Chem 1515 Section 9 - 15
Review Problem Set
Spring 2015

Name_____

TA's Name _____

Sec _____

RPS.1. Write the chemical formula(s) of the product(s) and balance the following reactions. Identify all product phases as either (g)as, (l)iquid, (s)olid or (aq)ueous. Soluble ionic compounds should be written in the form of their component ions.

a) ammonium carbonate(aq) + lead nitrate(aq) --->

b) hexane(g) + oxygen(g) --heat-->

c) nitric acid(aq) + potassium hdroxide(aq) --->

d) iron(s) + lead nitrate(aq) --->

e) sodium carbonate(aq) + nitric acid(aq) --->

f) potassium hydroxide(aq) + hydrofluoric acid(aq) --->

g) ethyl alcohol(l) + oxygen(g) --heat-->

RPS.2. Write ionic and net ionic equations for 1a, 1c, and 1f).

1a) ionic equation

1a) net ionic equation

1c) ionic equation

1c) net ionic equation

1f) ionic equation

1f) net ionic equation

RPS.3. Methane, CH_4, is a hydrocarbon that is commonly used as a fuel for cooking and heating.
a) Write a balanced chemical equation for the complete combustion of methane.

b) Calculate the volume of air at 28 ˚C and 1.1 atmosphere that is needed to burn completely 13.81 grams of methane. Assume that air is 21.0 percent O_2 by volume.

c) The heat of combustion of methane is -889 kJ mol^{-1}. Calculate the heat of formation, H°_f, of methane given that the H°_f of $H_2O(l)$ is -285.3 kJ mol^{-1} and H°_f of $CO_2(g)$ is -393.5 kJ mol^{-1}. (Note: I expect you to calculate the H°_f of methane from the data in this problem.)

d) Assuming that all of the heat evolved in burning 13.81 grams of methane is transferred to 6.01 kilograms of water (specific heat = 4.184 J g-1 deg C-1) initially at 24.7 degrees Celsius, calculate the increase in temperature of the water.

RPS4. 124.7 g of NO are added to an amount of O_2. After the reaction occurs 1.21 moles of N_2O_3 are produced according to the equation,

$$4NO(g) + O_2(g) \text{ ---> } 2N_2O_3(l)$$

Is it possible to determine

a) the moles of N_2O_3 produced?

b) the moles of O_2reacting?

c) the moles of NO reacting?

d) the moles of NO remaining?

e) the moles of O_2 remaining?

RPS5. Use effective nuclear charge and shielding to explain why:

a) the atomic radius of S is smaller than the atomic radius of Mg;

b) it takes considerably more energy to remove the 3rd electron in Mg compared to the energy required to remove the 3rd electron in Al;

c) the ionic radius of O^{2-} is greater than the ionic radius of F^{-}.

RPS6. A sample of dolomite limestone containing only $CaCO_3$ and $MgCO_3$ was analyzed.

a) When a 0.2564 gram sample of this limestone was decomposed by heating, 0.0725 L of CO_2 at 751 mmHg and 34 degrees Celsius were evolved. How many grams of CO_2 were produced?

b) write chemical equations for the decomposition of both carbonates described above.

c) It was also determined that the initial sample contained 0.04272 grams of calcium. What percent of the limestone by mass is $CaCO_3$?

d) How many grams of magnesium containing product were present in the sample in part a) after it had been heated?

RPS7. Complete the following table

Compound	Lewis Structure	# of bonding groups (CA)	# of lone-pairs (CA)	Molecular geometry	Bond angle(s)	Polarity
ClO_3^-						
XeF_5^+						
BF_3						
IF_3						
$SbCl_5$						

RPS8a. Write the complete electron configuration for each of the following:

i) P

ii) Na

iii) I

iv) Zn

v) O

vi) Al^{3+}

b) Which elements listed in RPS8a. are metals and which are nonmetals?

c) As it relates to electron gain or loss, explain the difference between metals and nonmetals. use 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 neutral elements listed in RPS8a, write the formula and name of at least eight compounds. The compounds should include 5 ionic and 3 covalent examples.

RPS9.Solve

a) $\log (7.45 \times 10^{7}) =$

b) $\log (7.45 \times 10^{-7}) =$

c) $-\log (7.45 \times 10^{-5}) =$

d) antilog(-5.481) =

e) antilog(5.96) =

f) ln (206) =

g) ln (0.596) =

h) $e^{-2.72} =$

i) $e^{4.21} =$

j) $\ln\left(\frac{378}{293}\right) =$

k) $\ln\left(\frac{864}{x}\right) = 0.251$ Solve for x

l) $\left(\frac{1}{0.204}\right) - \left(\frac{1}{x}\right) = 5.61$ Solve x

m) $x^2 + 7x - 19 = 0$

RPS10. Consider five unlabeled bottles, each containing 5.0 g of one of the following pure salts.

$$AgCl, BaCl_2, CoCl_2, NaCl, NH_4Cl$$

(a) Identify the salt that can be distinguished by its appearance alone. Describe the observation that supports your identification.

(b) Identify the salt that can be distinguished by adding 10 mL of H2O to a small sample of each of the remaining unidentified salts. Describe the observation that supports your identification.

(c) Identify a chemical reagent that could be added to the salt identified in part (b) to confirm the salt's identity. Describe the observation that supports your identification.

(d) Identify the salt that can be distinguished by adding 1.0 M Na_2SO_4 to a small sample of each of the remaining unidentified salts. Describe the observation that supports your identification.

(e) Identify the salt that can be distinguished by adding 1.0 M NaOH to a small sample of each of the remaining unidentified salts. Describe the observation that supports your identification.

RPS11. Design an experiment to collect data that supports the claim that a 1.0 *M* NaCl solution is a ***homogeneous*** mixture. Describe the steps, the data you would collect, and how the data support the claim. Laboratory equipment for your experiment should be taken from the list below. (You may not need all of the equipment.)

50 – mL beakers	Drying oven
Volumetric pipets (5 mL, 10 mL and 25 mL	Hot plate
Stirring rod	balance
100 mL of 1.0 *M* NaCl	Fume hood