Example Problems

AP Chemistry- Aqueous Solutions

1. What are the concentrations of each ion in a solution of 0.32 M $Ba(NO_3)_2$?

Ba^{2+} = .32 M and NO_3^{1-} = .64

2. Phosphite is a mineral containing PO_4^{3-} and OH^- anions and sulfuric acid in the manufacture of phosphate fertilizers. A chemist finds the calcium content in an impure sample of phosphate rock by weighing out a 0.4367 g sample, dissolving in water, and precipitating the Ca^{2+} ions as insoluble hydrated $CaC_2O_4 * H_2O$. After being filtered and dried, the $CaC_2O_4 * H_2O$ precipitate weighed 0.2920 g. Calculate the mass percent of Ca in the sample phosphate rock.

0.2920 g x 1 mole/146 g $CaC_2O_4 * H_2O$ x 1 mole Ca/1 mole $CaC_2O_4 * H_2O$ x 40.0 g Ca/1 mole Ca = .08 g

Ca

.08/0.4367 x 100= 18% Ca

3. What volume of 0.100 M HCl is needed to neutralize 50.0 mL of a 0.43 M NaOH solution?
   MV= mol
   (0.43) (.0500)= .0215 mol NaOH
   Mol NaOH is equivalent to mol HCl
   MV=mol
   (0.100)(V)= 0.0215
   V= 0.215 L = 215 mL

4. A student carries out an experiment to standardize a sodium hydroxide solution. To do this the student weighs out a 1.3009 g sample of potassium hydrogen phthalate (KHP, mol. Wt. = 204.22 g/mol), a compound with the formula $KHC_8H_4O_4$ which has one acidic hydrogen. The student dissolves the KHP in distilled water and titrates it with the sodium hydroxide solution. The difference between the final and initial buret readings indicates that 41.20 mL of the sodium hydroxide solution is required to react with the mass of KHP. Calculate the concentration of the sodium hydroxide solution.

1.3009 g x 1 mole/204.22 g = 6.370 x 10^{-3} mol   mol acid=mol base

MV= mol   (M)(.04120)= 6.370 x 10^{-3} M= .1546 M

5. A sample of an analgesic drug was analyzed for aspirin, a monoprotic acid, $HC_9H_7O_4$, by titration with a base. In a titration, a 0.500 g sample of the drug required 21.50 mL of a 0.100 M NaOH for complete neutralization. What percent by mass of the drug aspirin?

MV= mol

(0.100) (.02150)= 2.15 x 10^{-3} mol NaOH

Mol base= mol acid

2.15x 10^{-3}mol aspirin x 180 g/1 mole = .387 g aspirin

.387/.500 x 100 = 77.4 %