CHM1045 Practice Test 2 v.1 - Answers Name: _____
Fall 2013 (Ch. 3 & 4)

MULTIPLE CHOICE AND FILL IN THE BLANK. Circle the one alternative that best completes the statement or answers the question or fill in the blank.

1. Which of the following is insoluble in water? (2 pts.)

   A) Li_2CO_3 B) $Pb(NO_3)_2$ *C) $Al(OH)_3$ D) $Ba(OH)_2$

2. Balance the following reaction. (3 pt.)

   ___3____K_2S (aq) + ___2___$Cr(NO_3)_3$ (aq) → ___1___ Cr_2S_3 (s) + ___6___ KNO_3 (aq)

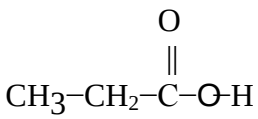
3. What is the oxidation charge of sulfur in SO_3^{-2}? _____+4_____ (2 pts.)

4. Which element in the following reaction is reduced? (2 pts.)

   2 CaO (s) → 2 Ca (s) + O_2 (g)

   A) CaO *B) Ca C) O_2 D) None of these, this is not a Redox reaction.

5. Classify the following organic compound. (2 pts.)



   a) alkene b) alkyne c) alcohol d) ether

   e) aldehyde f) ketone g) ester h) amine

   *i) carboxylic acid

CALCULATIONS and STRUCTURES. Show answers with units and correct significant figures. MUST SHOW WORK!

6. Write the chemical equation of the combustion reaction of C_2H_6 (g) . You do not need to balance the equation. (2 pts.)

   C_2H_6 (g) + O_2 (g) → CO_2 (g) + H_2O (l)

7. Calculate the molarity of a solution made by dissolving 15.0 g of $MgCl_2$ in enough deionized water to make a total volume of 122.4 mL. (3 pts.)

$$15.0\,\text{g}\left(\frac{1\,\text{mole MgCl}_2}{95.2104\,\text{g}}\right) = 0.15\overline{7}5458143\,\text{mole MgCl}_2$$

$$0.15\overline{7}5458143\,\text{mole MgCl}_2 \div 0.1224\,\text{L} = 1.29\,\text{M}$$

8. What is the molar mass of $Ni(NO_3)_2$? Give answer to 5 sig. figs. (3 pts.)

= (molar mass of Ni) + (2)(molar mass of N) + (6)(molar mass of O)

=(58.6934 g/mole) + (2*14.0067 g/mole) + (6*15.9996 g/mole)

= 182.7032 = 182.70 g/mole

9. How many moles of $Ni(NO_3)_2$ are in 37.0 g of $Ni(NO_3)_2$? (2 pts.)

$$37.0\,\text{g}\left(\frac{1\,\text{mole Ni(NO}_3)_2}{182.70\,\text{g}}\right) = 0.203\,\text{mol}$$

10. What is the percent composition by mass of nitrate ions in $Ni(NO_3)_2$? Use 4 sig. figs. (3 pts.)

nitrate ion = NO_3^{-1}

$$\frac{\text{molar mass of nitrate ions}}{\text{molar mass of compound}} x100 = \frac{\{(2*14.0067\,\text{g/mol}) + (6*15.9995\,\text{g/mol})\}}{182.7032\,\text{g/mol}} x100 = 67.88\%$$

11. Find the molecular formula of a compound having the empirical formula of C_6H_7N and the molar mass of 186.24 g/mol. (3 pts.)

molar mass of C_6H_7N = 93.12828 g/mol

$$\frac{186.24\ \text{g/mol}}{93.12828\ \text{g/mol}} = 1.9998 \cong 2$$

$2(C_6H_7N) = C_{12}H_{14}N_2$

12. How many moles of chloride ions are in 120.00 mL of 0.144 M $BaCl_2$? (3 pts.)

$$0.12000\ \text{L}\left(\frac{0.144\ \text{mol BaCl}_2}{\text{L}}\right)\left(\frac{2\ \text{mole Cl}^-}{1\ \text{mol BaCl}_2}\right) = 0.034\overline{5}6 = 0.0346\ \text{mol Cl}^-\ \text{ions}$$

13. How many mL of 8.0 M NaOH are needed to prepare 200.00 mL of 3.00 M NaOH? (3 pts.)

$M_1V_1 = M_2V_2$ for a dilution

$(8.0\ \text{M})V_1 = (3.00\ \text{M})(200.00\ \text{mL})$

$V_1 = 75$ mL

14. How many moles of N_2 react when 0.633 moles of hydrogen gas react? (2 pts.)

$$3\ H_2\ (g)\ +\ N_2\ (g)\ \rightarrow\ 2\ NH_3\ (g)$$

mole-to-mole ratio: 3 mol H_2 = 1 mol N_2

$$0.633\ \text{mol H}_2\left(\frac{1\ \text{mol N}_2}{3\ \text{mol H}_2}\right) = 0.211\ \text{mol N}_2$$

15. If we want to make 28.0 g of ammonia, how many moles of hydrogen gas do we need to react? (4 pts.)

$$3\ H_2\ (g)\ +\ N_2\ (g)\ \rightarrow\ 2\ NH_3\ (g)$$

$$28.0\ g\ NH_3\left(\frac{1\ mol\ NH_3}{17.03052\ g}\right)\left(\frac{3\ mol\ H_2}{2\ mol\ NH_3}\right) = 2.4\overline{66} = 2.47\ mol\ H_2$$

16. Which of the following reactions will occur? Circle one answer. **If yes, write the products.** You do NOT need to balance the reaction. If you believe there is no reaction, do not write any products, or cross off any products. (2-3 pts. each)

(a) $Ba(C_2H_3O_2)_2\,(aq)\ +\ K_2CO_3\,(aq) \rightarrow$ *yes or no $\rightarrow$ ___$BaCO_3\,(s)\ +\ KC_2H_3O_2\,(aq)$ _____
(this is a precipitation reaction, you have to remember solubility rules to see what compounds will dissolve in water and which will not dissolve)

(b) $(NH_4)_2S\,(aq)\ +\ Na_2CO_3\,(aq)\ \rightarrow$ yes or *no $\rightarrow$ _____
(look at solubilty rules, all of the possible products will dissolve in water, are (aq), so there is no net reaction.)

(c) $Ca(OH)_2\,(aq)\ +\ HNO_3\,(aq)\ \rightarrow$ *yes or no $\rightarrow$ ___$H_2O\,(l)\ +\ Ca(NO_3)_2\,(aq)$ _____
(this is an acid-base neutralization reaction: acid + base $\rightarrow$ water (l) + a salt)

(d) $Li_2CO_3\,(aq)\ +\ HCl\,(aq) \rightarrow$ *yes or no $\rightarrow$ ___$CO_2\,(g)\ +\ H_2O\,(l)\ +\ LiCl\,(aq)$ _____
(this is an acid + carbonate ion $\rightarrow$ carbon dioxide gas + water liquid + a salt)

17. (a) Write the balanced Complete Ionic Equation for the following reaction. (4 pts.)
(b) Write the balanced Net Ionic Equation for the following reaction. (3 pts.)

$$Pb(NO_3)_2\ (aq) + 2\ LiBr\ (aq) \rightarrow PbBr_2\ (s) + 2\ LiNO_3\ (aq)$$

(a) $Pb^{+2}\ (aq) + 2\ NO_3^-\ (aq) + 2\ Li^+\ (aq) + 2\ Br^-\ (aq) \rightarrow PbBr_2\ (s) + 2\ Li^+\ (aq) + 2\ NO_3^-\ (aq)$

(b) $Pb^{+2}\ (aq) + 2\ Br^-\ (aq) \rightarrow PbBr_2\ (s)$

18. If 34.77 mL of 0.322 M KOH was required to completely neutralize 20.00 mL of H_2SO_4, what is the molarity of the H_2SO_4? (6 pts.)

$$H_2SO_4\ (aq) + 2\ KOH\ (aq) \rightarrow 2\ H_2O\ (l) + K_2SO_4\ (aq)$$

$$34.77\ mL\left(\frac{1\ L}{1000\ mL}\right)\left(\frac{0.322\ mol\ KOH}{L}\right)\left(\frac{1\ mol\ H_2SO_4}{2\ mol\ KOH}\right) = 0.00559797\ mol \div 0.02000\ L = 0.280\ M\ H_2SO_4$$

19. What is the percent yield in the following reaction if 128.7 g of Cl_2 (g) react with excess aluminum and 135.8 g of aluminum chloride are produced? (5 pts.)

$$2\ Al\ (s)\ +\ 3\ Cl_2\ (g)\ \rightarrow\ 2\ AlCl_3\ (s)$$

$$128.7\ g\ Cl_2\left(\frac{1\ mol\ Cl_2}{70.9054\ g}\right)\left(\frac{2\ mol\ AlCl_3}{3\ mol\ Cl_2}\right)\left(\frac{133.33964\ g}{1\ mol\ AlCl_3}\right)=161.\overline{3}493628\ g\ AlCl_3$$

$$\frac{135.8\ g}{161.\overline{3}493628\ g}\ x\ 100=84.17\ \%$$

20. What is the empirical formula of ibuprofen (an aspirin substitute) which contains 75.69% C, 8.80% H, and 15.51% O by mass? (5 pts.)

$$75.69\ g\ C\left(\frac{1\ mol\ C}{12.011\ g}\right)=6.3017\ mol\ C \quad , \quad 8.80\ g\ H\left(\frac{1\ mol\ H}{1.00794\ g}\right)=8.73\ mol\ H$$

$$15.51\ g\ O\left(\frac{1\ mol\ O}{15.9994\ g}\right)=0.9694\ mol\ O$$

$$C:H:O\ =\ \frac{6.3017\ mol\ C}{0.9694\ mol\ O}\ :\ \frac{8.73\ mol\ H}{0.9694\ mol\ O}\ :\ \frac{0.969\ mol\ O}{0.969\ mol\ O}\ =\ 6.501:9.006:1$$

$$2(C:H:O)\ =\ 2(6.501:9.006:1)=13.00:18.012:2\sim\ 13:18:2\ =\ C_{13}H_{18}O_2$$

21. (a) How many moles of aluminum sulfate are produced when 0.203 moles of aluminum react with 0.241 moles of H_2SO_4? (b) How many moles of the excess reactant remain? MUST show work and explain. (7 pts.)

$$2\ Al\ (s) + 3\ H_2SO_4\ (aq) \rightarrow Al_2(SO_4)_3\ (aq) + 3\ H_2\ (g)$$

0.203 mol 0.241 mol

excess L.R.

$$0.203\,\text{mol}\left(\frac{3\,\text{mol}\ H_2SO_4}{2\,\text{mol Al}}\right) = 0.30\overline{4}5\,\text{mol}\ H_2SO_4\ \text{needed}$$

(don't have this much, so H_2SO_4 is the limiting reactant)

$$\text{(a)}\qquad 0.241\,\text{mol}\ H_2SO_4\left(\frac{1\,\text{mol}\ Al_2(SO_4)_3}{3\,\text{mol}\ H_2SO_4}\right) = 0.0803\,\text{mol}\ Al_2(SO_4)_3\ \text{produced}$$

$$\text{(b)}\qquad 0.241\,\text{mol}\ H_2SO_4\left(\frac{2\,\text{mol Al}}{3\,\text{mol}\ H_2SO_4}\right) = 0.161\,\text{mol Al used}$$

0.203 mol Al – 0.161 mol Al = 0.042 mol Al remain

NOMENCLATURE. Fill in the chemical formula or the chemical name, whichever is missing. (2 pts. each)

	Chemical Formula	Chemical Name
22.	SO_3	sulfur trioxide
23.	SO_3^{-2}	sulfite ion
24.	FeO	iron (II) oxide
25.	Ni_2SO_4	nickel (I) sulfate
26.	Li_3PO_4	lithium phosphate
27.	HNO_3	nitric acid
28.	$Ti(ClO)_2$	titanium (II) hypochlorite
29.	$Mg(NO_2)_2$	magnesium nitrite
30.	PbS_2	lead (IV) sulfide
31.	$HClO_2$	chlorous acid