Exam II General Chemistry I Lecture Fall 2013 10/21/13 Monday 9:30 A Dr. Hahn Exam # _____

Name Key (print) Name _____ (sign)

Please show work for partial credit and full credit on the Long Answers and in some of the Short Answer Questions. Multip choice questions have no partial credit. Please write anything you want graded legibly. If I cannot read your work, I obviously cannot grade it. (1 pts print and sign exam) If you run out of space, please continue on the back page of the exam and clearly tell me where the remaining answer can be found. Avogadro's number = $6.022 \times 10^{23}$

**Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 22 pts pts total)**

1) What is the empirical formula for $Hg_2(NO_3)_2$? 1) E

÷2 → $Hg_1(NO_3)_1$

A) $Hg_2NO_3$
B) $Hg_4(NO_3)_4$
C) $Hg_2(NO_3)_2$
D) $Hg(NO_3)_2$
E) $HgNO_3$

2) Which of the following solutions will have the highest concentration of chloride ions? 2) A

A) 0.10 M $AlCl_3$ → $Al^{+3} + 3Cl^-$ → $3(0.10) = 0.30$
B) 0.10 M LiCl → $Li^+ + Cl^-$ → $2(0.10) = 0.20$
C) 0.10 M $MgCl_2$ → $Mg^{+2} + 2Cl^-$ → $2(0.10) = 0.20$
D) 0.05 M $CaCl_2$ → $Ca^{+2} + 2Cl^-$ → $2(0.05) = 0.1$
E) All of these solutions have the same concentration of chloride ions.

3) Determine the oxidation state of P in $PO_3^{3-}$. 3) C

A) +2 B) 0 C) +3 D) -3 E) +6

4) Calculate the molar mass for $Mg(ClO_4)_2$. 4) D

A) 119.52 g/mol
B) 75.76 g/mol
C) 123.76 g/mol
D) 223.21 g/mol
E) 247.52 g/mol

$24.3 + [35.5 + 4(16.0)] \times 2 = 223.3$ g/mol

5) Determine the name for $P_4O_{10}$. 5) B

A) phosphorus (IV) oxide
B) tetraphosphorus decoxide
C) diphosphorus pentoxide
D) phosphorus oxide
E) phosphorus (II) oxide

$P + 3(-2) = -3$

$P = -3 + 6 = +3$

6) Give the name for $HNO_3$. 6) A

A) nitric acid
B) hydrogen nitrate
C) hydrogen nitride
D) nitrous acid
E) hydrogen nitrite

$\frac{\left(\frac{97.7}{86.84}\right)}{0.750} = 1.50$

7) How many $H^+$ ions can the acid, $H_2SO_4$, donate per molecule? 7) A

A) 2 B) 0 C) 3 D) 1

8) Determine the molarity of a solution formed by dissolving 97.7 g LiBr in enough water to yield 750.0 mL of solution. (formula weight LiBr = 86.84 g / mol) 8) B

A) 1.18 M B) 1.50 M C) 0.130 M D) 2.30 M E) 0.768 M

9) Identify acetic acid. ($CH_3COOH$) 9) E

A) strong electrolyte, strong acid
B) nonelectrolyte, not acid
C) weak electrolyte, strong acid
D) strong electrolyte, weak acid
E) weak electrolyte, weak acid

10) Which of the following is an acid–base reaction? both 10) B

A) $Fe(s) + 2\ AgNO_3(aq) \rightarrow 2\ Ag(s) + Fe(NO_3)_2(aq)$
B) $2\ HClO_4(aq) + Ca(OH)_2(aq) \rightarrow 2\ H_2O(l) + Ca(ClO_4)_2(aq)$
C) $MgSO_4(aq) + Ba(NO_3)_2(aq) \rightarrow Mg(NO_3)_2(aq) + BaSO_4(s)$
D) $C(s) + O_2(g) \rightarrow CO_2(g)$
E) None of the above are acid base reactions.

acid + base → salt + $H_2O$

11) According to the following balanced reaction, how many moles of KO are required to exactly react with 5.44 moles of $H_2O$? 11) E

$$4\ KO(s) + 2\ H_2O(l) \rightarrow 4\ KOH(s) + O_2(g)$$

A) 21.8 moles $H_2O$
B) 5.44 moles $H_2O$
C) 2.72 moles $H_2O$
D) 1.36 moles $H_2O$
E) 10.9 moles $H_2O$

$5.44\ mol\ H_2O \times \frac{4\ mol\ KO}{2\ mol\ H_2O} = 10.9\ mol\ KO$

**Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit. (44 pts )**

1. Complete the following naming question by either providing the name or providing the formula. (4 pts, 2 pts each)

# prefix for 4 tetra sulfate $SO_4^{-2}$

2. Balance the following reaction by filling in the blank with a number. The number may be the number one or any other number. The parts without a blank do not need any numbers input to balance the equation. (4 pts, 2 pts each)

2 KI (aq) + $Pb(NO_3)_2$ (aq) → 1 $PbI_2$ (s) + 2 $KNO_3$ (aq)

3. For your reaction to work, if you need 5.78 moles of NaOH and you have a 1.02 M solution of the of NaOH in water, how many mL of the NaOH solution do you need ? To answer this question, complete the following expression by filling in the 4 parenthesis below with numbers. (8 pts, 2 pts each)

( 5.78 ) mol Na OH * ( 1000 ) ml NaOH soln = ( 5666.7 ) mL NaOH solution
( 1.02 ) mol NaOH $5.68 \times 10^3$

4. The following molecule is [(soluble) or (insoluble)] (circle one) in water. (4 pts)

$Hg_2SO_4$ sulfates soluble except for $Hg_2^{2+}$

5. Complete the following precipitation reaction by filling in each blank with an ion or molecule. (7pts, 1 pt each)

molecular equation

$Na_2S$ (aq) + $Mg(NO_3)_2$ → $2NaNO_3$ (aq) + Mg S (s)

ionic equation

2 $Na^+$ (aq) + $S^{-2}$ (aq) + $Mg^{+2}$ (aq) + $2NO_3^-$ (aq) → $2Na^+$ (aq) + $2NO_3^-$ (aq) + Mg S (s)

Net ionic equation

$Mg^{+2}$ (aq) + $S^{-2}$ (aq) → MgS (s)

6. Circle the following which are strong bases. (5 pts)

$NH_4OH$ (LiOH) $NH_3$ (NaOH) ($Sr(OH)_2$)

7. For the following redox reaction, fill in the parenthesis by the reagent with either the letter (a) or (b). (a) is being oxidized (b) is being reduced (4 pts)

(a)

minus 2 electrons

$Zn(s) + 2\ AgNO_3\ (aq) \rightarrow Zn(NO_3)_2\ (aq) + 2\ Ag\ (s)$

ox state Zn = zero Ag = +1 Zn = +2 Ag = zero

8. If you collect oxygen gas being generated in a reaction under water, if the total pressure is 1.3 atm and the water pressure is 0.2 atm, what is the pressure of the oxygen ? (show work) (8 pts)

$P_{total} = 1.3\,atm = P_{H_2O} + P_{O_2}$

$P_{H_2O} = 0.2\,atm$

$P_{O_2} = P_{total} - P_{H_2O} = 1.3\,atm - 0.2\,atm$

$P_{O_2} = 1.1\,atm$

**Part III. Long Answer Please show work for full credit and to receive partial credit. (33 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

1. a. Given the reaction below, what is the theoretical yield of $PbCl_2$ in grams if you start out with 87.2 grams of KCl (FW of $PbCl_2$ = 278.20 g/mol, FW of KCl 74.60 g/mol ) Assume excess amount of the other reactant. (show work) (15 pts)

$2\ KCl\ (aq) + Pb(NO_3)_2\ (aq) \rightarrow PbCl_2\ (s) + 2\ KNO_3\ (aq)$

87.2 g

$$87.2\text{ g KCl} \times \frac{1\text{ mol KCl}}{74.60\text{ g KCl}} \times \frac{1\text{ mol } PbCl_2}{2\text{ mol KCl}} \times \frac{278.20\text{ g } PbCl_2}{1\text{ mol } PbCl_2}$$

$$= 162.65\text{ g } PbCl_2 \rightarrow 163\text{ g } PbCl_2$$

3 sig f. g

b. If the number of grams of the $PbCl_2$ based on the amount of $Pb(NO_3)_2$ is 200.5 grams, what is the limiting reagent ?

{ [KCl] or $[Pb(NO_3)_2]$} (circle one) (3 pts)

get less with KCl
KCl is limiting Rxn

2. You have a mixture of gases with a pressure of 1.1 atm. in a container of volume 2.5 L at 275 K. If the new temperature is 305 K at a pressure of 0.97 atm, what is the volume ? $(P_1V_1) / (P_2V_2) = T_1/T_2$ (I made up these numbers so that the numbers have no relation to reality.) (show work) (15 pts)

$P_1 = 1.1\ atm$ $\quad P_2 = 0.97\ atm$

$V_1 = 2.5\ l$ $\quad V_2 = ?$

$T_1 = 275\ K$ $\quad T_2 = 305\ K$

$$\frac{P_1 V_1}{P_2 V_2} = \frac{T_1}{T_2} \quad \text{or} \quad \frac{P_2 V_2}{P_1 V_1} = \frac{T_2}{T_1}$$

$$V_2 = \frac{T_2\ P_1 V_1}{T_1\ P_2} = \frac{(305\ K)(1.1\ atm)(2.5\ l)}{(275\ K)(0.97\ atm)}$$

$V_2 = 3.1$ liter

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**Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 22 pts pts total)**

1) According to the following balanced reaction, how many moles of KO are required to exactly react with 5.44 moles of $H_2O$? 1) C

$$4\ KO(s) + 2\ H_2O(l) \rightarrow 4\ KOH(s) + O_2(g)$$

A) 5.44 moles ~~$H_2O$~~ KO
B) 21.8 moles ~~$H_2O$~~ KO
C) 10.9 moles ~~$H_2O$~~ KO
D) 1.36 moles ~~$H_2O$~~ KO
E) 2.72 moles ~~$H_2O$~~ KO

2) How many $H^+$ ions can the acid, $H_2SO_4$, donate per molecule? 2) A

A) 2 B) 3 C) 0 D) 1

3) Calculate the molar mass for $Mg(ClO_4)_2$. 3) D

A) 75.76 g/mol
B) 119.52 g/mol
C) 247.52 g/mol
D) 223.21 g/mol
E) 123.76 g/mol

4) What is the empirical formula for $Hg_2(NO_3)_2$? 4) C

A) $Hg(NO_3)_2$
B) $Hg_2(NO_3)_2$
C) $HgNO_3$
D) $Hg_4(NO_3)_4$
E) $Hg_2NO_3$

5) Determine the oxidation state of P in $PO_3^{3-}$. 5) B

A) 0 B) +3 C) –3 D) +2 E) +6

6) Give the name for $HNO_3$. 6) E

A) nitrous acid
B) hydrogen nitrite
C) hydrogen nitride
D) hydrogen nitrate
E) nitric acid

7) Determine the name for $P_4O_{10}$. 7) D

A) phosphorus (II) oxide
B) diphosphorus pentoxide
C) phosphorus (IV) oxide
D) tetraphosphorus decoxide
E) phosphorus oxide

8) Determine the molarity of a solution formed by dissolving 97.7 g LiBr in enough water to yield 750.0 mL of solution. (formula weight LiBr = 86.84 g / mol) 8) E

A) 0.130 M B) 0.768 M C) 1.18 M D) 2.30 M E) 1.50 M

9) Identify acetic acid. ($CH_3$ COOH) 9) C

A) weak electrolyte, strong acid
B) strong electrolyte, weak acid
C) weak electrolyte, weak acid
D) strong electrolyte, strong acid
E) nonelectrolyte, not acid

10) Which of the following is an acid-base reaction? 10) B

A) $Fe(s) + 2\ AgNO_3(aq) \rightarrow 2\ Ag(s) + Fe(NO_3)_2(aq)$
B) $2\ HClO_4(aq) + Ca(OH)_2(aq) \rightarrow 2\ H_2O(l) + Ca(ClO_4)_2(aq)$
C) $MgSO_4(aq) + Ba(NO_3)_2(aq) \rightarrow Mg(NO_3)_2(aq) + BaSO_4(s)$
D) $C(s) + O_2(g) \rightarrow CO_2(g)$
E) None of the above are acid base reactions.

11) Which of the following solutions will have the highest concentration of chloride ions? 11) D

A) 0.10 M LiCl
B) 0.05 M $CaCl_2$
C) 0.10 M $MgCl_2$
D) 0.10 M $AlCl_3$
E) All of these solutions have the same concentration of chloride ions.

**Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit. (44 pts )**

1. Complete the following naming question by either providing the name or providing the formula. (4 pts, 2 pts each)

# prefix for 5 penta nitrate $NO_3^-$

2. Balance the following reaction by filling in the blank with a number. The number may be the number one or any other number. The parts without a blank do not need any numbers input to balance the equation. (4 pts, 2 pts each)

$H_2SO_4$ (aq) + 2 NaOH (aq) → 1 $Na_2SO_4$ (aq) + 2 $H_2O$

3. For your reaction to work, if you need 8.23 moles of HCl and you have a 2.00 M solution of the of HCl in water, how many mL of the HCl solution do you need ? To answer this question, complete the following expression by filling in the 4 parenthesis below with numbers. (8 pts, 2 pts each)

(8.23) mol HCl * (1000) ml HCl soln = (4115) mL of HCl solution

(2.00) mol HCl

Sig fig. $4.11 \times 10^3$

4. The following molecule is [(soluble) or (insoluble)] (circle one) in water. (4 pts)

$(NH_4)_2S$ $S^{-2}$ insoluble except for $NH_4^+$ soluble

5. Complete the following precipitation reaction by filling in each blank with an ion or molecule. (7 pts, 1 pt each)

molecular equation

$(NH_4)_3PO_4$ (aq) + 3 $AgNO_3$ (aq) → 3 $NH_4NO_3$ (aq) + $Ag_3PO_4$ (s)

ionic equation

3 $NH_4^+$(aq) + $PO_4^{-3}$ (aq) + 3 $Ag^+$ (aq) + 3 $NO_3^-$ (aq) → 3 $NH_4^+$(aq) + 3 $NO_3^-$ (aq) + $Ag_3PO_4$ (s)

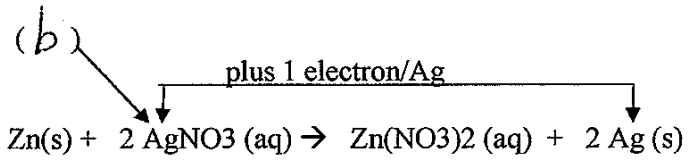
Net ionic equation

3 $Ag^+$ (aq) + $PO_4^{-3}$ (aq) → $Ag_3PO_4$ (s)

6. Circle the following which are weak bases (5 pts)

Na OH $NH_3$ $Ba(OH)_2$ $NH_4OH$ KOH

7 For the following redox reaction, fill in the parenthesis by the reagent with either the letter (a) or (b). (a) is being oxidized (b) is being reduced (4 pts)




ox state Zn = zero Ag = +1 Zn = +2 Ag = zero

8. If you collect oxygen gas being generated in a reaction under water, if the total pressure is 775 mm Hg and the water pressure is 26 mm Hg what is the pressure of the oxygen ? (show work) (8 pts)

$P_{total} = 775\ mm\ Hg = P_{H_2O} + P_{O_2}$

$P_{H_2O} = 26\ mm\ Hg$

$P_{O_2} = P_{total} - P_{H_2O}$

$P_{O_2} = 775\ mm\ Hg - 26\ mm\ Hg$

$P_{O_2} = 749\ mm\ Hg$

**Part III. Long Answer Please show work for full credit and to receive partial credit. (33 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

1. a. Given the reaction below, what is the theoretical yield of Ag in grams if you start out with 77.9 grams of $AgNO_3$ ( FW of Ag = 107.87 g/mol, FW of $AgNO_3$ 169.88 g/mol ) Assume excess amount of the other reactant. (show work) (15 pts)

$Zn\,(s) + 2\,AgNO_3\,(aq) \rightarrow Zn(NO_3)_2\,(aq) + 2\,Ag\,(s)$

$$77.9\,g\,AgNO_3 \times \frac{1\,mol\,AgNO_3}{169.88\,g\,AgNO_3} \times \frac{2\,mol\,Ag}{2\,mol\,AgNO_3} \times \frac{107.87\,g\,Ag}{1\,mol\,Ag} =$$

$$49.5\,g\,Ag$$

b. If the number of grams of the Ag based on the amount of Zn is 25 g, what is the limiting reagent ?

{[Zn] or [$AgNO_3$]} (circle one) (3 pts)

$AgNO_3 \rightarrow 49.5\,g\,Ag$

$Zn \rightarrow 25\,g\,Ag$

2 You have a mixture of gases in a volume of 0.75 liters at pressure 1.4 atm at an unknown temperature. If the new volume is 1.8 liters at pressure 0.7 atm and temperature of 298.5 K, what is the old unknown temperature? $(P_1V_1) / (P_2V_2) = T_1/T_2$ (I made up these numbers so that the numbers have no relation to reality.) (show work) (15 pts)

$V_1 = 0.75\,\ell$ $\quad V_2 = 1.8\,\ell$

$P_1 = 1.4\,atm$ $\quad P_2 = 0.7\,atm$

$T_1 = ?$ $\quad T_2 = 298.5\,K$

$$\frac{P_1 V_1}{P_2 V_2} = \frac{T_1}{T_2}$$

$$T_1 = \left(\frac{P_1 V_1}{P_2 V_2}\right) T_2$$

$$T_1 = \frac{(1.4\,atm)(0.75\,\ell)(298.5\,K)}{(0.7\,atm)(1.8\,\ell)}$$

$T_1 = 248.75 \rightarrow 2.5 \times 10^2\,K$

2 sig fig

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**Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 22 pts pts total)**

1) Determine the name for $N_2O_5$. binary covalent 1) D
A) nitrogen (II) oxide
B) nitrogen (IV) oxide
C) nitrogen tetroxide
D) dinitrogen pentoxide
E) nitrogen oxide

$\frac{(0.4689\text{ g}/278.11)}{(50.0/1000)} = 0.033$

2) Determine the molarity of a solution formed by dissolving 0.468 g of $MgI_2$ in enough water to yield 50.0 mL of solution. (formula weight $MgI_2$ = 278.11 g/mol) 2) C
A) 0.0651 M B) 0.0936 M C) 0.0337 M D) 0.0297 M E) 0.0107 M

3) Give the correct formula for aluminum sulfate. 3) C
A) $Al_3(SO_4)_2$ B) $Al(SO_4)_3$ C) $Al_2(SO_4)_3$ D) $Al_2SO_4$

Al +3 $SO_4$ -2 $2(+3) + 3(-2) = 0$

4) Which of the following solutions will have the highest concentration of chloride ions? 4) D
A) 0.40 M $CaCl_2$ $2(0.40)$
B) 0.40 M $MgCl_2$ $2(0.40)$
C) 0.20 M LiCl 0.20
D) 0.60 M $AlCl_3$ $3(0.60)$
E) All of these solutions have the same concentration of chloride ions.

5) Which one of the following is **not** an empirical formula? ← lowest ratios 5) D
A) CHO B) $CH_2O$ C) $C_2H_4O$ D) $C_2H_4O_2$ ÷2 → $CH_2O$

6) Identify HCl. 6) C
A) weak electrolyte, strong acid
B) strong electrolyte, weak acid
C) strong electrolyte, strong acid
D) weak electrolyte, weak acid
E) nonelectrolyte, not acid

7) Calculate the molar mass of $Al(C_2H_3O_2)_3$. 177 7) E
A) 258.09 g/mol
B) 56.00 g/mol
C) 86.03 g/mol
D) 139.99 g/mol
E) 204.13 g/mol

Al 27.0 + [(2×12) + 3(1.01) + 2(16.0)] ×3 = 204.1
24 32

8) Which of the following is an acid-base reaction? acid + base → salt + $H_2O$ 8) C

A) $Fe(s) + 2\ AgNO_3(aq) \rightarrow 2\ Ag(s) + Fe(NO_3)_2(aq)$

B) $MgSO_4(aq) + Ba(NO_3)_2(aq) \rightarrow Mg(NO_3)_2(aq) + BaSO_4(s)$

C) $2\ HClO_4(aq) + Ca(OH)_2(aq) \rightarrow 2\ H_2O(l) + Ca(ClO_4)_2(aq)$

D) $C(s) + O_2(g) \rightarrow CO_2(g)$

E) None of the above are acid base reactions.

9) Determine the oxidation state of C in $CO_3^{-2}$. 9) C

A) -4 B) +6 C) +4 D) -2 E) +2

10) How many $H^+$ ions can the acid, $H_2SO_4$, donate per molecule? 10) C

A) 0 B) 3 C) 2 D) 1

11) According to the following balanced reaction, how many moles of KO are required to exactly react with 5.44 moles of $H_2O$? 11) B

$$4\ KO(s) + 2\ H_2O(l) \rightarrow 4\ KOH(s) + O_2(g)$$

A) 1.36 moles ~~$H_2O$~~ KO

B) 10.9 moles ~~$H_2O$~~

C) 2.72 moles ~~$H_2O$~~

D) 5.44 moles ~~$H_2O$~~

E) 21.8 moles ~~$H_2O$~~

$5.44\ mol\ H_2O \times \frac{4\ mol\ KO}{2\ mol\ H_2O} = 10.88$

9) $C + 3(-2) = -2$

$C = -2 + 6 = +4$

**Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit. (44 pts )**

1. Complete the following naming question by either providing the name or providing the formula. (4 pts, 2 pts each)

# prefix for 6 hexa acetate $CH_3-\overset{O}{\overset{\|}{C}}-O^{\ominus}$

2. Balance the following reaction by filling in the blank with a number. The number may be the number one or any other number. The parts without a blank do not need any numbers input to balance the equation. (4 pts, 2 pts each)

$K_2SO_4$ (aq) + $CaI_2$ (aq) → 1 $CaSO_4$(s) + 2 KI (aq)

3 For your reaction to work, if you need 7.25 moles of LiOH and you have a 0.255 M solution of the of LiOH in water, how many mL of the LiOH solution do you need ? To answer this question, complete the following expression by filling in the 4 parenthesis below with numbers. (8 pts, 2 pts each)

(7.25) mol Li OH * (1000) ml LiOH soln.= (28431) mL of of LiOH solution
(0.255) mol LiOH $2.84 \times 10^4$ mL

4. The following molecule is [(soluble) or (insoluble)] (circle one) in water. (4 pts)

$Mg(NO_3)_2$ all nitrates are soluble

5. Complete the following precipitation reaction by filling in each blank with an ion or molecule. (7 pts, 1 pt each)

molecular equation

$MgCl_2$ + $Ca(OH)_2$ → $CaCl_2$ (aq) + $Mg(OH)_2$ (s)

ionic equation

$Mg^{+2}$(aq) + $2Cl^-$ (aq) + $Ca^{+2}$ (aq) + $2OH^-$ (aq) → $Ca^{+2}$ (aq) + $2Cl^-$ (aq) + $Mg(OH)_2$ (s)

Net ionic equation

$Mg^{+2}$ (aq) + $2OH^-$ (aq) → $Mg(OH)_2$ (s)

6. Circle the following which are strong acids.(5 pts)

HI $H_2SO_4$ HF $HNO_3$ $CH_3COOH$

7. For the following redox reaction, fill in the parenthesis by the reagent with either the letter (a) or (b). (a) is being oxidized (b) is being reduced (4 pts)

(a)

Minus 1 electron

Na(s) + H Cl (aq) → Na Cl + $H_2$ (g)

ox state Na = zero H = +1 Na = +1 H = zero

8. What is the pressure of nitrogen if the total pressure of $O_2$ (g) and $N_2$ (g) is 780 torr and the pressure of $O_2$ is 38 torr ? (show work) (8 pts)

$P_{total} = P_{O_2} + P_{N_2}$

$P_{N_2} = P_{total} - P_{O_2}$

$P_{N_2} = 780\ torr - 38\ torr = 742\ torr$

**Part III. Long Answer Please show work for full credit and to receive partial credit. (33 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

1. a. Given the reaction below, what is the theoretical yield of $CO_2$ in grams if you start out with 35.7 grams of $CH_4$ ( FW of $CO_2$ = 44.01 g/mol, FW of $CH_4$ 16.05 g/mol ) Assume excess amount of the other reactant. (show work) (15 pts)

$CH_4\,(g) + 2\,O_2\,(g) \rightarrow CO_2\,(g) + H_2O\,(g)$

$35.7\,g\,CH_4 \times \frac{1\,mol\,CH_4}{16.05\,g\,CH_4} \times \frac{1\,mol\,CO_2}{1\,mol\,CH_4} \times \frac{44.01\,g\,CO_2}{1\,mol\,CO_2}$

$= 97.9\,g\,CO_2$

b. If the number of grams of the $CO_2$ based on the amount of $O_2$ is 25 grams, what is the limiting reagent ?

{[$CH_4$ ] or [$O_2$]} (circle one) (3 pts)

$35.7\,g\,CH_4 \rightarrow 97.9\,g\,CO_2$

$O_2 \rightarrow 25\,g\,CO_2$

2 If you have 1.5 moles of a gas at pressure 1.05 atm occupying a volume of 2.5 liters, what is the temperature ? [PV = nRT, R=0.08206 (L atm)/(mol K) ] (I made up these numbers so the numbers have no relation to reality.) (show work) (15 pts)

$n = 1.5$ mol

$P = 1.05$ atm

$V = 2.5$ l

$T = ?$

$PV = nRT$

$\frac{PV}{nR} = T$

$$T = \frac{PV}{nR} = \frac{(1.05\,\text{atm})(2.5\,\text{l})}{(1.50\,\text{mol})\left(0.08206\,\frac{\text{l atm}}{\text{mol K}}\right)}$$

$T = 21.3$ K

Green

Exam II General Chemistry I Lecture Fall 2013 10/21/13 Monday 10:30 B Dr. Hahn Exam # _____

Name Key (print) Name _____(sign)

Please show work for partial credit and full credit on the Long Answers and in some of the Short Answer Questions. Multip choice questions have no partial credit. Please write anything you want graded legibly. If I cannot read your work, I obviously cannot grade it. (1 pts print and sign exam) If you run out of space, please continue on the back page of the exam and clearly tell me where the remaining answer can be found. Avogadro's number = $6.022 \times 10^{23}$

**Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 22 pts pts total)**

1) Identify acetic acid. ($CH_3COOH$) 1) B

A) weak electrolyte, strong acid
B) weak electrolyte, weak acid
C) strong electrolyte, weak acid
D) strong electrolyte, strong acid
E) nonelectrolyte, not acid

2) Give the name for $HNO_3$. 2) B

A) nitrous acid
B) nitric acid
C) hydrogen nitrate
D) hydrogen nitride
E) hydrogen nitrite

3) What is the empirical formula for $Hg_2(NO_3)_2$? 3) E

A) $Hg_4(NO_3)_4$
B) $Hg_2(NO_3)_2$
C) $Hg_2NO_3$
D) $Hg(NO_3)_2$
E) $HgNO_3$

4) Determine the oxidation state of P in $PO_3^{3-}$. 4) C

A) 0 B) +2 C) +3 D) +6 E) -3

5) Which of the following is an acid-base reaction? both 5) C

A) $C(s) + O_2(g) \rightarrow CO_2(g)$
B) $MgSO_4(aq) + Ba(NO_3)_2(aq) \rightarrow Mg(NO_3)_2(aq) + BaSO_4(s)$
C) $2\,HClO_4(aq) + Ca(OH)_2(aq) \rightarrow 2\,H_2O(l) + Ca(ClO_4)_2(aq)$
D) $Fe(s) + 2\,AgNO_3(aq) \rightarrow 2\,Ag(s) + Fe(NO_3)_2(aq)$
E) None of the above are acid base reactions.

6) Calculate the molar mass for $Mg(ClO_4)_2$. 6) A

A) 223.21 g/mol
B) 247.52 g/mol
C) 123.76 g/mol
D) 119.52 g/mol
E) 75.76 g/mol

7) Which of the following solutions will have the highest concentration of chloride ions? 7) B

A) 0.05 M $CaCl_2$
B) 0.10 M $AlCl_3$
C) 0.10 M LiCl
D) 0.10 M $MgCl_2$
E) All of these solutions have the same concentration of chloride ions.

8) Determine the name for $P_4O_{10}$. 8) A

A) tetraphosphorus decoxide
B) phosphorus (IV) oxide
C) diphosphorus pentoxide
D) phosphorus oxide
E) phosphorus (II) oxide

9) How many $H^+$ ions can the acid, $H_2SO_4$, donate per molecule? 9) C

A) 0 B) 1 C) 2 D) 3

10) Determine the molarity of a solution formed by dissolving 97.7 g LiBr in enough water to yield 750.0 mL of solution. (formula weight LiBr = 86.84 g / mol) 10) E

A) 0.130 M B) 0.768 M C) 2.30 M D) 1.18 M E) 1.50 M

11) According to the following balanced reaction, how many moles of KO are required to exactly react with 5.44 moles of $H_2O$? 11) E

$$4\ KO(s) + 2\ H_2O(l) \rightarrow 4\ KOH(s) + O_2(g)$$

A) 2.72 moles ~~$H_2O$~~ KO
B) 21.8 moles ~~$H_2O$~~ KO
C) 5.44 moles ~~$H_2O$~~ KO
D) 1.36 moles ~~$H_2O$~~ KO
E) 10.9 moles ~~$H_2O$~~ KO

**Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit. (44 pts )**

1. Complete the following naming question by either providing the name or providing the formula. (4pts, 2 pts each)

# prefix for 8 octa ammonium $NH_4^+$

2. Balance the following reaction by filling in the blank with a number. The number may be the number one or any other number. The parts without a blank do not need any numbers input to balance the equation. (4 pts, 2 pts each)

$Na_2CO_3$ (aq) + 2 $HNO_3$ (aq) → 2 $NaNO_3$ (aq) + 1 $H_2CO_3$ (aq)

3. For your reaction to work, if you need 2.77 moles of $HNO_3$ and you have a 0.555 M solution of the of $HNO_3$ in water, how many mL of the $HNO_3$ solution do you need ? To answer this question, complete the following expression by filling in the 4 parenthesis below with numbers. (8 pts, 2 pts each)

$$(2.77)\ \text{mol } HNO_3 * \frac{(1000)\ \text{ml } HNO_3 \text{ soln}}{(0.555)\ \text{mol } HNO_3} = (4990.99)\ \text{mL } HNO_3 \text{ solution}$$

↓ sig. fig.

$4.99 \times 10^3$

4. The following molecule is [(soluble) or (insoluble)] (circle one) in water. (4 pts)

LiOH $OH^-$ insoluble → but alkali metals are soluble

5. Complete the following precipitation reaction by filling in each blank with an ion or molecule. (7 pts, 1 pt each)

molecular equation

$SrCl_2$ + $Na_2SO_4$ → 2 NaCl (aq) + $SrSO_4$ (s)

ionic equation

$Sr^{+2}$(aq) + $2Cl^-$ (aq) + $2Na^+$ (aq) + $SO_4^{-2}$ → $2Na^+$ (aq) + $2Cl^-$ (aq) + $SrSO_4$ (s)

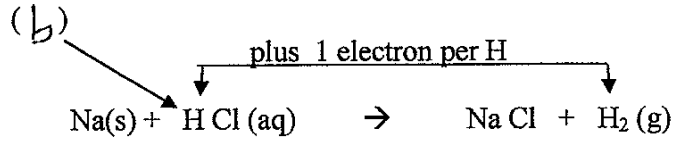
Net ionic equation

$Sr^{+2}$ (aq) + $SO_4^{-2}$ (aq) → $SrSO_4$ (s)

6. Circle the following which are weak acids. (5 pts)

$HNO_3$ (H F) H Cl ($CH_3COOH$) $H_2SO_4$

7. For the following redox reaction, fill in the parenthesis by the reagent with either the letter (a) or (b). (a) is being oxidized (b) is being reduced (4 pts)




ox state Na = zero H = +1 Na = +1 H = zero

8. What is the pressure of nitrogen if the total pressure of $O_2$ (g) and $N_2$ (g) is 1.1 atm and the pressure of $O_2$ is 0.2 atm ? (show work) (8 pts)

$P_{total} = P_{O_2} + P_{N_2}$

1.1 atm 0.2 atm

$P_{N_2} = P_{tot} - P_{O_2} = 1.1\,atm - 0.2\,atm$

$P_{N_2} = 0.9\,atm$

**Part III. Long Answer Please show work for full credit and to receive partial credit. (33 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

1. a. Given the reaction below, what is the theoretical yield of KOH in grams if you start out with 24.8 grams of KO ( FW of KOH = 56.11 g/mol FW of KO 55.10 g/mol ) Assume excess amount of the other reactant. (show work) (15 pts)

$4\ KO\ (s) + 2\ H_2O\ (l) \rightarrow 4\ KOH\ (s) + O_2\ (g)$

$$24.8\ g\ KO \times \frac{1\ mol\ KO}{55.10\ g\ KO} \times \frac{4\ mol\ KOH}{4\ mol\ KO} \times \frac{56.11\ g\ KOH}{1\ mol\ KOH}$$

$$= 25.3\ g\ KOH$$

b. If the number of grams of the KOH based on the amount of $H_2O$ is 30.5 grams, what is the limiting reagent ?

{ [KO] or $[H_2O]$} (circle one) (3 pts)

$KO \rightarrow 25.3\ g\ KOH$

$H_2O \rightarrow 30.5\ g\ KOH$

2. If you have a gas at pressure 0.57 atm at a temperature of 285 K for a 2.0 mole sample of gas, what is the volume ? [PV = nRT, R=0.08206 (L atm)/(mol K)] (I made up these numbers so the numbers have no relation to reality.) (show work) (15 pts)

$P = 0.57 \text{ atm}$

$T = 285 \text{ K}$

$n = 2.0 \text{ mol}$

$V = ?$

$PV = nRT$

$V = \frac{nRT}{P}$

$$V = \frac{(2.0 \text{ mol})\left(0.0820 \frac{\text{L atm}}{\text{mol K}}\right)(285 \text{ K})}{0.57 \text{ atm}}$$

$V = 82.1 \text{ L}$

Exam II General Chemistry I Lecture Fall 2013 10/21/13 Monday 9:30 A Dr. Hahn Exam # 5 5

Name_____ (print) Name _____(sign)

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**Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 22 pts pts total)**

1) What is the empirical formula for $Hg_2(NO_3)_2$? 1) _____

A) $Hg_2NO_3$
B) $Hg_4(NO_3)_4$
C) $Hg_2(NO_3)_2$
D) $Hg(NO_3)_2$
E) $HgNO_3$

2) Which of the following solutions will have the highest concentration of chloride ions? 9 2) _____

A) 0.10 M $AlCl_3$
B) 0.10 M LiCl
C) 0.10 M $MgCl_2$
D) 0.05 M $CaCl_2$
E) All of these solutions have the same concentration of chloride ions.

3) Determine the oxidation state of P in $PO_3^{3-}$. 3) _____

A) +2 B) 0 C) +3 D) –3 E) +6

4) Calculate the molar mass for $Mg(ClO_4)_2$. 4) _____

A) 119.52 g/mol
B) 75.76 g/mol
C) 123.76 g/mol
D) 223.21 g/mol
E) 247.52 g/mol

5) Determine the name for $P_4O_{10}$. 5) _____

A) phosphorus (IV) oxide
B) tetraphosphorus decoxide
C) diphosphorus pentoxide
D) phosphorus oxide
E) phosphorus (II) oxide

6) Give the name for $HNO_3$. 6) _____

A) nitric acid
B) hydrogen nitrate
C) hydrogen nitride
D) nitrous acid
E) hydrogen nitrite

7) How many $H^+$ ions can the acid, $H_2SO_4$ , donate per molecule? 7) _____

A) 2 B) 0 C) 3 D) 1

8) Determine the molarity of a solution formed by dissolving 97.7 g LiBr in enough water to yield 750.0 mL of solution. (formula weight LiBr = 86.84 g / mol) 8) _____

A) 1.18 M B) 1.50 M C) 0.130 M D) 2.30 M E) 0.768 M

9) Identify acetic acid. ($CH_3$ COOH) 9) _____

A) strong electrolyte, strong acid
B) nonelectrolyte, not acid
C) weak electrolyte, strong acid
D) strong electrolyte, weak acid
E) weak electrolyte, weak acid

10) Which of the following is an acid–base reaction? both 10) _____

A) $Fe(s) + 2\ AgNO_3(aq) \rightarrow 2\ Ag(s) + Fe(NO_3)_2(aq)$
B) $2\ HClO_4(aq) + Ca(OH)_2(aq) \rightarrow 2\ H_2O(l) + Ca(ClO_4)_2(aq)$
C) $MgSO_4(aq) + Ba(NO_3)_2(aq) \rightarrow Mg(NO_3)_2(aq) + BaSO_4(s)$
D) $C(s) + O_2(g) \rightarrow CO_2(g)$
E) None of the above are acid base reactions.

11) According to the following balanced reaction, how many moles of KO are required to exactly react with 5.44 moles of $H_2O$? 11) _____

$$4\ KO(s) + 2\ H_2O(l) \rightarrow 4\ KOH(s) + O_2(g)$$

A) 21.8 moles $H_2O$ 1 KO
B) 5.44 moles $H_2O$ 1 KO
C) 2.72 moles $H_2O$ 1 KO
D) 1.36 moles $H_2O$ 1 KO
E) 10.9 moles $H_2O$ 1 KO

**Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit. (44 pts )**

1. Complete the following naming question by either providing the name or providing the formula. (4 pts, 2 pts each)

# prefix for 4 _____ sulfate _____

2. Balance the following reaction by filling in the blank with a number. The number may be the number one or any other number. The parts without a blank do not need any numbers input to balance the equation. (4 pts, 2 pts each)

2 KI (aq) + $Pb(NO_3)_2$ (aq) → _____ $PbI_2$ (s) + _____ $KNO_3$ (aq)

3. For your reaction to work, if you need 5.78 moles of NaOH and you have a 1.02 M solution of the of NaOH in water, how many mL of the NaOH solution do you need ? To answer this question, complete the following expression by filling in the 4 parenthesis below with numbers. (8 pts, 2 pts each)

$$\left(\frac{\quad}{\quad}\right) \text{ mol Na OH} * \left(\frac{\quad}{\quad}\right) \text{ ml NaOH soln} = \left(\frac{\quad}{\quad}\right) \text{ mL NaOH solution}$$

4. The following molecule is [(soluble) or (insoluble)] (circle one) in water. (4 pts)

$Hg_2SO_4$

5. Complete the following precipitation reaction by filling in each blank with an ion or molecule. (7pts, 1 pt each)

molecular equation

$Na_2$ S (aq) + Mg $(NO_3)_2$ → _____ (aq) + Mg S (s)

ionic equation

2 $Na^+$ (aq)+ _____(aq) + $Mg^{+2}$(aq) + _____(aq) → _____ (aq) + _____ (aq) + Mg S (s)

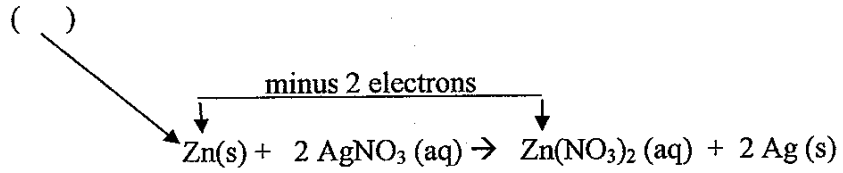
Net ionic equation

_____ (aq) + _____ (aq) → MgS (s)

6. Circle the following which are strong bases. (5 pts)

$NH_4OH$ LiOH $NH_3$ NaOH $Sr(OH)_2$

7. For the following redox reaction, fill in the parenthesis by the reagent with either the letter (a) or (b). (a) is being oxidized (b) is being reduced (4 pts)




ox state Zn = zero Ag = +1 Zn = +2 Ag = zero

8. If you collect oxygen gas being generated in a reaction under water, if the total pressure is 1.3 atm and the water pressure is 0.2 atm, what is the pressure of the oxygen ? (show work) (8 pts)

**Part III. Long Answer Please show work for full credit and to receive partial credit. (33 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

1. a. Given the reaction below, what is the theoretical yield of $PbCl_2$ in grams if you start out with 87.2 grams of KCl (FW of $PbCl_2$ = 278.20 g/mol, FW of KCl 74.60 g/mol ) Assume excess amount of the other reactant. (show work) (15 pts)

$2\ KCl\ (aq) + Pb(NO_3)_2\ (aq) \rightarrow PbCl_2\ (s) + 2\ KNO_3\ (aq)$

b. If the number of grams of the $PbCl_2$ based on the amount of $Pb(NO_3)_2$ is 200.5 grams, what is the limiting reagent ? (Compare to yield above)

{ [KCl] or [$Pb(NO_3)_2$]} (circle one) (3 pts)

2. You have a mixture of gases with a pressure of 1.1 atm. in a container of volume 2.5 L at 275 K. If the new temperature is 305 K at a pressure of 0.97 atm, what is the volume ? $(P_1V_1) / (P_2V_2) = T_1/T_2$) (I made up these numbers so that the numbers have no relation to reality.) (show work) (15 pts)

Exam II General Chemistry I Lecture Fall 2013 10/21/13 Monday 9:30 B Dr. Hahn Exam # 5-2

Name_____ (print) Name _____(sign)

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**Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 22 pts pts total)**

1) According to the following balanced reaction, how many moles of KO are required to exactly react with 5.44 moles of $H_2O$? 1) _____

$$4\ KO(s) + 2\ H_2O(l) \rightarrow 4\ KOH(s) + O_2(g)$$

A) 5.44 moles ~~$H_2O$~~ KO
B) 21.8 moles ~~$H_2O$~~ KO
C) 10.9 moles ~~$H_2O$~~ KO
D) 1.36 moles ~~$H_2O$~~ KO
E) 2.72 moles ~~$H_2O$~~ KO

2) How many $H^+$ ions can the acid, $H_2SO_4$, donate per molecule? 2) _____

A) 2 B) 3 C) 0 D) 1

3) Calculate the molar mass for $Mg(ClO_4)_2$. 3) _____

A) 75.76 g/mol
B) 119.52 g/mol
C) 247.52 g/mol
D) 223.21 g/mol
E) 123.76 g/mol

4) What is the empirical formula for $Hg_2(NO_3)_2$? 4) _____

A) $Hg(NO_3)_2$
B) $Hg_2(NO_3)_2$
C) $HgNO_3$
D) $Hg_4(NO_3)_4$
E) $Hg_2NO_3$

5) Determine the oxidation state of P in $PO_3^{3-}$. 5) _____

A) 0 B) +3 C) -3 D) +2 E) +6

6) Give the name for $HNO_3$. 6) _____

A) nitrous acid
B) hydrogen nitrite
C) hydrogen nitride
D) hydrogen nitrate
E) nitric acid

7) Determine the name for $P_4O_{10}$. 7) _____

A) phosphorus (II) oxide
B) diphosphorus pentoxide
C) phosphorus (IV) oxide
D) tetraphosphorus decoxide
E) phosphorus oxide

8) Determine the molarity of a solution formed by dissolving 97.7 g LiBr in enough water to yield 750.0 mL of solution. (formula weight LiBr = 86.84 g / mol) 8) _____

A) 0.130 M B) 0.768 M C) 1.18 M D) 2.30 M E) 1.50 M

9) Identify acetic acid. ($CH_3COOH$) 9) _____

A) weak electrolyte, strong acid
B) strong electrolyte, weak acid
C) weak electrolyte, weak acid
D) strong electrolyte, strong acid
E) nonelectrolyte, not acid

10) Which of the following is an acid–base reaction? 10) _____

A) $Fe(s) + 2\ AgNO_3(aq) \rightarrow 2\ Ag(s) + Fe(NO_3)_2(aq)$
B) $2\ HClO_4(aq) + Ca(OH)_2(aq) \rightarrow 2\ H_2O(l) + Ca(ClO_4)_2(aq)$
C) $MgSO_4(aq) + Ba(NO_3)_2(aq) \rightarrow Mg(NO_3)_2(aq) + BaSO_4(s)$
D) $C(s) + O_2(g) \rightarrow CO_2(g)$
E) None of the above are acid base reactions.

11) Which of the following solutions will have the highest concentration of chloride ions? 11) _____

A) 0.10 M LiCl
B) 0.05 M $CaCl_2$
C) 0.10 M $MgCl_2$
D) 0.10 M $AlCl_3$
E) All of these solutions have the same concentration of chloride ions.

**Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit. (44 pts )**

1. Complete the following naming question by either providing the name or providing the formula. (4 pts, 2 pts each)

# prefix for 5 _____ nitrate _____

2. Balance the following reaction by filling in the blank with a number. The number may be the number one or any other number. The parts without a blank do not need any numbers input to balance the equation. (4 pts, 2 pts each)

$H_2SO_4$ (aq) + 2 NaOH (aq) → _____ $Na_2SO_4$ (aq) + _____ $H_2O$

3. For your reaction to work, if you need 8.23 moles of HCl and you have a 2.00 M solution of the of HCl in water, how many mL of the HCl solution do you need ? To answer this question, complete the following expression by filling in the 4 parenthesis below with numbers. (8 pts, 2 pts each)

$$(\_\_\_\_\_)\ \text{mol HCl} * \frac{(\_\_\_\_\_)\ \text{ml HCl soln}}{(\_\_\_\_\_)\ \text{mol HCl}} = (\_\_\_\_\_)\ \text{mL of HCl solution}$$

4. The following molecule is [(soluble) or (insoluble)] (circle one) in water. (4 pts)

$(NH_4)_2S$

5. Complete the following precipitation reaction by filling in each blank with an ion or molecule. (7 pts, 1 pt each)

molecular equation

$(NH_4)_3PO_4$ (aq) + 3 $AgNO_3$ (aq) → _____ (aq) + $Ag_3PO_4$ (s)

ionic equation

3 $NH_4^+$(aq) + _____(aq) + _____ (aq) + _____ (aq) → 3 $NH_4^+{}_{(aq)}$ + _____ (aq) + $Ag_3PO_4$ (s)

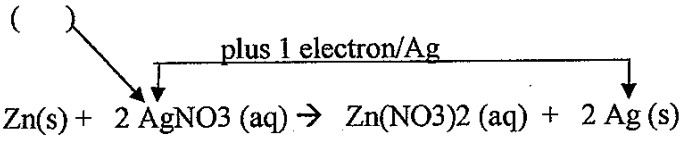
Net ionic equation

_____ (aq) + _____ (aq) → $Ag_3PO_4$ (s)

6. Circle the following which are weak bases (5 pts)

Na OH $NH_3$ $Ba(OH)_2$ $NH_4OH$ KOH

7 For the following redox reaction, fill in the parenthesis by the reagent with either the letter (a) or (b). (a) is being oxidized (b) is being reduced (4 pts)




ox state Zn = zero Ag = +1 Zn = +2 Ag = zero

8. If you collect oxygen gas being generated in a reaction under water, if the total pressure is 775 mm Hg and the water pressure is 26 mm Hg what is the pressure of the oxygen ? (show work) (8 pts)

**Part III. Long Answer Please show work for full credit and to receive partial credit. (33 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

1. a. Given the reaction below, what is the theoretical yield of Ag in grams if you start out with 77.9 grams of $AgNO_3$ ( FW of Ag = 107.87 g/mol, FW of $AgNO_3$ 169.88 g/mol ) Assume excess amount of the other reactant. (show work) (15 pts)

$Zn\,(s) + 2\,AgNO_3\,(aq) \rightarrow Zn(NO_3)_2\,(aq) + 2\,Ag\,(s)$

b. If the number of grams of the Ag based on the amount of Zn is 25 g, what is the limiting reagent ?
(Compare to above)

{[Zn] or [$AgNO_3$]} (circle one) (3 pts)

2 You have a mixture of gases in a volume of 0.75 liters at pressure 1.4 atm at an unknown temperature. If the new volume is 1.8 liters at pressure 0.7 atm and temperature of 298.5 K, what is the old unknown temperature? $(P_1V_1) / (P_2V_2) = T_1/T_2$ (I made up these numbers so that the numbers have no relation to reality.) (show work) (15 pts)

Exam II General Chemistry I Lecture Fall 2013 10/21/13 Monday 10:30 A Dr. Hahn Exam # _____

Name_____ (print) Name _____(sign)

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**Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 22 pts pts total)**

1) Determine the name for $N_2O_5$. 1) _____

A) nitrogen (II) oxide
B) nitrogen (IV) oxide
C) nitrogen tetroxide
D) dinitrogen pentoxide
E) nitrogen oxide

2) Determine the molarity of a solution formed by dissolving 0.468 g of $MgI_2$ in enough water to yield 50.0 mL of solution. (formula weight $MgI_2$ = 278.11 g/mol) 2) _____

A) 0.0651 M B) 0.0936 M C) 0.0337 M D) 0.0297 M E) 0.0107 M

3) Give the correct formula for aluminum sulfate. 3) _____

A) $Al_3(SO_4)_2$ B) $Al(SO_4)_3$ C) $Al_2(SO_4)_3$ D) $Al_2SO_4$

4) Which of the following solutions will have the highest concentration of chloride ions? 4) _____

A) 0.40 M $CaCl_2$
B) 0.40 M $MgCl_2$
C) 0.20 M LiCl
D) 0.60 M $AlCl_3$
E) All of these solutions have the same concentration of chloride ions.

5) Which one of the following is **not** an empirical formula? 5) _____

A) CHO B) $CH_2O$ C) $C_2H_4O$ D) $C_2H_4O_2$

6) Identify HCl. 6) _____

A) weak electrolyte, strong acid
B) strong electrolyte, weak acid
C) strong electrolyte, strong acid
D) weak electrolyte, weak acid
E) nonelectrolyte, not acid

7) Calculate the molar mass of $Al(C_2H_3O_2)_3$. 7) _____

A) 258.09 g/mol
B) 56.00 g/mol
C) 86.03 g/mol
D) 139.99 g/mol
E) 204.13 g/mol

8) Which of the following is an acid–base reaction? 8) _____

A) $Fe(s) + 2\ AgNO_3(aq) \rightarrow 2\ Ag(s) + Fe(NO_3)_2(aq)$

B) $MgSO_4(aq) + Ba(NO_3)_2(aq) \rightarrow Mg(NO_3)_2(aq) + BaSO_4(s)$

C) $2\ HClO_4(aq) + Ca(OH)_2(aq) \rightarrow 2\ H_2O(l) + Ca(ClO_4)_2(aq)$

D) $C(s) + O_2(g) \rightarrow CO_2(g)$

E) None of the above are acid base reactions.

9) Determine the oxidation state of C in $CO_3^{-2}$. 9) _____

A) –4 B) +6 C) +4 D) –2 E) +2

10) How many $H^+$ ions can the acid, $H_2SO_4$, donate per molecule? 10) _____

A) 0 B) 3 C) 2 D) 1

11) According to the following balanced reaction, how many moles of KO are required to exactly react with 5.44 moles of $H_2O$? 11) _____

$$4\ KO(s) + 2\ H_2O(l) \rightarrow 4\ KOH(s) + O_2(g)$$

A) 1.36 moles ~~$H_2O$~~ KO

B) 10.9 moles ~~$H_2O$~~ KO

C) 2.72 moles ~~$H_2O$~~ KO

D) 5.44 moles ~~$H_2O$~~ KO

E) 21.8 moles ~~$H_2O$~~ KO

**Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit. (44 pts )**

1. Complete the following naming question by either providing the name or providing the formula. (4 pts, 2 pts each)

# prefix for 6 _____ acetate _____

2. Balance the following reaction by filling in the blank with a number. The number may be the number one or any other number. The parts without a blank do not need any numbers input to balance the equation. (4 pts, 2 pts each)

$K_2SO_4$ (aq) + $CaI_2$ (aq) → _____ $CaSO_4$(s) + _____ KI (aq)

3 For your reaction to work, if you need 7.25 moles of LiOH and you have a 0.255 M solution of the of LiOH in water, how many mL of the LiOH solution do you need ? To answer this question, complete the following expression by filling in the 4 parenthesis below with numbers. (8 pts, 2 pts each)

$$\left(\_\_\_\_\_\right)\ \text{mol Li OH} \times \frac{\left(\_\_\_\_\_\right)\ \text{ml LiOH soln.}}{\left(\_\_\_\_\_\right)\ \text{mol LiOH}} = \left(\_\_\_\_\_\right)\ \text{mL of of LiOH solution}$$

4. The following molecule is [(soluble) or (insoluble)] (circle one) in water. (4 pts)

$Mg(NO_3)_2$

5. Complete the following precipitation reaction by filling in each blank with an ion or molecule. (7 pts, 1 pt each)

molecular equation

$Mg\ Cl_2$ + $Ca(OH)_2$ → _____ (aq) + $Mg\ (OH)_2$ (s)

ionic equation

$Mg^{+2}$(aq) + _____ (aq) + $Ca^{+2}$ (aq) + _____(aq) → _____(aq) + _____(aq) + $Mg(OH)_2$ (s)

Net ionic equation

_____(aq) + _____(aq) → $Mg\ (OH)_2$ (s)

6. Circle the following which are strong acids.(5 pts)

H I $H_2SO_4$ H F $HNO_3$ $CH_3COOH$

7. For the following redox reaction, fill in the parenthesis by the reagent with either the letter (a) or (b). (a) is being oxidized (b) is being reduced (4 pts)

( )

Minus 1 electron

$Na(s) + H Cl (aq) \rightarrow Na Cl + H_2 (g)$

ox state Na = zero H = +1 Na = +1 H = zero

8. What is the pressure of nitrogen if the total pressure of $O_2$ (g) and $N_2$ (g) is 780 torr and the pressure of $O_2$ is 38 torr ? (show work) (8 pts)

**Part III. Long Answer Please show work for full credit and to receive partial credit. (33 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

1. a. Given the reaction below, what is the theoretical yield of $CO_2$ in grams if you start out with 35.7 grams of $CH_4$ ( FW of $CO_2$ = 44.01 g/mol, FW of $CH_4$ 16.05 g/mol ) Assume excess amount of the other reactant. (show work) (15 pts)

$CH_4\,(g) + 2\,O_2\,(g) \rightarrow CO_2\,(g) + H_2O\,(g)$

b. If the number of grams of the $CO_2$ based on the amount of $O_2$ is 25 grams, what is the limiting reagent ?
(Compare to above)

{[$CH_4$ ] or [ $O_2$]} (circle one) (3 pts)

2 If you have 1.5 moles of a gas at pressure 1.05 atm occupying a volume of 2.5 liters, what is the temperature ? [PV = nRT, R=0.08206 (L atm)/(mol K) ] (I made up these numbers so the numbers have no relation to reality.) (show work) (15 pts)

Exam II General Chemistry I Lecture Fall 2013 10/21/13 Monday 10:30 B Dr. Hahn Exam # 3-11

Name_____ (print) Name _____(sign)

Please show work for partial credit and full credit on the Long Answers and in some of the Short Answer Questions. Multip choice questions have no partial credit. Please write anything you want graded legibly. If I cannot read your work, I obviously cannot grade it. (1 pts print and sign exam) If you run out of space, please continue on the back page of the exam and clearly tell me where the remaining answer can be found. Avogadro's number = $6.022 \times 10^{23}$

**Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 22 pts pts total)**

1) Identify acetic acid. ($CH_3COOH$) 1) _____

A) weak electrolyte, strong acid
B) weak electrolyte, weak acid
C) strong electrolyte, weak acid
D) strong electrolyte, strong acid
E) nonelectrolyte, not acid

2) Give the name for $HNO_3$. 2) _____

A) nitrous acid
B) nitric acid
C) hydrogen nitrate
D) hydrogen nitride
E) hydrogen nitrite

3) What is the empirical formula for $Hg_2(NO_3)_2$? 3) _____

A) $Hg_4(NO_3)_4$
B) $Hg_2(NO_3)_2$
C) $Hg_2NO_3$
D) $Hg(NO_3)_2$
E) $HgNO_3$

4) Determine the oxidation state of P in $PO_3^{3-}$. 4) _____

A) 0 B) +2 C) +3 D) +6 E) -3

5) Which of the following is an acid-base reaction? both 5) _____

A) $C(s) + O_2(g) \rightarrow CO_2(g)$
B) $MgSO_4(aq) + Ba(NO_3)_2(aq) \rightarrow Mg(NO_3)_2(aq) + BaSO_4(s)$
C) $2\ HClO_4(aq) + Ca(OH)_2(aq) \rightarrow 2\ H_2O(l) + Ca(ClO_4)_2(aq)$
D) $Fe(s) + 2\ AgNO_3(aq) \rightarrow 2\ Ag(s) + Fe(NO_3)_2(aq)$
E) None of the above are acid base reactions.

6) Calculate the molar mass for $Mg(ClO_4)_2$. 6) _____

A) 223.21 g/mol
B) 247.52 g/mol
C) 123.76 g/mol
D) 119.52 g/mol
E) 75.76 g/mol

7) Which of the following solutions will have the highest concentration of chloride ions? 7) _____

A) 0.05 M $CaCl_2$
B) 0.10 M $AlCl_3$
C) 0.10 M LiCl
D) 0.10 M $MgCl_2$
E) All of these solutions have the same concentration of chloride ions.

8) Determine the name for $P_4O_{10}$. 8) _____

A) tetraphosphorus decoxide
B) phosphorus (IV) oxide
C) diphosphorus pentoxide
D) phosphorus oxide
E) phosphorus (II) oxide

9) How many $H^+$ ions can the acid, $H_2SO_4$, donate per molecule? 9) _____

A) 0 B) 1 C) 2 D) 3

10) Determine the molarity of a solution formed by dissolving 97.7 g LiBr in enough water to yield 750.0 mL of solution. (formula weight LiBr = 86.84 g / mol) 10) _____

A) 0.130 M B) 0.768 M C) 2.30 M D) 1.18 M E) 1.50 M

11) According to the following balanced reaction, how many moles of KO are required to exactly react with 5.44 moles of $H_2O$? 11) _____

$$4\ KO(s) + 2\ H_2O(l) \rightarrow 4\ KOH(s) + O_2(g)$$

A) 2.72 moles ~~$H_2O$~~ KO
B) 21.8 moles ~~$H_2O$~~ KO
C) 5.44 moles ~~$H_2O$~~ KO
D) 1.36 moles ~~$H_2O$~~ KO
E) 10.9 moles ~~$H_2O$~~ KO

**Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may get some partial credit. (44 pts )**

1. Complete the following naming question by either providing the name or providing the formula. (4pts, 2 pts each)

# prefix for 8 _____ ammonium_____

2. Balance the following reaction by filling in the blank with a number. The number may be the number one or any other number. The parts without a blank do not need any numbers input to balance the equation. (4 pts, 2 pts each)

$Na_2CO_3$ (aq) + 2 $HNO_3$ (aq) → _____ $NaNO_3$ (aq) + _____ $H_2CO_3$ (aq)

3. For your reaction to work, if you need 2.77 moles of $HNO_3$ and you have a 0.555 M solution of the of $HNO_3$ in water, how many mL of the $HNO_3$ solution do you need ? To answer this question, complete the following expression by filling in the 4 parenthesis below with numbers. (8 pts, 2 pts each)

$$(\_\_\_\_\_)\ \text{mol } HNO_3 * \frac{(\_\_\_\_\_)\ \text{ml } HNO_3\ \text{soln}}{(\_\_\_\_\_)\ \text{mol } HNO_3} = (\_\_\_\_\_)\ \text{mL } HNO_3\ \text{solution}$$

4. The following molecule is [(soluble) or (insoluble)] (circle one) in water. (4 pts)

LiOH

5. Complete the following precipitation reaction by filling in each blank with an ion or molecule. (7 pts, 1 pt each)

molecular equation

$SrCl_2$ + $Na_2SO_4$ → _____ (aq) + $SrSO_4$ (s)

ionic equation

$Sr^{+2}$(aq) + _____ (aq) + _____ (aq) + $SO_4^{-2}$ → _____(aq) + _____ (aq) + $SrSO_4$ (s)

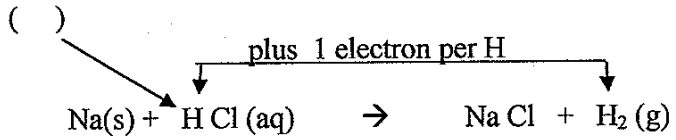
Net ionic equation

_____ (aq) + _____ (aq) → $SrSO_4$ (s)

6. Circle the following which are weak acids. (5 pts)

$HNO_3$ H F H Cl $CH_3COOH$ $H_2SO_4$

7. For the following redox reaction, fill in the parenthesis by the reagent with either the letter (a) or (b). (a) is being oxidized (b) is being reduced (4 pts)




ox state Na = zero H = +1 Na = +1 H = zero

8. What is the pressure of nitrogen if the total pressure of $O_2$ (g) and $N_2$ (g) is 1.1 atm and the pressure of $O_2$ is 0.2 atm ? (show work) (8 pts)

**Part III. Long Answer Please show work for full credit and to receive partial credit. (33 pts)**
****** Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.******

1. a. Given the reaction below, what is the theoretical yield of KOH in grams if you start out with 24.8 grams of KO ( FW of KOH = 56.11 g/mol FW of KO 55.10 g/mol ) Assume excess amount of the other reactant. (show work) (15 pts)

$4\ KO\ (s) + 2\ H_2O\ (l) \rightarrow 4\ KOH\ (s) + O_2\ (g)$

b. If the number of grams of the KOH based on the amount of $H_2O$ is 30.5 grams, what is the limiting reagent ? (Compare to above)

{ [KO] or [$H_2O$]} (circle one) (3 pts)

2. If you have a gas at pressure 0.57 atm at a temperature of 285 K for a 2.0 mole sample of gas, what is the volume ? [PV = nRT, R=0.08206 (L atm)/(mol K)] (I made up these numbers so the numbers have no relation to reality.) (show work) (15 pts)