Problem Set 1. Basic Calculations. Answers for numeric results. See instructor for others.
Chem 2222. Summer 2008

1. A 500-mL volumetric flask containing 0.40 M KCl is emptied and allowed to drain briefly, leaving 1.0 mL of liquid in the flask. The flask is then rinsed with distilled water and used to prepare a standard solution of $KNO_3$. Compute the concentration of $Cl^-$ in the standard $KNO_3$ solution if the flask is rinsed
   a) with one 50-mL portion of distilled water.
   b) with five 10-mL portions of distilled water.
   Assume that 1.0 mL of liquid remains in the flask each time it is emptied. For convenience, you may use 50 or 10 mL (instead of 51 or 11 mL) as the total volume of rinse water used in each rinse step (rinse volumes are generally approximate).

2. What volume of concentrated nitric acid (72% $HNO_3$ (w/w), sp. gr. 1.42) is required to prepare exactly 2.0 L of 0.20 M $HNO_3$?

3. A water sample contains 7.2 ppm dissolved calcium fluoride. Calculate $[F^-]$.

4. Samples of liquid water (density 1.00 g/mL) and solid $AgNO_3$ (density = 4.45 g/mL) each have an apparent mass of 18.0000 g. The density of the balance weight is 8.0 g/cm$^3$.
   a) Calculate the true mass of each sample.
   b) Based on your results in part a, what can you say about the relative magnitude of the buoyancy correction as a function of the density of the object being weighed?

5. Consider the reaction (unbalanced)

   $KIO_3(aq) + La(NO_3)_3(aq) \rightarrow La(IO_3)_3(s) + KNO_3(aq)$

   a) write the balanced net ionic equation.
   b) 50.0 mL of a 0.100M solution of $KIO_3$ is added to 15.0 mL of 0.100 M $La(NO_3)_3$. Compute the formal concentration of each of the four ions in solution.

Answers.
1. a) $1.6 \times 10^{-5}$ M (approximate) or $1.6 \times 10^{-5}$ M (exact)
   b) $8.0 \times 10^{-9}$ M (approximate) or $5.0 \times 10^{-9}$ M (exact)
2. 24.6 mL
3. $[F^-] = 1.8 \times 10^{-4}$ M
4a $m_{t,water} = 18.0189$ g
   $m_{t.AgNO3} = 18.0022$ g
5. Representing formal concentration of X as c.X,
   $c.La^{3+} = 0$
   $c.IO_3^- = 0.0077$ M
   $c.K^+ = 0.077$ M
   $c.NO_3^- = 0.069$ M