Problem Set I: REVIEW OF SOME BASIC CONCEPTS

I. Calculation of Solution Concentrations

A. Molarity (moles/liter) or (millimoles/milliliter) mol/L or mmol/mL
Thus how would one define Molarity? Molarity = # moles = (#9/molar mass) # Liters = # Liters
What analytic problems are often associated with determining high concentrations?
Solubility of solute and some times reactivity of Solution
Why is Molarity the most common measure used in chemistry? Molarity is inducator of # molecules in fixed volume.
Equilibrium's regure Moberity because Equil. is Special cased Kinetics Equilibrium Molarity describes the molar concentration of a particular chemical species at equilibrium, i.e., after acid/base dissociation or complexation reactions.
B. Weight Percent = 100 X # g solute # g total solution
C. Volume Percent = 100 x Volume (ml) of solution (tobe)
D. Weight/Volume Percent = 100 x #50 solute # solution (total)
Important: B and D may be considered the same for dilute Aqueous solutions
Why is this possible? I'ml = I gram when density = 1.00 (Very Dilute.)
E. Parts per million = 106 x #5 soluter ~ 106 #5 solution # ril of solution
9=1,00 #9solita & 9solution
mg/kg = ppm, concentrations in $mg/liter$ may be expressed as ppm for dilute solutions. (PPM = mg/L) Vary close if < $loop ppm$
How would you define parts per billion (ppb) or parts per trillion (ppt)?

Ratio = # S solutionRatio $\times 10^{2} = \%$ Ratio $\times 10^{6} = Ppm$ Ratio $\times 10^{9} = Ppb$ Ratio $\times 10^{12} = Ppt$

II. Density and Specific Gravity

A. Density is defined as mass per unit volume. Solution densities are expressed as
grams/ml. Gas densities are expressed as grams/liter.
grams/ml. Gas densities are expressed as grams/liter. Because solid/seguid morecules to 3 closer than in gas
B. Specific Gravity (Dimensionless quantity) is the ratio of the mass of a substance to the
mass of an equal volume of water at 4° C.

Consider the following example:

A bottle of concentrated sulfuric acid that you would get from the stockroom has a concentration of 18.3 M and is 98% by weight H₂SO₄.

How many mL of concentrated reagent should be diluted to 1.00 L to give a concentration of 1.00 M?

What is the density of the concentrated reagent?

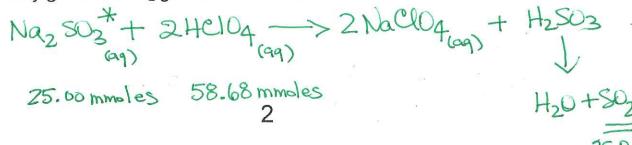
Consider the following problem:

Exactly 75.00 ml of a 0.3333 M solution of Na_2SO_3 were mixed with 150.00 ml of a 0.3912 M $HClO_4$ solution. (126.043)

(100.4585

When you approach a problem of this sort you must realize only one of THREE POSSIBLE outcomes can occur.

- There will be excess Na₂SO₃ when the reaction is complete.
- There will be excess HCLO₄ when the reaction is complete. v
- Both species will have reacted totally.
- a.) How many grams of SO₂ gas were evolved?



b.) What is the concentration of the unreacted reagent?

- In solving this problem you must first BALANCE the equation. (NaClO4 and H2O are the other species produced in this reaction.)
- Then you must identify the limiting reagent. In doing this you must calculate the number of moles or millimoles of each reactant you have at the beginning.

The number of millimoles of HCLO₄ you have is given by: $m \chi M = mmoles$

(150 ml) (.3912) = 58.68 mmoles (Excess)

The number of millimoles of Na₂SO₃ you have is given by:

In order to react all the Na₂SO₃ that is present how many millimoles of HClO₄ are necessary?

In order to react all the HClO₄ that is present in solution how many millimoles of Na₂SO₃ are needed?

In order to determine the limiting reagent you must compare the amounts of reagents available to amounts necessary to consume each reagent totally. The limiting reagent is:



(64.07)

How many grams of SO₂ gas were evolved? (Amount of gas or precipitate formed is defined by the limiting reagent.)

Indeed Na2 SO3 -> Indee SO2

25,0 mmles Na2 SO3 -> 25,00 mmles SO2

25,0 mmles SO2 ->
$$\times \frac{64,0799}{mml} = \frac{1601,7mg}{1.602g}$$

What is the concentration of the HClO₄ remaining?

What is the pH of this solution? Why is this calculation fairly simple?

If
$$SO_2$$
 stayed in solution 28 H_2SO_3
then $[H_2SO_3] = [BO_2]$ pKai = 192
Weak Acid pKaz = 7.18 (Ignore)
(for now)
 $[H_3O^{\dagger}] = \sqrt{(10^{-1.92})(.0386)}$
 $= 0.0215 4 \Rightarrow [PH = 1.67]$

If it had been strong pH=-log (.0386)=1.41 (close)