Atomic Structure

- Atomic derived from Greek word which means 'not divisible'.
- In 1808 John Dalton proposed that matter is composed of small indestructible particles 'atoms'.
- According to Dalton's atomic theory – Atoms of all the elements are alike and they cannot be created, divided or destroyed. These are different for different elements.
- Goldstein (1876) disclosed that atom comprises of some small fundamental particles on the basis of discharge tube experiment.

Particle	Electron	Proton	Neutron
Symbol	e, -1eo, 1βo	p, -1H1, 1p1	on1, n
Discovered by	J.J. Thomson (1887)	Goldstein (1919)	Chadwick (1932)
Charge	-1.6021 X 10-19 C	1.6021 X 10-19 C	No charge
Mass	9.10 X 10-31 kg	1.6722 X 10-27 kg	1.675 X 10-27 kg

Rutherford's Nuclear Atomic Model:

- Atoms consist of central nucleus encircled by electrons moving in an orbit.
- Nucleus consists of positively charged protons and varies according to elements.
- The numbers of protons and electrons are equal and the atom is neutral.
- Nucleus contains the entire mass of an atom.
- Nucleus/atom ratio is 1:1012.

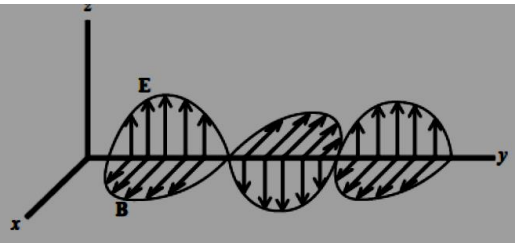
Drawbacks of Rutherford Model:

- It didn't explain the stability of an atom.
- The model predicts H-atom spectrum to be continuous but in real the spectrum is discrete line spectrum.

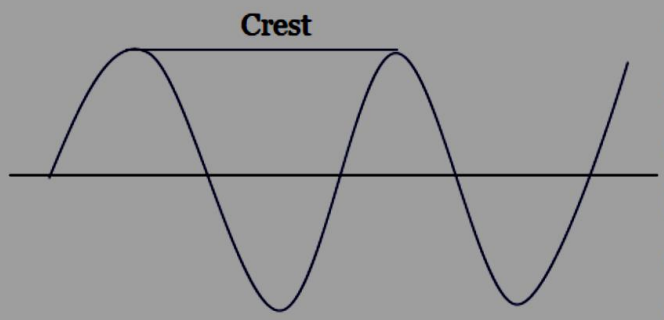
Electromagnetic Radiation

The maximum displacement A is known as amplitude. The period τ is the time for one revolution and since the angular path for one revolution is 2π rad, $\tau = \frac{2\pi}{\omega}$ where ω is the angular velocity and its SI unit is rad.s-1. The frequency is the reciprocal of the period.

$$\nu = \frac{1}{\tau} = \frac{\omega}{2\pi}$$



A graphical representation of how an electromagnetic radiation travels. Both electric and magnetic components are perpendicular to each other



The distance between two crests is known as wavelength.

One cycle is the number of waves lying between two successive crests. The frequency ν of the wave is the number of cycles passing a given point per unit time.

The unit of wavelength λ is 'm' and that of frequency is hertz (H).

E = hc/λ = h ν where c is the velocity of light and h is Planck's Constant.

And therefore ω = (2π ν) and the mathematical form of the displacement y,

$$y = A \sin(\omega t)$$

The ωt is called the phase.

The equation for simple harmonic motion is given:

$$\frac{d^2y}{dt^2} = -\omega^2 y$$

Blackbody Radiation and Energy Quantization:

A blackbody is a body that absorbs all the electromagnetic radiation that falls on it. A good approximation to a blackbody is a cavity with a tiny hole. Radiation that enters the hole is repeatedly reflected within the cavity.

Planck's theoretical expression for the frequency distribution of blackbody radiation is given by:

$$R(\nu) = \frac{2\pi h}{c^2} \frac{\nu^3}{e^{h\nu/kT} - 1}$$

Planck obtained a numerical value of h by fitting the formula to the observed blackbody curves. The modern value is h= 6.626 X 10-34 J.s