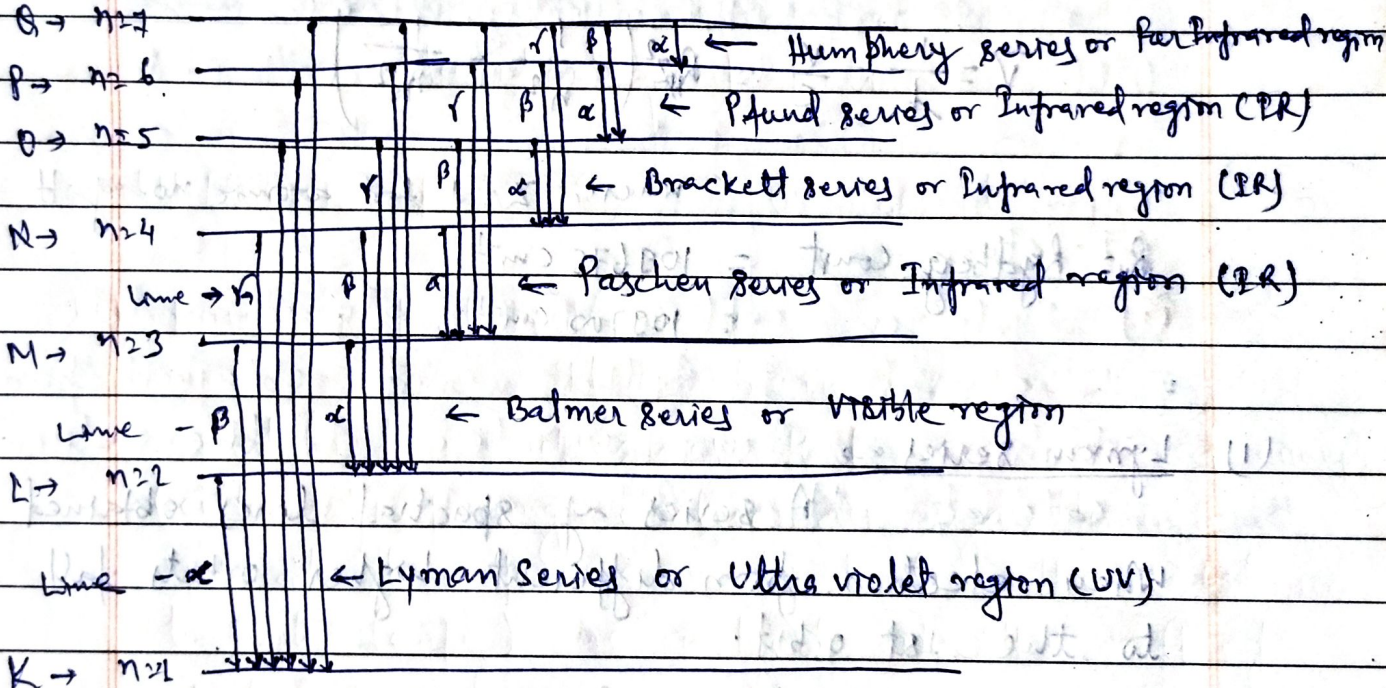
Hydrogen spectrum (A bluish light emitted)

In ground state hydrogen atom has one electron in the 1st orbit. When energy from some outside source is supplied to it, it can absorb a definite amount of energy and jumped from ground state to higher energy state (excited state) $n=2$ or $n=3$. This excited state are unstable. Hence when supply of energy is cut-off then, the electron come back to lower energy level (ground state, $n=1$) and energy is emitted which give a series of lines known as Hydrogen spectrum.



Series	Discovered by	Region	(n_2-n_1) n_1	n_2	No. of lines
Lyman	Lyman	U-V	1	2,3,4,5,6,7	n_2-1
Balmer	Balmer	visible	2	3,4,5,6,7	n_2-2
Paschen	Paschen	I.R	3	4,5,6,7	n_2-3
Brackett	Brackett	IR	4	5,6,7	n_2-4
Pfund	Pfund	IR	5	6,7	n_2-5
Humphery	Humphery	Far IR	6	7	n_2-6

Similar words :→

* First line / Starting line / Initial line (λ_{max} & ν_{min})
* Last line / limiting line / marginal line (λ_{min} & ν_{max})
* First line of any series = α line
* Second line of any series = β line
* Third line of any series = γ line

Remark :→

Ritz presented a mathematical formula to find the wave-length of various hydrogen lines.

$$\bar{\nu} = \frac{1}{\lambda} = \frac{\nu}{c} = R_H Z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

where, Z = 1 for atomic no. of H

R_H = Rydberg const = 109678 cm^{-1}
= 109700 cm^{-1}

(i) Lyman series :→

A series of spectral lines obtained when electron from different higher orbits fall to the 1st orbit.

$n_1 = 1$ & $n_2 = 2, 3, 4, 5, 6, 7$

$$\boxed{\bar{\nu} = R_H \left(\frac{1}{(1)^2} - \frac{1}{(n_2)^2} \right)}$$

(ii) Balmer series :→

A series of spectral lines obtained when electron from different higher orbits fall to the 2nd orbit.

$n_1 = 2$ & $n_2 = 3, 4, 5, 6, 7$

$$\bar{V} = R_H \left[\frac{1}{4} - \frac{1}{(n_2)^2}\right]$$

(iii) Paschen series :→

A series of spectral lines obtained when electron from different higher orbits fall to the 3rd orbit.

$n_1 = 3$ & $n_2 = 4, 5, 6, 7$

$$\bar{V} = R_H \left[\frac{1}{9} - \frac{1}{(n_2)^2}\right]$$

(iv) Brackett series :→

A series of spectral lines obtained when electron from different higher orbits fall to the 4th orbit.

$n_1 = 4$ & $n_2 = 5, 6, 7$

$$\bar{V} = R_H \left[\frac{1}{16} - \frac{1}{(n_2)^2}\right]$$

(v) Pfund series :→

A series of spectral lines obtained when electron from different higher orbits fall to the 5th orbit.

$n_1 = 5$ & $n_2 = 6, 7$

$$\bar{V} = R_H \left[\frac{1}{25} - \frac{1}{(n_2)^2}\right]$$

(vi) Humphery series :→

A series of spectral lines obtained when electron from different higher orbits fall to the 6th orbit.

$n_1 = 6$ & $n_2 = 7$

$$\bar{V} = R_H \left[\frac{1}{36} - \frac{1}{(n_2)^2}\right]$$