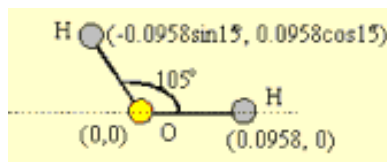


The distance between the oxygen molecule and each of the hydrogen atoms in a water (H₂O) molecule is 0.96 Å and the angle between the two oxygen-hydrogen bonds is 105°. Treating the atoms as particles, find the center of mass of the system.

Solution

The first step is to choose a coordinate system, such as the one in the diagram, and locate each particle. The chosen origin is the location of the oxygen molecule.



Atom	Mass (H)	x_i	y_i	$m_i x_i$	$m_i y_i$
H	1	$-0.96 \sin 15^\circ$	$0.96 \cos 15^\circ$	-0.248466	0.927289
O	16	0	0	0	0
H	1	0.96	0	0.96	0
Totals:	18			0.711534	0.927289

The coordinates of the center of mass are given by

$$x_{cm} = \frac{\sum m_i x_i}{M_{\text{Total}}} = \frac{0.711534}{18} = 0.0395 \text{ Å},$$

$$y_{cm} = \frac{\sum m_i y_i}{M_{\text{Total}}} = \frac{0.927289}{18} = 0.0515 \text{ Å}.$$

Answers will vary based on the choice of coordinate system.