Q- The normal hydrogen atom consists of a proton nucleus and an orbital electron. Assume that the electron orbit is circular and that the constant distance between the proton and electron is 5.3×10^{-11} m.

(a) What is the force of attraction between the two fundamental particles?

The force is given by the Coulomb's law as

$$F = \frac{q_1 q_2}{4\pi \epsilon_0 r^2} \qquad \qquad \left[\frac{1}{4\pi \epsilon_0} = 9 * 10^9\right]$$

The magnitude of the charge on a proton and the electron both is $1.6*10^{-19}$ C. Hence the magnitude of the force between the proton and electron will be

$$F = \frac{9*10^9*1.6*10^{-19}*1.6*10^{-19}}{(5.3*10^{-11})^2} = 8.2*10^{-8} \,\mathrm{N}$$

(b) What is the orbital speed of the orbiting electron?

The force calculated in above question is acting as centripetal force on the electron and hence we have

Centripetal force $=mv^2/r = F$

Gives
$$v = \sqrt{\frac{FR}{m}} = \sqrt{\frac{8.2*10^{-8}*5.3*10^{-11}}{9.11*10^{-31}}} = 2.18*10^6 \text{ m/s}$$