The above equation can be written in terms of equality by inserting a constant. $\frac{\mu_0}{4\pi}$

Therefore,

$$B = \frac{\mu_0}{4\pi} \cdot \frac{qv\sin\theta}{r^2} \quad \text{--- (1)}$$

or, $$\vec{B} = \frac{\mu_0}{4\pi} q\left(\frac{\vec{v}\times\vec{r}}{r^3}\right)$$

$$\therefore \vec{B} = \frac{\mu_0}{4\pi} q \frac{\vec{v}\times\vec{r}}{r^3}.$$

The Biot-savart law;

We are often interested not field of moving charge but element of current, as a lenth 'dl' of wire carrying a Current I.

Cross section in wire charge density is n and ρ, velocity v.

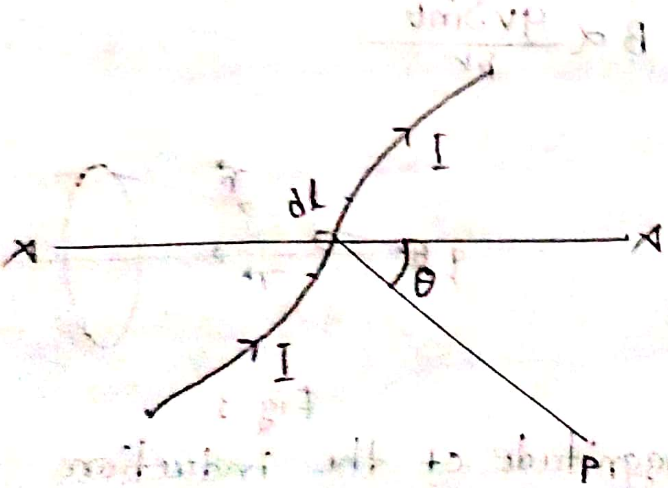

fig 2.

The charge crossing any cross-section;

per second $= \rho v A$, current $= I$

or, $\rho v A = I$

we get,

$\rho v A \, dl = I \, dl$

$\Rightarrow qv = I \, dl$ [total charge $q = \rho A \, dl$]

So, the magnetic induction $\vec{dB}$ due to dl length of wire carrying current I is given by the following relation at a point p. After substituting

$$qv = I dl$$

in equation (i) we get,

$$\vec{dB} = \frac{\mu_0}{4\pi} \times \frac{I(\vec{dl} \times \hat{r})}{r^2} \quad \text{.......} \text{(ii)}$$

The law described by equation (i) and (ii) is called Biot-Savart law.

Lecture sheet : 4:

Q. Find the resistance of 1cc of copper when drawn into a wire of diameter 0.32 mm, specific resistance of copper $= 1.59 \times 10^{-6} \Omega$.

Solution:

Radius of the wire,

$$r = \frac{0.32\,mm}{2} = 0.16\,mm$$
$$= 0.016\,cm$$

lenth of the ~~wair~~ wire,

$$l = \frac{\text{volume}}{\text{area}}$$

$$= \frac{1\,cc}{\pi r^2} = \frac{1}{3.1416(0.016)^2}$$

Again,

Resistance $R = \frac{\rho l}{A}$

$$= \frac{\rho l}{\pi r^2}$$

$$= \frac{1.59\times10^{-6}\times1\times\frac{1}{3.1416(0.016)^2}}{3.1416(0.016)^2\times0.016}$$

$$= \frac{1.59\times10^{-6}}{3.1416(0.016)^2}\times\frac{1}{3.1416\times(0.016)^2 \cancel{\times 0.016}}$$

$$= 2.46\,\Omega.$$

Lecture : 1

Ampere's circuital law :

Ampere's circuital law, named after the French · physicist Andre · Marie Ampere's is a fundamental principle in electromagnetism that relates the magnetic field around a closed loop to the electric current passing through the loop.

According to Ampere's circuital law the line integal of the magnetic fild (B) along a closed path (c) is equal to the product of the permeability of free space (μ_0) and the total current (I) passing through any surface bounded by the closed path:

The experimental result's can be represented mathematically

$$B \propto \frac{I}{r} \quad or, \quad B = K\frac{I}{r} \quad or \quad B = \frac{\mu_0 I}{2\pi r}$$

In this equation, $\oint$ represents the line integral around the closed path, B is the magnetic field vector, dI represents an infinitesimally small length element along the path, μ_0 is a permeability of free space (a constant value) and I is the total current passing thought any surface bounded by the closed path.

Ampere's circuital law is a rule in physics that says the magnetic field around a closed ~~loop is related~~ to the electrical current passing through the loop. It means that if you have a closed path, like a circle, and there is an electrical current flowing through it, there will be magnetic field around the path.

The strength of magnatic field around depends on two things: The size of the current and the shape of the path. The bigger the current the stronger the magnetic will be. The law also tells us that the magnetic fields gets weaker as you move farther away from the path.

$\vec{dl}$ which is always tangent to the path of integratio

$$\oint \vec{B}\cdot\vec{dl} = \oint B\,dl = B\oint dl = B(2\pi r) \quad \text{(ii)}$$

In this special case we can write the experimentally observed connection between $\vec{B}$ and I.

$$\oint \vec{B}\cdot\vec{dl} = \mu_0 I \quad \text{[Comparing equation i and ii]}$$

energy at room temperature. But the holes far out-number the conduction band electrons. It is because of the predominance of holes over free electrons that is called as a p-type semiconductor.

The word 'p' stands for positive material.

Lecture sheet : 2 : Biot- Savert law

Magnetic field of a Moving point charge [Laplace Rule]

It was found experimentally that the magnetic induction resulting from 'q' moving with velocity $\vec{v}$ at a distance 'r' away from the charge. Where r is a charge to the point where the field is being found is related by,

$$B \propto \frac{qv\sin\theta}{r^2}$$

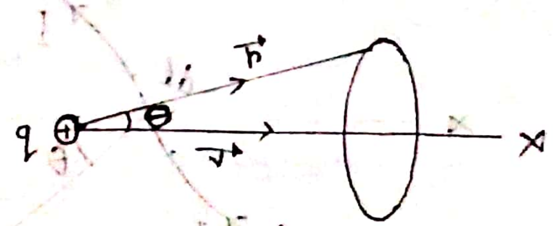

Fig. 1

B = magnitude of the induction

θ = Angle between $\vec{v}$ and $\vec{r}$.

In the fourth co-valent bonds, only germanium atom contribuits one valence ~~atom~~ electron, while gallium atom has no valence band. Hence, the fourth co-valent bond is incomplete, having one electron short. This missing electron is known as a Hole.

Thus, each gallium atom provides one hole in the germanium crystal. therefore, it provides millions of holes in the semi-conductor.

• Energy Band Diagram of p-Type semiconductor:

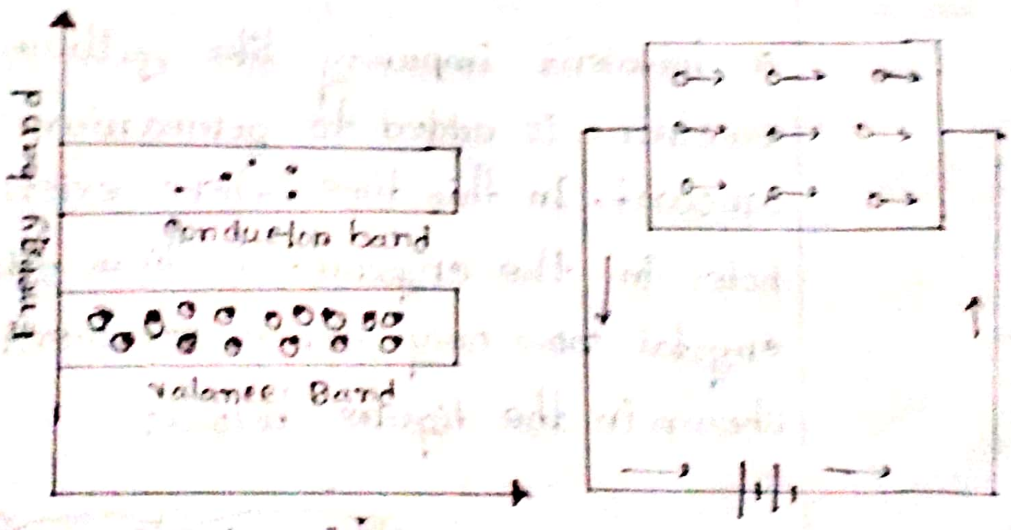

fig. 4

fig. 4 shown ~~blo~~ below the addition of trivalent impurity has produced a large number of holes. Howevere there are a few conduction band electrons due to thermal

Lecture 2: P-type semiconductors:

P-Type semiconductor: A p-type semiconductor is a type of semiconductor. When a small amount of trivalent impurity is added to an intrinsic or pure semi-conductor, it said to be a p-type semi-conductor.

The addition of trivalent impurity, provides a large number of holes in the semi-conductor. Trivalent impurities such as boron (B), gallium (Ga), indium (In), aluminum (Al) etc.

A trivalent impurity like gallium, having three valence electrons is added to germanium crystal in a small amount. In this time, there exists a large number of holes in the crystal. Gallium fits in the Germanium crystal now only three co-valent bonds can be formed as shown in the figure below:

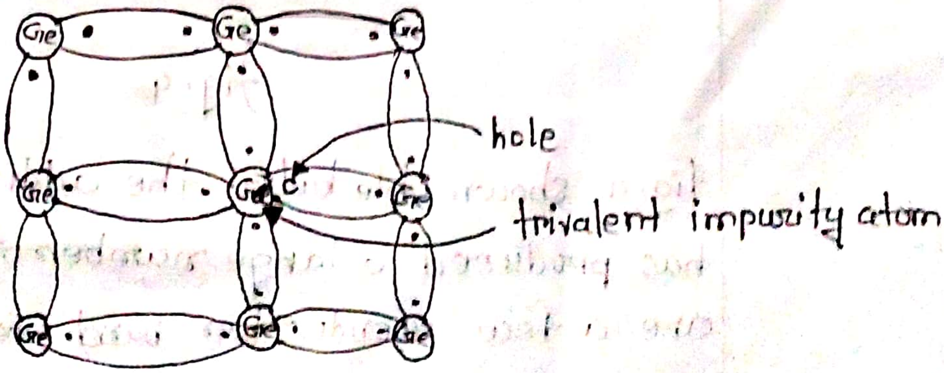

Fig. 3: Ga = Gallium atom
Ge = Germanium atom.