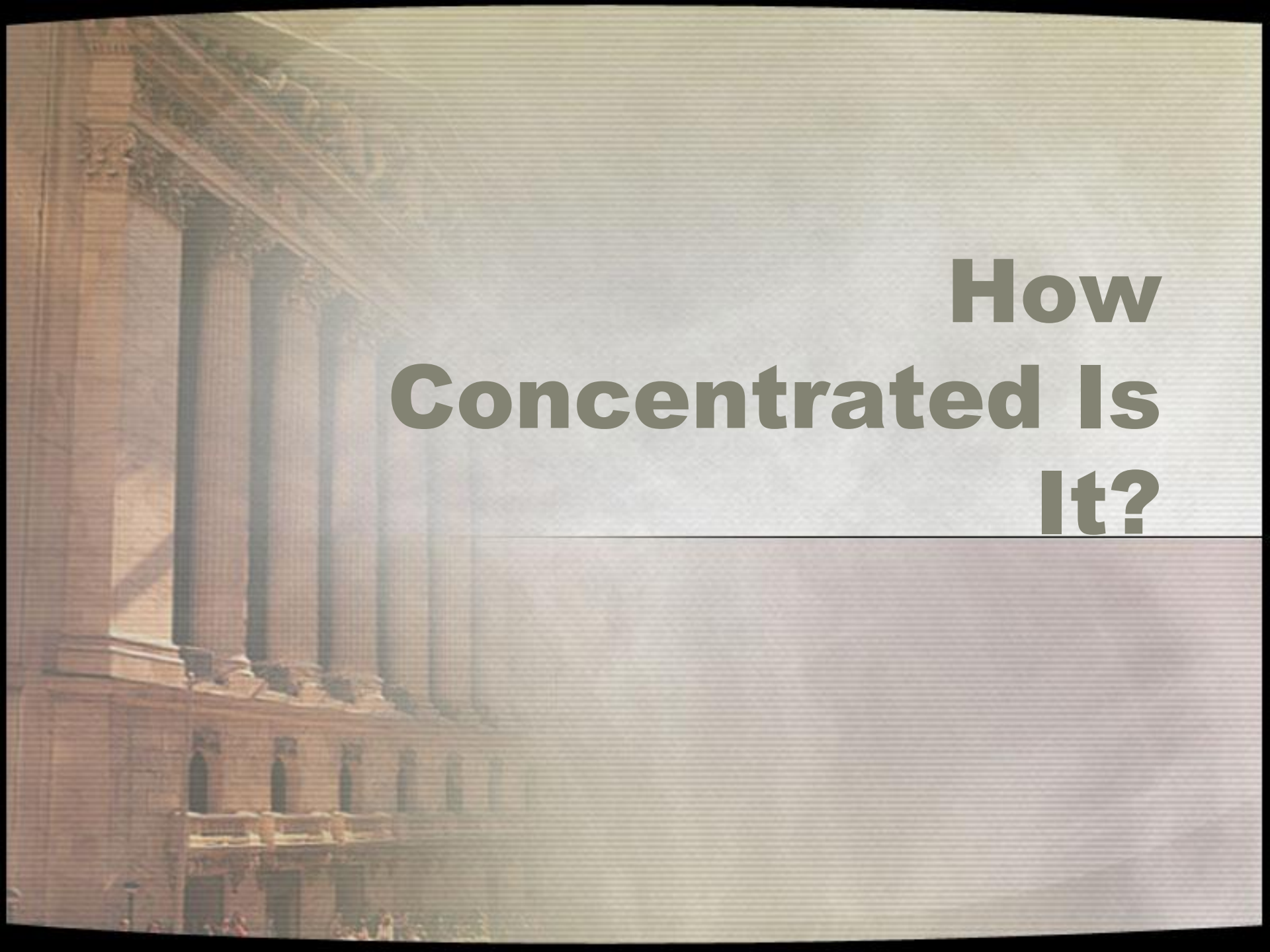
How Concentrated Is It?

- **Concentration** - the amount of **SOLUTE** dissolved in a given quantity of solvent at a given temperature.

- There are two main methods of stating concentration:

A. Qualitative - based on judgment, described with words

- 1. Dilute - the solution contains a relatively **SMALL** amount of solute.
- 2. Concentrated - the solution contains a **LARGE** amount of solute.

B. Quantitative - involves quantities, described with NUMBERS

- 1. Molarity (M)
- 2. Percent concentration(%)
- 3. Parts per million (ppm)

Molarity

- **Molarity** - the number of **MOLES** of a solute dissolved in one liter (L) of solution, not solvent.

- Molarity (M) =
- $\frac{\text{number of moles of solute}}{\text{number of Liters of solution}}$

- Example: Enough water is added to 2 moles of glucose to make 5 L of solution,
- what is it’s molarity?

2 moles of glucose =

5 L of _____

0.4 moles/L (M)

- What is the concentration (M) of a 2.5 L solution containing 1.3 moles of ethylene glycol (anti-freeze)?

- What is the molarity of 800 mL of a solution containing 0.25 moles of salt?

- Because molarity is a **PROPORTION**, it can be used in the picket fence to solve more complex problems. Review the steps for using the picket fence !

For example:

- A salt solution contains 0.90 g of NaCl per 100 mL of solution.
- What is its molarity?

Solution:

- **Step 1**: proportions given and needed
- 0.90 g NaCl (given in problem)
- **100 mL**

- $\frac{1000\ \text{mL}}{\text{L}}$ $\frac{58.5\ \text{g NaCl}}{\textbf{MOLE}}$

- **Step 2:** The answer needs the units expressed in moles/L **(M)**

- **Step 3 & 4**: Because only a proportion is given in the problem, start the picket fence with it.

II. Percent Concentration

- **PERCENT** concentrations can be used in the following ways:

- A. % mass / mass (% m/m) - is the number of grams of solute per gram of **SOLUTION**, expressed as a percent.
-

- $\frac{\text{grams of solute}}{\text{grams of } \mathbf{SOLUTION}} \times 100$

- = % m/m concentration

- B. % mass / volume (% m/v)
  - is the number of **GRAMS** of solute per milliliter of solution, expressed as a percent.

- $\frac{\text{grams of solute}}{\textbf{mL of solution}} \times 100$

- = % m/v concentration

- C. % volume / volume (% **V/V**)
  - is the number of milliliters of solute per milliliter of solution, expressed as a percent.

$$\frac{\text{mL of solute}}{\text{mL of solution}} \times \mathbf{100}$$

= % v/v concentration

- Useful conversions for WATER only!
- 1 g = 1 mL = 1 cm3 = 0.001 Kg = 0.0001 L
  1 L = 1 Kg = 1,000 g = 1,000 mL
-

III. Parts Per Million (ppm, mg/Kg)

- **Parts per million is a concentration expression that relates <u>MILLIGRAMS</u> of solute to kilograms of solution (mg/Kg)**

- $\frac{\text{mg of solute}}{\text{KG of solution}} =$

Ppm (mg/Kg)

- **Useful Conversions**
- 1g = 1,000 mg; 0.0001g = 1mg; 1Kg = 1,000g = 1,000,000mg