Electric Dipole

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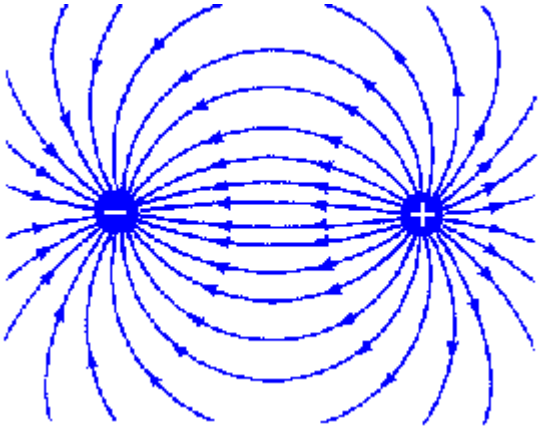
Introduction to Electric Dipole



An **electric dipole** is a separation of positive and negative charges. The simplest example of this is a pair of electric charges of equal magnitude but opposite sign, separated by some (usually small) distance. Dipoles can be characterized by their dipole moment, which is a vector quantity. For the simple electric dipole given above, theelectric dipole moment points from the negative charge towards the positive charge, and has a magnitude equal to the strength of each charge times the separation between the charges.

Field lines of an electric dipole, separated by a distance d.

Thus, the electric dipole moment vector **p** points from the negative charge to the positive charge. There is no inconsistency here, because the electric dipole moment has to do with the orientation of the dipole, that is, the positions of the charges, and does not indicate the direction of the field originating through these charges

Electric Dipole Field

Anelectric field produced by a dipole is known as a dipole field.

Let +q and -q be equal and opposite point charges separated by a small distance 2l. The strength of an electric dipole is measured by a vector quantity known as the electric dipole moment $(\vec{P})$, which is the product of the charge and the separation between the charges. That is,

$$\vec{P} = q \times 2l$$

The direction of $(\vec{P})$ is always from negative to positive. The SI unit of a dipole movement is the Coulomb-meter.

Important Points:

Charge (+q) and (-q) are called the poles of the dipole

The displacement vector always flows from a –ve charge to +ve charges

The straight line l joining the two poles is called the axial line

The perpendicular bisector of l is called the equatorial line.

Examples of electric dipoles:

Some of examples of electric dipoles are HCl and H_2O.

There may be two or more atoms joined to form a single molecule. Every atom consists of a nucleus which is positively charged and electrons which are negatively charged. Both nucleus and electrons are rotating. At the middle of the atom both positive and negative charges coincide which makes an electric dipole moment that is zero.

If we place a molecule that has a zero electric dipole moment in an external electrical field, then the charges associated with the electric dipole will be displaced and the molecule will become an electric dipole.

Want to know more about electric dipoles? Click here to schedule a live session with an eAge eTutor!

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Reference links:

- http://www.en.wikipedia.org/wiki/Electric_field
- http://www.en.wikipedia.org/wiki/Electric_current
- http://en.wikipedia.org/wiki/Electric_dipole_moment
- http://electron9.phys.utk.edu/phys136d/modules/m4/efield.htm

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