

**Problem Set 1 -- Stoichiometry and Concentration Review**

Complete all problems on separate paper. Show all work for credit. Correct use of significant figures is required for full credit.

1. Describe how to prepare 2.00 L of a solution that has a potassium concentration of 0.0100 M starting with:
  - a. solid potassium sulfate
  - b. 0.200 M potassium sulfate solution.
2. Ammonia can be generated by heating together the solids  $\text{Ca(OH)}_2$  and  $\text{NH}_4\text{Cl}$ .  $\text{CaCl}_2$  and water are also formed. How many grams of  $\text{NH}_3$  will form if 33.0 grams each of  $\text{NH}_4\text{Cl}$  and  $\text{Ca(OH)}_2$  are heated? (molar masses (g/mol):  $\text{NH}_4\text{Cl} = 53.4912$ ,  $\text{NH}_3 = 17.03056$ ,  $\text{Ca(OH)}_2 = 74.093$ ,  $\text{CaCl}_2 = 110.983$ , water = 18.0153)
3. 22.5 grams of magnesium nitrate, 23.0 mL of 1.20 M nitric acid and 14.9 grams of aluminum nitrate are placed in a 500.0 mL volumetric flask, dissolved and diluted to a total volume of 500.0 mL. What is the nitrate concentration, in moles per liter, in the resulting solution?
4. You dissolve 2.83 g of a copper-containing mixture in water in a 100.0 mL volumetric flask and dilute it to the mark to prepare solution A. You then pipet 5.00 mL of solution A into a 25.00 mL volumetric flask and dilute it to the mark to make solution B. Finally, you pipet 1.00 mL of solution B into a 25.00 mL flask and dilute it to the mark to make solution C. You then determine the copper concentration in solution C to be  $6.62 \times 10^{-4}\text{M}$ . What is the percent copper by mass in your original solid mixture?
5. In order for your car battery to function properly, the sulfuric acid in the battery must be between 4.8 and 5.3 M  $\text{H}_2\text{SO}_4$ . A 5.00 mL sample of acid from a battery requires 49.74 mL of 0.935 M NaOH to be completely neutralized in a titration. Does the concentration of this battery acid fall within the desired range? Justify your answer with a calculation.