

Ion concentration and solubility reaction problems.

For each problem involving ion concentration, please do not forget to include the solubility reaction(s) and set up ICF tables in molarity or mol (or mmol) units.

- 1) Calculate nitrate ion molarity in a solution prepared by dissolving 2.75 g of aluminum nitrate, $\text{Al}(\text{NO}_3)_3$ in a total solution volume of 500. mL.
- 2) 75 mL of the solution in problem 1 as mixed with 45 mL of 0.030 M $\text{Ca}(\text{NO}_3)_2$. Calculate millimolar (mM) concentration of all ions in the final mixture.
- 3) A student mixes 75.0 mL of 0.150 M aluminum nitrate with 25.0 mL of 0.150 M NaOH solution. A reaction should take place (verify!). Write the overall, ionic and the net ionic equations. Calculate all ion concentrations (M) and calculate mass (g) of the insoluble product formed.

----- A solution preparation problem-----

- 4) Imagine you get a well-paid summer job working in a research chem lab and in your first day, your supervisor asks you to prepare 470. mL of sulfuric acid, H_2SO_4 solution close to 0.18 M but she needs it to be precise to 4 significant digits (0.18XX). You check your inventory and find that you have 3.5 L of a standardized (precise) stock solution of 6.100 M sulfuric acid and of course plenty of deionized water available. Following pictures show types of volumetric glassware (volumetric flasks and pipets) and their sizes that are commonly available in your chem lab. Which glassware set would you select to accomplish this task? List steps necessary to prepare this solution. Also, determine the last two digits of precision of the molarity (0.18XX) so you can report precise concentration of the prepared solution to your supervisor.

**Check your answers:**

- 1) 0.0775 M
- 2) $[\text{Al}^{3+}] = 16 \text{ mM}$, $[\text{Ca}^{2+}] = 11 \text{ mM}$, $[\text{NO}_3^-] = 71 \text{ mM}$
- 3) $[\text{Al}^{3+}] = 0.100 \text{ M}$, $[\text{Na}^+] = 0.0375 \text{ M}$, $[\text{NO}_3^-] = 0.338 \text{ M}$, 0.0975 g $\text{Al}(\text{OH})_3$
- 4) 0.1830 M (Steps: 1-Condition pipet and rinse volumetric flask; 2-Use pipet to transfer the specified volume into the volumetric flask of specified size; 3-Add water to the mark; 4-Cap flask and mix well)