CHEM 2810 Stoichiometry Review / Sig Fig and Propagation of Error Practice

1. A sample of bismuth metal, weighing 0.687 ± 0.003 g, was converted to the chloride by reaction with HNO_3 and HCl, with careful evaporation to dryness. The weight of the bismuth chloride was 1.025 ± 0.003 g. From this data, how would you best express the percent of bismuth in the chloride compound, to include the precision of the weighings?

2. Based on the masses in (1), calculate the empirical formula of the bismuth chloride compound. Given the whole number ratios in the empirical formula, what is the theoretical percent bismuth in the bismuth chloride? What is the percent error in the experimental determination? If you consider the uncertainty reported in 1, is the actual value represented by the experimental value?

3. Nutritional supplement tablets contain 15.0 ± 0.2 mg of Fe each, so how many tablets are necessary to ensure that at least 0.250 g of Fe_2O_3 can be prepared in a gravimetric analysis?

4. If a tablet containing 15.0 ± 0.2 mg of Fe, 22.5 ± 0.3 mg Ca, and 2.225 ± 0.015 mg Zn is dissolved in an uncalibrated 100.00 mL volumetric flask (tolerance is ± 0.08 mL), then what is the concentration, in ppm, of each metal with associated uncertainty? What is the total metal concentration with associated uncertainty? How could you reduce the uncertainty of these concentrations?

5. Stoichiometric coefficients are “counted” and are thus exact values. Only whole molecules can participate in reactions, no ½ molecules of O_2 exist in the environment, which is why integers are preferred for balancing reactions. In thermochemical equations however, fractions are allowed. Why?

6. Given the reaction below for the dissolution of solid NH_4Cl, how much heat is released/absorbed when 5.350 ± 0.002 g of NH_4Cl dissolves in water? $NH_4Cl\ (s) \rightarrow NH_4^+\ (aq) + Cl^-\ (aq)$ $\Delta H° = 14.0$ kJ/mole

7. An unknown metal with mass of 55.7 g at 99.9 °C is dropped into 100.0 g of water (s= 4.184 J/g°C) at 20.0 °C. The final temperature of the water and the metal is 23.7 °C. What is the specific heat of the metal, including uncertainty?

8. Dakota is calibrating a 25 mL pipet. Instead of performing multiple trials, she wants to propagate error from one measurement. She measures 25.0000 ± 0.0005 g of water on a warm day, 30 °C, which means 1 g of water at this temperature occupies 1.0053 mL at 20 °C, which is the calibration temperature of glassware. What volume does her pipet deliver at 20 °C, including uncertainty?