LOGIC BLOOM · JEE MAIN PHYSICS

Electrostatics *PYQ Practice*

Class 12 Physics · **JEE Main Previous-Year Pattern**

20 must-do questions with detailed solutions

20 MCQs | Full Chapter | Detailed Solutions

Logic Bloom
logicbloom.co.in

Understand through games.
Score through practice.

PART I · QUESTIONS

Electrostatics – 20 JEE Main MCQs

Single correct answer. Covers Coulomb's law, field, dipole, potential, Gauss's law and capacitors.

Attempt all 20 before checking the key. Target under 90 seconds per question, the JEE Main pace. Take g and constants as given.

Q1 COULOMB'S LAW

Two point charges of 2 μC and 3 μC are placed 30 cm apart in vacuum. The magnitude of the electrostatic force between them is:

A. 0.3 N

B. 0.6 N

C. 6 N

D. 0.06 N

Q2 COULOMB'S LAW

If the same two charges (2 μC, 3 μC, 30 cm apart) are now immersed in a medium of dielectric constant K = 2, the force becomes:

A. 0.6 N

B. 0.15 N

C. 1.2 N

D. 0.3 N

Q3 COULOMB'S LAW

The force between two charges is F. If the distance between them is halved and each charge is doubled, the new force is:

A 8F

B 2F

C 4F

D 16F

Q4 ELECTRIC FIELD

The electric field at a distance of 3 m from a point charge of 4 μC is:

A 1200 N/C

B 400 N/C

C 4000 N/C

D 3600 N/C

Q5 ELECTRIC FIELD

A charge of 4 μC experiences a force of 0.2 N when placed at a point in an electric field. The magnitude of the field there is:

A 8×10^{-7} N/C

B 5×10^{5} N/C

C 2×10^{4} N/C

D 5×10^{4} N/C

Q6 CONDUCTORS

The electric field inside a charged hollow conductor (away from any cavity charge), in electrostatic equilibrium, is:

A) Equal to the surface field

B) Directed radially inward

C) Zero everywhere inside

D) Maximum at the centre

Q7 DIPOLE

An electric dipole consists of charges ±2 μC separated by 3 cm. Its dipole moment is:

A) 6×10^{-6} C·m

B) 3×10^{-8} C·m

C) 2×10^{-8} C·m

D) 6×10^{-8} C·m

Q8 DIPOLE

For a short dipole, the ratio of the electric field on its axial line to that on its equatorial line, at equal distances, is:

A) 1 : 1

B) 4 : 1

C) 1 : 2

D) 2 : 1

Q9 DIPOLE

The torque on an electric dipole of moment p placed in a uniform field E is maximum when the angle between p and E is:

(A) $0°$
(B) $180°$
(C) $90°$
(D) $45°$

Q10 POTENTIAL

The electric potential at a distance of 0.2 m from a point charge of 5 μC is:

(A) 2.25×10^5 V
(B) 1.125×10^5 V
(C) 2.25×10^4 V
(D) 4.5×10^5 V

Q11 POTENTIAL

The work done in moving a charge of 2 μC through a potential difference of 100 V is:

(A) 200 J
(B) 2×10^{-4} J
(C) 2×10^{-2} J
(D) 2×10^{-6} J

Q12 POTENTIAL

The electric potential at the midpoint of the line joining the two equal and opposite charges of a dipole is:

(A) 2kq/a

(B) Zero

(C) Maximum

(D) kp/r^2

Q13 POTENTIAL

Two equipotential surfaces are separated by 2 cm and differ by 10 V. The average electric field between them (assumed uniform, perpendicular) is:

(A) 500 V/m

(B) 5 V/m

(C) 200 V/m

(D) 0.2 V/m

Q14 GAUSS'S LAW

A charge of 8.85 μC is enclosed by a closed surface. The net electric flux through the surface is (ε_0 = 8.85×10^{-12} $C^2\ N^{-1}\ m^{-2}$):

(A) 10^6 N m^2 C^{-1}

(B) 8.85 N m^2 C^{-1}

(C) 10^5 N m^2 C^{-1}

(D) 10^8 N m^2 C^{-1}

Q15 GAUSS'S LAW

A point charge Q is placed at the exact centre of a cube. The electric flux through one face of the cube is:

A $Q/8\varepsilon_0$

B $Q/6\varepsilon_0$

C Q/ε_0

D $6Q/\varepsilon_0$

Q16 GAUSS'S LAW

The electric field due to an infinitely long straight uniformly charged wire, at a perpendicular distance r, varies as:

A $1/r^2$

B independent of r

C $1/r$

D $1/r^3$

Q17 CAPACITORS

A parallel-plate capacitor has plates of area 100 cm^2 separated by 1 mm in air. Its capacitance is ($\varepsilon_0 = 8.85\times10^{-12}$ F/m):

A 8.85 pF

B 88.5 pF

C 44.25 pF

D 885 pF

Q18 CAPACITORS

The above capacitor (88.5 pF in air) is filled completely with a dielectric of constant $K = 5$. Its new capacitance is:

(A) 442.5 pF

(B) 88.5 pF

(C) 17.7 pF

(D) 1327.5 pF

Q19 CAPACITORS

Two capacitors of 2 μF and 3 μF are connected in series. Their equivalent capacitance is:

(A) 1.2 μF

(B) 5 μF

(C) 0.6 μF

(D) 6 μF

Q20 CAPACITORS

A capacitor of 2 μF is charged to a potential difference of 100 V. The energy stored in it is:

(A) 1 J

(B) 0.1 J

(C) 0.01 J

(D) 0.02 J

PART II · ANSWER KEY & SOLUTIONS

Detailed Solutions

Quick-check grid first, then full working for every question.

Q1 B	Q2 D	Q3 D	Q4 C	Q5 D	Q6 C	Q7 D	Q8 D	Q9 C	Q10 A	Q11 B	Q12 B
Q13 A	Q14 A	Q15 B	Q16 C	Q17 B	Q18 A	Q19 A	Q20 C				

Q1 Correct: B *0.6 N*

By Coulomb's law $F = kq_1q_2/r^2$ with $k = 9\times10^9$ N m² C⁻². Here $F = (9\times10^9)(2\times10^{-6})(3\times10^{-6})/(0.30)^2 = (9\times10^9)(6\times10^{-12})/0.09 = (54\times10^{-3})/0.09 =$ **0.6 N**. Convert cm to m before squaring, that is the usual slip.

Q2 Correct: D *0.3 N*

A medium of dielectric constant K reduces the Coulomb force by a factor K: $F_{medium} = F_{vacuum}/K$. So $F = 0.6/2 =$ **0.3 N**. The dielectric partially screens the charges, always weakening the force, never strengthening it.

Q3 Correct: D *16F*

$F \propto q_1q_2/r^2$. Doubling each charge multiplies the numerator by 2×2 = 4; halving r divides r^2 by 4, multiplying the force by 4. Total factor = 4×4 = **16**, so the new force is 16F. Track each dependence separately, then multiply.

Q4 Correct: C *4000 N/C*

$E = kQ/r^2 = (9\times10^9)(4\times10^{-6})/(3)^2 = (36\times10^3)/9 =$ **4000 N/C**, directed radially outward for a positive charge. Field falls off as $1/r^2$.

Q5 Correct: D *5×10⁴ N/C*

Electric field is force per unit charge: $E = F/q = 0.2/(4\times10^{-6}) =$ **5×10^4 N/C**. This is the operational definition of E and does not depend on how the field was produced.

Q6 Correct: C *Zero everywhere inside*

In electrostatic equilibrium the field inside the conducting material and inside a charge-free cavity is **zero**: any internal field would drive charges until it cancels. All excess charge resides on the outer surface. This is the basis of electrostatic shielding (Faraday cage).

Q7 Correct: D $6\times10^{-8}\,C\cdot m$

Dipole moment $p = q\times(2a)$, the charge times the separation: $p = (2\times10^{-6})(3\times10^{-2})$ = $\mathbf{6\times10^{-8}\ C\cdot m}$, directed from the negative to the positive charge. Use the full separation 2a, not half.

Q8 Correct: D *2 : 1*

Axial field $E_{axial} = 2kp/r^3$ and equatorial field $E_{equ} = kp/r^3$. Their ratio is **2 : 1**. Both fall as $1/r^3$ (faster than a point charge), but the axial field is always twice the equatorial field at the same distance.

Q9 Correct: C *90°*

Torque $\tau = pE\sin\theta$, which is maximum when $\sin\theta = 1$, i.e. θ = **90°** (dipole perpendicular to the field). At θ = 0° or 180° the torque is zero (equilibrium: stable at 0°, unstable at 180°).

Q10 Correct: A $2.25\times10^5\,V$

$V = kQ/r = (9\times10^9)(5\times10^{-6})/0.2 = (45\times10^3)/0.2$ = $\mathbf{2.25\times10^5\ V}$. Potential is a scalar and falls off as $1/r$ (slower than the field's $1/r^2$).

Q11 Correct: B $2\times10^{-4}\,J$

Work done by the external agent $W = q\Delta V = (2\times10^{-6})(100)$ = $\mathbf{2\times10^{-4}\ J}$. Potential difference is work per unit charge, so this follows directly and is independent of the path taken.

Q12 Correct: B *Zero*

At the midpoint the two charges are equidistant, and being equal and opposite their scalar potentials cancel: $V = kq/a + k(-q)/a$ = **0**. Note the field there is *not* zero, only the potential is. Potential is scalar, field is vector.

Q13 Correct: A *500 V/m*

For a uniform field, $E = \Delta V/d = 10/(2\times10^{-2})$ = **500 V/m**, pointing from the higher to the lower potential surface. The field is the negative gradient of potential, hence perpendicular to equipotentials.

Q14 Correct: A *$10^6\ N\ m^2\ C^{-1}$*

By Gauss's law the net flux depends only on the enclosed charge: $\Phi = Q_{enc}/\varepsilon_0 = (8.85\times10^{-6})/(8.85\times10^{-12})$ = **10^6 N m² C⁻¹**. The shape and size of the surface are irrelevant, only the enclosed charge counts.

Q15 Correct: B *$Q/6\varepsilon_0$*

Total flux through the cube is Q/ε_0. By symmetry it divides equally among the 6 faces, so each face gets **$Q/6\varepsilon_0$**. This symmetry shortcut is a JEE favourite. (If the charge sits at a corner, the fraction changes because it is shared among 8 cubes.)

Q16 Correct: C *1/r*

Using a cylindrical Gaussian surface, $E = \lambda/(2\pi\varepsilon_0 r)$, so $E \propto$ **1/r**. Compare: a point charge gives $1/r^2$, an infinite sheet gives a field independent of r. Recognising the geometry fixes the r-dependence instantly.

Q17 Correct: B *88.5 pF*

$C = \varepsilon_0 A/d$. With $A = 100\ cm^2 = 10^{-2}\ m^2$ and $d = 10^{-3}$ m: $C = (8.85\times10^{-12})(10^{-2})/(10^{-3}) = 8.85\times10^{-11}$ F = **88.5 pF**. Convert area to m^2 carefully ($1\ cm^2 = 10^{-4}\ m^2$).

Q18 Correct: A *442.5 pF*

Inserting a dielectric multiplies capacitance by K: C' = KC = 5×88.5 = **442.5 pF**. The dielectric increases capacitance because it reduces the field between the plates for the same charge.

Q19 Correct: A *1.2 μF*

In series $1/C_{eq} = 1/C_1 + 1/C_2 = 1/2 + 1/3 = 5/6$, so $C_{eq} = 6/5$ = **1.2 μF**. Series capacitance is always *less* than the smallest capacitor (contrast with resistors in series). In parallel these would give 5 μF.

Q20 Correct: C *0.01 J*

Energy stored $U = \frac{1}{2}CV^2 = \frac{1}{2}(2\times10^{-6})(100)^2 = \frac{1}{2}(2\times10^{-6})(10^4) =$ **0.01 J**. Equivalent forms are $U = \frac{1}{2}QV = Q^2/2C$, useful depending on which quantities are held constant.

KEEP GOING · ON THE APP

Don't just solve 20. *Master the whole chapter.*

You've worked the core electrostatics PYQs on paper. On the Logic Bloom app, every question you attempt is tracked, so you fix the exact mistakes you keep repeating and turn practice into marks.

- **Mistake Book** – every wrong answer auto-saved with the concept you missed, so revision is targeted, not random.
- **In-depth analysis** – topic-wise accuracy, speed, and weak-area breakdown after every session.
- **Play the chapter** – Electrostatics turned into games that make fields and potentials stick.
- **Unlimited JEE PYQs** – practice by topic with traps and predictions you won't find anywhere else.

Practice on the app →

logicbloom.co.in

Understand through games. Score through practice.

Logic Bloom

Understand through games. Score through practice.

`logicbloom.co.in`