**Homework #1 : Solution Preparation Computations 22 pts total**

*Chem 6614 Chemical Instrumentation*

*Due Wednesday 1 February 2017*

*Your name: \_\_\_\_\_\_\_\_\_\_\_\_answers\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

1. Convert the indicated solution compositions on the left to indicated units (3 sig figs). (1 pt per box)

(detailed solutions below)

 solution1 w/v % g CuCl2\*2H2O/L μM Cu2+ g Cu2+/100 mL ppt (w/v)

 10.0 ppm Cu2+(w/v) **0.001 0.0268 157 1.00\*10-3  0.0100**

 0.852 g CuCl2\*2H2O 0**.852 8.52 5.00\*104 0.318 8.52**

 diluted to 100.0 mL

1Note: Atomic mass of Cu =63.546 g/mol Molecular weight of CuCl2\*2H2O = 170.44 g/mol

10 ppm Cu2+ =10 mg Cu2+ /1 L = 0.01 g/1000 mL = 0.001 g/100 mL =100\*0.001/100=0.001 w/v % (remember: 1 % w/v = 1 g/100 mL

 =0.01 g Cu2+/L \* (1 mol Cu2+ /63.546 g Cu ) \*170.44 g CuCl2/mol Cu = 0.0268 g CuCl2\*2H2O/L

 =0.01 g Cu2+/L \* (1 mol Cu2+/63.546 g Cu) = 1.57\*10-4 mol Cu2+/L= 157 uM Cu2+

= 0.01 g/1000 mL = 0.0100 ppt

0.852 gCuCl2\*2H2O/100 ml =100\* (0.852 g CuCl2\*2H2O/100 mL =0.852%

 =5.00\*10‑3 mol Cu/0.1L

 =(5\*10‑3 mol Cu\*63.54 g/mol)/100 mL=0.318 g Cu/100 mL=0.318 w/v%

 =0.852 gCuCl2\*2H2O/100 ml \*(1000 mL/1 L)=8.52 g/L

 =0.852 g CuCl2\*2H2O/100 mL =8.52 g/1000 =8.52 ppt

1. How many grams of NiCl2\*6H2O (MW=237.688 g/mol) must be weighed out to prepare 100.0 mL of 50 mM Ni2+ ? (2 pts) **Show work**

50 mM =0.05 M Ni2+=> 0.05 mol Ni\*0.10 L/L= 0.005 mol Ni=0.005 mol NiCl2\*6H2O

 =0.005 ~~mol NiCl~~~~2~~~~\*6H~~~~2~~~~O~~ \*237.688 g NiCl2\*6H2O /~~mol NiCl~~~~2~~~~\*6H~~~~2~~~~O~~

 =1.188 g

**\_1.188**\_\_\_\_\_\_ g NiCl2\*6H2O (4 sig figs)

1. A 0.900 gram sample of CuCl2\*2H2O (MW =170.44 g/mol) is dissolved in 100.0 mL of 1% HNO3. A 10.00 mL volume of this primary stock is diluted to 25.00 mL with more 1% HNO3  Next, 2.00 mL of this intermediate solution is delivered to a clean 100.0 mL volumetric flask and diluted to the mark with 1% HNO3 to make a secondary stock. Finally, 20.000 mL of the secondary stock is diluted to 50.00 mL in 1% HNO3.

What is the final solution’s concentration in:

1. μM Cu2+ (3 sig figs) **Show work**

primary (0.900 g Cu salt 1 mol Cu salt/170.44 g/mol \* (1 mol Cu/1 mol Cu salt)0/0.1 L= 5.28\*10-3 mol Cu/0.1 L =0.0528 M

 intermediate: 10/25 \*0.0528 = 0.0211 M

 secondary: 2/100 \*0.0211=4.22\*10-4 M

 final 20/50 \* 4.22\*10-4 =1.69\*10-4 M Cu2+ =169 μM

**\_169**\_\_ μM Cu2+

 2 pts

1. ppm Cu2+ (w/v) (3 sig figs) **Show work**

**169 μM Cu=(1.69\*10-4 mol \*63.54 g Cu/mol) /L= 0.0107 g Cu/L= 10.7 ppm**

 **\_10.7**\_\_\_ ppm Cu2+

 (w/v) 2 pts

1. Commercial concentrated nitric acid (MW=63 g/mol) density of ~1.4 g/mL and contains ~70% w/w HNO3. What is the molarity of concentrated HNO3 (2 sig fig)? 2 pts **Show work**

70% HNO3 w/w= 70 g HNO3/100 g solution = (70 g/63 g mol-1) /100 g solution = 1.11 mol/100 g solution

100 g solution/V = 1.4 g/mL=> V=100/1.4= 71.4 mL =0.0714 L

70% HNO3 w/w = 1.11 mol/0.0714 L= 15.56 ~16 M **16**  = M HNO3

(over)

1. **Factoids yea or nay ?**
2. 1 % nitric acid = 1 mL concentrated nitric acid diluted to 1 L T **F**
3. 1 ppt w/v = 1 g/L **T** F
4. Conc. H2SO4 ( density of 1.81 g/mL; 98.6% sulfuric acid w/w) **T** F

has an [H+] ~ 36 M assuming complete dissociation

1. You always add concentrated acid to water, not the other way around **T** F