$M_{molarity} = \frac{\text{moles of solute}}{\text{liters of solution}}$	$m_{molality} = \frac{\text{moles of solute}}{\text{kg of solvent}}$

$\%_{mass} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 100$	$\chi_{mole\ fraction} = \frac{\text{moles of solute}}{\text{mole of solution}}$
$\%_{mass} = \frac{\text{mass of solute}}{\text{mass of solute + mass of solvent}} \times 100$	$\chi_{mole\ fraction} = \frac{\text{moles of solute}}{\text{mole of solute + mole solvent}}$

Nitric acid = 70.0% by mass with a density of 1.42 g/cm^3

Find χ, m, and M

$$\chi_{HNO_3} = \frac{70.0\text{g } HNO_3 \times \frac{1\text{mol}HNO_3}{63.02\text{g } HNO_3}}{70.0\text{g } HNO_3 \times \frac{1\text{ mol } HNO_3}{63.02\text{g } HNO_3} + 30.0\text{g } H_2O \times \frac{1\text{mol } H_2O}{18.02\text{g } H_2O}} = 0.400$$

$$m = \frac{70.0\text{g } HNO_3 \times \frac{1\text{mol } HNO_3}{63.02\text{g } HNO_3}}{30.0\text{g } H_2O \times \frac{\text{kg}}{1000\text{g}}} = 37.0\ m\ HNO_3$$

$$M = \frac{70.0\text{g } HNO_3 \times \frac{1\text{mol } HNO_3}{63.02\text{g } HNO_3}}{100.0\text{ g solution} \times \frac{1\text{ mL}}{1.42\text{ g solution}} \times \frac{0.001\text{ L}}{1\text{m L}}} = 15.8M\ HNO_3$$