CONCENTRATION UNITS and COLLIGATIVE PROPERTIES

Given: Solution of 40.0g of ethylene glycol ($HOCH_2CH_2OH$) with 60.0g water.
Solution density = 1.05 g/mL

mass based

wt% $\dfrac{\text{grams solute}}{\text{grams solute + grams solvent}}$ **X 100**

$\dfrac{40.0\text{ g}}{40.0\text{g} + 60.0\text{g}} \times 100 = 40.0\%$

ppm $\dfrac{\text{milligrams solute}}{\text{kilograms solution}}$

ppb $\dfrac{\text{micrograms solute}}{\text{kilograms solution}}$

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mole fraction (χ) $\dfrac{\text{moles solute (or solvent)}}{\text{moles solute + moles solvent}}$

$\dfrac{40.0\text{g}}{\dfrac{1\text{ mole}}{62.0\text{g}}} = 0.645\text{ mole}$ $\qquad \dfrac{0.645}{0.645 + 3.33} = 0.162$

$\dfrac{60.0\text{g}}{\dfrac{1\text{ mole}}{18.0\text{g}}} = 3.33\text{ mole}$ $\qquad \dfrac{3.33}{0.645 + 3.33} = 0.838$

Lowering of Vapor Pressure

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molality (m) $\dfrac{\text{moles solute}}{\text{kilogram solvent}}$

$\dfrac{0.645\text{ mole}}{0.0600\text{ kg}} = 10.8\text{ m}$

$\dfrac{60.0\text{g}}{\dfrac{1\text{ kg}}{1000\text{g}}} = 0.0600\text{ kg}$

Raising the Boiling Point

Lowering the Freezing Point

Molarity (M) $\dfrac{\text{moles solute}}{\text{liter of solution}}$

$\dfrac{0.645\text{ mole}}{0.0952\text{ L}} = 6.78\text{ M}$

$\dfrac{100.0\text{ g solution}}{\dfrac{1\text{ mL solution}}{1.05\text{ g solution}}} \dfrac{10^{-3}\text{ L}}{1\text{ mL}} = 0.0952\text{ L}$

Osmotic Pressure