* Magnetic properties of materials :

1. Magnetic field : (B)

A space around a magnet within which its influence can be experienced is called magnetic field. SI unit of B is tesla(T).

A uniform magnetic field acting in the plane of paper is represented by equidistant parallel lines as shon in fig 1(a).
A uniform magnetic field acting perpendicular to the paper and directed towards is represented by dots [fig 1.(b)].
A uniform magnetic field acting perpendicular to the plane of paper and directed inwards is represented by crosses [fig 1.(c)].

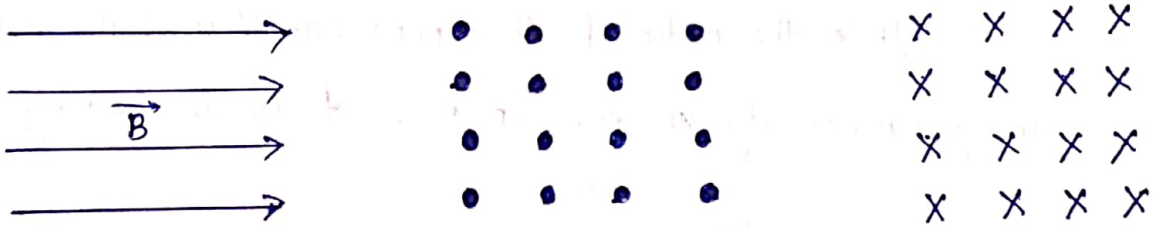


fig: 1.a fig 1.b fig: 1.c

2. Magnetic intensity : (H)

The no. of field lines generated by a moving charge is called magnetic intensity (H). S.I unit is Am^{-1}.

3. Magnetic induction :

It is the total number of magnetic lines of force crossing per unit area through a magnetic material. S.I unit is tesla (T).

4. Magnetisation :

It is the magnetic moment developed per unit volume of a material when placed in a magnetic field. Its S.I unit is Am^{-1}.

5. Magnetic permeability :

It is the ratio of the magnetic induction to the magnetic intensity. It is denoted by —

$$\mu = \frac{B}{H}$$

Its unit is TmA^{-1}.

6. Relative permeability :

It is the ratio of the permeability of the material to the permeability of free space. It is denoted by —

$$\mu_R = \frac{\mu}{\mu_0}$$

7. Magnetic susceptibility :

It is the ratio of the intensity of magnetisation (M) induced to the maagnetic field intensity (H). It is denoted by —

$$\chi_m = \frac{M}{H}$$

It can be shown that —

$$\mu = \mu_0 (1 + \chi_m)$$

$$\mu_R = 1 + \chi_m$$

* Classification of magnetic materials :

Magnetic materials are broadly classified as — Diamagnetic, paramagnetic and ferromagnetic.

Diamagnetic substance :

These are the substances which when placed in a magnetic field get magnetised in the opposite direction of the applied field. Diamagnetic substances are repelled by magnets due to the fact that they produced negative magnetization. The net magnetic moment is zero in diamagnetic substance because when an external field is applied to a diamagnetic substance then the magnetic moment of electron is aligned to the opposite direction of the applied field. Every element in the periodic table posses the property of diamagnetism, but few elements like Cu, Al_2O_3, Si, Zn have stronger diamagnetic property.

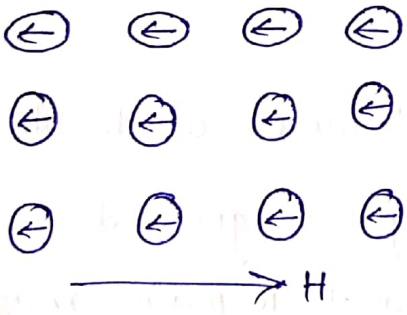
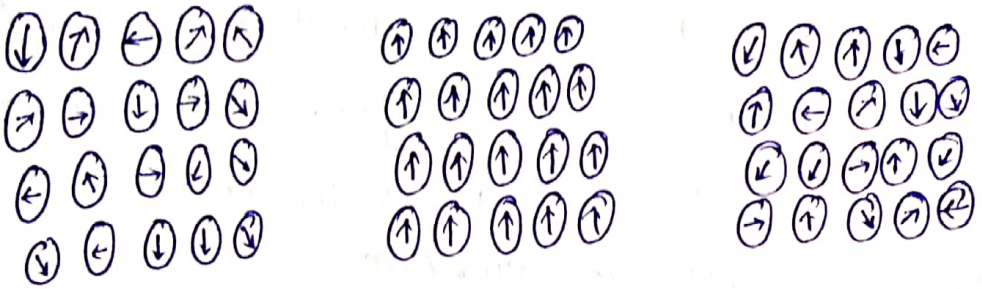


fig: Alignment of electrons opposite to magnetic field (H).

Paramagnetic Substance :

These are the substances which when placed in a magnetising field get feebly magnetised in the direction of the magnetic field, so net magnetic moment is not cancelled out completely. The magnetic moments in paramagnetic material are randomly aligned and when they are subjected to an external magnetic field, these magnetic moments align themselves in the direction of the applied magnetic field H. Examples of paramagnetic materials are — Al, Ca, Na, O_2.



normal | magnetic field applied. | magnetic field removed

Ferromagnetic substance

These are the substances which when placed in a magnetic field get strongly magnetised in the direction of the magnetic field, tend to remain magnetized even when the magnetic field is removed exhibits ferromag-netism. Examples of ferromagnetic materials are — Fe, Ni, Co, Gd etc.