OBJECTIVE I

1. A charge Q is unifromly distributed over a large plastic plate. The electric field at a point P close to the centre of the plate is 10 V/m. If the plastic plate is replaced by a copper plate of the same geometrical dimensions and carrying the same charge Q, the electric field at the point P will become

(A) zero (B) 5 V/m (C*) 10 V/m (D) 20 V/m

Sol. **A**

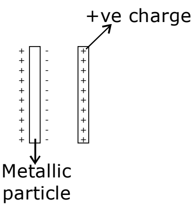
Electric field at centre of the plastic Platcis same as the centre of the copper plate.

2. A metallic particle having no net charge is placed near a finite metal plate carrying a positive charge. The electric force on the particle will be

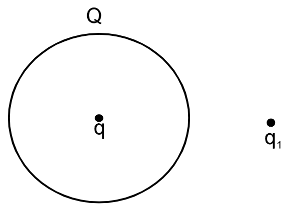
(A*) towards the plate (B) away from the plate (C) parallel to the plate (D) zero

Sol. **A**

Plase :- The electric force on the particle will be owards the plate. Because the distance bewteen attraction force is Less than the distance between repulsive force.
So attrctive Force > repulsive force.

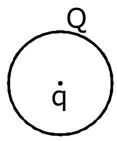


3. A thin, metallic spherical shell contains a chrage Q on it. A point charge q is placed at the centre of the shell and another charge q_1 is placed outside it as shown in fig. All the three charges are positive. The force on the charge at the centre is -



(A) towards left (B) towards right (C) upward (D*) zero

Sol. D

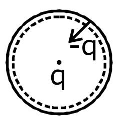


Electric field due to Q & q, inside the spherical shell is zero.

4. Consider the situation of the previous problem. The force on the centre charge due to the shell is

(A) towards left (B*) towards right (C) upward (D) zero

Sol. **B**



Force on the central charge due to shell is right $\frac{Kq^2}{r^2}$ towards.

5. Electric charges are distributed in a small volume. The flux of the electric field through a spherical surface of radius 10cm surrounding the total charge is 25 V-m. The flux over a concentric sphere of radius 20cm will be

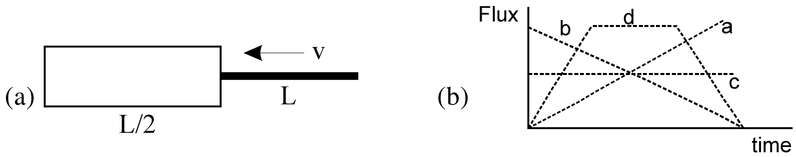
(A*) 25 V-m (B) 50 V-m (C) 100 V-m (D) 200 V-m

Sol. **A**

f is not depend on the shape & size of the closed volume surface.

q_m Þ q_m is the net charge inside the closed volume surface.

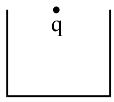
6. Fig. shows an imaginary cube of edge L/2. A unifromly charged rod of length L moves towards left at a small but constant speed v. At t = 0, the left end just touches the centre ot the face of the cube opposite it. Which of the graphs shown in fig. represents the flux of the electric filed through the cube at the rod goes through it ?)



Sol. **D**

Flux is constant with respect to time.

7. A charge q is placed at the centre of the open end of a cylindrical vessel as shown in fig. The flux of the electric field through the surface of the vessel is -

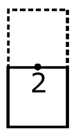


(A) zero (B) q/e_0 (C*) $q/2e_0$ (D) $2q/e_0$

Sol. **C**

In the charge ‘q’ in side closed cylinder, due to charge the flux of the electric field through the surface of the vessel is “q/e_0”. Here A charge q is placed at the centre of the open end of a cylindrical, By symmetricily Half line of flux goes outside & half flux line goes inside.

So we can say that the flux of the electric field through the surface of the vessel is “$q/2e_0$”.



OBJECTIVE II

1. Mark the correct options :

(A) Gausss's law is valid only for symmetrical charge distributions

(B) Gauss's law is valid only for charges placed in vacuum

(C) The electric field calculated by Gauss's law is the field due to the charges inside the Gaussian surface

(D*) The flux of the electric field through a closed surface due to all the charge is equal to the flux due to the charges enclosed by the surface.

Sol. D

The flux of the electric field through a closed surface due to all the charges is equal to the flux due to the charges enclosed by the surface.

2. A positive point charge Q is brought near an isolated metal cube.

(A) The cube becomes negatively charged

(B) The cube becomes positively charged

(C) The interior becomes positively charged and the surface becomes negatively charged.

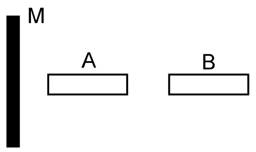
(D*) The interior becomes remains charged free and the surface gets nonuniform charge distribution.

Sol. D

A positive point charge Q is brought near an Isolated metal cube.

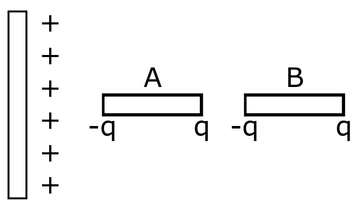
So charge distributed on the surface of Isolated metal is non uniformly and the interior remains charge free.

3. A large nonconducting sheet M is given a uniform charge density. Two uncharged small metal rods A and B are placed near the sheet as shown in fig.



(A*) M attracts A (B*) M attracts B (C*) A attracts B (D*) B attracts A

Sol. D



Charge distribution or M, A & B

So we can say that M attracts A, M attracts B, A attracts B and 'B' attracts A.

4. If flux of the electric field through a closed surface is zero,

(A) the electric field must be zero everywhere on the surface

(B*) the electric field may be zero everywhere in the surface

(C*) the charge inside the surface must be zero

(D) the charge in the vicinity of the surface must be zero.

Sol. BC

$$\phi = \frac{q_{inside}}{\epsilon_0} = \int \vec{E}.d\vec{s}$$

If the flux of the electric field through a closed surface is zero mean the Ne+ charge inside the surface must be zero or the electric field may be zero every where on the surface.

5. An electric dipole is placed at the cnetre of a sphere, Mark the correct options.

(A*) The flux of the electric filed through the sphere is zero

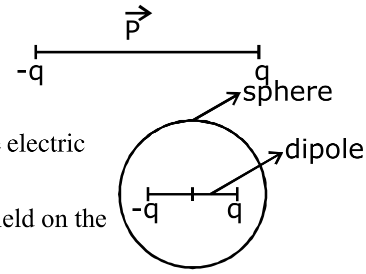
(B) The electric field is zero at every point of the sphere

(C*) The electic field is not zero anywhere on the sphere

(D) The electric field is zero on a circle on the sphere.

Sol. **AC**

$\therefore$ Net charge of electric dipole is always zero.

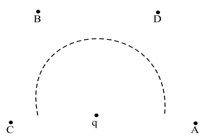


$\phi = \frac{q_{inside}}{\epsilon_0}$ Here inside = 0

The flux of the electric field through the sphere is zero. But the electric field is not zero any where on the sphere.

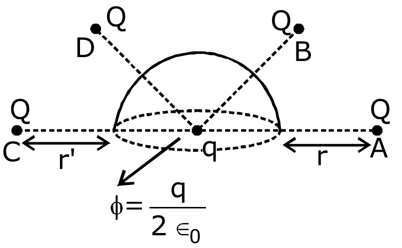
Take 'A' point any where on the sphere, and find the electric field on the surface. You will get non zero electric field on the sphere.

6. Figure (30-Q5) shows a charge q placed at the centre of a hemisphere. A second charge Q is placed at one of the positions A, B, C and D. In which position(s) of this second charge, the flux of the electric field through the hemisphere remains unchanged ?



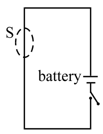
(A*) A (B) B (C*) C (D) D

Sol. AC



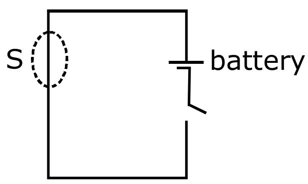
The flux of electric field through the hemishpere remains unchanged dur to 'A & C' point because these point lies on the line joining the centre of hemisphere.

7. A closed surface S is constructed around a conducting wire connected to a battery and a switch (fig.) As the switch is closed, the free electrons in the wire start moving along the wire. In any time interval, the number of electrons entering the closed surface S is equal to the number of electorns leaving it. On closing the switch, the flux of the electric field through the closed surface.



(A) is increased (B) is decreased (C*) remains unchanged (D*) remains zero

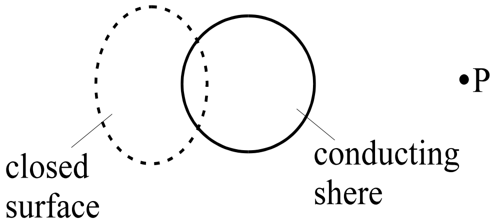
Sol. C



The flux of the electric field through the closed surface is remain unchanged.

Because the no. of electric field lines enter in the closed path = no. of electric field lines existsin the closed path.

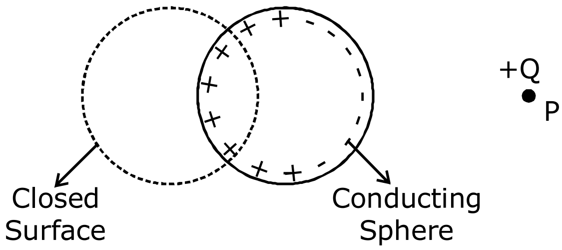
8. Fig. shows a closed surface which intersects a conducting sphere. If a positive charged is placed at the point P, the flux of the electic field through the closed surface



(A) will remain zero (B*) will become positive (C) will become neagative (D) will become undefined

Sol. **B**

Charge distribution :-



Due to charge distribution, intersection by the closed surface of conducting sphere containing the positive charge. So we can say that the flux of the electric field through the closed surface will become positive.

" $\therefore \quad \phi = \frac{q_{in}}{\epsilon_0} \Rightarrow +\text{ve}$ "