lec / 1 " Magnetism " م. حسن

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Magnetism : The early Greeks knew about magnetism as early as 800 B.C. They discoverd that the stone magnetic Fe_3O_3 attracts pieces of iron.

Subsequent experiment showed that every magnet regardless of its shape, has two poles called north (N) and south (S) poles, that exert forces on other magnetic poles similar to the way electric charges exert forces on one another. That is like poles (N – N or (S – S) repel each other and opposite poles (N – S) attract each other.

Magnetic poles exert attractive or repulsive forces on each other and that these forces vary as the inverse squar of the distance between interacting poles. Al though the force between two magnetic poles is otherwire smilar to the force between to electric charges

Realationship between magnetism and electricity

The relation between them was discovered in 1819 Orsted found that an electric current in awire deflected anearby compass needle. In the 1820 further by Faraday. They showed that an electric current can be produced in a circuit either by moving a magnet near circuit or by changing the current in anearby circuit.

Orsted : current $\longrightarrow$ magnetic

Faraday : magnetic $\longrightarrow$ current .

Magnetic fields

The magnetic force that acts on a charge q moving with velocity $\vec{v}$ in magnetic field $\vec{B}$ has magnitud $F = qvB \sin\theta$ where θ is the angle between $\vec{v}$ and $\vec{B}$.

To find the direction of this force use right hand rule. point the figures of your open right hans in the direction of $\vec{v}$ and then curl them in the direction of $\vec{B}$ your thumb then points in the direction of the magnetic force $\vec{F}$

The SI unit of the magnetic field is the Tesla or Weber/m^2. An additional commanly used unit for the ~~magn~~ magnetic field is the gauss's (G) $1T = 10^4$ Gauss's

Ex : A proton moves at 8×10^6 m/sec along x-axis. It enters aregion in which ther is amagnetic field of magnitude 2.5T directed at an angle 60° with x-axis. Find (a): The initial magnitude andofthe magnetic force on the proton. (b): Calculate the protons initial acceleration (a).

Solution :

(a) $F = qVB \sin \theta = 1.6 \times 10^{-19} \times 8 \times 10^{6} \times 2.5 \times \sin 60$

$F = 2.77 \times 10^{-12}$ Nt

(b) $F = ma$

$2.77 \times 10^{-12} = 1.67 \times 10^{-27}\ a$

$a = \dfrac{2.77 \times 10^{-12}}{1.67 \times 10^{-27}} = 1.66 \times 10^{15}$ m/sec²

Magnetic Fields and Forces

$\vec{B}$ has been used to represent a magnetic field. The direction of the magnetic field $\vec{B}$ at any location is the direction in which a compass needle points at that location. As with the electric field, we can represent the magnetic field by means of drawings with magnetic field lines.

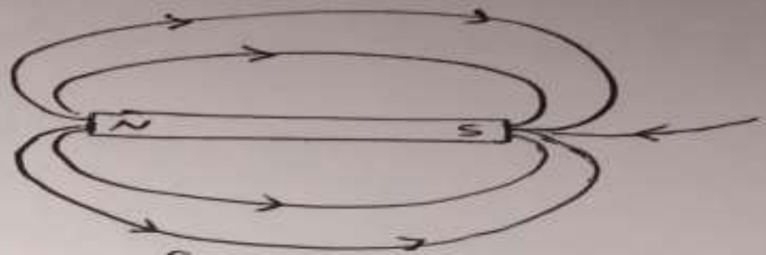

figure (1)

In figure (1) notice that the magnetic field line outside the magnet point away from the north pole and toword the south pole.

The magnitude F_B of the magnetic force exerted on the particle is propertional to the charge q and to the speed v of the particle.

when acharged particle moves parallel to to the magnetic field vector, the magnetic force acting on the particle is zero.

when the particles velocity vector makes any angle $\theta \neq 0$ with the magnetic force acts in adirection perpendicular to both $\vec{v}$ and $\vec{B}$ that is $\vec{F_B}$ is perpendicular to the plane formed by $\vec{v}$ and $\vec{B}$.

The magnitude of the magnetic force exerted on the moving particle is propertional to $\sin\theta$ where θ is the angle the particles velocity vector makes with the direction of $\vec{B}$

$$\vec{F}_B = q\vec{v} \times \vec{B} \quad \text{----} (1)$$

$$F = qVB\sin\theta \quad \text{——} (2)$$