Atomic/Nuclear Physics

Book Chapter: 28, 29, 30
Book Pages: 865-883, 900-916, 933-943
Practice Problems: pp895-897: 10; 928-929: 4, 14, 20, 26, 38; pp963: 2
Terms/ Ideas:
Photoelectric Effect
Photoelectron
Threshold frequency
Planck's constant
Matter Waves
Rutherford's experiment-Gold Foil
Bohr Atomic Model
Principle Quantum Number
Electron energies in eV
Nucleus
Planetary Model
Binding Energy
Nucleon
Nuclear Reactions
Equations:

$$E = hf$$

$$KE_{\max} = hf - \phi(photoelectricequation)$$

$$E = mc^2$$

$$p = \frac{h}{\lambda}$$

$$E = mc^2$$

$$r = \frac{mv}{eB}$$

$$n \rightarrow p + \beta + \bar{v}(betaemission)$$

$$p \rightarrow n + \beta + v(positronemission)$$

$$p + e \rightarrow n + v$$

For # 14 chapter 29: Mg mass 23.986042 and Rb mass 84.911793

Free Response:

An unstable nucleus that is initially at rest decays into a nucleus of fermium-252 and an alpha particle that has kinetic energy of 8.4MeV. The atomic mass of the alpha particle and the fermium are 4.00260 and 252.08249 amu.

1) What is the atomic number of the original unstable nucleus?

2) What is the velocity of the alpha particle? What is the velocity of the fermium nucleus?

3) Where does the kinetic energy of the alpha particle come from? Calculate the binding energy of the Fm atom.

4) Suppose the fermium-252 nucleus could undergo a decay in which a beta particle was produced. How would this affect the atomic number of the nucleus? What would the atomic mass and number be of the resulting element.

5) Using Coulomb's Law and an assumed circular orbit, derive an expression for the orbital velocity of an electron in the ground state of a hydrogen atom. (Leave answer in constants)