Put, $r = \frac{n^2h^2}{4\pi^2 m Z e^2}$

$$E_n = -\frac{2\pi^2 m Z e^4}{n^2 h^2}$$

$$E_n \propto \frac{1}{n^2}$$

1st Bohr orbit

$$E_1 = -\frac{2\pi^2 m e^4}{h^2}$$

$$= \frac{2 \times (3.14)^2 \times (9.10 \times 10^{-28})(4.8 \times 10^{-10})^4}{(6.62 \times 10^{-27})^2}$$

$$= -21.79 \times 10^{-12} \text{ erg/atom} = -13.6 \text{ ev/atom}$$

($1 \text{ erg} = 6.2419 \times 10^{11}$ ev ; $1 \text{ ev} = 23.06$ kcal)

Relationship between E_1 and E_n

$$\frac{E_n}{E_1} = \frac{2\pi^2 m e^4}{n^2 h^2} \times \frac{h^2}{2\pi^2 m e^4}$$

$$E_n = E_1 \times \frac{1}{n^2} = -\frac{13.6}{n^2} \text{ eV/atom}$$

$$E = E_{II} - E_I$$

$$= \frac{-2\pi^2 m e^4}{n_{II}^2 h^2} - \frac{-2\pi^2 m e^4}{n_I^2 h^2}$$

$$= \frac{-2\pi^2 m e^4}{n_{II}^2 h^2} + \frac{2\pi^2 m e^4}{n_I^2 h^2}$$

$R = 109737 \text{ cm}^{-1}$.

$$= \frac{2\pi^2 m e^4}{h^2}\left[\frac{1}{n_I^2} - \frac{1}{n_{II}^2}\right]$$

ν, corresponding to the energy E

$$\nu = \frac{E}{h} = \frac{2\pi^2 m e^4}{h^3}\left[\frac{1}{n_I^2} - \frac{1}{n_{II}^2}\right]$$

$$\bar{\nu} = \frac{\nu}{c} = \frac{2\pi^2 m e^4}{c h^3}\left[\frac{1}{n_I^2} - \frac{1}{n_{II}^2}\right]$$

$= R\left[\frac{1}{n_I^2} - \frac{1}{n_{II}^2}\right]$, R = Rydberg's Constant.