



NEET — JEE MAINS - ADVANCED

Chapter 1 : Electric Charges and Fields (50 Important MCQs)

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Notes

50 important MCQs from GSEB, CBSE, NEET and JEE exams • Answer key at the end

Section A — Multiple Choice Questions

Each question carries 4 marks. Choose the correct option.

Q.1 A charged oil drop is suspended in a uniform field of 3×10^4 V/m so that it neither falls nor rises. The charge on the drop will be (Take mass of the drop = 9.9×10^{-15} kg and $g = 10$ m/s²)

- (A) 3.3×10^{-18} C (B) 3.2×10^{-18} C (C) 1.6×10^{-18} C (D) 4.8×10^{-18} C

Q.2 A charged ball B hangs from a silk thread S, which makes an angle θ with a large charged conducting sheet P (the sheet is vertical). The surface charge density σ of the sheet is proportional to

- (A) $\cos \theta$ (B) $\tan \theta$ (C) $\sin \theta$ (D) $\cot \theta$

Q.3 Two point charges $+8q$ and $-2q$ are located at $x = 0$ and $x = L$ respectively. The point on the X-axis at which the net electric field is zero is

- (A) $4L$ (B) $8L$ (C) $L/4$ (D) $2L$

Q.4 The graph of electric field $E(r)$ against the distance r from the centre of a body shows E increasing linearly from zero up to a certain radius, and then decreasing (as $1/r^2$). So the body should be

- (A) a solid conductor having electric charge.
(B) a solid sphere having uniform volume charge density.
(C) a solid body only.
(D) a solid body conductor.

Q.5 Two spheres, each of charge $+q$, are connected with a non-conducting string of length $2a$. What would be the tension in the string? (Neglect gravity)

- (A) $\frac{q^2}{4\pi\epsilon_0 a^2}$ (B) $\frac{q^2}{8\pi\epsilon_0 a^2}$ (C) $\frac{q^2}{16\pi\epsilon_0 a^2}$ (D) $\frac{q^2}{32\pi\epsilon_0 a^2}$

Q.6 Suppose $[\epsilon_0]$ is the dimensional formula of the permittivity of free space. If M = mass, L = length, T = time and A = electric current, then

- (A) $[\epsilon_0] = [M^{-1}L^{-3}T^2A]$ (B) $[\epsilon_0] = [M^{-1}L^{-3}T^4A^2]$
(C) $[\epsilon_0] = [M^{-1}L^2T^{-1}A^{-2}]$ (D) $[\epsilon_0] = [M^{-1}L^2T^{-1}A]$

Q.7 Find the electric field at a point P on the perpendicular bisector of a uniformly charged thin wire of length l carrying charge Q . The distance of P from the centre of the rod is $a = \frac{\sqrt{3}l}{2}$.

- (A) $\frac{Q}{2\sqrt{3}\pi\epsilon_0 l^2}$ (B) $\frac{Q}{\sqrt{3}\pi\epsilon_0 l^2}$ (C) $\frac{Q}{2\sqrt{2}\pi\epsilon_0 l^2}$ (D) $\frac{Q}{2\pi\epsilon_0 l^2}$



Q.8 If $\vec{E} = \frac{3}{5}\hat{i} + \frac{4}{5}\hat{j}$ (in N/C), find the electric flux through an area of 0.4 m^2 parallel to the y-z plane.

- (A) $0.12 \text{ N m}^2/\text{C}$ (B) $0.24 \text{ N m}^2/\text{C}$ (C) $0.36 \text{ N m}^2/\text{C}$ (D) $0.48 \text{ N m}^2/\text{C}$

Q.9 A vertical electric field of magnitude $4.9 \times 10^5 \text{ N/C}$ just prevents a water droplet of mass 0.1 g from falling. The value of charge on the droplet will be (Given $g = 9.8 \text{ m/s}^2$)

- (A) $1.6 \times 10^{-9} \text{ C}$ (B) $2.0 \times 10^{-9} \text{ C}$ (C) $3.2 \times 10^{-9} \text{ C}$ (D) $0.5 \times 10^{-9} \text{ C}$

Q.10 A positively charged particle of 100 mg is thrown opposite to a uniform electric field of strength $1 \times 10^5 \text{ N C}^{-1}$. If the charge on the particle is $40 \mu\text{C}$ and the initial velocity is 200 m s^{-1} , how much distance will it travel before coming to rest momentarily?

- (A) 1 m (B) 5 m (C) 10 m (D) 0.5 m

Q.11 Two point charges $4q_0$ and $-q_0$ are separated by a distance r . Find the distance from $4q_0$ where the net electric field is zero.

- (A) $4r$ (B) $3r$ (C) $r/2$ (D) $2r$

Q.12 A $10 \mu\text{C}$ charge is divided into two parts and placed 1 cm apart so that the repulsive force between them is maximum. The charges of the two parts are

- (A) $9 \mu\text{C}, 1 \mu\text{C}$ (B) $5 \mu\text{C}, 5 \mu\text{C}$ (C) $7 \mu\text{C}, 3 \mu\text{C}$ (D) $8 \mu\text{C}, 2 \mu\text{C}$

Q.13 Two charges $5Q$ and $-2Q$ are situated at the points $(3a, 0)$ and $(-5a, 0)$ respectively. The electric flux through a sphere of radius $4a$ having its centre at the origin is

- (A) $\frac{2Q}{\epsilon_0}$ (B) $\frac{5Q}{\epsilon_0}$ (C) $\frac{7Q}{\epsilon_0}$ (D) $\frac{3Q}{\epsilon_0}$

Q.14 Two charges q and $3q$ are placed at a distance r from each other. Find the distance from q where the electric field is zero.

- (A) $\frac{r}{\sqrt{3}+1}$ (B) $\frac{r}{2}$ (C) $\frac{r}{\sqrt{3}-1}$ (D) $\frac{2r}{3}$

Q.15 The electric field at the centre O of a semicircle of radius a having linear charge density λ is [CBSE PMT 2000]

- (A) $\frac{2\lambda}{\epsilon_0 a}$ (B) $\frac{\lambda\pi}{\epsilon_0 a}$ (C) $\frac{\lambda}{2\pi\epsilon_0 a}$ (D) $\frac{\lambda}{\pi\epsilon_0 a}$

Q.16 The electric intensity due to a dipole of length 10 cm , having a charge of $500 \mu\text{C}$, at a point on its axis at a distance of 20 cm from one of the charges in air is

- (A) $6.25 \times 10^7 \text{ N/C}$ (B) $9.28 \times 10^7 \text{ N/C}$ (C) $13.1 \times 10^{11} \text{ N/C}$ (D) $20.5 \times 10^7 \text{ N/C}$

Q.17 The electric field in a certain region is acting radially outward and is given by $E = Ar$. The charge contained in a sphere of radius a centred at the origin of the field will be given by

- (A) $4\pi\epsilon_0 Aa^2$ (B) $A\epsilon_0 a^2$ (C) $4\pi\epsilon_0 Aa^3$ (D) $\epsilon_0 Aa^3$

Q.18 An electric dipole is at 30° with a uniform electric field of $2 \times 10^5 \text{ N/C}$. The torque acting on it is 4 N m . If the length of the dipole is 2 cm , what will be the charge at one end of the dipole?

- (A) 5 mC (B) $7 \mu\text{C}$ (C) 8 mC (D) 2 mC

Q.19 Suppose the proton and electron have slightly different charges: one has $-e$ and the other $(e + \Delta e)$. Two hydrogen atoms are at a very large distance compared with their radii. If the resultant of electric force and gravitational force is zero, then the magnitude of Δe is of the order of (Mass of hydrogen $m_h = 1.67 \times 10^{-27} \text{ kg}$)

- (A) 10^{-23} C (B) 10^{-37} C (C) 10^{-47} C (D) 10^{-20} C

Q.20 Two parallel infinite line charges with linear charge densities $+\lambda \text{ C/m}$ and $-\lambda \text{ C/m}$ are placed at a distance of $2R$ in free space. What is the electric field midway between the two line charges?

- (A) $\frac{\lambda}{2\pi\epsilon_0 R} \text{ N/C}$ (B) zero (C) $\frac{2\lambda}{\pi\epsilon_0 R} \text{ N/C}$ (D) $\frac{\lambda}{\pi\epsilon_0 R} \text{ N/C}$

Q.21 A spherical conductor of radius 10 cm has a charge of 3.2×10^{-7} C distributed uniformly. What is the magnitude of the electric field at a point 15 cm from the centre of the sphere? $\left(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ N m}^2/\text{C}^2\right)$

- (A) $1.28 \times 10^5 \text{ N/C}$ (B) $1.28 \times 10^6 \text{ N/C}$ (C) $1.28 \times 10^7 \text{ N/C}$ (D) $1.28 \times 10^4 \text{ N/C}$

Q.22 Two point charges $-q$ and $+q$ are placed at a distance L . The magnitude of electric field intensity at a distance R ($R \gg L$) varies as

- (A) $\frac{1}{R^4}$ (B) $\frac{1}{R^6}$ (C) $\frac{1}{R^2}$ (D) $\frac{1}{R^3}$

Q.23 The distance between two parallel conducting infinite plates is very small. Their charge densities are $+\sigma$ and $-\sigma$, with free space between the plates. If ϵ_0 is the permittivity, the electric field between the plates is

- (A) 0 V m^{-1} (B) $\frac{\sigma}{2\epsilon_0} \text{ V m}^{-1}$ (C) $\frac{\sigma}{\epsilon_0} \text{ V m}^{-1}$ (D) $\frac{2\sigma}{\epsilon_0} \text{ V m}^{-1}$

Q.24 Two parallel metal sheets have equal surface charge densities of opposite signs ($\sigma = 26.4 \times 10^{-12} \text{ C/m}^2$). The electric field between the sheets is

- (A) 1.5 N/C (B) $1.5 \times 10^{-10} \text{ N/C}$ (C) 3 N/C (D) $3 \times 10^{-10} \text{ N/C}$

Q.25 The electric field is proportional to for the case of an infinitely long wire.

- (A) $\frac{1}{r}$ (B) $\frac{1}{r^2}$ (C) $\frac{1}{r^3}$ (D) r^0

Q.26 A charge q is uniformly distributed over a ring of radius r . A sphere of the same radius r is placed such that its centre lies on the circumference of the ring. The flux coming out of the sphere is

- (A) $\frac{q}{\epsilon_0}$ (B) $\frac{q}{2\epsilon_0}$ (C) $\frac{q}{3\epsilon_0}$ (D) $\frac{q}{4\epsilon_0}$

Q.27 When air is replaced by a dielectric medium of constant K , the maximum force of attraction between two charges separated by a distance d

- (A) becomes K^2 times (B) becomes K^{-1} times (C) becomes K times (D) remains unchanged

Q.28 A circle of radius a has charge density given by $\lambda = \lambda_0 \cos^2 \theta$ on its circumference. What will be the total charge on the circle?

- (A) $\pi a \lambda_0$ (B) zero (C) $2\pi a$ (D) none of these

Q.29 If F is the force between two point charges submerged in a medium of dielectric constant K , then on withdrawing the medium, the force between the charges becomes

- (A) $F\sqrt{K}$ (B) FK (C) $\frac{F}{\sqrt{K}}$ (D) $\frac{F}{K}$

Q.30 Two point charges $+16 \mu\text{C}$ and $-9 \mu\text{C}$ are separated by a distance of 10 cm in air. The resultant electric field will be zero at a distance from the $-9 \mu\text{C}$ charge.

- (A) 30 cm (B) 20 cm (C) 10 cm (D) 40 cm

Q.31 The electric field produced by an infinitely long straight uniformly charged wire at a perpendicular distance of 2 cm is $3 \times 10^8 \text{ N C}^{-1}$. Then the linear charge density on the wire is ($k = 9 \times 10^9 \text{ SI unit}$)

- (A) $333 \mu\text{C/m}$ (B) $666 \mu\text{C/m}$ (C) $3.33 \mu\text{C/m}$ (D) $6.66 \mu\text{C/m}$

Q.32 When two spheres having charges $4Q$ and $-2Q$ are placed at a certain distance, the force acting between them is F . Now they are connected by a conducting wire and again separated from each other. Now they are kept at a distance half of the previous one. The force acting between them is (assume identical spheres)

- (A) F (B) $\frac{F}{4}$ (C) $\frac{F}{2}$ (D) $\frac{F}{8}$



Q.33 A $1\text{ }\mu\text{C}$ charge is placed on each of five vertices of a regular hexagon of side 1 m. The electric field at its centre is

- (A) $\frac{5}{6} \times 10^{-6}k$ (B) $5 \times 10^{-6}k$ (C) $\frac{6}{5} \times 10^{-6}k$ (D) $10^{-6}k$

Q.34 If an electric dipole is placed in a non-uniform electric field, then

- (A) resultant force on the dipole is 0. (B) torque on the dipole may be 0.
(C) resultant force on the dipole may be 0. (D) torque on the dipole is 0.

Q.35 Two point electric charges $+10^{-8}\text{ C}$ and -10^{-8} C are placed 0.1 m apart. Find the magnitude of the total electric field at the centre of the line joining the two charges.

- (A) $7.2 \times 10^4\text{ N C}^{-1}$ (B) $3.6 \times 10^4\text{ N C}^{-1}$ (C) zero (D) $12.96 \times 10^4\text{ N C}^{-1}$

Q.36 An electron falls through a distance of 1.5 cm in a uniform electric field of magnitude $2.0 \times 10^4\text{ N C}^{-1}$. Find the acceleration of the electron due to the electric field. [$e = 1.6 \times 10^{-19}\text{ C}$, $m_e = 9.1 \times 10^{-31}\text{ kg}$]

- (A) $2.90 \times 10^{19}\text{ m s}^{-2}$ (B) $3.52 \times 10^{15}\text{ m s}^{-2}$ (C) $1.67 \times 10^{27}\text{ m s}^{-2}$ (D) $6.62 \times 10^{34}\text{ m s}^{-2}$

Q.37 An electric dipole with dipole moment $4 \times 10^{-9}\text{ C m}$ is aligned at 30° with the direction of a uniform electric field of magnitude $5 \times 10^4\text{ N C}^{-1}$. The magnitude of the torque on the dipole is J.

- (A) 10^{-2} (B) 10^2 (C) 10^4 (D) 10^{-4}

Q.38 Consider a uniform electric field $\vec{E} = 3 \times 10^3\hat{k}\text{ N/C}$. The electric flux of this field through a square of 20 cm on a side whose plane is parallel to the yz plane is $\text{N m}^2/\text{C}$.

- (A) 90 (B) 120 (C) 60 (D) zero

Q.39 For an electric dipole, the angle between $\vec{E}$ and $\vec{p}$ at a point on the equatorial plane is

- (A) 90° (B) 180° (C) 0° (D) 45°

Q.40 The number of positive charges (in coulomb) in a cup having 180 g of water is

- (A) 1.34×10^7 (B) 1.34×10^6 (C) 0.963×10^7 (D) 0.963×10^6

Q.41 The electric force between an electron and a proton separated by a distance of 1 mm is $F_E = \dots\dots\text{ N}$.

$$\left[k = \frac{1}{4\pi\epsilon_0} \right]$$

- (A) $-10^{-6}ke^2$ (B) -10^6ke^2 (C) $-10^{-3}k^2e$ (D) $-10^{-3}ke^2$

Q.42 A uniformly charged conducting sphere of 2.4 m diameter has a surface charge density of $80\text{ }\mu\text{C m}^{-2}$. The charge on the sphere is mC.

- (A) 45.1 (B) 5.41 (C) 1.45 (D) 4.51

Q.43 How much charge should be placed on a spherical shell of radius 25 cm to have a surface charge density of $\frac{3}{\pi}\text{ C/m}^2$?

- (A) 0.25 C (B) 0.75 C (C) 0.57 C (D) 0.5 C

Q.44 The Coulombian repulsive force between two alpha particles kept at a distance of 3 cm in air is N.

- (A) 1.024×10^{-24} (B) 1.024×10^{-25} (C) 1.024×10^{-27} (D) 1.024×10^{-23}

Q.45 If an electric charge q is placed at the centre of a cube, then the flux associated with each surface of the cube is

- (A) $\frac{q}{\epsilon_0}$ (B) $\frac{q}{6\epsilon_0}$ (C) $\frac{q}{4\epsilon_0}$ (D) $\frac{q}{2\epsilon_0}$

Q.46 Two identical conducting spheres A and B, having charges $+q$ and $-q$, are kept d distance apart and experience a Coulombian force F between them. If 50% of the charge is transferred from sphere B to A, then the new Coulombian force between them is

- (A) F (B) $\frac{F}{2}$ (C) $\frac{F}{4}$ (D) $\frac{2F}{3}$



Q.47 Three equal charges $+q$ each are placed at the three vertices of an equilateral triangle. The electric field at the centroid of the triangle is

(A) $\frac{3kq}{r^2}$

(B) $\frac{kq}{r^2}$

(C) zero

(D) $\frac{\sqrt{3}kq}{2r^2}$

Q.48 If two infinite plane sheets having the same surface charge density σ are placed parallel to each other, then the electric field between the two sheets is

(A) zero

(B) $\frac{\sigma}{\epsilon_0}$

(C) $\frac{\sigma}{2\epsilon_0}$

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

Q.49 Charges $+q$ each are placed at the four vertices A, B, C, D of a square of side a (A and C are diagonally opposite, B and D are diagonally opposite). The Coulombian force acting on the charge placed at vertex D is

(A) $\left(\sqrt{2} + \frac{1}{2}\right) \frac{kq^2}{a^2}$

(B) $\left(\sqrt{2} - \frac{1}{2}\right) \frac{kq^2}{a^2}$

(C) $\frac{\sqrt{2}kq^2}{a^2}$

(D) $\frac{kq^2}{2a^2}$

Q.50 If a body contains 10^{24} electrons and 10^{26} protons, the total amount of charge on the body is C.

(A) 1.58×10^{-7}

(B) 1.58×10^7

(C) 1.6×10^{17}

(D) 1.6×10^{-17}

Answer Key

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