

Electrostatic Potential & Capacitance

Electric potential :-

The work done to carry unit positive charge from electric field to infinity is called electric potential.

- It is scalar quantity.
- It is denoted by V .

$\therefore$ Electric potential = $\frac{\text{Work}}{\text{charge}}$

$V = \frac{W}{q}$

- SI unit = $\frac{J}{C}$
 $= JC^{-1}$
 $= \text{Volt (V)}$

- Dimension = $\frac{ML^2T^{-2}}{AT}$
 $= ML^2T^{-3}A^{-1}$

Potential difference :-

The difference in the electric potential between two point an electric field is called potential difference.

Current Electricity

Current Electricity :-

The study of charges in motion is called current electricity.

Electric current :-

The rate of flow of charge is called electric current.

It has direction but it does not obey vector rules, so it is scalar.

Its SI unit is ampere (A).

Its dimension is A or I .

It is denoted by I or i .

We know,

$$Q = IT$$

$$\therefore \boxed{I = \frac{Q}{t}}$$

$$Q = ne$$

$$\boxed{I = \frac{ne}{t}}$$

Here,

n = no. of electron

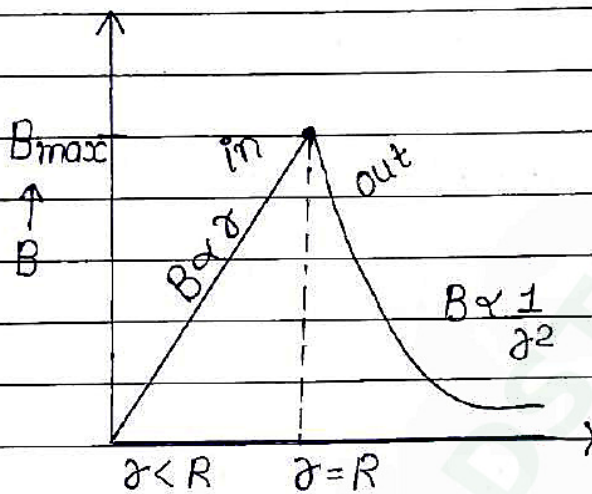
$e = 1.6 \times 10^{-19} \text{ C}$

Case (III) Magnetic field outside the cylinder ($r > R$).

Now consider a point P from distance r' from the centre of cylinder such that $r > R$.

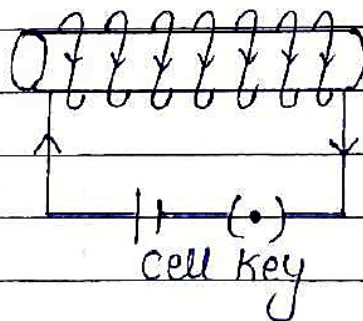
$$B = \frac{\mu_0 I}{2\pi r}$$

Graphical Representation :-



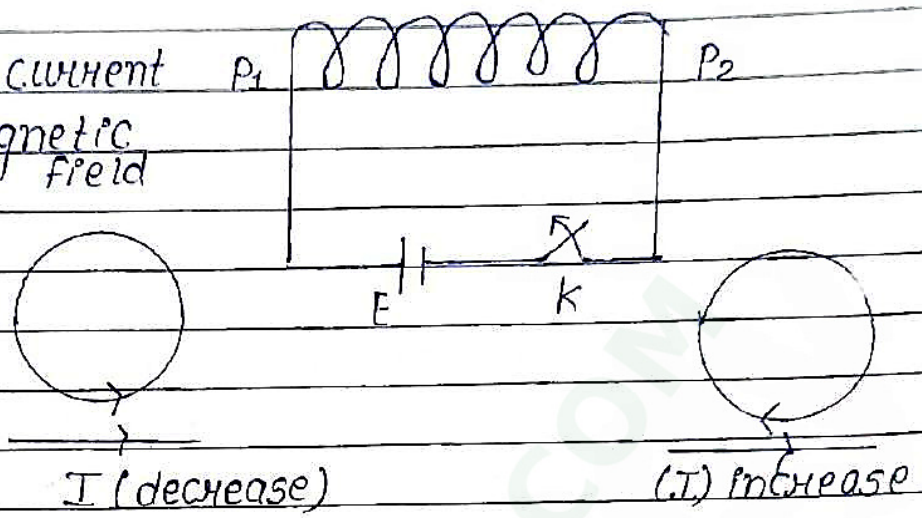
* Solenoid

A solenoid is an insulated long wire closely wound in the form of helix.



Its length is very long as compared to its diameter. We make use of solenoid to generate magnetic field.

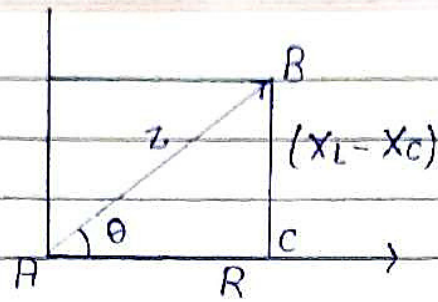
R. Finger curl $\rightarrow$ Current
R. Thumb $\rightarrow$ Magnetic field



As the key is switched on current starts flowing in the circuit from P_1 and P_2 , as current never reaches its maximum value instantaneously. i.e. takes certain finite time. During this time flux linked with the coil changes and hence current gets induced in the coil.

According to Lenz's law, the direction of induced current opposes the increase in current flowing in the circuit from P_2 to P_1 . This induced current opposes the increase in current flowing in the circuit.

As the key is switched off, current starts reducing in the circuit it can never reach its minimum value instantaneously i.e., takes certain finite time, during this time flux linked with the coil changes and hence current gets induced in the circuit. This induced current



Phase difference is given by $\tan \phi$

$$\tan \phi = \frac{X_L - X_C}{R}$$

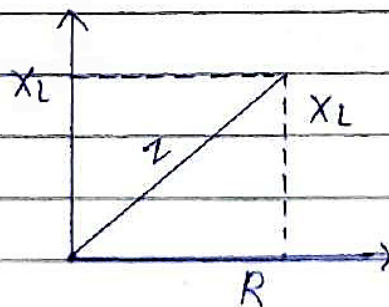
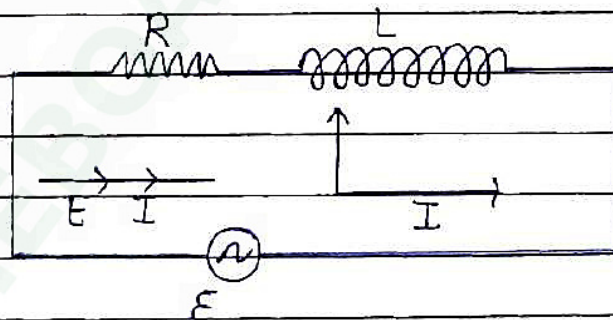
$$\tan \phi = \frac{E_L - E_C}{E_R}$$

Power factor, $\cos \phi = \frac{R}{Z}$

$$V = \sqrt{(V_L - V_C)^2 + V_R^2}$$

Current $\Rightarrow I = \frac{V}{Z}$

~ R-L series circuit :-



$$\frac{\mu_a}{\mu_w} = \frac{BA/OA}{BA/IA}$$

$$\mu_a = \frac{IA}{OA}$$

As angle i is very small, A is close to B .

$$\mu_a = \frac{IB}{OB} = \frac{y}{x}$$

$$\frac{1}{\mu_w} = \frac{y}{x} \quad (\text{principle of reversibility})$$

$$\mu_w = \frac{x}{y} = \frac{\text{real depth}}{\text{apparent depth}}$$

$$\text{or } \mu_w = \frac{x}{y}$$

Normal shift ; d

$d = \text{real depth} - \text{Apparent depth}$

$$d = x - y$$

$$d = x - \frac{x}{\mu_w}$$

$$d = x \left[1 - \frac{1}{\mu_w} \right]$$

$$d = x \left[1 - \frac{1}{\mu_w} \right]$$

* Critical Angle :-

The angle of incidence in a denser medium for which the angle of refraction in rarer medium becomes 90° , is called critical angle (c).

Resultant Intensity Due to Two Identical waves :-

The resultant intensity for two coherent sources is given by

$$I = I_1 + I_2 + 2\sqrt{I_1 I_2} \cos \phi$$

For identical source $I_1 = I_2 = I_0$

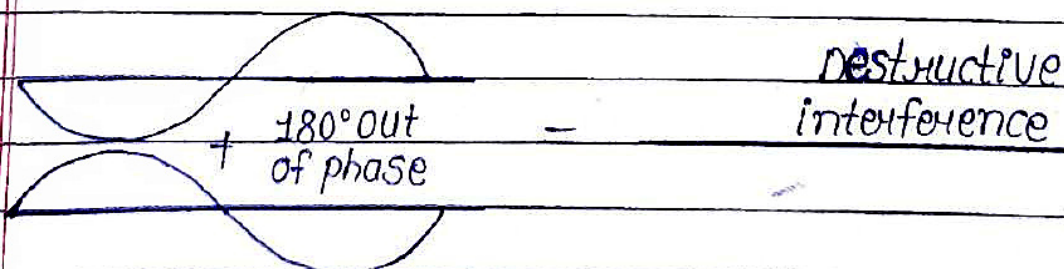
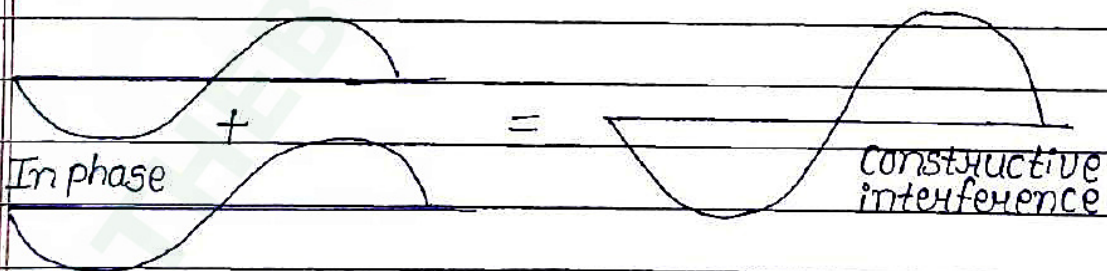
$$\Rightarrow I = I_0 + I_0 + 2\sqrt{I_0 I_0} \cos \phi = 4I_0 \cos^2 \frac{\phi}{2}$$

$$\left[1 + \cos \theta = 2 \cos^2 \frac{\theta}{2} \right]$$

* Interference of light :-

The phenomenon of redistribution of light energy in a medium on account of superposition of light wave from two coherent source.

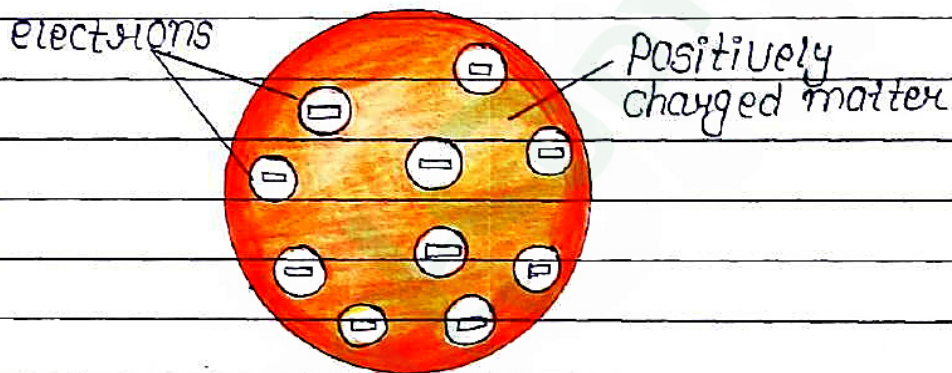
Types of Interference :-



Atoms

- * Atom :- A atom is the smallest particle which can take part in all physical and chemical reactions.

Thomson Model (Plum Pudding) of Atom :-



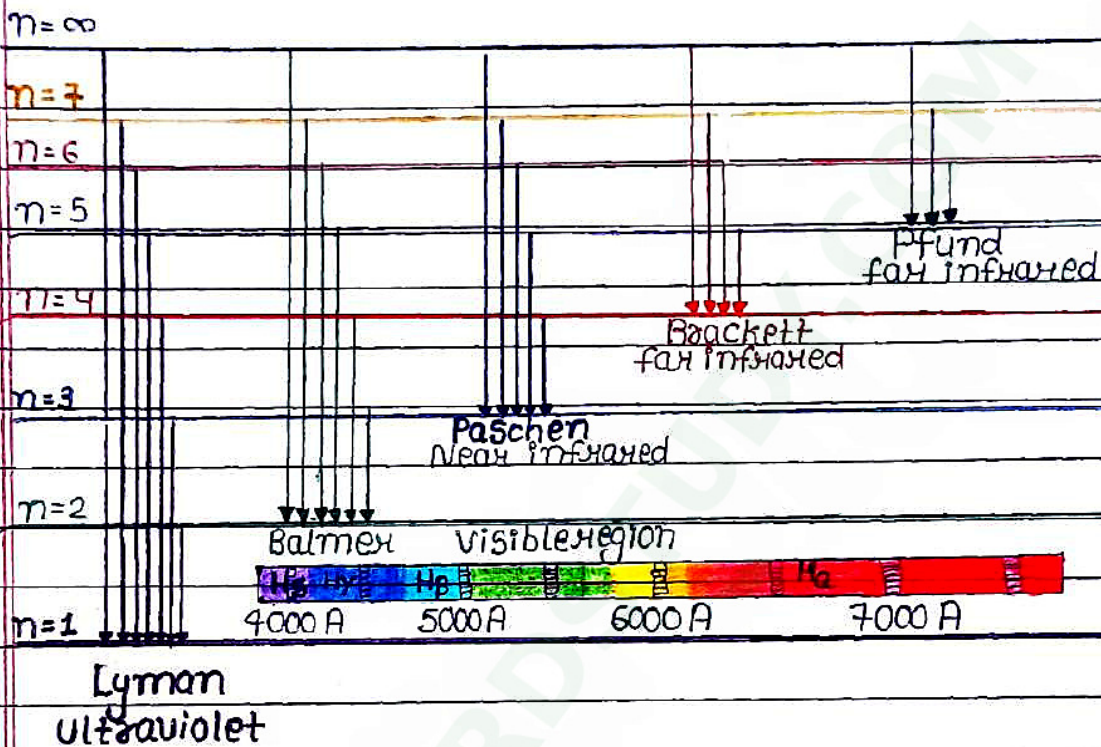
According to this model an atom consist of nucleus in which there are protons and neutron and electron are embedded inside the nucleus like seeds in water-melon.

But this theory was wrong because electrons are not embedded inside nucleus.

- * Rutherford α -Particle Scattering Experiment :-

$$\bar{\nu} = \frac{1}{\lambda} = R \left[\frac{1}{(5)^2} - \frac{1}{n^2} \right]$$

This series lies in infrared region.

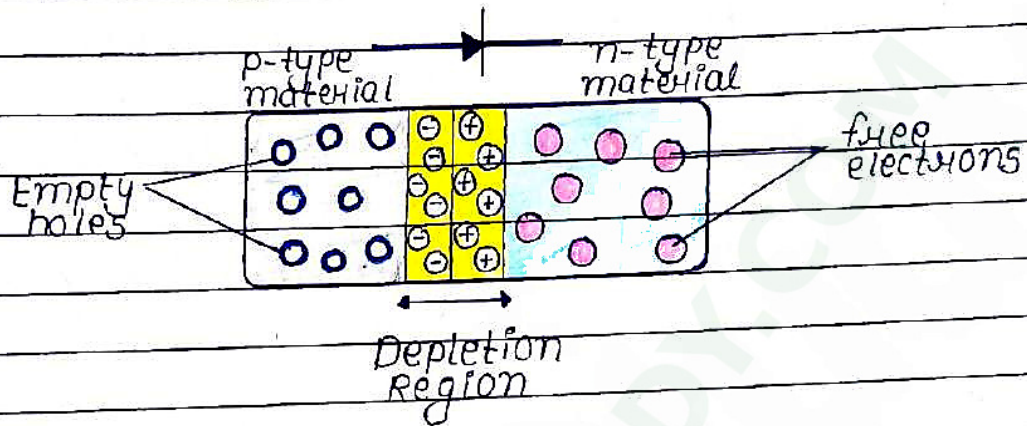


* Limitation of Bohr's model :-

- 1) This model is applicable only to a simple atom like hydrogen having $z=1$.
- 2) It does not explain the structure of spectral lines.
- 3) This model does not explain why orbital of e^- are taken as circular where as elliptical orbitals are also possible.
- 4) Bohr does say anything about relative intensities of spectral lines.

Unbiased P-n junction Diode :-

Unbiased P-n junction -



Symbol :-



* Biasing :-

The connection of p-n junction diode with battery is called Biasing.

Forward Biasing of P-n junction Diode :-

