

GENERAL CHEMISTRY

STANDARD 10.7

DEFINITIONS

- **Parts Per Thousand (PPT):** Parts of solute per thousand parts of solvent
- **Parts Per Million (PPM):** Parts of solute per million parts of solvent
- **Parts Per Billion (PPB):** Parts of solute per billion parts of solvent

EXAMPLE

- What is the concentration in ppt, ppm, and ppt of a solution of 2.52 grams of NaCl mixed into 1.25 L of water?
 - First, the units for the solute and solvent must be the same
 - In this case, convert everything to grams, knowing the density of water is 1 g / cm³ OR 1 kg / dm³ (L) OR 1000 kg / m³

$$\begin{array}{|c|c|c|}
 \hline
 1.25 \text{ L Water} & 1 \text{ kg water} & 1000 \text{ g} \\
 \hline
 & 1 \text{ L water} & 1 \text{ kg} \\
 \hline
 \end{array} = 125\,000 \text{ g water}$$

Now set up a proportion with the grams of solute divided by the grams of solvent equal to x over 1000 to find ppt, over 1000000 to find ppm, and over 1000000000 to find ppb:

$$\frac{2.52 \text{ g NaCl}}{125\,000 \text{ g H}_2\text{O}} = \frac{x \text{ g NaCl}}{1000 \text{ g H}_2\text{O}} \quad x = 0.0202 \text{ ppt}$$

EXAMPLE CONTINUED

$$\frac{2.52 \text{ g NaCl}}{125\,000 \text{ g H}_2\text{O}} = \frac{x \text{ g NaCl}}{10\,000\,000 \text{ g H}_2\text{O}} \quad x = 20.2 \text{ ppm}$$

$$\frac{2.52 \text{ g NaCl}}{125\,000 \text{ g H}_2\text{O}} = \frac{x \text{ g NaCl}}{10\,000\,000\,000 \text{ g H}_2\text{O}} \quad x = 20200 \text{ ppb}$$

ANOTHER EXAMPLE

- Convert 1.25 M HCl to ppt, ppm, and ppb
 - First, remember that molarity is equal to moles per liter
 - Again, convert everything to grams, knowing the density of water is 1 g / cm^3 OR 1 kg / dm^3 (L) OR 1000 kg / m^3 and use 1 L of water

1.00 L Water	1 kg water	1000 g	= 100 000 g water
	1 L water	1 kg	
1.25 mol HCl			= 45.6 g HCl
		36.5 g HCl	
		1 mol HCl	

Now set up a proportion with the grams of solute divided by the grams of solvent equal to x over 1000 to find ppt, over 1000000 to find ppm, and over 1000000000 to find ppb:

ANOTHER EXAMPLE CONTINUED

$$\frac{45.6 \text{ g HCl}}{100\,000 \text{ g H}_2\text{O}} = \frac{x \text{ g HCl}}{1000 \text{ g H}_2\text{O}} \quad x = 0.456 \text{ ppt}$$

$$\frac{45.6 \text{ g HCl}}{100\,000 \text{ g H}_2\text{O}} = \frac{x \text{ g HCl}}{1000000 \text{ g H}_2\text{O}} \quad x = 456 \text{ ppm}$$

$$\frac{45.6 \text{ g HCl}}{100\,000 \text{ g H}_2\text{O}} = \frac{x \text{ g HCl}}{1000000000 \text{ g H}_2\text{O}} \quad x = 456000 \text{ ppb}$$

TRY IT YOURSELF

- Convert 3.5 M NaOH to ppt, ppm, and ppb
- Consider a 2.5 L solution of 2.52 g Mg(OH)₂ and convert the ppt, ppm, and ppb
- Consider a solution of 5.56 g of KCl dissolved in 350 mL of water and convert the ppt, ppm, and ppb

TRY IT YOURSELF SOLUTIONS

- Convert 3.5 M NaOH to ppt, ppm, and ppb
140 ppt, 140 000 ppm, 140 000 000 ppb
- Consider a 2.5 L solution of 2.52 g Mg(OH)₂ and convert the ppt, ppm, and ppb
1.01 ppt, 1001 ppm, 1 001 000 ppb
- Consider a solution of 5.56 g of KCl dissolved in 350 mL of water and convert the ppt, ppm, and ppb
15.9 ppt, 15 900 ppm, 15 900 000 ppb