Problem 23.15
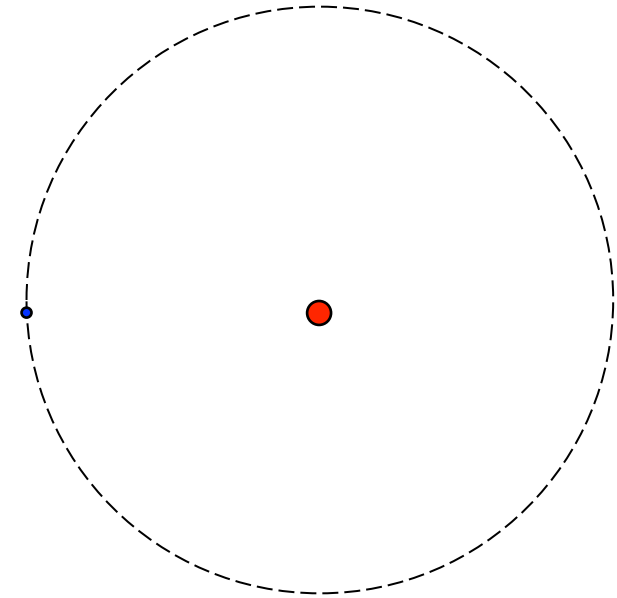
a.) The force on the electron due to the proton in a hydrogen atom is just a Coulomb force, or:

$$F_C = k\frac{q^2}{r^2}$$

$$= \left(8.99\text{x}10^9 \text{ N} \bullet \text{m}^2/\text{C}^2\right)\frac{\left(1.60\text{x}10^{-19} \text{ C}\right)^2}{\left(5.29\text{x}10^{-11} \text{ m}\right)^2}$$

$$= 8.22\text{x}10^{-8} \text{ N}$$

b.) A centripetal force would require a velocity of:

$$F_C = m\frac{v^2}{r}$$

$$\Rightarrow \quad v = \sqrt{F_C r / m}$$

$$= \sqrt{\left(8.22\text{x}10^{-8} \text{ N}\right)\left(5.29\text{x}10^{-11} \text{ m}\right)/\left(9.11\text{x}10^{-31} \text{ kg}\right)}$$

$$= 2.19\text{x}10^6 \text{ m/s}$$