) between two points A and B within the cavity of conductor remains constant.

Statement-2: The electric field due to charges on outer surface of conductor and outside the conductor is zero at all points inside the conductor.



(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

(C) Statement-1 is true, statement-2 is false.

(D) Statement-1 is false, statement-2 is true.

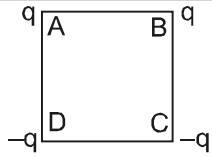
JEE MAINS PYQ

1. An electric charge 10^{-3}μC is placed at the origin (0,0) of X–Y co-ordinate system. Two points A and B are situated at $\left(\sqrt{2},\sqrt{2}\right)$ and (2,0) respectively. The potential difference between the points A and B will be **[AIEEE-2007, 3/120]**

(A) 9 volt (B) zero

(C) 2 volt (D) 4.5 volt

2. 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 **[AIEEE-2007, 3/120]**



(A) $\vec{E}$ remains unchanged, V changes

(B) Both $\vec{E}$ and V change

(C) $\vec{E}$ and V remain unchanged

(D) $\vec{E}$ changes, V remains unchanged

3. The potential at a point x (measured in μm) due to some charges situated on the x-axis is given by $V(x) = 20/(x^2 - 4)$ volts. The electric field E at x = 4 μm is given by : **[AIEEE-2007, 3/120]**

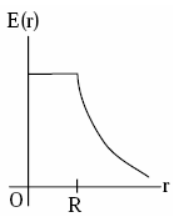
(A) 5/3 volt/μm and in the –ve x direction

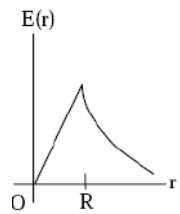
(B) 5/3 volt/μm and in the +ve x direction

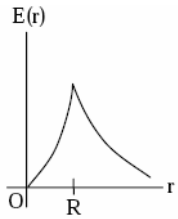
(C) 10/9 volt/μm and in the –ve x direction

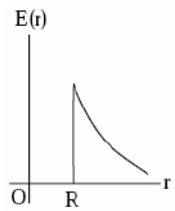
(D) 10/9 volt/μm and in the +ve x direction

4. A thin spherical shell of radius R has charge Q spread uniformly over its surface. Which of the following graphs most closely represents the electric field E (r) produced by the shell in the range $0 \leq r < \infty$, where r is the distance from the centre of the shell? **[AIEEE-2008, 3/105]**

(A) 

(B) 

(C) 

(D) 

69. In a cuboid of dimension $2L\times 2L\times L$, a charge q is placed at the center of the surface 'S' having area of $4L^2$. The flux through the opposite surface to 'S' is given by **[JEE MAIN-2023]**

(A) $\frac{q}{6\varepsilon_0}$ (B) $\frac{q}{2\varepsilon_0}$

(C) $\frac{q}{3\varepsilon_0}$ (D) $\frac{q}{12\varepsilon_0}$

70. A cubical volume is bounded by the surfaces $x=0, x=a, y=0, y=a, z=0, z=a$. The electric field in the region is given by $\vec{E}=E_0 x\hat{i}$. Where $E_0=4\times10^4 NC^{-1}m^{-1}$. If a $=2cm$, the charge contained in the cubical volume is $Q\times10^{-14}C$. The value of Q is._____. **[JEE MAIN-2023]**
Take $E_0 = 9 \times 10^{-12}C^2/Nm^2$)

NSEP PYQ

1. A uniform spherical charge distribution of radius R produces electric fields E_1 and E_2 at two points at distances r_1 and r_2 respectively from the centre of the distribution. Out of the following the possible expression/s for $\frac{E_1}{E_2}$ is/are **[NSEP-2016]**

(A) $\frac{r_2}{r_1}$ (B) $\left(\frac{r_1}{r_2}\right)^2$

(C) $\frac{R^3}{r_1^2 r_2}$ (D) $\frac{r_1 r_2^2}{R^3}$

2. The breakdown field for air is about 2×10^6 V/m. Therefore, the maximum charge that can be placed on a sphere of diameter 10 cm is **[NSEP-2016]**

(A) 2.0×10^{-4} C (B) 5.6×10^{-7} C

(C) 5.6×10^{-2} C (D) 2.0×10^{2} C

3. The force of attraction between the positively charged nucleus and the electron in a hydrogen atom is given by $f=k\frac{e^2}{r^2}$. Assume that the nucleus is fixed. The electron, initially moving in an orbit of radius R_1 jumps into an orbit of smaller radius R_2. The decrease in the total energy of the atom is [**NSEP-2016]**

(A) $\frac{ke^2}{2}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$ (B) $\frac{ke^2}{2}\left(\frac{R_1}{R_2^2}-\frac{R_2}{R_1^2}\right)$

(C) $\frac{ke^2}{2}\left(\frac{1}{R_2}-\frac{1}{R_1}\right)$ (D) $\frac{ke^2}{2}\left(\frac{R_2}{R_1^2}-\frac{R_1}{R_2^2}\right)$

4. A charge q is situated at the origin. Let E_A, E_B and E_C be the electric fields at the points A (2, –3, –1), B (–1, –2, 4) and C (2, –4, 1). Therefore [**NSEP-2016]**

(A) $E_A \perp E_B$

(B) no work is done in moving a test charge q_0 from B to C

(C) $2|E_A| = 3|E_B|$

(D) $E_B = -E_C$

5. The physical quantity that has unit volt-second is [**NSEP-2017]**

(A) energy (B) electric flux

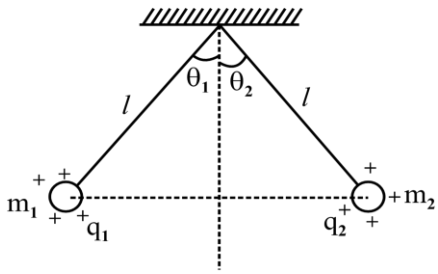
(C) magnetic flux (D) Inductance

6. Two identical charged spheres suspended from a common point by two light strings of length *l*, are initially at a distance d (<< *l*) apart due to their mutual repulsion. The charges begin to leak from both the spheres at a constant rate. As a result, the spheres approach each other with a velocity v. If x denotes the distance between the spheres, then v varies as [**NSEP-2017]**

(A) x^{-1} (B) $x^{1/2}$

(C) $x^{-1/2}$ (D) x

36. Two small positively charged spherical balls are suspended from a common point at the ceiling by non-conducting massless strings of equal length ℓ. The first ball has mass m_1 and charge q_1 while the second ball has mass m_2 and charge q_2. If the two strings subtend angles θ_1 and θ_2 with the vertical as shown, then **[NSEP-2024]**



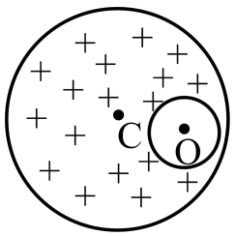
(A) $\frac{\sin\theta_1}{\sin\theta_2}=\frac{q_2}{q_1}$ (B) $\frac{\sin\theta_1}{\sin\theta_2}=\frac{m_2}{m_1}$

(C) $\frac{\tan\theta_1}{\tan\theta_2}=\frac{q_1}{q_2}\times\frac{m_2}{m_1}$ (D) $\frac{\sin\theta_1}{\sin\theta_2}=1$

37. A soap bubble 10 cm in radius, with a film thickness of $\frac{10}{3}\times10^{-6}$ cm, is charged to a potential of 80 V. The bubble bursts and converts into a single spherical drop. Assuming that the soap solution is a good conductor, the potential at the surface of the drop is **[NSEP-2024]**

(A) 2 kV (B) 4 kV
(C) 6 kV (D) 8 Kv

38. A uniformly charged non-conducting sphere with its center at C carries positive charge with uniform charge density +ρ, except in a spherical cavity (inside the sphere) with center O. The electric field E at any point inside the cavity is **[NSEP-2024]**



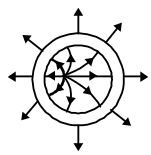
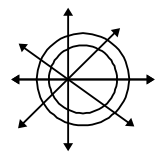
(A) zero
(B) uniform
(C) directed radially outward
(D) directed radially inward

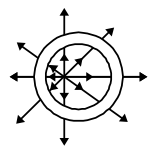
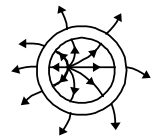
JEE ADVANCED PYQ

1. Two equal point charges are fixed at x = –a and x = +a on the x-axis. Another point charge Q is placed at the origin. The change in the electrical potential energy of Q, when it is displaced by a small distance x along the x-axis, is approximately proportional to **[IIT JEE-2002 (Scr)]**

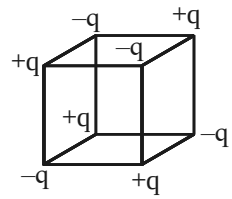
(A) x
(B) x^2
(C) x^3
(D) 1/x

2. A point charge q is placed at a point inside a hollow conducting sphere. Which of the following electric force pattern is correct? **[IIT JEE-2003 (scr)]**

(A)  (B) 

(C)  (D) 

3. Charges +q and –q are located at the corners of a cube of side a as shown in the figure. Find the work done to separate the charges to infinite distance. **[IIT JEE-2003]**



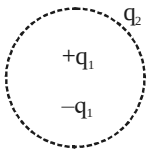
4. A charge +Q is fixed at the origin of the coordinate system while a small electric dipole of dipole-moment $\vec{p}$ pointing away from the charge along the x-axis is set free from a point far away from the origin.

[IIT JEE-2003]

(a) calculate the K.E. of the dipole when it reaches to a point (d, 0)

(b) calculate the force on the charge +Q at this moment.

5. Consider the charge configuration and a spherical Gaussian surface as shown in the figure. When calculating the flux of the electric field over the spherical surface, the electric field will be due to **[IIT JEE-2004]**



(A) q_2

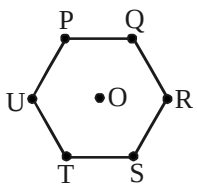
(B) only the positive charges

(C) all the charges

(D) $+q_1$ and $-q_1$

6. Six charges, three positive and three negative of equal magnitude are to be placed at the vertices of a regular hexagon such that the electric field at O is double the electric field when only one positive charge of same magnitude is placed at R. Which of the following arrangements of charges is possible for P, Q, R, S, T and U respectively?

[IIT JEE-2004]



(A) +, –, +, –, –, +

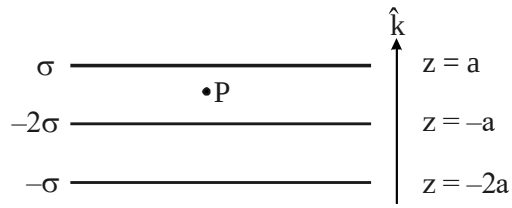
(B) +, –, +, –, +, –

(C) +, +, –, +, –, –

(D) –, +, +, –, +, –

7. Two uniformly charged infinitely large plane sheets S_1 and S_2 are held in air parallel to each other with separation d between them. The sheets have charge distributions per unit area σ_1 and σ_2 (Cm^{-2}), respectively, with $\sigma_1 > \sigma_2$. Find the work done by the electric field on a point charge Q that moves from S_1 towards S_2 along a line of length a (a > d) making an angle of $\pi/4$ with the normal to the sheets. Assume that the charge Q does not affect the charge distributions of the sheets. **[IIT JEE-2004]**

8. Three large parallel plates have uniform surface charge densities as shown in the figure. Find out electric field intensity at point P. **[IIT JEE-2005 (Scr.)]**



(A) $-\frac{4\sigma}{\epsilon_0}\hat{k}$

(B) $\frac{4\sigma}{\epsilon_0}\hat{k}$

(C) $-\frac{2\sigma}{\epsilon_0}\hat{k}$

(D) $\frac{2\sigma}{\epsilon_0}\hat{k}$

9. Which of the following groups do not have same dimensions **[IIT JEE-2005 (Scr.)]**

(A) Young's modulus, pressure, stress

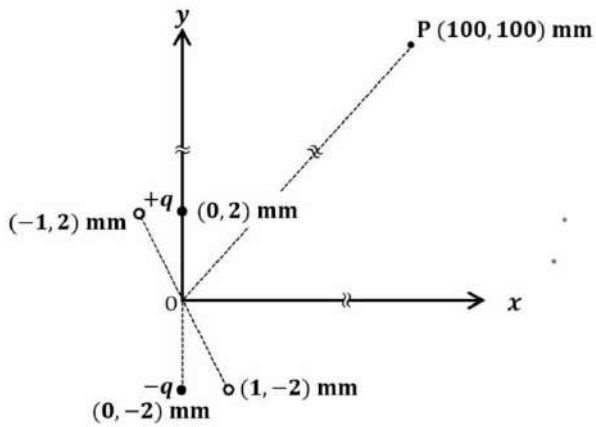
(B) Work, heat, energy

(C) Electromotive force, potential difference, voltage

(D) Electric dipole moment, electric flux, electric field

10. A conducting liquid bubble of a and thickness t (t<< a) is charged to potential V. If the bubble collapses to a droplet, find the potential on the droplet. **[IIT JEE-2005]**

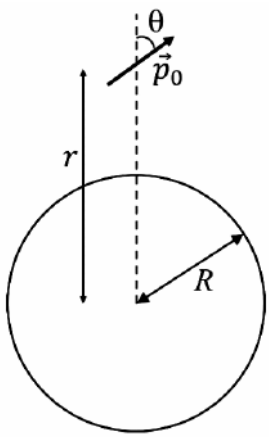
59. An electric dipole is formed by two charges $+q$ and $-q$ located in xy-plane at (0,2) mm and (0, −2) mm, respectively, as shown in the figure. The electric potential at point P (100,100) mm due to the dipole is $V0$. The charges $+q$ and $-q$ are then moved to the points (−1,2) mm and (1, −2) mm, respectively. What is the value of electric potential at P due to the new dipole? **[IIT JEE-2023]**



(A) $V_0/4$ (B) $V_0/2$
(C) $V_0/\sqrt{2}$ (D) $3V_0/4$

60. A small electric dipole $\vec{p}_0$, having a moment of inertia I about its center, is kept at a distance r from the center of a spherical shell of radius R. The surface charge density σ is uniformly distributed on the spherical shell. The dipole is initially oriented at a small angle θ as shown in the figure. While staying at a distance r, the dipole is free to rotate about its center.

[JEE Adv -2024]



If released from rest, then which of the following statement(s) is(are) correct?

[$\varepsilon_0$is the permittivity of free space.]

(A) The dipole will undergo small oscillations at any finite value of r

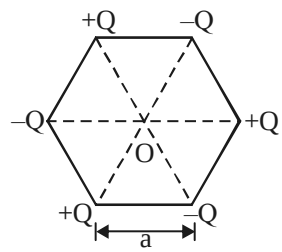
(B) The dipole will undergo small oscillations at any finite value of r > R

(C) The dipole will undergo small oscillations with an angular frequency of $\sqrt{\frac{2\sigma p_0}{\epsilon_0 I}}$ at r = 2R

(D) The dipole will undergo small oscillations with an angular frequency of $\sqrt{\frac{\sigma p_0}{100\,\epsilon_0 I}}$ at r = 10 R

Advanced & Olympiad Challenger Questions

1. Six charges are placed at the vertices of a regular hexagon as shown in the figure. Find the electric field on the line passing through O and perpendicular to the plane of the figure as a function of distance x from point O.



2. A circular ring of radius R with uniform positive charge density λ per unit length is fixed in the Y-Z plane with its centre at the origin O. A particle of mass m and positive charge q is projected from the point P $(\sqrt{3}R, 0, 0)$ on the positive X-axis directly towards O, with initial velocity *v*. Find the smallest value of the speed *v* such that the particle does not return to P.

Answer Key

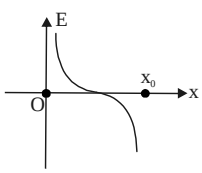
EXERCISE-1

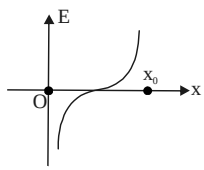
1. (B)	**2.** (D)	**3.** (D)	**4.** (D)
5. (B)	**6.** (B)	**7.** (A)	**8.** (B)
9. (D)	**10.** (C)	**11.** (D)	**12.** (A)
13. (A)	**14.** (C)	**15.** (B)	**16.** (B)
17. (B)	**18.** (C)	**19.** (C)	**20.** (C)
21. (D)	**22.** (C)	**23.** (D)	**24.** (A)
25. (D)	**26.** (A)	**27.** (B)	**28.** (A)
29. (D)	**30.** (A)	**31.** (B)	**32.** (A)
33. (C)	**34.** (B)	**35.** (B)	**36.** (B)
37. (A)	**38.** (A)	**39.** (D)	**40.** (D)
41. (B)	**42.** (C)	**43.** (D)	**44.** (B)
45. (A)	**46.** (B)	**47.** (B)	**48.** (B)
49. (B)	**50.** (B)	**51.** (B)	**52.** (A)
53. (B)	**54.** (B)	**55.** (A)	**56.** (B)
57. (C)	**58.** (B)	**59.** (D)	**60.** (A)
61. (A)	**62.** (B)	**63.** (A)	**64.** (C)
65. (B)	**66.** (B)	**67.** (B)	**68.** (D)
69. (C)	**70.** (A)	**71.** (D)	**72.** (B)
73. (A)	**74.** (B)	**75.** (B)	**76.** (A)
77. (A)	**78.** (C)	**79.** (B)	**80.** (D)

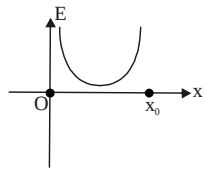
EXERCISE-2

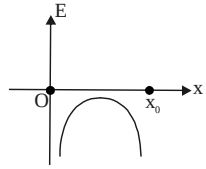
1. $a = \ell(1+\sqrt{2})$ outside line segment AB and near to B, the equilibrium will be stable.

2. 9 **3.** –q

4. (i) 

(ii) 

(iii) 

(iv) 

5. 9.30 **6.** $-\left[\frac{3}{11}\right]^{3/2}\times 3\times 10^{-9}$C, No. **7.** 1/3

8. $\frac{2\varepsilon_0 u^2 m}{q\sigma}$ **9.** $F=\frac{q^2\sqrt{6}}{4\pi\varepsilon_0 a^2}$ **10.** $\frac{q}{24\varepsilon_0}$ **11.** $a=\frac{R}{\sqrt{3}}$

12. N = 11 **13.** 2 **14.** (a) 7.08×10^{-8} (b) No

15. 3 **16.** $-\frac{kq^2}{a}\left(3-\sqrt{2}\right)$ **17.** 1.8×10^5 sec **18.** $20\sqrt{\ln 2}$

19. $\sqrt{\frac{2kQ^2}{mR}}$ **20.** 5.86 m/s **21.** $2\tan^{-1}\left(\frac{\sigma q}{2\varepsilon_0 mg}\right)$ **22.** $9V_0$

23. 7 **24.** 0 **25.** $\frac{kP}{\sqrt{2}y^3}(-\hat{i}-2\hat{j})$ **26.** 4

27. $\frac{1}{2\pi}\sqrt{\frac{qQ}{4\pi\varepsilon_0 mR^3}}$ **28.** –Q/3 **29.** (i) $q_2=-\frac{b}{a}q_1$ (ii)

$$\begin{cases} V_r=\frac{q_1}{4\pi\varepsilon_0}\left(\frac{1}{r}-\frac{1}{a}\right);\ a\le r\le b \\ V_b=\frac{q_1}{4\pi\varepsilon_0}\left(\frac{1}{b}-\frac{1}{a}\right);\ r=b \\ V_r=\frac{1}{4\pi\varepsilon_0}\left(\frac{q_1}{r}+\frac{q_2}{r}\right);\ r\ge b \end{cases}$$

30. 1.125 q

EXERCISE-3

1. (D) **2.** (A, D) **3.** (A, B, C) **4.** (B, C)

5. (A, C) **6.** (A, C) **7.** (A) **8.** (A, C, D)

9. (B, D) **10.** (A) **11.** (A, C) **12.** (B, C, D)

13. (A, B, D) **14.** (A, D) **15.** (A, B, D) **16.** (C)

17. (C) **18.** (C, D) **19.** (A, B) **20.** (A, B, C)

21. (A, D) **22.** (A, D) **23.** (B, C) **24.** (A, C)

25. (A, D) **26.** (A, D)

27. (A)→(QS); (B)→(PR); (C)→(PR); (D)→(QR)

28. (A)→(S); (B)→(P); (C)→(R); (D)→(Q)

29. (B) **30.** (D) **31.** (C) **32.** (A)

33. (B) **34.** (D) **35.** (C) **36.** (C)

37. (C) **38.** (D) **39.** (A)

JEE MAINS PYQ

1. (B) **2.** (D) **3.** (D) **4.** (D)
5. (C) **6.** (D) **7.** (A) **8.** (B)
9. (C) **10.** (B) **11.** (C) **12.** (D)
13. (D) **14.** (C) **15.** (C) **16.** (A)
17. (D) **18.** (C) **19.** (D) **20.** (B, C)
21. (D) **22.** (C) **23.** (B) **24.** (D)
25. (C) **26.** (B) **27.** (B) **28.** (C)
29. (C) **30.** (A) **31.** (B) **32.** (A)
33. (D) **34.** (D) **35.** (D) **36.** (B)
37. (B) **38.** (A) **39.** (C) **40.** (A)
41. (D) **42.** (D) **43.** (D) **44.** (C)
45. (B) **46.** (C) **47.** (C) **48.** (D)
49. (D) **50.** (500) **51.** (128) **52.** (180)
53. (243) **54.** (D) **55.** (B) **56.** (A)
57. (14) **58.** (2) **59.** (C) **60.** (24)
61. (10) **62.** (4) **63.** (B) **64.** (D)
65. (A) **66.** (C) **67.** (640) **68.** (12)
69. (A) **70.** (288)

NSEP PYQ

1. (C, D) **2.** (B) **3.** (C) **4.** (A, B, C)
5. (C) **6.** (C) **7.** (B) **8.** (A)
9. (D) **10.** (B) **11.** (C, D) **12.** (C)
13. (B, D) **14.** (C) **15.** (A) **16.** (B)
17. (A, C, D) **18.** (D) **19.** (B) **20.** (D)
21. (A, C, D) **22.** (C) **23.** (D) **24.** (C)
25. (B) **26.** (A, C, D) **27.** (A) **28.** (B)
29. (B) **30.** (D) **31.** (A, C, D) **32.** (B, C)
33. (D) **34.** (D) **35.** (D) **36.** (B)
37. (D) **38.** (B)

JEE ADVANCED PYQ

1. (B) **2.** (A) **3.** $-\frac{1}{4\pi\varepsilon_0}\frac{q^2}{a}\cdot\frac{4}{\sqrt{6}}[3\sqrt{3}-3\sqrt{6}-\sqrt{2}]$

4. (a) K.E. $=\frac{P}{4\pi\varepsilon_0}\frac{Q}{d^2}$; (b) $\frac{QP}{2\pi\varepsilon_0 d^3}$ along positive x-axis

5. (C) **6.** (D) **7.** $\frac{(\sigma_1-\sigma_2)Qa}{2\sqrt{2}\varepsilon_0}$ **8.** (C)

9. (D) **10.** $V'=\left(\frac{a}{3t}\right)^{1/3}V$ **11.** (A, B, C, D) **12.** (A)

13. (D) **14.** (B) **15.** (C) **16.** (C)

17. (A) **18.** (B) **19.** (C) **20.** (A)

21. (B) **22.** (A) **23.** (2) **24.** (A)

25. (D) **26.** (A, D) **27.** (C) **28.** (A, B, C, D)

29. (A) **30.** (C or C, D) **31.** (C) **32.** (D)

33. (A, C, D) **34.** (6) **35.** (A, B, C) **36.** (B, D)

37. (C, D) **38.** (C) **39.** (C) **40.** (A)

41. (6) **42.** (C) **43.** (D) **44.** (A, D)

45. (B, C) **46.** (A, B) **47.** (A, B) **48.** (B)

49. (C) **50.** (B, C, D) **51.** (A, C) **52.** (6.40)

53. (B, C) **54.** (02) **55.** (A, C) **56.** R = 1.732

57. (3) **58.** (A) **59.** (B) **60.** (B, D)

Advanced & Olympiad Challenger Questions

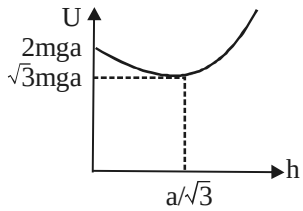
1. zero **2.** $\sqrt{\frac{\lambda q}{2\varepsilon_0 m}}$ **3.** $H_2 = h_1 + h_2 - g\left(\frac{\ell}{v}\right)^2$

4. $W_{\text{first step}} = \left(\frac{8}{3} - \frac{4}{\sqrt{5}}\right)\frac{Kq^2}{r}$, $W_{\text{second step}} = 0$, $W_{\text{total}} = 0$ **5.** $\sqrt{4\pi\varepsilon_0 Ka}$

6. $\lambda R E_0 \hat{i}$ **7.** $-\frac{4kq}{\pi R^2}\hat{i}$ **8.** $\frac{Qq}{2\pi\varepsilon_0 L}$ **9.** **2**

10. $\left[\frac{2KQq}{mR}\left(\frac{r-R}{r}+\frac{3}{8}\right)\right]^{1/2}$ **11.** $\sqrt{\frac{6\sqrt{2}\,mr\varepsilon_0}{e_\rho a}}$

12. (a) $H = \frac{4a}{3}$ (b) $U = mg\left[2\sqrt{h^2+a^2} - h\right]$ equilibrium at $h = \frac{a}{\sqrt{3}}$



13. (c) $\left(\frac{kQr}{R^3}\right)\left(\frac{4R-3r}{R}\right)$

14. $v_0 = 3$ m/s.; K.E. at the origin $= (27 - 10\sqrt{6}) \times 10^{-4}$ J approx 2.5×10^{-4} J

16. **5** **17.** No

18. $\oint \vec{E}.d\vec{A} = \frac{\Sigma q_{in}}{\varepsilon_0}$

E.A = Zero

for equipotential E A $\Rightarrow$ E = Zero

$\Rightarrow$ Volume inside ie equipotential

19. The total charge enclosed by a surface is zero, does not imply that the electric field everywhere on the surface is zero, it means only net flux is zero. If the electric field everywhere on a surface is zero, implies that net flux through the surface is zero, that means charge inside the surface is zero.

20. $E_{O_1} = \frac{7\rho R}{12 \in_0}$

OLYMPIAD WALLAH

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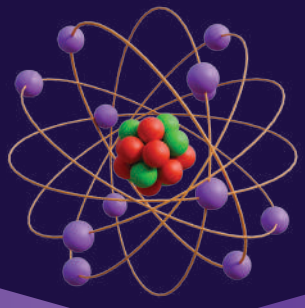

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