

Converting Concentration

H_2O_2 soln. is 30.0% by mass with a density of 1.11 g/mL. Find molarity, mole fraction, and molality

Molarity: Assume 100g sample

- Convert %:

$$100\text{g soln.} - 30.0\text{g H}_2\text{O}_2 = 70.0\text{g H}_2\text{O}$$

$$30.0\text{g H}_2\text{O}_2 \times \frac{1\text{mol H}_2\text{O}_2}{34.02\text{g H}_2\text{O}_2} = 0.882\text{mol H}_2\text{O}_2$$

$$\text{Volume soln.} = 100.0\text{g} \times \frac{1\text{mL}}{1.11\text{g}} = 90.1\text{mL}$$

$$M = \frac{\text{mol}}{\text{L}} = \frac{.882\text{mol H}_2\text{O}_2}{.091\text{L}} = \boxed{9.79\text{M}}$$

Molality: $m = \frac{\text{mol H}_2\text{O}_2}{\text{kg H}_2\text{O}}$

$$m = \frac{.882\text{mol H}_2\text{O}_2}{.070\text{kg H}_2\text{O}} = \boxed{12.6\text{m H}_2\text{O}_2}$$

Mole Fraction: $X_{\text{H}_2\text{O}_2} = \frac{\text{mol H}_2\text{O}_2}{\text{mol H}_2\text{O}_2 + \text{mol H}_2\text{O}}$

$$70.0\text{g H}_2\text{O} \times \frac{1\text{mol}}{18.02\text{g}} = 3.88\text{mol H}_2\text{O}$$

$$X_{\text{H}_2\text{O}_2} = \frac{.882\text{mol}}{.882 + 3.88} = 0.185$$

$$X_{\text{H}_2\text{O}} = \frac{3.88}{.882 + 3.88} = 0.815$$