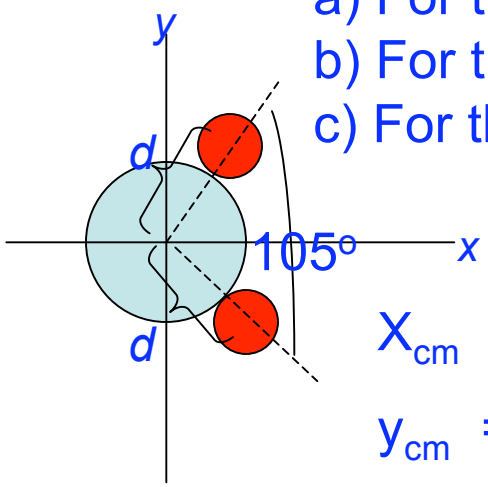
Center of Mass of a Water Molecule H_2O

1) A water molecule consists of a single oxygen atom (O) to which is attached two hydrogen atoms (H).
2) The H atoms are 105° apart from one another, and a distance *d* from the O atom, as in the figure, where $d = 9.57 \times 10^{-11}$ meters. (Masses: O = 16u, H = 1u)
3) Where is the center-of-mass located in a coordinate system whose origin is at the center of the O atom?



a) For the O atom $(x_0,y_0) = (0,0)$
b) For the top H atom $(x_1,y_1) = (d*\cos(105/2), d*\sin(105/2))$
c) For the low H atom $(x_2,y_2) = (d*\cos(105/2), -d*\sin(105/2))$

$$X_{cm} = (m_0*x_0 + m_1*x_1 + m_2*x_2)/(m_0+m_1+m_2)$$

$$y_{cm} = (m_0*y_0 + m_1*y_1 + m_2*y_2)/(m_0+m_1+m_2)$$

$$X_{cm} = (16*0.0 + d*\cos 52.5 + d*\cos 52.5)/18 = 0.068d$$

$$y_{cm} = (16*0.0 + d*\sin 52.5 - d*\sin 52.5)/18 = 0.0$$