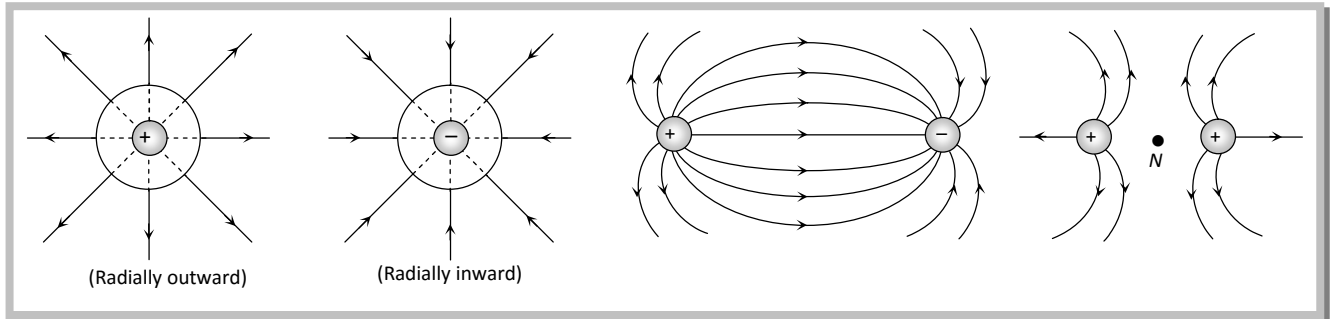


Electric Lines of Force.

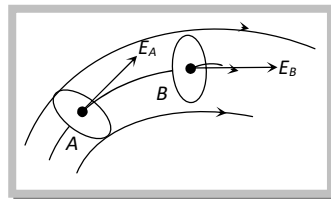
(1) **Definition:** The electric field in a region is represented by continuous lines (also called lines of force). Field line is an imaginary line along which a positive test charge will move if left free.

Electric lines of force due to an isolated positive charge, isolated negative charge and due to a pair of charge are shown below



(2) Properties of electric lines of force

- (i) Electric field lines come out of positive charge and go into the negative charge.
- (ii) Tangent to the field line at any point gives the direction of the field at that point.

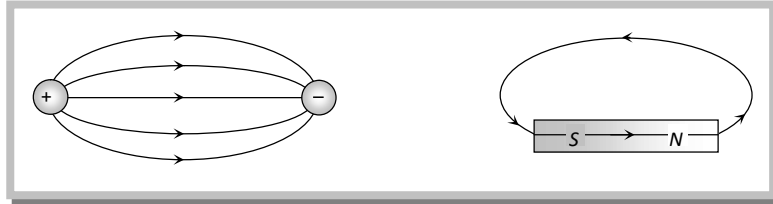


- (iii) Field lines never cross each other.
- (iv) Field lines are always normal to conducting surface.

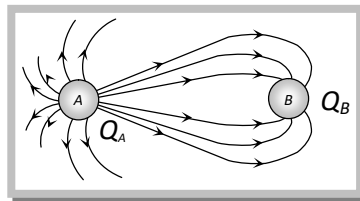


(v) Field lines do not exist inside a conductor.

(vi) The electric field lines never form closed loops. (While magnetic lines of forces form closed loop)

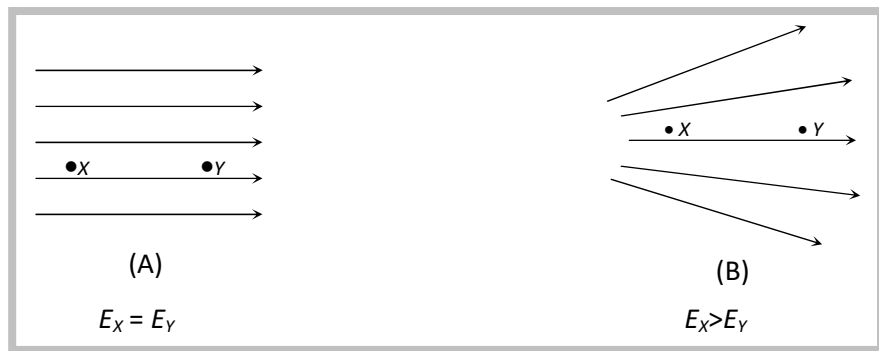


(vii) The number of lines originating or terminating on a charge is proportional to the magnitude of charge. In the following figure electric lines of force are originating from A and terminating at B hence Q_A is positive while Q_B is negative, also number of electric lines at force linked with Q_A are more than those linked with Q_B hence $|Q_A| > |Q_B|$



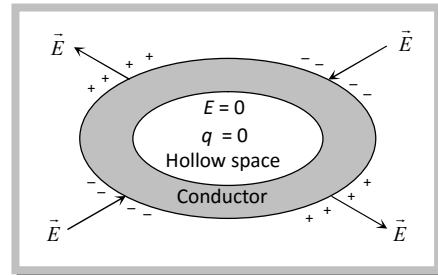
(viii) Number of lines of force per unit area normal to the area at a point represents magnitude of intensity (concept of electric flux i.e. $\phi = EA$)

(ix) If the lines of forces are equidistant and parallel straight lines the field is uniform and if either lines of force are not equidistant or straight line or both the field will be non-uniform, also the density of field lines is proportional to the strength of the electric field. For example see the following figures.



(3) **Electrostatic shielding:** Electrostatic shielding/screening is the phenomenon of protecting a certain region of space from external electric field. Sensitive instruments and appliances are affected seriously with strong external electrostatic fields. Their working suffers and they may start misbehaving under the effect of unwanted fields.

The electrostatic shielding can be achieved by protecting and enclosing the sensitive instruments inside a hollow conductor because inside hollow conductors, electric fields is zero.



(i) It is for this reason that it is safer to sit in a car or a bus during lightning rather than to stand under a tree or on the open ground.

(ii) A high voltage generator is usually enclosed in such a cage which is earthen. This would prevent the electrostatic field of the generator from spreading out of the cage.

(iii) An earthed conductor also acts as a screen against the electric field. When conductor is not earthed field of the charged body C due to electrostatic induction continues beyond AB. If AB is earthed, induced positive charge neutralizes and the field in the region beyond AB disappears.

