Fall 2014 **CHEM 100 – Exam 3** **Dr. Bolaños**

Name:_____ **Student #**:_____

There are 21 questions on this examination totaling 104 points (scored out of 100 points). Specific point values are clearly stated on each computation/short answer problem. You have 1.25 hours to complete this examination and may only use a basic scientific calculator and the reference tables provided. All work must be shown for credit when specified. An extra sheet is attached that may be used as "scratch" paper. Clearly write your name of this sheet, remove from exam, and submit at the end of the examination period. If you need additional scratch paper, please raise your hand. Please sign the honor code below. If you need further clarification, please raise your hand. Good Luck!

I certify that the work presented in this examination is my own and that the rules set-forth for this examination were followed.

Signature _____

Part 1: Fill-in, Multiple Choice Section. For Questions 1-13, each blank is worth 1 pt,; 20 pts. total. No partial credit.

1. A barometer reads 758.0 mmHg. This corresponds to _____ atmospheres of pressure and _____ torr of pressure.

2. As you hike up a tall mountain, the pressure __increases ***or*** decreases__ **(circle one)**, and at higher elevations, the boiling point of water __increases ***or*** decreases__ **(circle one).**

3. Reactants are always located on the _____ side of a chemical reaction and the (aq) label means that the specified substance is _____.

4. A 0.250 mole sample of carbon weighs _____ grams.

5. True ***or*** False ? Temperature and pressure are inversely proportion for gases?

6. Gases can diffuse into a room because they _____.

7. The liquid sample is heated and the vapor pressure measures 740 torr. If the barometric pressure is 600 mmHg, is the liquid sample boiling? ___Yes ***or*** No___

8. Pressure and Volume have a _____ relationship; if volume is quadrupled (x4), the resulting pressure __increases ***or*** decreases__ by _____.

9. My youngest son wishes he obtained one mole of Halloween candy! This quantity equates to _____ pieces of candy.

10. The molar mass of ibuprofen, $C_{13}H_{18}O_2$ is _____ g/mol.

11. For the substances below, please circle the ones that are soluble in water. (2 pts)

$CaCO_3$ AgCl Na_3PO_4 $(NH_4)_2S$

12. Consider the substances below and <u>circle</u> the substances that have quantities less than one mole. Intense calculations are NOT necessary, and work is not required. *No partial credit here, so be careful!* (2 pts)

9.0×10^{22} atoms C 22.4 g of O_2 25.0 L He at STP

13. In this reaction below, the substance being reduced is _____. In the reaction below, the substance that is losing electrons is _____.

$$Zn_{(s)} + Cu^{2+}_{(aq)} \rightarrow Cu_{(s)} + Zn^{2+}_{(aq)}$$

14. Please classify each reaction as a *single replacement, double replacement, decomposition, combination, or combustion reaction*. (2 pts each, 8 pts. total)

Chemical Reaction	Reaction Type
$2\ AgBr_{(s)} \rightarrow 2\ Ag_{(s)} + Br_{2\,(g)}$	
$4\ P_{(s)} + 5\ O_{2\,(g)} \rightarrow P_4O_{10\,(S)}$	
$Ni_{(s)} + 2\ AgCl_{(aq)} \rightarrow NiCl_{2\,(aq)} + 2\ Ag_{(s)}$	
$NaOH_{(aq)} + HCl_{(aq)} \rightarrow HOH_{(l)} + 2\ NaCl_{(aq)}$	

15. Please **translate and balance** the following reaction. Be sure to include phase labels. (6 pts)
Propane, $C_3H_{8\,(g)}$ is combusted with oxygen to make carbon dioxide and water vapor.

16. Please balance each of the following reactions. (4 pts each, 8 pts total)

____Fe_2O_3 (s) + _____C (s) → ____CO_2 (g) + ____Fe (s)
____$Al_2(SO_4)_3$ + ___ KOH → ____$Al(OH)_3$ + _____ $K_2(SO_4)$

17. A procedure calls for 5.50 g of $Ca_3(PO_4)_2$. Show work for credit. (12 pts total, 4 pts each)
    a. How many moles of $Ca_3(PO_4)_2$ is this?

    b. How many ***moles of oxygen atoms*** are contained in this sample?

    c. ***How many oxygen atoms*** are present in this sample?

18. A weather balloon with a volume of 50.0 L contains 2.1 moles of He. When more He is added, the volume increases to 134.0 L. How many moles of *He were added*? **Show work below.** (6 pts.)

19. Please PREDICT the products, balance and provide phase label for each of the following reactions. **Assume all transitions metals are 2+ as ions**. If no reaction occurs, please write NR. (12 pts total, 4 pts each)

a. ____$Cr_{(s)}$ + ____$ZnCl_{2\ (aq)}$ →

b. ____$K_3PO_{4\ (aq)}$ + _____$Ba(NO_3)_{2\ (aq)}$ →

c. ____$Mn_{(s)}$ + ____$Fe(NO_3)_{2\ (aq)}$ →

20. A gas cylinder of acetylene in my Dad's garage in Texas reads 5.30 L of acetylene on a 87.9 ^{o}C day. The barometer is reading 759.0 mmHg. How many moles of acetylene are in the gas cylinder? Show work for credit. (5 pts)

21. For the reaction, nitrogen reacts with hydrogen to form ammonia, according to the reaction below:
(22 pts total; a-c, each blanks worth 2 pts; d is worth 4 pts; first blank in e is worth 2 pts; last blank is worth 8 pts)

$$N_{2\,(g)} + 3\,H_{2\,(g)} \longrightarrow 2NH_{3\,(g)} \qquad \Delta H = -92.2\ kJ$$

a. If 3.0 moles of hydrogen reaction in excess nitrogen, _____ moles of NH_3 are formed.

b. If 4.0 moles of NH_3 are made, _____ kJ of energy are ___absorbed ***or*** released **(circle one).**

c. If a student wants to use the balanced reaction as the "recipe" for synthesizing NH_3, they would need

_____ g N_2 and _____ g H_2 to make _____ g NH_3.

d. If the reaction occurs at **STP**, and 25.0 L of NH_3 are created, _____ L of H_2 were reacted. ***Show work below for credit.***

e. If a student reacts 1.0 mole of N_2 reacts with 1.0 mol of H_2, and generates 3.8 g of NH_3, the limiting

reactant is _____ and the percent yield is _____ g NH_3. ***Show work below for credit.***

Reference Sheet:

Avogadro's Number= 6.02×10^{23} 1 atm = 760 torr = 760 mmHg R = 0.0821 L*atm/mol*K

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $PV=nRT$ $\frac{V_1}{n_1} = \frac{V_2}{n_2}$

TABLE 4.1 Solubility Rules for Ionic Compounds in Water

Compounds Containing the Following Ions Are Generally Soluble	Exceptions
Li^+, Na^+, K^+, and NH_4^+	None
NO_3^- and $C_2H_3O_2^-$	None
Cl^-, Br^-, and I^-	When these ions pair with Ag^+, Hg_2^{2+} or Pb^{2+}, the resulting compounds are insoluble.
SO_4^{2-}	When SO_4^{2-} pairs with Sr^{2+}, Ba^{2+}, Pb^{2+}, Ag^+, or Ca^{2+}, the resulting compound is insoluble.
Compounds Containing the Following Ions Are Generally Insoluble	**Exceptions**
OH^- and S^{2-}	When these ions pair with Li^+, Na^+, K^+, or NH_4^+, the resulting compounds are soluble.
	When S^{2-} pairs with Ca^{2+}, Sr^{2+}, or Ba^{2+}, the resulting compound is soluble.
	When OH^- pairs with Ca^{2+}, Sr^{2+}, or Ba^{2+}, the resulting compound is slightly soluble.
CO_3^{2-} and PO_4^{3-}	When these ions pair with Li^+, Na^+, K^+, or NH_4^+, the resulting compounds are soluble.

TABLE 4.5 Activity Series of Metals in Aqueous Solution

Metal	Oxidation Reaction
Lithium	$Li(s) \longrightarrow Li^+(aq) + e^-$
Potassium	$K(s) \longrightarrow K^+(aq) + e^-$
Barium	$Ba(s) \longrightarrow Ba^{2+}(aq) + 2e^-$
Calcium	$Ca(s) \longrightarrow Ca^{2+}(aq) + 2e^-$
Sodium	$Na(s) \longrightarrow Na^+(aq) + e^-$
Magnesium	$Mg(s) \longrightarrow Mg^{2+}(aq) + 2e^-$
Aluminum	$Al(s) \longrightarrow Al^{3+}(aq) + 3e^-$
Manganese	$Mn(s) \longrightarrow Mn^{2+}(aq) + 2e^-$
Zinc	$Zn(s) \longrightarrow Zn^{2+}(aq) + 2e^-$
Chromium	$Cr(s) \longrightarrow Cr^{3+}(aq) + 3e^-$
Iron	$Fe(s) \longrightarrow Fe^{2+}(aq) + 2e^-$
Cobalt	$Co(s) \longrightarrow Co^{2+}(aq) + 2e^-$
Nickel	$Ni(s) \longrightarrow Ni^{2+}(aq) + 2e^-$
Tin	$Sn(s) \longrightarrow Sn^{2+}(aq) + 2e^-$
Lead	$Pb(s) \longrightarrow Pb^{2+}(aq) + 2e^-$
Hydrogen	$H_2(g) \longrightarrow 2\,H^+(aq) + 2e^-$
Copper	$Cu(s) \longrightarrow Cu^{2+}(aq) + 2e^-$
Silver	$Ag(s) \longrightarrow Ag^+(aq) + e^-$
Mercury	$Hg(l) \longrightarrow Hg^{2+}(aq) + 2e^-$
Platinum	$Pt(s) \longrightarrow Pt^{2+}(aq) + 2e^-$
Gold	$Au(s) \longrightarrow Au^{3+}(aq) + 3e^-$