Hydrogen Spectrum

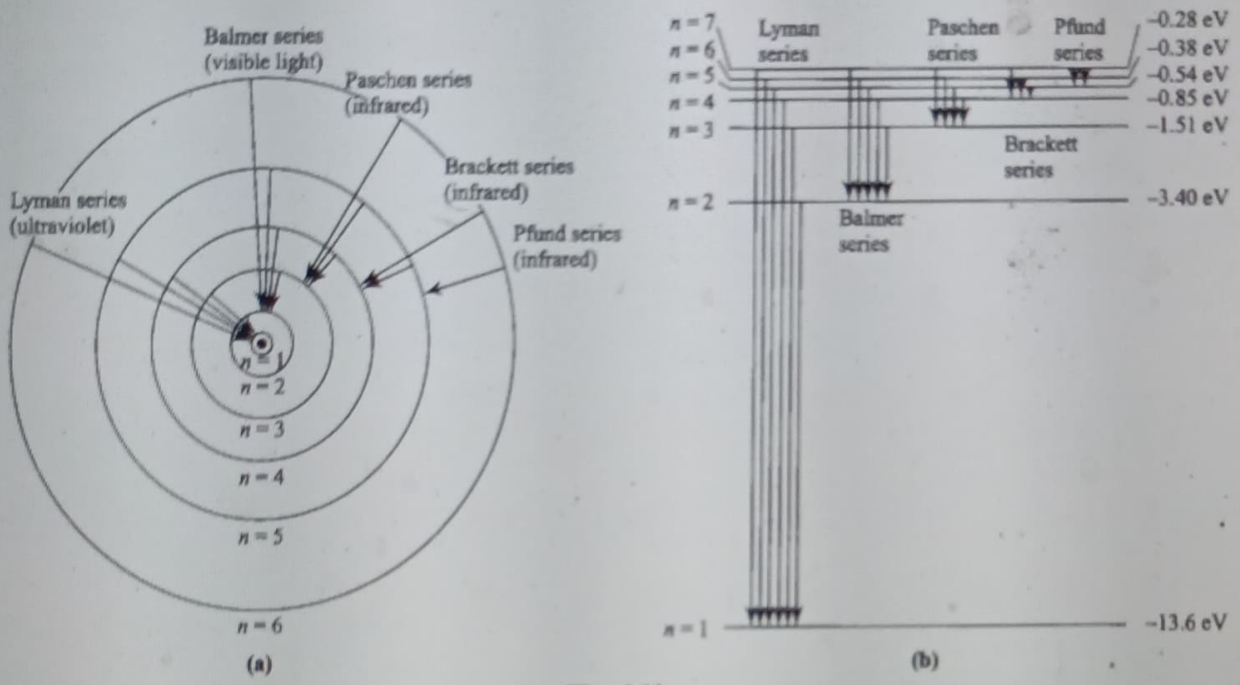

Fig. 4.11

	Initial State	Final State	Wavelength Formula	First Member-Second Member	Series Limit $n_i \to \infty$ to n_f	Maximum Wavelength $(n_f + 1)$ to n_f	Lines Found in
Lyman	$n_i = 2, 3, 4, 5, 6, \ldots$	$n_f = 1$	$\frac{1}{\lambda} = R\left(\frac{1}{1^2} - \frac{1}{n_i^2}\right)$	$n_i = 2$ to $n_f = 1$ $n_i = 3$ to $n_f = 1$	From ∞ to 1 $l = \frac{4}{R}$ $\lambda = 911$ Å	From 2 to 1 $l = \frac{4}{3R}$ $l = 121$ Å	UV region
Balmer	$n_i = 3, 4, 5, 6, 7, \ldots$	$n_f = 2$	$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{n_i^2}\right)$	$n_i = 3$ to $n_f = 2$ $n_i = 4$ to $n_f = 2$	From ∞ to 2 $l = \frac{4}{R}$ $l = 3646$ Å	From 3 to 2 $l = \frac{36}{5R}$ $l = 6563$Å	Visible region
Paschen	$n_i = 4, 5, 6, 7, 8, \ldots$	$n_f = 3$	$\frac{1}{\lambda} = R\left(\frac{1}{3^2} - \frac{1}{n_i^2}\right)$	$n_f = 4$ to $n_f = 3$ $n_f = 5$ to $n_f = 3$	From ∞ to 3 $l = \frac{9}{R}$ $l = 8204$ Å	From 4 to 3 $l = \frac{144}{7R}$ $l = 18753$ Å	IR region
Brackett	$n_i = 5, 6, 7, 8, 9, \ldots$	$n_f = 4$	$\frac{1}{\lambda} = R\left(\frac{1}{4^2} - \frac{1}{n_i^2}\right)$	$n_i = 5$ to $n_f = 4$ $n_i = 6$ to $n_f = 4$	From ∞ to 4 $l = \frac{16}{R}$ $l = 1485$ Å	From 5 to 4 $l = \frac{400}{9R}$ $l = 40515$ Å	IR region
Pfund	$n_i = 6, 7, 8, 9, 10, \ldots$	$n_f = 5$	$\frac{1}{\lambda} = R\left(\frac{1}{5^2} - \frac{1}{n_i^2}\right)$	$n_i = 6$ to $n_f = 5$ $n_i = 7$ to $n_f = 5$	From ∞ to 5 $l = \frac{25}{R}$ $l = 22790$ Å	From 6 to 5 $l = \frac{900}{11R}$ $l = 74583$ Å	Far IR region