Reminders 04-21-08:
-NONE

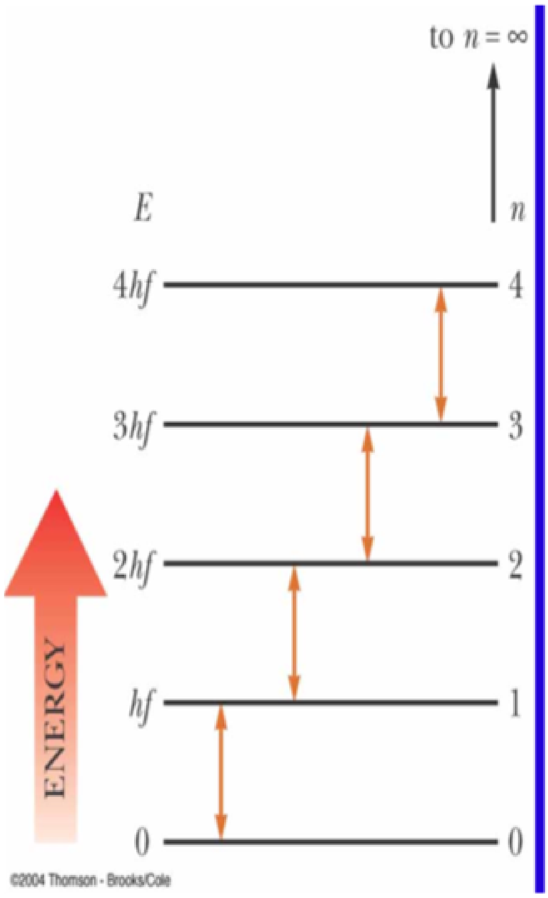
Outline:
-Photoelectric Effect
-Compton Effect
-Line Spectra and the Bohr Model of Atom

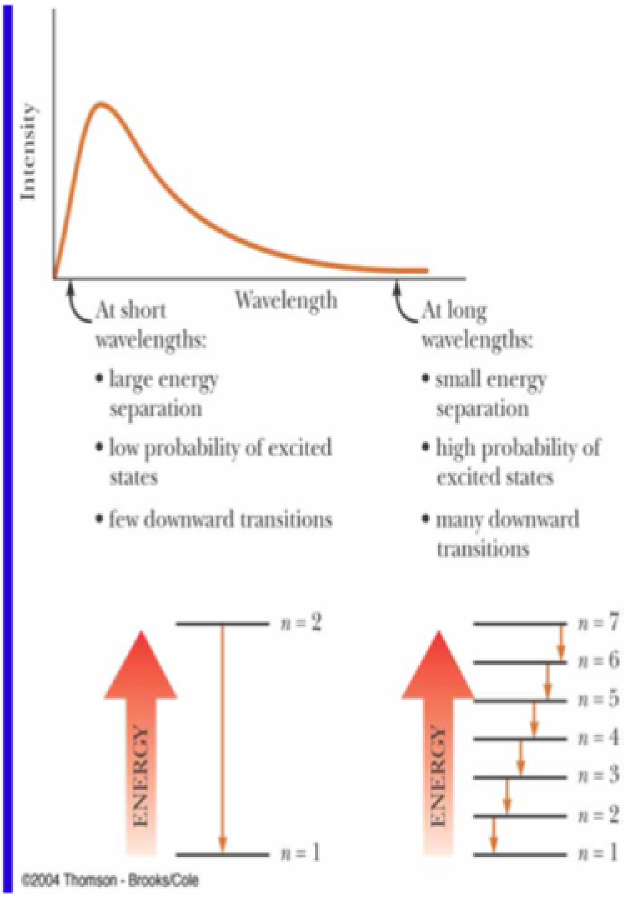
Planck assumed average energy associated with given wavelength is the average energy difference between levels weighted according to the probability of waves being emitted. The probability is based on Maxwell-Boltzmann statistics.

In addition energy levels were discrete, not continuous with E=nhf. This means that an oscillator emits or absorbs energy only when it changes quantum states.

As transition frequency decreases, spacing between states decreases. The discrete levels appear to be continuous (i.e. approach classical regime)

Electromagnetic waves emitted from a blackbody or any other source consists of discrete packets called photons!





- What should the energy of photons be so that the maximum change in wavelength due to Compton scattering by electrons is 1%?
  - Using these photons, what is $\Delta\lambda$ in angstroms for Compton scattered photons at 60°?
  - What is the energy of the recoil electrons in this case?

$E = K + U =$ ________ - ____________ (1)

$\Sigma F = ma \rightarrow$ _________ = ____________ (2)

Use (2) to get $K =$ _____________

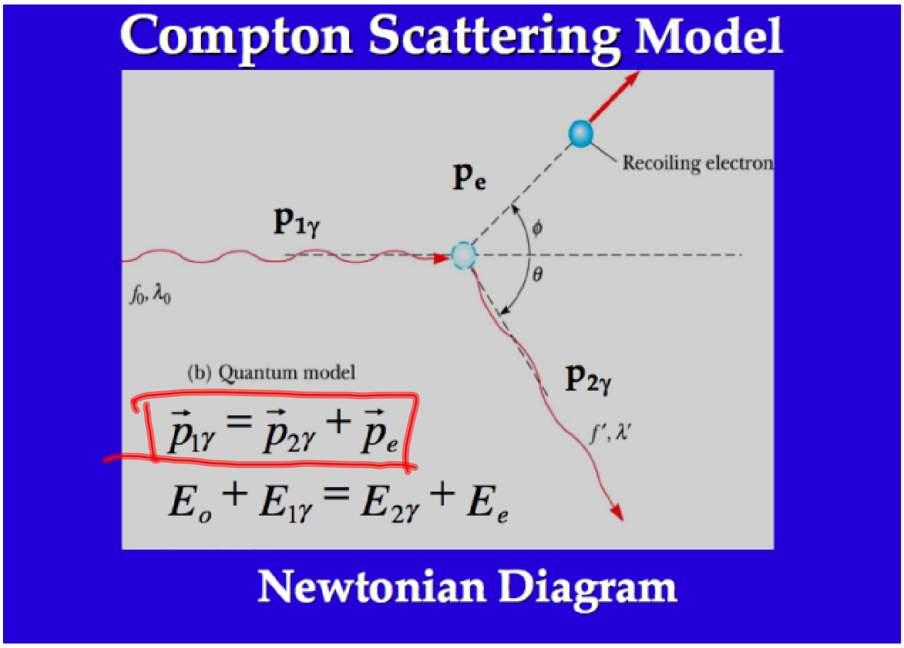
Use that result substitute into (1) to get

$E =$ _____________ (3)

Solve (2) for $v^2 =$ ______________

Solve the quantized L for $v^2 =$ ____________

Equate and solve for $r_n =$ ____________



$$m_e c^2 + \frac{hc}{\lambda_0} = \frac{hc}{\lambda'} + \left((m_e c^2)^2 + (p_e c)^2\right)^{1/2}$$

$$\frac{h}{\lambda} = \frac{h}{\lambda'}\cos\theta + p_e\cos\phi$$

$$0 = \frac{h}{\lambda'}\sin\theta - p_e\sin\phi$$

$$\vec{p}_e = \vec{p}_{2\gamma} - \vec{p}_{1\gamma}$$

square it!

$$\vec{p}_e \cdot \vec{p}_e = (\vec{p}_{2\gamma} - \vec{p}_{1\gamma}) \cdot (\vec{p}_{2\gamma} - \vec{p}_{1\gamma})$$

$$= p_{2\gamma}^2 + p_{1\gamma}^2 - 2\,\vec{p}_{2\gamma} \cdot \vec{p}_{1\gamma}$$

Can show that

$$\lambda' - \lambda_0 = \frac{h}{m_e c}(1 - \cos\theta)$$

$$\lambda' - \lambda_0 = .0243 \times 10^{-10}(1 - \cos\theta)$$

$$1\,\text{Å} = 10^{-10}$$

Apr 21-10:37 AM