

MGMs JUNIOR COLLEGE

Electrostatics

60 min

XII PHYSICS ASSIGNMENT 1

Marks : 30

1) An electric dipole placed with its axis in the direction of a uniform electric field experiences

- A) a force but no torque
B) a torque but no force
C) a force as well as a torque
D) neither a force nor a torque.

2) An electric dipole placed with its axis inclined at an angle to the direction of a uniform electric field experiences

- A) a force but no torque
B) a torque but no force
C) a force as well as a torque
D) neither a force nor a torque

3) An electric dipole placed in a non-uniform electric field experiences

- A) a force but no torque
B) a torque but no force
C) a force as well as a torque
D) neither a force nor a torque.

4) A cube of side b has a charge q at each of its vertices. What is the electric potential at the centre of the cube?

- A) $\frac{4q}{\sqrt{3}\pi\epsilon_0 b}$ B) $\frac{\sqrt{3}q}{\pi\epsilon_0 b}$ C) $\frac{2q}{\pi\epsilon_0 b}$ D) zero

5) In A cube of side b has a charge q at each of its vertices., the electric field at the centre of the cube is

- A) $\frac{4q}{3\pi\epsilon_0 b^2}$ B) $\frac{3q}{\pi\epsilon_0 b^2}$ C) $\frac{2q}{\pi\epsilon_0 b^2}$ D) zero

6) In Two point charges $-q$ and $+q$ are located at points $(0, 0, -a)$ and $(0, 0, a)$ respectively., how much work is done in moving a small test charge q_0 from point $(5, 0, 0)$ to a point $(-7, 0, 0)$ along the x -axis?

- A) $\frac{5}{7} \times \frac{q_0 q}{4\pi\epsilon_0 a}$ B) $\frac{7}{5} \times \frac{q_0 q}{4\pi\epsilon_0 a}$ C) $\frac{2}{12} \times \frac{q_0 q}{4\pi\epsilon_0 a}$ D) Zero

7) In a hydrogen atom, the electron and the proton are bound together at a separation of about $0.53 \text{ \AA}$. If the zero of potential energy is taken at an infinite separation of the electron– proton system, the potential energy of the electron– proton system is

- A) -54.4 eV B) -27.2 eV C) -13.6 eV D) zero

8) A positive charge $(+q)$ is located at the centre of a circle as shown in Fig. W_1 is the work done in taking a unit positive charge from A to B and W_2 is the work done in taking the same charge from A to C. Then

- A) $W_1 > W_2$ B) $W_1 < W_2$
C) $W_1 = W_2$ D) $W_1 = W_2 = 0$

9) Two concentric spheres of radii r_1 and r_2 carry charges q_1 and q_2 respectively. If the surface charge density (σ) is the same for both spheres, the electric potential at the common centre will be

- A) $\frac{\sigma}{\epsilon_0} \cdot \frac{r_1}{r_2}$ B) $\frac{\sigma}{\epsilon_0} \cdot \frac{r_2}{r_1}$ C) $\frac{\sigma}{\epsilon_0} (r_1 - r_2)$ D) $\frac{\sigma}{\epsilon_0} (r_1 + r_2)$

10) The magnitude of the electric field on the surface of a sphere of radius r having a uniform surface charge density σ is

- A) $\frac{\sigma}{\epsilon_0}$ B) $\frac{\sigma}{2\epsilon_0}$ C) $\frac{\sigma}{\epsilon_0 r}$ D) $\frac{\sigma}{2\epsilon_0 r}$

11) A point charge $+q$ is placed at the mid point of a cube of side L . The electric flux emerging from the cube is

- A) $\frac{q}{\epsilon_0}$ B) zero C) $\frac{6qL^2}{\epsilon_0}$ D) $\frac{q}{6L^2\epsilon_0}$

12) A solid conducting sphere having a charge Q is surrounded by an uncharged concentric conducting hollow spherical shell. The potential difference between the surface of the solid sphere and the outer surface of the hollow shell is V . If the shell is now given a charge of $-3Q$, the new potential difference between the same two surfaces is

- A) V B) $2V$ C) $4V$ D) $-2V$

13) An electron of mass m_e , initially at rest, moves through a certain distance in a uniform electric field in time t_1 . A proton of mass m_p , also initially at rest, takes time t_2 to move through an equal distance in this uniform electric field. Neglecting the effect of gravity, the ratio t_2/t_1 is nearly equal to

- A) 1 B) $\left(\frac{m_p}{m_e}\right)^{1/2}$ C) $\left(\frac{m_e}{m_p}\right)^{1/2}$ D) 1836

14) A metallic solid sphere is placed in a uniform electric field. In Fig. , which path will the lines of force follow? IIT, 1996

- A) 1 B) 2 C) 3 D) 4

15) Three charges Q , $+q$ and $+q$ are placed at the vertices of a right-angled isosceles triangle as shown in Fig. The net electrostatic energy of the configuration is zero if Q is equal to IIT, 2000

- A) $\frac{-q}{1 + \sqrt{2}}$ B) $\frac{-2q}{2 + \sqrt{2}}$ C) $-2q$ D) $+q$

16) Eight dipoles of charges of magnitude e are placed inside a cube. The total electric flux coming out of the cube will be

- A) $\frac{8e}{\epsilon_0}$ B) $\frac{16e}{\epsilon_0}$ C) $\frac{e}{\epsilon_0}$ D) zero

17) A point Q lies on the perpendicular bisector of electrical dipole of dipole moment p . If the distance of Q from the dipole is r (much larger than the size of the dipole), then the electric field at Q is proportional to

- A) p^{-1} and r^{-1} B) p and r^{-2} C) p^2 and r^{-3} D) p and r^{-3}

18) A particle of mass m and charge q is released from rest in a uniform electric field E . The kinetic energy attained by the particle after moving a distance x is

- A) qEx^2 B) qE^2x C) qEx D) q^2Ex

19) A charge Q is given to a hollow metallic sphere of radius R . The electric potential at the surface of the sphere is

- A) zero B) $\frac{1}{4\pi\epsilon_0} \cdot \frac{Q}{R}$ C) $\frac{1}{4\pi\epsilon_0} \cdot \frac{Q}{R^2}$ D) $4\pi\epsilon_0 \cdot \frac{Q}{R}$

20) In a charge Q is given to a hollow metallic sphere of radius R , the potential at a distance r from the centre of the sphere where $r < R$ is

- A) zero B) $\frac{1}{4\pi\epsilon_0} \cdot \frac{Q}{R-r}$ C) $\frac{1}{4\pi\epsilon_0} \cdot \frac{Q}{R+r}$ D) $\frac{4\pi\epsilon_0 Q}{R-r}$

21) The electric potential V at any point (x, y, z) in space is given by $V = 4x^2$ volt where x, y and z are all in metre. The electric field at the point $(1\text{m}, 0, 2\text{m})$ in Vm^{-1} is

- A) 8 along negative x-axis B) 8 along positive x-axis
C) 16 along negative x-axis D) 16 along positive x-axis

22) Two spheres of radii r and R carry charges q and Q respectively. When they are connected by a wire, there will be no loss of energy of the system if

- A) $qr = QR$ B) $qR = Qr$ C) $qr^2 = QR^2$ D) $qR^2 = QR^2$

23) Three equal point charges q are placed at the corners of an equilateral triangle. Another charge Q is placed at the centroid of the triangle. The system of charges will be in equilibrium if Q equals

- A) $\frac{q}{\sqrt{3}}$ B) $-\frac{q}{\sqrt{3}}$ C) $\frac{q}{3}$ D) $-\frac{q}{3}$

24) A metallic sphere A of radius a carries a charge Q . It is brought in contact with an uncharged sphere B of radius b . The charge on sphere A now will be

- A) $\frac{aQ}{b}$ B) $\frac{bQ}{a}$ C) $\frac{bQ}{a+b}$ D) $\frac{aQ}{a+b}$

25) A quantity X is given by $\epsilon_0 L \frac{\Delta V}{\Delta t}$ where ϵ_0 is the permittivity of free space, L is a length, ΔV is a potential difference and Δt is a time interval. The dimensional formula for X is the same as that of **IIT, 2001**

- A) resistance B) charge C) voltage D) current

26) A uniform electric field pointing in positive x -direction exists in a region. Let A be the origin, B be the point on the x -axis at $x = +1$ cm and C be the point on the y -axis at $y = +1$ cm. Then the potentials at the points A, B and C satisfy:

- A) $V_A < V_B$ B) $V_A > V_B$ C) $V_A < V_C$ D) $V_A > V_C$

27) A metallic sphere of radius R is charged to a potential V . The magnitude of the electric field at a distance r ($> R$) from the center of the sphere is

- A) $\frac{V}{r}$ B) $\frac{Vr}{R^2}$ C) $\frac{VR}{r^2}$ D) zero

28) Positive and negative point charges of equal magnitude are kept at $\left(0, 0, \frac{a}{2}\right)$ and $\left(0, 0, -\frac{a}{2}\right)$

respectively. The work done by the electric field when another positive point charge is moved from $(-a, 0, 0)$ to $(0, a, 0)$ is **[IIT, 2007]**

- A) positive

B) negative

C) zero

D) depends on the path connecting the initial and final positions

29) An α -particle is travelling to its right with 1.5 kms^{-1} . What uniform magnetic field be applied so that it starts moving with same speed to its left after $2.65 \mu\text{s}$?

- A) 2.35 N/C toward left B) 23.5 NC^{-1} toward left

- C) 23.5 NC^{-1} toward left D) 2.35 NC^{-1} toward left

30) A charge $+q$ is placed $(a, 0, 0)$ and another $+q$ charge is placed at $(-a, 0, 0)$. A charge $-q$ is placed at the origin. If it is slightly displaced along y -axis, then

- A) it will move away
B) it will oscillate but not SHM
C) it will execute SHM
D) it will stand at the displaced position.