Homework - #3-6 p. 477

$\frac{30\text{g}}{100\text{mL}}$ $\frac{\quad}{200\text{mL}}$

$\frac{35\text{g}}{100\text{mL}}$

Solubility Generalizations

- solubility of solids increases with an increase in temperature
- solubility of gases decreases with an increase in temperature
- some liquids have no maximum limit of dissolving (**miscible liquids**)
- some liquids will not dissolve in other liquids (**immiscible liquids**)
- as the partial pressure of a gas increases, its solubility increases

Henry's Law

$$\frac{S_1}{P_1} = \frac{S_2}{P_2}$$

The solubility of a gas is 0.58 g/L at a pressure of 104 kPa. What is its solubility if the pressure increases to 250 kPa at the same temperature?

$S_1 = 0.58\ g/L$

$P_1 = 104\ kPa$

$S_2 = ?$

$P_2 = 250\ kPa$

$$\frac{S_1}{P_1} = \frac{S_2}{P_2}$$

$$\frac{0.58\ g/L}{104\ kPa} = \frac{S_2}{250\ kPa}$$

$$\frac{(0.58\ g/L)(250\ kPa)}{(104\ kPa)} = S_2$$

$$S_2 = 1.4\ g/L$$

Solubility Problem Example

A 50.0 mL sample of saturated calcium chloride solution at 20°C was evaporated to produce 10.2 g of solid dry residue.

(a) What is the solubility in grams per hundred millilitres?

(b) What is the solubility in mol/L?

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$S_1 = 3.6\ g/L$

$P_1 = 1.0\ atm$

$S_2 = 9.5\ g/L$

$P_2 = ?$

$$\frac{S_1}{P_1} = \frac{S_2}{P_2}$$

$$P_2 = \frac{S_2 P_1}{S_1}$$

$$P_2 = \frac{(9.5\ g/L)(1.0\ atm)}{(3.6\ g/L)}$$

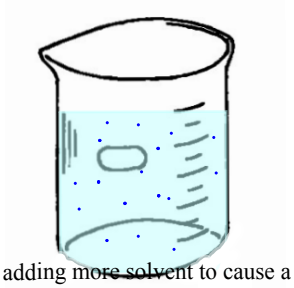
$$\boxed{P_2 = 2.6\ atm}$$

Concentration of a Solution

concentration - a numerical ratio comparing the quantity of solute to the quantity of solution.

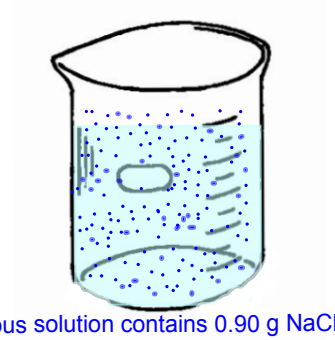
molar concentration (molarity) - the amount of moles of solute dissolved in one litre of solvent
units: mol/L

dilute - a solution that has a small amount of solute as compared to the amount of solvent



dilution - process of adding more solvent to cause a solution to become more dilute

concentrated - a solution that has a large amount of solute as compared to the amount of solvent



Ex. An intravenous solution contains 0.90 g NaCl in 100.mL of solution. What is the molarity of this solution?

$m = 0.90\,g$ NaCl

$V = 100.\,mL$

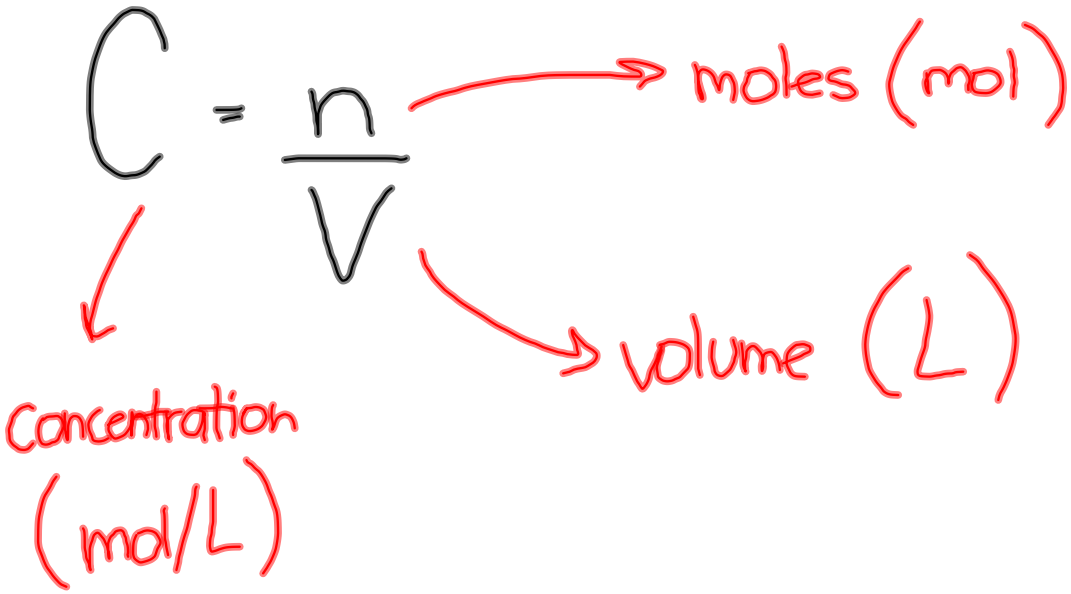
$C = ?$

$0.90\,g\,NaCl \times \frac{1\,mol\,NaCl}{58.44\,g\,NaCl} = 0.0154\,mol$

$C = \frac{n}{V}$

$C = \frac{0.0154\,mol}{0.100\,L}$

$C = 0.15\,mol/L$


C = n/V
moles (mol)
volume (L)
concentration (mol/L)

Ex. What volume of solution is required to dissolve 1.75 mol to make a 0.95 mol/L solution of $CaCO_3$?

Ex. A sample of laboratory ammonia solution has a concentration of 14.8 mol/L. What mass of ammonia is present in a 25.0 mL sample of this solution?