

Stuff for Friday, April 20, 2012

- NEXT WEEK: Guest lecturers! (I'm in Germany.)
- Stop at 4pm for quiz #4 on Q7 and Q8.

Spectral lines from transitions: $E_{\text{photon}} = hc/\lambda_{\text{photon}} = (E_i - E_f)_{\text{system}}$

- 1 Quanton in a box: $V(x) = 0$ for $0 \leq x \leq L$ and infinite outside.

$$E_n = \frac{\hbar^2 n^2}{8mL^2} = \frac{(p_n c)^2}{2mc^2}, \quad p_n c = \frac{\hbar c}{\lambda_n} = \frac{\hbar c}{(2L/n)}, \quad \lambda_{\text{photon}} = \frac{8mc^2 L^2}{hc(n_i^2 - n_f^2)}$$

- 2 Harmonic oscillator: $V(x) = \frac{1}{2}k_s x^2 = \frac{1}{2}m\omega^2 x^2$ ($\omega = \sqrt{k_s/m}$)

$$E_n = \frac{\hbar\omega}{2\pi} \left(n + \frac{1}{2}\right) = \hbar\omega \left(n + \frac{1}{2}\right), \quad n = 0, 1, 2, \dots, \quad \lambda_{\text{photon}} = \frac{1}{\hbar\omega} \frac{hc}{n_i - n_f}$$

- 3 Bohr model of hydrogen atom: circular orbit of radius r

$$E_n = -\frac{ke^2}{2a_0 n^2} = -\frac{13.6 \text{ eV}}{n^2}, \quad r_n = n^2 a_0 = n^2 \frac{(\hbar c)^2}{mc^2 ke^2}, \quad \lambda_{\text{photon}} = \frac{2(\hbar c)a_0}{ke^2} \frac{n_i^2 n_f^2}{n_i^2 - n_f^2}$$

How do we fill energy levels for larger atoms? (Pauli!)