Chem 1515
Review Problem Set
Fall 2001

Name_____

TA Name _____

Lab Section #_____

ALL work must be shown to receive full credit. **Due in lecture, at 2:30 p.m. on Friday, August 31, 2001.**

RPS.1. Write the chemical formula(s) of the product(s) and balance all of the following reactions. Identify all products phases as either (g)as, (l)iquid, (s)olid or (aq)ueous.

a) $Na_{(s)} + Cl_{2(g)} \xrightarrow{H_2O}$

b) $C_4H_{10(l)} +$ oxygen$_{(g)} \rightarrow$

c) silver bromide$_{(s)}$ + sodium thiosulfate$_{(aq)} \rightarrow$

d) $NaCl_{(s)} + H_2SO_{4(l)} \xrightarrow{\Delta}$

e) $SiO_{2(l)} + C_{(s)} \xrightarrow{\Delta}$

f) $AgNO_{3(aq)} + NaCl_{(aq)} \rightarrow$

g) iron metal$_{(s)}$ + warm dilute nitric acid$_{(aq)} \rightarrow$

h) $HgS_{(s)} + O_{2(g)} \rightarrow$

RPS.2. Write the ionic and net ionic chemical equations for 1a), 1c), 1d), 1f) and 1g).

RPS.3. Figure I shows a glass cylinder containing four liquids each of different density. Two of the liquids have been identified. A table containing a list of substances and their density (at 25 ˚C) has been provided. From the list select a substance for Liquid #1 and Liquid #3. Briefly explain the reason(s) for your selections and for the remaining substances the reason they were not selected.

Substance	Density ($\frac{g}{mL}$)	Liquid #
Mercury	13.5	Liquid #4
Water	1.0	Liquid #2
Hexane	0.660	
Ethyl alcohol	0.789	
Dichloromethane	1.33	
Aluminum	2.699	
Bromine	2.928	
Gold	19.3	

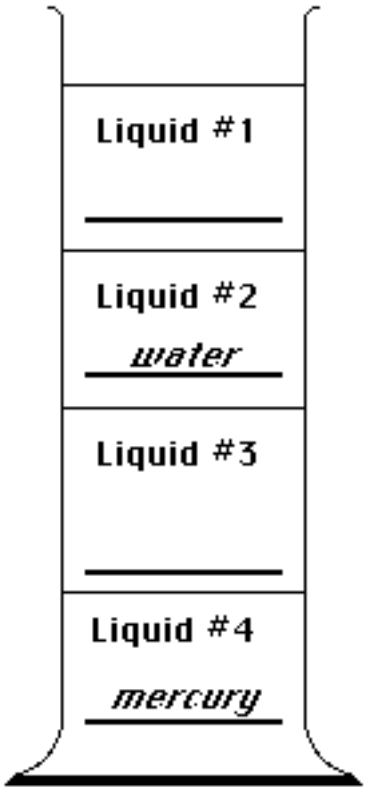

Figure I.

RPS.4. The amount of copper in a sample can be determined by dissolving the sample in water and reacting with zinc metal, according to the following reaction;

$$CuSO_{4(aq)} + Zn_{(s)} \rightarrow Cu_{(s)} + ZnSO_{4(aq)}$$

The metallic copper can be weighed after separating it from the solution. To insure complete conversion of the copper an excess of zinc is typically added to the solution. Any zinc which remains unreacted can be converted to a soluble form by adding an acid like H_2SO_4.

a) Write the reaction which you would expect to occur between zinc metal and sulfuric acid.

b) Calculate the value of *x* in the formula $CuSO_4 \cdot xH_2O$, if a 1.20 g sample of the hydrate reacts with excess zinc metal followed by addition of sulfuric acid yields 0.306 g of copper metal.

RPS.5. A gaseous mixture in a 5.00 L reaction vessel containing 114.0 g of $CS_{2(g)}$, 3.500 g of $H_{2(g)}$ and 88.00 g of $CH_{4(g)}$ at a particular temperature is allowed to react. After the reaction occurs, analysis shows 94.34 g of CH_4 are present. The equation which describes the reaction is;

$$CS_{2(g)} + 4H_{2(g)} \rightarrow CH_{4(g)} + 2H_2S_{(g)}$$

Calculate the mass of CS_2 and H_2 reacting and the mass of CS_2 and H_2 remaining.

RPS.6. Using a table of Standard Enthalpies of Formation (Appendix C, p 1012 in Brown, LeMay and Bursten), calculate the enthalpy of reaction for each of the following;

a) $CaO_{(s)} + H_2O_{(l)} \rightarrow Ca(OH)_{2(aq)}$

b) $C_6H_{12}O_{6(s)} + 6O_{2(g)} \rightarrow 6CO_{2(g)} + 6H_2O_{(l)}$ (Note: $\Delta H^\circ_f(C_6H_{12}O_{6(s)}) = -1254 \frac{kJ}{mol}$)

RPS.7. In a particular version of a solar heating system the radiation from the sun is used in the following chemical conversion,

$$Na_2SO_4 \cdot 10H_2O_{(s)} \rightarrow Na^+_{(aq)} + SO_4^{2-}{}_{(aq)} + 10H_2O_{(l)}$$

The enthalpy, ΔH°, for this reaction is +78.7 kJ. If clouds form, or during the evening the outside temperature drops and the reverse reaction occurs. The heat produced when the reverse reaction occurs heats water in a storage tank. If 1.00 kg of $Na_2SO_4 \cdot 10H_2O_{(s)}$ is formed, calculate the final temperature of a 10.0 gallon storage tank containing water at 25.0 $^\circ$C.

RPS.8a. Complete the following table

Sketch Geometry	Compound	Number of bonding groups on central atom	Number of non-bonding pairs on central atom	Name of the molecular geometry	Bond Angle(s)
	NO_2^-				
	CH_4				
	HCN				
	SF_4				
	XeF_4				

b. Indicate which of the molecular substances in part 8a) is polar and which are nonpolar. Support your conclusions with a brief explanation.

RPS.9a. Write the electron configuration for S, Ba, O, Fe, Cl and Bi.

b) Which elements in part a) are metals and which are nonmetals?

c) As it relates to electron gain or loss, explain the difference between metals and nonmetals. Use the electron configuration of a neutral atom and its ion to support your explanation.

d) By combining a metal and a nonmetal, or a nonmetal and a nonmetal, from the elements listed in part a), write the formula and name of at least eight compounds. The compounds should include 5 ionic and 3 covalent examples.

e) Use an extra sheet of paper to describe each of the compounds in d). Provide me with some of its physical and chemical properties and brief discussion of what makes each compound interesting/useful.

RPS.10. Solve

a) $\log 6.57 \times 10^{-4} =$

b) $\log 3.51 \times 10^{4} =$

c) $-\log 8.67 \times 10^{-7} =$

d) antilog (-10.004) =

e) antilog (.789) =

f) ln 500 =

g) ln 0.0159 =

h) $e^{-4.14} =$

i) $e^{3.90} =$

j) $\ln\left(\frac{452}{235}\right) =$

k) $\ln\left(\frac{348}{x}\right) = 0.941$ Solve for x

l) $\frac{1}{0.150} - \frac{1}{x} = 5.02$ Solve for x

m) $0.954 = 1.57 - \frac{0.0591}{2} \log\left(\frac{1}{1 \cdot x^{8}}\right)$ Solve for x

RPS.10. (Continued)

n) $x^2 + 5x - 20 = 0$ Solve for x

o) $x^3 - 0.1x^2 - 1.06 \times 10^{-2}x - 9.37 \times 10^{-4} = 0$ Solve for x