

7. By symmetry the center of mass is located on the axis of symmetry of the molecule. We denote the distance between the nitrogen atom and the center of mass of NH_3 as x . Then $m_{\text{N}}x = 3m_{\text{H}}(d - x)$, where d is the distance from the nitrogen atom to the plane containing the three hydrogen atoms:

$$d = \sqrt{(10.14 \times 10^{-11} \text{ m})^2 - (9.4 \times 10^{-11} \text{ m})^2} = 3.803 \times 10^{-11} \text{ m} .$$

Thus,

$$x = \frac{3m_{\text{H}}d}{m_{\text{N}} + 3m_{\text{H}}} = \frac{3(1.00797)(3.803 \times 10^{-11} \text{ m})}{14.0067 + 3(1.00797)} = 6.8 \times 10^{-12} \text{ m}$$

where Appendix F has been used to find the masses.