HYDROGEN SPECTRUM

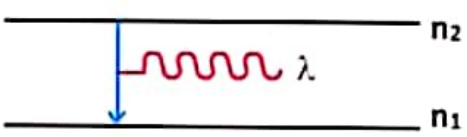
Bohr's model

Niels Bohr proposed a model for the hydrogen atom that explained the spectrum of the hydrogen atom. The Bohr model was based on the following assumptions.

- The electron in a hydrogen atom travels around the nucleus in a circular orbit.
- The energy of the electron in an orbit is proportional to its distance from the nucleus. The further the electron is from the nucleus, the more energy it has.
- Only a limited number of orbits with certain energies are allowed. In other words, the orbits are quantized.
- The only orbits that are allowed are those for which the angular momentum of the electron is an integral multiple of Planck's constant divided by 2π.

$$L = \frac{nh}{2\pi} \text{ (where h = planck's constant)}$$

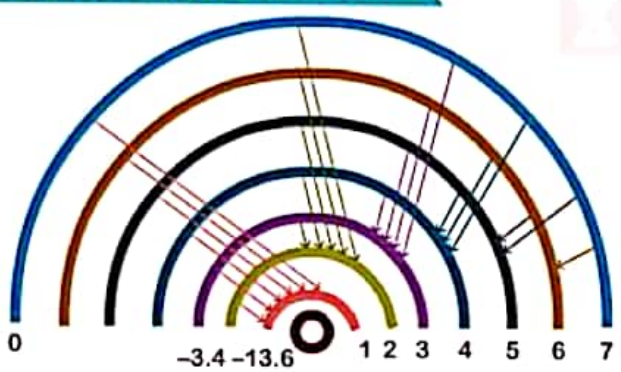
- Light is absorbed when an electron jumps to a higher energy orbit and emitted when an electron falls into a lower energy orbit.
- The energy of the light emitted or absorbed is exactly equal to the difference between the energies of the orbits
- When electron in an excited atom comes back from higher energy level (n_2) to lower energy level (n_1) then it emits a photon, having energy equal to difference in energy levels.
- $h\nu = \Delta E = En_2 - En_1$



Wavelength or wave no. of any line of any one electron species can be calculated as

$$\frac{1}{\lambda} = R_H Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right], \quad \frac{hc}{\lambda} = \Delta E$$

Different series



Successes

- Combining successfully Rutherford's solar system's model, with the **Planck hypothesis** on the quantified energy states at atomic level and Einstein's photons
- Explaining the atomic emission and **absorption spectra**
- Explaining the general features of the **periodic table**
- First working model for the **atom**

LYMAN SERIES	BALMER SERIES	PASCHEN SERIES	BRACKETT SERIES	PFUND SERIES	HUMPHREY SERIES
$n_f = 1$	$n_f = 2$	$n_f = 3$	$n_f = 4$	$n_f = 5$	$n_f = 6$
$n_i = 2,3,4,5,...$	$n_i = 3,4,5,6,...$	$n_i = 4,5,6,7,...$	$n_i = 5,6,7,...$	$n_i = 6,7,...$	$n_i = 7,8,...$
ULTRAVIOLET	VISIBLE	INFRARED	INFRARED	FAR INFRARED	FAR INFRARED