Problems of the Week 7

Always show your work to receive credit (NO WORK=NO CREDIT)

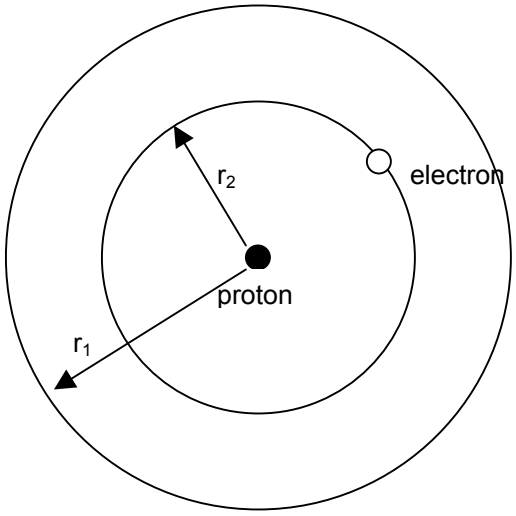
1. The magnitude of the force of attraction between the proton and the electron in a hydrogen atom is:

$$F = k\frac{e^2}{r^2}$$

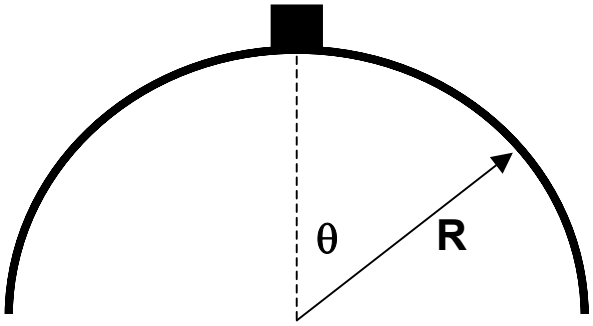
where e is the magnitude of the electric charge, k is a constant, and r is the radius of the circular orbit. Assume the proton is fixed in place and the electron is in a circular orbit of radius r_1. The electron "jumps" to a new, smaller radius r_2. What is the change in the total energy of the system? Hint: Use dynamics to calculate the kinetic energy for the electron in the initial and final orbits, and then calculate the potential energy in both orbits (you will need to derive an expression for the potential energy).

A. $ke^2\left(\frac{1}{r_1}-\frac{1}{r_2}\right)$ B. $\frac{ke^2}{2}\left(\frac{1}{r_1^2}-\frac{1}{r_2^2}\right)$

C. $\frac{ke^2}{4}\left(\frac{1}{r_2}-\frac{1}{r_1}\right)$ D. $\frac{ke^2}{2}\left(\frac{1}{r_1}-\frac{1}{r_2}\right)$ E. $\frac{ke^2}{2}(r_1-r_2)$



2. A small particle slides down a frictionless, inverted hemispherical bowl of radius R=1.0m. The speed of the particle at the top of the bowl is v_o= 2.0m/s. Calculate the angle at which the particle leaves the surface of the bowl.
   A. 24.4° B. 36.6° C. 41.5° D. 48.2° E. 57.5°



What happens if v_o= 4.0m/s? There is a problem similar to this one in your textbook. It is problem 72 on page 249. You must show all work, you can't just use the results from problem 72.