Reminders 04-28-08:
- -Overall Class Average 80%
- -Exam 4 Monday May 5
- -Final Exam Wednesday May 7

Outline:
- -Line Spectra and the Bohr Model of Atom
- -DeBroglie Waves
- -Davison-Germer Experiment
- -Particles as Waves

$E = K + U = \_\_\_\_\_\_ - \_\_\_\_\_\_\_\_$ (1)

$\Sigma F = ma \rightarrow \_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_$ (2)

Use (2) to get $K = \_\_\_\_\_\_\_\_\_$

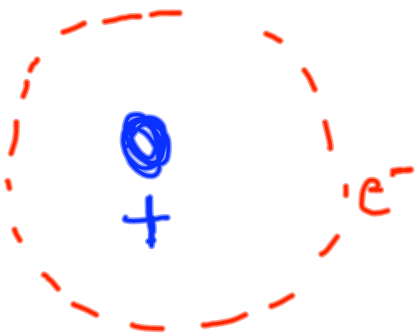
Use that result substitute into (1) to get

$E = \_\_\_\_\_\_\_\_\_$ (3)

Solve (2) for $v^2 = \_\_\_\_\_\_\_\_\_\_$

Solve the quantized L for $v^2 = \_\_\_\_\_\_\_\_$

Equate and solve for $r_n = \_\_\_\_\_\_\_\_$



$$F = \frac{k|q_1||q_2|}{r^2}$$

$$F = \frac{ke^2}{r^2}$$

$$k = 9 \times 10^9 \frac{N \cdot m^2}{C^2}$$

$$e = 1.6 \times 10^{-19} C$$

$$U = -\frac{ke^2}{r}$$

$$E = K + U = \frac{1}{2}mv^2 - \frac{Ke^2}{r}$$

$$\frac{mv^2}{\cancel{r}} = \frac{Ke^2}{r^{\cancel{2}}} \qquad V = \sqrt{\frac{Ke^2}{mr}}$$

$$E = \frac{1}{2}m\left(\frac{Ke^2}{mr}\right) - \frac{Ke^2}{r} = \frac{-Ke^2}{2r}$$

$$mvr = n\hbar \Rightarrow V = \frac{n\hbar}{mr} = \sqrt{\frac{Ke^2}{mr}}$$

$$\frac{n^2\hbar^2}{m^{\cancel{2}}r^{\cancel{2}}} = \frac{Ke^2}{\cancel{mr}} \qquad r = \frac{n^2\hbar^2}{mKe^2}$$

$r = n^2 a_0$ where $a_0 = \dfrac{\hbar^2}{mKe^2}$

$= .0529\,\mathrm{nm}$

$$E = \frac{-Ke^2}{2n^2a_0} = \frac{-13.6\,\mathrm{eV}}{n^2}$$

$$E_i - E_f = 13.6\left[\frac{1}{n_f^2} - \frac{1}{n_i^2}\right] = hf$$

$$\longrightarrow f = \frac{13.6\,eV}{h}\left[\frac{1}{n_f^2} - \frac{1}{n_i^2}\right] = \frac{c}{\lambda}$$

$$= \frac{Ke^2}{2a_0 h}\left[\frac{1}{n_f^2} - \frac{1}{n_i^2}\right]$$

$$\frac{1}{\lambda} = \frac{Ke^2}{2a_0 hc}\left[\frac{1}{n_f^2} - \frac{1}{n_i^2}\right]$$

For Z protons in nucleus

$$E = -\frac{13.6\, Z^2}{n^2}$$

$$\frac{1}{\lambda} = \frac{Z^2 k e^2}{a_0 h c}\left[\frac{1}{n_f^2} - \frac{1}{n_i^2}\right]$$

What's the de Broglie wavelength of a 60 g bullet traveling at 500 m/s?

What's the de Broglie wavelength of an electron with a velocity of 1 x 10^{6} m/s

$$\lambda = \frac{h}{p} = \frac{h}{mv} = \frac{6.626\times10^{-34}\,J\cdot s}{(.06\,kg)(500\,m/s)}$$

$$= 2.2\times10^{-35}\,m$$

$$\lambda = \frac{h}{mv} = \frac{6.626\times10^{-34}\,J\cdot s}{(9.11\times10^{-31}\,kg)(1\times10^{6}\,\frac{m}{s})}$$

$$\lambda = 7.27\times10^{-10}\,m$$

$$= \underline{0.727\,nm}$$

- Does the Bohr model violate the uncertainty principle?

- If you measure the x-coordinate of a 1200kg car within 1.00μm, what is the uncertainty in its velocity? Does the uncertainty impose a practical limit on macroscopic measurements?

- Consider a 1D box of length L. Because of the uncertainty principle its kinetic energy cannot be zero. Estimate the minimum energy of an electron in a box of length $L=a_o$.

- The wave function for a hydrogenic atom in its ground state is $Ce^{-Zr/a}$. This function represents the probability amplitude over a sphere of radius r. Determine the value C and the maximum value of the probability distribution $Cr^2e^{-2Zr/a}$ function.