

## Answer on Question #41589 - Chemistry - Other

### Question

Find the molality of  $\text{H}_2\text{SO}_4$  solution whose specific gravity is 1.98 g/ml and 90% by volume  $\text{H}_2\text{SO}_4$ .

### Solution

Molality ( $b$ ) of a solution is defined as the amount of substance (in mol) of solute ( $n_{\text{solute}}$ ) divided by the mass (in kg) of the solvent ( $m_{\text{solvent}}$ ):

$$b = \frac{n_{\text{solute}}}{m_{\text{solvent}}}$$

Let us assume we have 1000 ml of the solution. Mass of the solution:

$$m_{\text{solution}} = V_{\text{solution}} \cdot \rho_{\text{solution}} = 1000\text{ml} \cdot 1.98\text{g/ml} = 1980\text{ g}$$

Volume of solvent:

$$V_{\text{solvent}} = \frac{V_{\text{solution}} \cdot (100 - 90)}{100} = 1000\text{ ml} \cdot 0.1 = 100\text{ ml}$$

Density of the solvent (water) is 1.00 g/ml, so the mass of the solvent:

$$m_{\text{solvent}} = V_{\text{solvent}} \cdot \rho_{\text{solvent}} = 100\text{ml} \cdot \frac{1.00\text{ g}}{\text{ml}} = 100\text{ g} = 0.1\text{ kg}$$

Mass of the solute:

$$m_{\text{solute}} = m_{\text{solution}} - m_{\text{solvent}} = 1980\text{ g} - 100\text{ g} = 1880\text{ g}$$

Number of moles of the solute ( $M_{\text{solute}} = M_{\text{H}_2\text{SO}_4} = 98\text{ g/mol}$ ):

$$n_{\text{solute}} = \frac{m_{\text{solute}}}{M_{\text{solute}}} = \frac{1880\text{ g}}{98\frac{\text{g}}{\text{mol}}} = 19.18\text{ mol}$$

Molality of the solution:

$$b = \frac{n_{\text{solute}}}{m_{\text{solvent}}} = \frac{19.18\text{ mol}}{0.1\text{ kg}} = 191.8\text{ mol/kg}$$

**Answer: 1918 mol/kg**