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ch216sp12syllabus: Calculations

Calculations. Although most of the calculations that you will perform in lab were taught in general chemistry or in Chemistry 211, there are some that you may not have seen before. Examples of each are shown below. Several practice problems are provided at the bottom of the page.

1. Determining Molarity from wt %:

If you have a 33 % w/w solution of NaOH, what is the molarity of the solution?

A 33 % w/w solution of NaOH has 33 g of NaOH per 100 g of solution. This is a ratio of solute to solution and the g units cancel out. So,

33 g / 100 g solution = 0.33

You can then use the density and the molecular weight to determine the molarity of the solution. If these are not provided for you, you need to look them up on Aldrich or Acros. In this case the density is 1.36 g / mL and the molecular weight of NaOH is 40.0 g. Since molarity is moles/L you will need to convert from mL to L.

0.33 * [1.36 g/mL] * [mol/ 40.0 g] * [1000 mL / L] = 11.22 M

Whenever you do a calculation you should check your work by:

1. making sure all of the units cancel and that you end up with the correct units
2. asking whether the final quantity makes sense. For instance if you determine a molarity of 300 M, you should check your calculations.

2. Determining the volume of a solution, when the molarity is different than that provided in the procedure:

In experiment 2, the procedure calls for 0.3 mL of a 6.0 M solution of NaOH. If you only had 33 % NaOH in the lab, you would first need to determine the molarity of the solution as described in A. You could then use the formula M1V1 = M2V2, to determine the volume needed. As follows:

M1 = 6.0 M
V1 = 0.3 mL
M2 = 11.22 M

V2 = (6.0 M) * (0.3 mL) / 11.22 M = 0.16 mL

Since M2 is a greater concentration than M1, you should expect that V2 would be less than V1. Therefore V2 = 0.16 mL makes sense.

3. Determining and using molar equivalents:

A molar equivalent is the ratio of the moles of one compound to the moles of another. Once you determine the moles (or mmols) of each compound you can determine the molar equivilants. Usually you are relating the moles of the limiting reagent to the moles of other starting materials or reagents used in the reaction. For experiment 1, if you had 2.5 mmol of aniline and 5 mmol of acetic anhydride, you could do the following:

5 mmol / 2.5 mmol = 2 mol. equiv acetic acid

This just tells you that for every 1 mole of aniline in the reaction, you are using 2 moles of acetic anhydride.

If you know the molar equivalent you can determine the actual mole quantity used in the reaction. For instance if you have 2.5 mmol of aniline and the procedure says you will use 1.2 mol. equiv. of acetic anhydride, you could do the following:

2.5 mmol aniline * [1.2 mol acetic anhydride / 1 mole aniline] = 3 mole acetic anhydride

Practice Calculations
Solutions