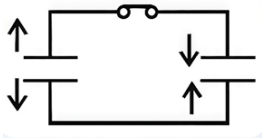
**18.** Two identical parallel plate capacitors are connected as shown in the figure. Initially one plate has total charge $q_o$ and separation between both plates is $x_o$. At an instant, plates of one capacitor begin to move towards each other and plates of the other capacitor away from each other. If velocity of a plate relative to the other in both the capacitors has the same magnitude v, find current (in A) in the circuit. (Given: $q_o$ = 1mC, $x_o$ = 1mm, v = 8m/s)



**OR**

A parallel plate capacitor A of capacitance $C$is charged by a battery to voltage $V$. The battery is disconnected and an uncharged capacitor B of capacitance $2C$is connected across A. Find the ratio of:

(i) final charges on A and B,

(ii) total electrostatic energy stored in A and B finally and that stored in A initially.

## SECTION D (5 MARKS)

**19.**

**a.** An electric dipole of dipole moment $\vec{P}$ consists of point charges +q and -q separated by a distance 2a. deduce the expression for $\vec{E}$ due to dipole at a distance x from the centre of dipole in axial line.

**b.** A thin metallic spherical shell of radius R carries a charge Q on its surface. A point charge of Q/2 is placed at its centre C. find the electric flux through the shell. Find the electric field at the centre of the shell.

**20.**

a. Derive an expression for the capacitance of a parallel plate capacitor with dielectric of constant k and thick ness t partially filled between the two plates.

b. A uniform electric field of 50 N $C^{-1}$is set up in a region along +$x$-axis. If the potential at the origin (0,0) is 220 V, find the potential at a point (4 m,3 m).

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# RK Academy

One Step Ahead To Your Success...

**Periodic Test - I Examination - 2026**

**CLASS-XII** **FM-40**

**SUB- PHYSICS** **TIME-1 HR 30MIN**

## SECTION A (1 MARK)

**1.** A unit Coulomb charge is one which when placed in air at a distance of 1 m from an equal and similar charge repel it with a force of

(a) 9 × $10^9$ N (b) 1 N (c) 1 dyne (d) None of these.

**2.** A hemisphere is uniformly charged positively. The electric field at a point on a diameter away from the centre is directed

(a) perpendicular to the diameter `(b) parallel to the diameter

(c) at an angle tilted towards the diameter

(d) at an angle tilted away from the diameter

**3.** An infinite number of charges each equal to 4 μC are placed along the X-axis at x = 1 m, x = 2 m, x = 4 m, x = 8 m, and so on, the Coulomb field at origin for all these charges is

(a) 4.8 x $10^3$ N/C (b) 4.8 x $10^4$ N/C (c) 4.8 × $10^5$ N/C (d) 4.8 x $10^6$ N/C

**4.** A point charge +q, is placed at a distance d from an isolated conducting plane. The field at a point P on the other side of the plane is

(a) directed radially towards the point charge

(b) directed radially away from the point charge

(c) directed perpendicular to the plane but towards the plane

(d) directed perpendicular to the plane and away from the plane

**5.** A parallel plate capacitor is charged to V volt by a battery. The battery is disconnected and the separation between the plates is halved. The new potential difference across the capacitor will be

(a) V (b) V/2 (c) 2V (d) V/4

**6.** The electric potential V at any point (x, y, z) is given V = 3x where x is in metres and V in volts. The electric field at the point (1 m, 0, 2 m) is

(a) 6 V/m along - x-axis (b) 6 V/m along + x-axis

(c) 1.5 V/m along - x-axis (d) 1.5 V/m along + x-axis

**7.** Equipotential surfaces

(a) are closer in regions of large electric fields compared to regions of lower electric fields.

(b) will be more crowded near sharp edges of a conductor.

(c) will be more crowded near regions of large charge densities.

(d) will always be equally spaced

**8.** Equipotential at a great distance from a collection of charges whose total sum is not zero are approximately

(a) spheres (b) planes (c) paraboloids (d) ellipsoids

**9.** Assertion (A): When a body acquires negative charge, its mass decreases.

Reason (R): A body acquires positive charge when it gains electrons.

(a) Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect

**10.** Assertion (A): The capacitance of a parallel plate capacitor increases when a dielectric constant of medium is filled between the plates.

Reason (R): Capacitance of a parallel plate capacitor is directly proportional to dielectric constant of medium between the plates

a. Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

b. Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

c. If the Assertion is correct but Reason is incorrect.

d. If both the Assertion and Reason are incorrect

**SECTION B (2 MARKS)**

**11.** Three charges +2μC, -2μC and +3μC are paced at three corner of an equilateral triangle of side 1m. find net force on +3μC.

**OR**

Obtain an expression for the electrostatic potential energy of a system of three charges $q$, $2q$and $-3q$ placed at the vertices of an equilateral triangle of side $a$.

**12.** State Gauss law. Use it to derive electric field at a point r from a non-conducting sheet of density $\sigma$

**13.** Why work done in moving a charge on a equipotential surface is zero. Show that electric field lines are always perpendicular to equipotential surface.

**OR**

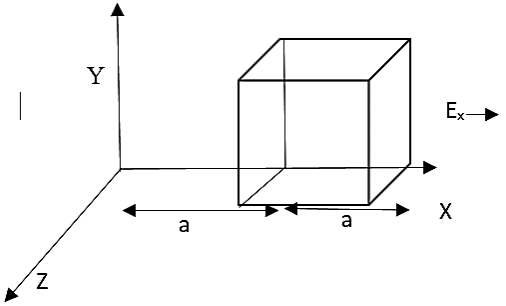
Obtain the expression for potential at distance r due to point charge q.

**14.** Two small conducting balls A and B of radii $r_1$and $r_2$have charges $q_1$and $q_2$ respectively. They are connected by a wire. Obtain the expression for charges on A and B in equilibrium.

**SECTION C (3 MARKS)**

**15.** If a dipole is kept in a uniform electric field $E$ then find the expression for torque. Diagrammatically represent the position of the dipole in stable and unstable equilibrium. Write the expression for torque in both cases.

**16.** The electric field component in the figure shown are $E_x=\beta x^2$, $E_y=0$, $E_z=0$. Where $\beta$= 200 N/Cm. calculate the charge within the cube assuming a=0.2m




**OR**

Define electric flux through a surface. Give the significance of a Gaussian surface. A small spherical shell $S_1$has point charges $q_1 = -3\,\mu C$, $q_2 = -2\,\mu C$and $q_3 = 9\,\mu C$inside it. This shell is enclosed by another big spherical shell $S_2$. A point charge $Q$is placed in between the two surfaces $S_1$and $S_2$. If the electric flux through the surface $S_2$is four times the flux through surface $S_1$, find charge $Q$.

**17.** Obtain the expression for capacitance for a parallel plate capacitor placed at distance d and area of plates A with air inside it.