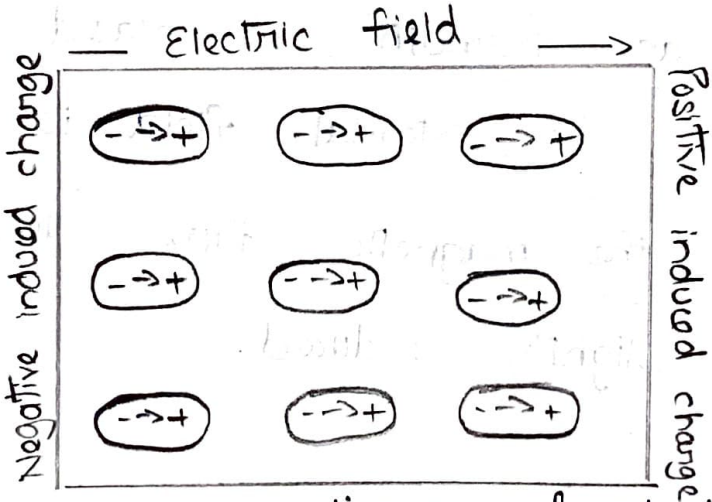
Polarization

When material is made up of polar molecules, each of its permanent dipole will experience a torque, tending to line it up along the electric field. As a result, a lot of little dipoles pointing along the direction of the field - the material gets polarized.

A convenient measure of this effect is,

P = dipole moment per unit volume.

If material is made up of neutral atoms, or non-polar molecules the field will induce in each a tiny dipole moment, pointing in the same direction as the field.



A schematic diagram of polarization of dielectrics

Permeability

The relative increase or decrease in the resultant magnetic field inside a material compared with the magnetizing field in which the given material is located.

Magnetic permeability $\mu = B/H$

where B is magnetic flux density

H is magnetic field strength

Materials may be classified magnetically on the basis of thier permeabilities. A diamagnetic material has a constant relative permeability slightly less than 1. When a diamagnetic material such as bismuth, is placed in a magnetic field, the external field is partly expelled and the magnetic flux density within it is slightly reduced.

Dielectric constant

Dielectric constant also called relative permittivity or specfic inductive capacity, property of an electrical insulating material equal to the ratio of the capacitence of a capacitor filled with the given material to the capacitence of an identical capacitor in a vaccum without the dielectric material. The insertion of a dielectric between the plates of, say, a parallel-plate capacitor always increases its capacitence or ability to store opposite charges on each plate, compared with this ability when the plates are separated by a vaccum.

Dielectric constant $K = C/C_0$

A paramagnetic material has a constant relative permeability slightly more than 1. When a paramagnetic material such as platinum is placed in a magnetic field, it becomes slightly magnetized in the direction of the external field.

A ferromagnetic material such as iron does not have a constant relative permeability. As the magnetizing field increases the relative permeability increases, reaches a maximum, and then decreases purified iron and many magnetic alloys have maximum relative permeabilities of 100,000 or more

The dielectric constant is a number without dimensions. In the centimetre - gram - second system, the dielectric constant is identical to the permittivity. It denotes a large - scale property of dielectrics without specifying the electrical behaviour on the atomic scale.

The value of the static dielectric constant of any material is always greater than one, its value for a vaccum. The value of the dielectrics constant at room Temperature (25°C or 77°F) is 1.00059 for air, 2.25 for paraffin, 78.2 for water and about 2,000 for barium Titanate ($BaTiO_3$) when the electric field is applied perpendicularly to the principal axis of the crystals. Because the value of the dielectric constant for air is nearly the same as that for a vaccum, for all practical purposes air does not increase the capacitence of a capacitor.