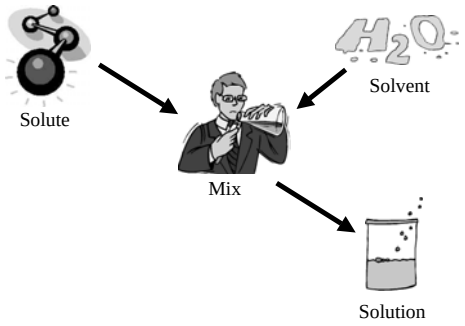
Concentration Units

CHEM 113 – Zumdahl 11
revised 6/2003

Beginnings . . .

Solution Preparation



Reasons to discuss solutions

- Real life samples are generally mixtures
- Properties of mixtures are different from those of pure substances (eg. colligative properties)
- Once made, solutions are easily diluted and transferred

Name that solution : #1

Doxylamine Succinate, Dextromethorphan Hydrobromide, Acetaminophen, Pseudoephedrine Hydrochloride, Alcohol, Citric Acid, Flavor, Green #3, High Fructose Corn Syrup, Polyethylene Glycol, Propylene Glycol, Purified Water, Saccharin Sodium, Sodium Citrate, Yellow #6, Yellow #10

NyQuil Liquid

Name that solution : #2

Carbonated Water, Concentrated Orange Juice, Citric Acid, Aspartame, Potassium Benzoate, Citrus Pectin, Potassium Citrate, Caffeine, Gum Arabic, Natural Flavors, Brominated Vegetable Oil, Yellow #5, Erythorbic Acid.

Diet Mountain Dew

Name that solution : #3

Thymol, Eucalyptol, Methyl Salicylate, Menthol, Water, Alcohol, Benzoic Acid, Poloxamer 407, Caramel.

Generic Listerine

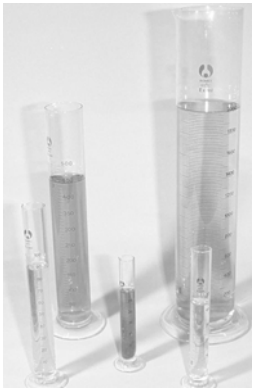
Describing Composition of Solutions

- Molarity: M
- Molality: m
- Mole Fraction: X
- Percent Composition: %(w/w)
- Density: d

- What is temperature dependence?

Graduated Cylinders

- Graduated cylinders may be labeled TD- "to deliver" or TC – "to contain"
- Volumes can be estimated to one more place than there are divisions!



Volumetric Flasks

- Have a single graduation mark
- Typically, TC – "to contain"
- The volume of a100 mL volumetric flasks can be read as 100.0 mL since they contain 100.0 ± 0.1 mL

Figure 2-10. Class A volumetric flask.

Solution Calculations – Example #1

A solution is prepared by dissolving 5.00 grams of Na_3PO_4 is dissolved in enough water to make 250.0 mL of solution. (Assume the solution has a density of 1.00 g/mL.)

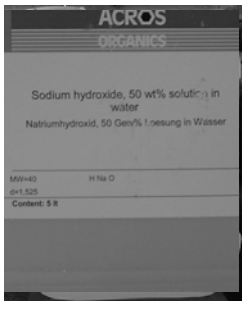
What is the molarity and percent by weight of Na_3PO_4 in the solution.
What is the molarity of Na^+ (aq) in solution?

Molar Mass of Na_3PO_4 = 164 g/mol

Solution Calculations – Example #2

A bottle of "concentrated" NaOH contains the following information on the label: 50.0 %w/w NaOH, Density = 1.525 g/mL.

<u>Calculate the molarity, molality, and mole fraction of the NaOH in the solution.</u>



Solution Calculations – Example #3

Given a 10.0 mL aliquot of the previous solution. How much water would be needed to dilute it to make a 0.100 M NaOH solution?

$$M_1V_1 = M_2V_2$$

(The dilution equation)

Solution Calculations – Example #4

An aqueous solution has a density of 1.25 g/mL and is found to be 34.0 % H_2SO_4 by mass. How many grams of H_2SO_4 are in 200. mL of this solution?

Solution Calculations – Example #5

- A baby formula contains 1.80 mg of iron per 5.00 fluid ounces. What is the molarity of iron in the baby formula?
- (Hint: 29.6 mL = 1.00 fluid ounce)

Two other thoughts . . .

2.0 N H_2SO_4 (aq) does not equal 2.0 M H_2SO_4 (aq)

$$M = \frac{moles\ solute}{L\ sol'n} = \frac{mmoles\ solute}{mL\ sol'n}$$