Questions

Q-12.1

The potential is constant throughout a given region of space. Is the electric field zero or non zero in this region? Explain.

Answer If in a given region of space, the potential is same. i.e $V_1 = V_2 = V$ (let)

Then Pot. difference $\Delta V = V_2 - V_1 =$ Zero.

According to relation

$$\Delta V = -E d$$

or

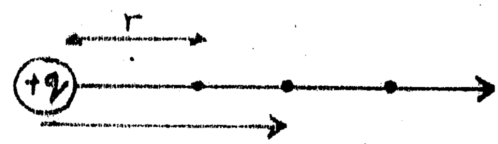
$$E = -\frac{\Delta V}{d} = -\frac{0}{d} = \text{Zero}$$

So in this region electric field will be zero.

Q-12.2 Suppose that you follow an electric field line due to a positive point charge. Do electric field and potential increase or decrease?

Answer:-

As we know that electric field intensity and electric potential at a pt. due to a positive point charge is given as



$$E = \frac{1}{4\pi\varepsilon_o}\frac{q}{r^2} \quad \text{and} \quad V = \frac{1}{4\pi\varepsilon_o}\frac{q}{r}$$

So $E \propto \frac{1}{r^2}$ and $V \propto \frac{1}{r}$

This shows that when we follow an electric field line then r increases due to which electric field intensity and electric potential will decrease.

Q-12.3 How can you identify that which plate of a capacitor is +vely charged?

Answer In order to check the electric field due to any type of charge we use a unit +ve charge as a test charge. If this test charge will move away from the plate it shows that plate is +vely charged.

Q-12.4 How the orbits of planets will be modified, if the planets were electrically charged?

Answer If the planets were electrically charged then the planet with most charge would be assumed the to be the centre charge of the orbit. All other planets which had smaller charge would start orbiting around this big charge centre in different radii.

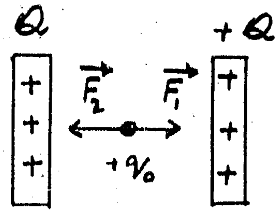
Q-12.5 Describe the force or forces on a positive point charge when placed between parallel plates

(a). with similar and equal charges.

(b). with opposite and equal charges.

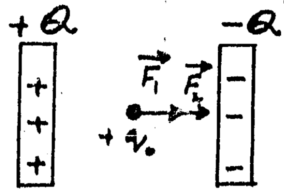
Answer:-

Case (a). When a +ve pt. charge is placed between similar and equal charged parallel plates, then this



charge will influence two forces of repulsion from each plate. These two forces will be same in magnitude but in opposite direction So resultant force on the charge will be zero. $\vec{F}_{result} = \vec{F_1} + \vec{F_2} = \vec{F} - \vec{F} =$ zero.

Case (b) When a +ve point charge is placed between two oppositely and equally charged plates, then this

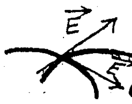


charge will be under the influence of two forces inwhich repulsive force by +vely charged plate and attractive force by -vely charged plate. Both forces will have same magnitude and direction. Hence resultant force will be sum of these forces i-e

$$\vec{F}_{resultant} = \vec{F_1} + \vec{F_2} = \vec{F} + \vec{F} = 2\vec{F}.$$

Q-12.6 Electric lines of force never cross. Why?

Answer Electric lines of force can never intersect each other, because electric intensity has only one value and direction at a given point. If field lines intersect each other then $\vec{E}$ could have more than one value and direction at that pt., which is impossible.



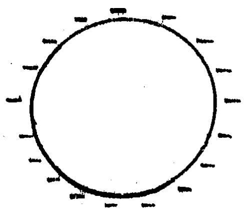
Q-12.7:- If a point charge 'q' of mass 'm' is released in a non-uniform electric field, will it make a rectilinear motion.

Answer :- A non-uniform field is always a curved line. Hence a point charge when placed in a non-uniform electric field will follow the field line.

Therefore its path will not be a straight line.

Q-12.8 :- Is $\vec{E}$ necessarily zero inside a charged rubber baloon if baloon is spherical? Assume that charge is distributed uniformly over the surface.

Answer :-



The electric intensity $\vec{E}$ in this case will be zero because

$$\Phi_e = \frac{q}{\epsilon_o}$$

Since no charge is enclosed by the baloon i.e $q = 0$ so $\Phi_e = 0$

and $\Phi_e = \vec{E}\cdot\vec{A} = 0$

Since $A \neq 0$ i.e

E = zero

Q-12.9 Is it true that Gauss's law states that the total number of lines of forces crossing any closed surface in the outward direction is proportional to the net +ve charge enclosed with in surface?

Answer According to Gauss's law

Total flux = $\frac{1}{\epsilon_o}$ (Total charge enclosed by the closed surface.)

i.e $\Phi_e = \frac{1}{\epsilon_o}(Q)$

$\Rightarrow \Phi_e \propto Q$

Hence flux passing through the closed surface is always equal to the positive charge enclosed by it. Lines of force will be radially moving away from closed surface containing the charge.

Q-12.10 Do electrons tend to go to region of high potential or of low potential?

Answer :-

Electrons will always move away from -vely charged plate (low potential) to positive charge plate (higher potential)