Chem 2990 **Molarity and Normality Assignment** **Dr. Walker**

1. Typical seawater contains 2.7 g NaCl per 100mL, or 2.7% $(^{m}/_{v})$. What is the molarity of NaCl in the ocean? The concentration of $MgCl_2$ is 0.054 M in seawater. How many grams of $MgCl_2$ are present in 25mL of seawater?

2. Copper(II) sulfate pentahydrate, $CuSO_4 \cdot 5H_2O$, has 5 moles of water for each mole of $CuSO_4$ in the solid crystal. Calculate the formula weight for the pentahydrate. How many grams of $CuSO_4 \cdot 5H_2O$ should be dissolved in a volume of 500.0 mL to make 8.00mM (8.00×10^{-3} M) Cu^{2+}?

3. Interconvert the following molarities and normalities:

a. 0.2 M HCl → _____ N HCl
b. 0.6 M H_2SO_4 → _____ N H_2SO_4
c. 0.04 M H_3PO_4 → _____ N H_3PO_4
d. 12 M HNO_3 → _____ N HNO_3
e. 1 M H_2CO_3 → _____ N H_2CO_3
f. 18 mM citric acid → _____ N citric acid
g. 0.04 M $Mg(OH)_2$ → _____ N $Mg(OH)_2$

4. An average human infant's blood serum contains 5-10 milliequivalents (mEq) of potassium per liter. Calculate this concentration range in both normality and ppm.

5. How many mL of H_2SO_4 solution (density = 1.1783) containing 25.0%$(^{w}/_{w})$ H_2SO_4 are required to prepare 1800 mL of 0.1000 N solution?

6. Permanganate is used as a reagent in a number of analyses. It reacts by donating five electrons to form the manganous ion:

$$5e^- + 8H^+ + MnO^-_4 \rightarrow Mn^{2+} + 2\ H_2O$$

What is the normality of 0.1 M $KMnO_4$ in this type of reaction?

7. Arsenic can be determined by a redox titration with standard iodine solution. The reaction is

$$HAsO_2 + I_2 \rightarrow H_3AsO_4 + 2H_+ + 2I^-$$

Pure As_2O_3 can be used as a primary standard in determining the concentration (normality) of the iodine solution. A sample of pure As_2O_3 weighing 4.0136 g is dissolved in 800.0 mL of solution. Calculate the normality of the solution when it is used in the reaction above. Also calculate the molarity of the solution.

Note that each arsenic atom loses two electrons in being oxidized from $HAsO_2$ to H_3AsO_4. Each As_2O_3 contains two arsenic atoms and hence loses four electrons during the standardization reaction:

$$As_2O_3 \rightarrow 2\ HAsO_2 \rightarrow 2\ H_3AsO_4 + 4e^-$$

Therefore, the equivalent weight of As_2O_3 is ____ of the molecular weight. *(what fraction?)*