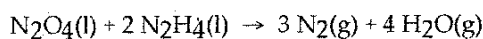


Name Key (print) Name _____ (sign)

Please show work for partial credit on the Long Answers and in some of the Short Answer Questions. Multiple 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) 7 page Exam, 5 page exam + periodic table & solubility rules chart (count pages to make sure you have the entire exam)

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 26 pts total)

- 1) Determine the limiting reactant (LR) and the mass (in g) of nitrogen that can be formed from 50.0 g N_2O_4 and 45.0 g N_2H_4 . Some possibly useful molar masses are as follows: $N_2O_4 = 92.02$ g/mol, $N_2H_4 = 32.05$ g/mol. 1) B
- (1 mol $N_2 = 28.02$ g N_2) $1.63 \times 28.02 = 45.78$



- A) LR = N_2H_4 , 13.3 g N_2 formed
- B) LR = N_2O_4 , 45.7 g N_2 formed
- C) No LR, 45.0 g N_2 formed
- D) LR = N_2H_4 , 59.0 g N_2 formed
- E) LR = N_2O_4 , 105 g N_2 formed

Handwritten calculations for question 1:

$50.0g \times \frac{1 \text{ mol } N_2O_4}{92.02g} \times \frac{3 \text{ mol } N_2}{1 \text{ mol } N_2O_4} = 1.63 \text{ mol } N_2$
 $45.0g \times \frac{1 \text{ mol } N_2H_4}{32.05g} \times \frac{3 \text{ mol } N_2}{2 \text{ mol } N_2H_4} = 2.10 \text{ mol } N_2$

- 2) Give the temperature and pressure at STP.
- A) 25°C and 30.00 in Hg
 - B) 300K and 1 torr Hg
 - C) 0°C and 1.00 atm
 - D) 0K and 1.00 atm
 - E) 0°C and 1 mm Hg

- 3) Determine the concentration of a solution prepared by diluting 20.0 mL of a 0.200 M NaCl to 250.0 mL. ($M_1V_1 = M_2V_2$) 3) B
- A) 0.160 M
 - B) 0.0160 M
 - C) 0.00800 M
 - D) 2.50 M
 - E) 0.0320 M

Handwritten calculation for question 3:

$$(20.0 \text{ mL})(0.200 \text{ M}) = (250.0 \text{ mL})(M_2)$$

- 4) Identify HCl.
- A) nonelectrolyte
 - B) weak electrolyte, strong acid
 - C) weak electrolyte, weak acid
 - D) strong electrolyte, weak acid
 - E) strong electrolyte, strong acid

- 5) Calculate the temperature, in K, of 2.20 moles of gas occupying 3.50 L at 3.30 atm. 5) A
- A) 64.0 K
 - B) 28.0 K
 - C) 5.25 K
 - D) 337 K

Handwritten calculation for question 5:

$$PV = nRT$$

$$T = \frac{PV}{nR} = \frac{(3.30 \text{ atm})(3.50 \text{ L})}{(2.20 \text{ mol})(0.08206 \frac{\text{L atm}}{\text{mol K}})}$$

6) Which of the following compounds is soluble in water?

- A) BaSO₄
- B) MgCO₃
- C) PbCl₂
- D) CaS
- E) None of these compounds is soluble in water.

6) D

7) Convert 1.25 atm to mm Hg.

- A) 1000 mm Hg
- B) 875 mm Hg
- C) 760 mm Hg
- D) 950 mm Hg
- E) 1520 mm Hg

$$1.25 \text{ atm} \times \frac{760 \text{ mmHg}}{1 \text{ atm}} =$$

7) D

8) How many H⁺ ions can the acid, H₂SO₄, donate per molecule?

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

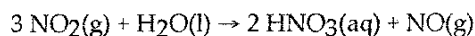
8) C

9) What volume will 0.780 moles of He occupy at STP?

- A) 17.5 L
- B) 22.4 L
- C) 43.7 atm
- D) 15.6 L
- E) 70.0 L

9) A

10) According to the following balanced reaction, how many moles of HNO₃ are formed from 8.44 moles of NO₂ if there is plenty of water present?



- A) 25.3 moles HNO₃
- B) 2.81 moles HNO₃
- C) 5.63 moles HNO₃
- D) 8.44 moles HNO₃
- E) 1.83 moles HNO₃

$$8.44 \text{ mol NO}_2 \times \frac{2 \text{ mol HNO}_3}{3 \text{ mol NO}_2}$$

$$0.780 \text{ mol} \times \frac{22.4 \text{ L}}{1 \text{ mol}}$$

10) C

11) A mixture of 0.220 moles CO, 0.350 moles H₂ and 0.640 moles He has a total pressure of 2.95 atm. What is the pressure of H₂?

- A) 1.17 atm
- B) 0.853 atm
- C) 0.649 atm
- D) 0.969 atm
- E) 1.03 atm

$$P_T = 0.220 + 0.350 + 0.640$$

11) B

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

- A) 0.10 M AlCl₃ 0.10×3
- B) 0.10 M MgCl₂ 0.10×2
- C) 0.10 M NaCl 0.10
- D) 0.05 M CaCl₂ 0.05×2
- E) All of these solutions have the same concentration of chloride ions.

$$\frac{P_{\text{H}_2}}{2.95 \text{ atm}} = \frac{0.350}{P_T}$$

12) A

13) How many moles of NaCl are required to make 250 mL of a 3.00 M solution?

- A) 3 moles
- B) 750 moles
- C) 0.250 moles
- D) 0.750 moles

$$250 \text{ mL} \times \frac{3.00 \text{ mol}}{1000 \text{ mL}} = 0.75 \text{ mol}$$

13) D

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answer the question. (43 pts)

- 14) 1. To calculate mass percent of ^Noxygen in NO₂ the formula is (8 pts total , 4 pt s top, 4 pts bottom)

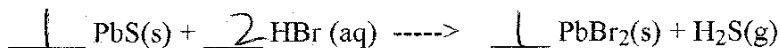
$$\text{mass \%} = \frac{\text{N} \text{ oxygen}}{\text{N}} = \frac{\textcircled{a} 14.0 \text{ g}}{(a) 16.0 \text{ g} \quad (b) 2 \times 14.0 \text{ g} \quad (c) 2 \times 1.01 \text{ g} \quad (d) [(2 \times 16.0) + 14.0] \text{ g}} \times 100$$

(a) 16.0 g (b) 2 x 14.0 g (c) 2 x 16.0 g (d) [(2 x 16.0)+ 14.0] g (circle one letter)

2. The definition of molarity (M) is (8 pts, 4 pts top, 4 pts bottom)

$$\text{molarity (M)} = \frac{\# \text{ moles of solute}}{\# \text{ Liter of solution}}$$

3. For the following reaction complete the balancing of the equation by filling in a number into each of blanks for the missing coefficients. Note to balance chemical reactions, you change coefficients but you leave the subscripts alone. (9 ts, 3 pts each blank)



4. Oxidation States: (10 pts total, 2 pts per blank)

a. What is the oxidation state of N in N₂ 0

b. What is the oxidation state of elemental Na 0

- c. What is the oxidation state of nitrogen in NH₃ Show work below by filling in the following blanks.

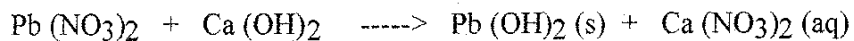
oxidation state of H is +1 charge on NH₃ is 0

oxidation state of N is -3

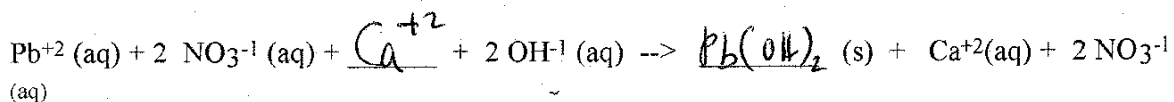
$$3(+1) + N = 0$$

$$N = -3$$

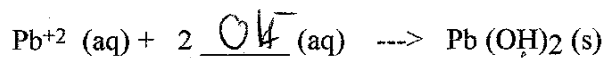
5. For the following reactants given the following balanced precipitation molecular reactions:
(9 pts total, 3 pts per blank)



a. Give the complete ionic equation for the precipitation molecular equation above.
by filling in the blanks.



b. Give the net ionic equation for the precipitation molecular equation above.
by filling in the blanks.



Part III Long Answer (30 pts, 15 pts per letter) Please show all work for full credit and you will get partial credit for any work shown. Both parts refer to the same balanced reaction.



a. For the above balanced chemical reaction (assuming complete reaction and a large excess of the other reactant), if you start the reaction with 12.7 grams of HCl (molar mass HCl = 36.51 g HCl / mol HCl) how many grams of CaCl₂ (molar mass of CaCl₂ = 111.08 g CaCl₂ / mol CaCl₂) would you get? (15 pts, show work)

$$12.7 \text{ g HCl} \times \frac{1 \text{ mol HCl}}{36.51 \text{ g HCl}} \times \frac{1 \text{ mol CaCl}_2}{2 \text{ mol HCl}} \times \frac{111.08 \text{ g CaCl}_2}{1 \text{ mol CaCl}_2} = 19.3 \text{ g CaCl}_2$$

b. For the above balanced chemical reaction, if you have 83.7 mL of 0.25 M of HCl, how many moles of H₂O will you make assuming complete reaction and a large excess of the other reactant. (15 pts)

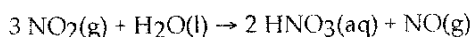
$$83.7 \text{ mL HCl soln} \times \frac{0.25 \text{ mol HCl}}{1000 \text{ mL HCl soln}} \times \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol HCl}} = 0.0209 \text{ mol H}_2\text{O}$$

Name Key (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, 26 pts total)

- 1) According to the following balanced reaction, how many moles of HNO_3 are formed from 8.44 moles of NO_2 if there is plenty of water present? 1) E



- A) 25.3 moles HNO_3
 B) 2.81 moles HNO_3
 C) 1.83 moles HNO_3
 D) 8.44 moles HNO_3
 E) 5.63 moles HNO_3
- $8.44 \text{ mole NO}_2 \times \frac{2 \text{ mol HNO}_3}{3 \text{ mol NO}_2} = 5.63 \text{ mol HNO}_3$

- 2) What volume will 0.780 moles of He occupy at STP? 2) D
- A) 70.0 L B) 43.7 atm C) 22.4 L D) 17.5 L E) 15.6 L

- 3) Determine the concentration of a solution prepared by diluting 20.0 mL of a 0.200 M NaCl to 250.0 mL. ($M_1V_1 = M_2V_2$) 3) E
- A) 0.00800 M B) 0.0320 M C) 2.50 M D) 0.160 M E) 0.0160 M
- $(20.0 \text{ mL})(0.200 \text{ M}) = (250.0 \text{ mL})(?) \Rightarrow \frac{(20.0)(0.200)}{250.0}$

- 4) How many moles of NaCl are required to make 250 mL of a 3.00 M solution? 4) B
- A) 3 moles B) 0.750 moles C) 750 moles D) 0.250 moles

- 5) Convert 1.25 atm to mm Hg. both 5) E

- A) 760 mm Hg
 B) 1520 mm Hg
 C) 875 mm Hg
 D) 1000 mm Hg
 E) 950 mm Hg

$250 \text{ mL} \times \frac{3.00 \text{ mol}}{1000 \text{ mL}} = 0.750$

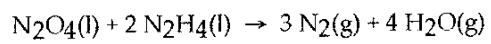
$1.25 \text{ atm} \times \frac{760 \text{ mm Hg}}{1 \text{ atm}} = 950 \text{ mm Hg}$

- 6) A mixture of 0.220 moles CO , 0.350 moles H_2 and 0.640 moles He has a total pressure of 2.95 atm. What is the pressure of H_2 ? 6) D
- A) 0.969 atm B) 0.649 atm C) 1.03 atm D) 0.853 atm E) 1.17 atm

$P_T = 2.95 \text{ atm}$

$X_A = \frac{n_A}{n_T} = \frac{P_A}{P_T}$

7) Determine the limiting reactant (LR) and the mass (in g) of nitrogen that can be formed from 50.0 g N₂O₄ and 45.0 g N₂H₄. Some possibly useful molar masses are as follows: N₂O₄ = 92.02 g/mol, N₂H₄ = 32.05 g/mol. (1 mol N₂ = 28.02 g N₂) 7) C



- A) LR = N₂O₄, 105 g N₂ formed
- B) LR = N₂H₄, 59.0 g N₂ formed
- C) LR = N₂O₄, 45.7 g N₂ formed
- D) No LR, 45.0 g N₂ formed
- E) LR = N₂H₄, 13.3 g N₂ formed

$$50.0 \text{ g N}_2\text{O}_4 \times \frac{1 \text{ mol N}_2\text{O}_4}{92.02 \text{ g N}_2\text{O}_4} \times \frac{3 \text{ mol N}_2}{1 \text{ mol N}_2\text{O}_4} \times \frac{28.02 \text{ g N}_2}{1 \text{ mol N}_2} = 45.7 \text{ g N}_2$$

$$45.0 \text{ g N}_2\text{H}_4 \times \frac{1 \text{ mol N}_2\text{H}_4}{32.05 \text{ g N}_2\text{H}_4} \times \frac{3 \text{ mol N}_2}{2 \text{ mol N}_2\text{H}_4} \times \frac{28.02 \text{ g N}_2}{1 \text{ mol N}_2} = 59.0 \text{ g N}_2$$

8) Calculate the temperature, in K, of 2.20 moles of gas occupying 3.50 L at 3.30 atm. 8) D

A) 5.25 K B) 28.0 K C) 337 K D) 64.0 K

$$PV = nRT \quad T = \frac{PV}{nR} = \frac{(3.30 \text{ atm})(3.50 \text{ L})}{(2.20 \text{ mol})(0.08206)} = 63.97 \rightarrow 64.0 \text{ K}$$

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

- A) 0.05 M CaCl₂ 0.05 × 2 = 0.10
- B) 0.10 M MgCl₂ 0.10 × 2 = 0.20
- C) 0.10 M NaCl 0.10
- D) 0.10 M AlCl₃ 0.10 × 3 = 0.30
- E) All of these solutions have the same concentration of chloride ions.

10) Which of the following compounds is soluble in water? 10) B

- A) BaSO₄
- B) CaS
- C) MgCO₃
- D) PbCl₂
- E) None of these compounds is soluble in water.

11) Identify HCl. 11) D

- A) weak electrolyte, weak acid
- B) nonelectrolyte
- C) weak electrolyte, strong acid
- D) strong electrolyte, strong acid
- E) strong electrolyte, weak acid

12) Give the temperature and pressure at STP. 12) D

- A) 0°C and 1 mm Hg
- B) 0K and 1.00 atm
- C) 25°C and 30.00 in Hg
- D) 0°C and 1.00 atm
- E) 300K and 1 torr Hg

13) How many H⁺ ions can the acid, H₂SO₄, donate per molecule? 13) A

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

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answer the question. (43 pts)

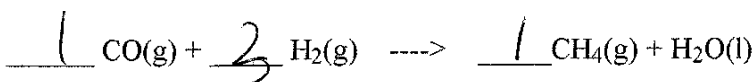
- 14) 1. To calculate mass percent of oxygen in SO_2 the formula is (8 pts total , 4 pts top, 4 pts bottom)

$$\text{mass \% oxygen} = \frac{\text{(a) } 16.0 \text{ g } \textcircled{\text{b}} \text{ } 2 \times 16.0 \text{ g } \text{ (c) } 2 \times 32.0 \text{ g } \text{ (d) } [(2 \times 16.0) + 32.0] \text{ g (circle one letter)}}{\text{(a) } 16.0 \text{ g } \text{ (b) } 2 \times 16.0 \text{ g } \text{ (c) } 2 \times 32.0 \text{ g } \text{ (d) } [(2 \times 16.0) + 32.0] \text{ g (circle one letter)}} \times 100$$

2. The definition of molarity (M) is (8 pts, 4 pts top, 4 pts bottom)

$$\text{molarity (M)} = \frac{\# \text{ } \underline{\text{moles}} \text{ of solute}}{\# \text{ } \underline{\text{liter.}} \text{ of solution}}$$

3. For the following reaction complete the balancing of the equation by filling in a number into each of blanks for the missing coefficients. Note to balance chemical reactions, you change coefficients but you leave the subscripts alone. (9 ts, 3 pts each blank)



4. Oxidation States: (10 pts total, 2 pts per blank)

a. What is the oxidation state of H in H_2 0

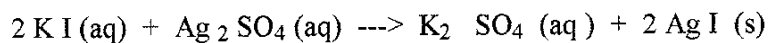
b. What is the oxidation state of elemental Li 0

c. What is the oxidation state of nitrogen in NO_3 (any charges may have been left off so that you can answer the question below) Show work below by filling in the following blanks.

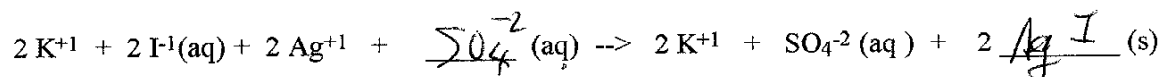
oxidation state of O is -2 charge on NO_3 is -1

oxidation state of N is +5 $\cdot N + 3(-2) = -1$
 $N = -1 + 6 = +5$

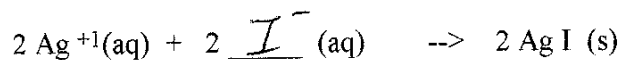
5. For the following reactants given the following balanced precipitation molecular reactions:
(9 pts total, 3 pts per blank)



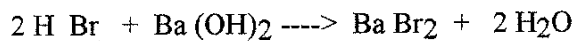
a Give the complete ionic equation for the precipitation molecular equation above. by filling in the blanks.



b Give the net ionic equation for the precipitation molecular equation above. by filling in the blanks.



Part III Long Answer (30 pts, 15 pts per letter) Please show all work for full credit and you will get partial credit for any work shown. Both parts refer to the same balanced reaction.



- a. For the above balanced chemical reaction (assuming complete reaction and a large excess of the other reactant), if you start the reaction with 37.5 grams of HBr (molar mass HBr = 80.91 g HBr / mol HBr) how many grams of BaBr₂ (molar mass of BaBr₂ = 297.13 g BaBr₂ / mol BaBr₂) would you get? (15 pts, show work)

$$\begin{aligned}
 & 37.5 \text{ g HBr} \times \frac{1 \text{ mol HBr}}{80.91 \text{ g HBr}} \times \frac{1 \text{ mol BaBr}_2}{2 \text{ mol HBr}} \times \frac{297.13 \text{ g BaBr}_2}{1 \text{ mol BaBr}_2} \\
 & = 68.9 \text{ g BaBr}_2
 \end{aligned}$$

- b. For the above balanced chemical reaction, if you have 83.7 mL of 0.11 M of HBr, how many moles of H₂O will you make assuming complete reaction and a large excess of the other reactant. (15 pts)

$$\begin{aligned}
 & 83.7 \text{ mL HBr} \times \frac{0.11 \text{ mol HBr}}{1000 \text{ mL HBr}} \times \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol HBr}} = 9.21 \times 10^{-3}
 \end{aligned}$$

Name Key (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, 26 pts total)

1) How many H⁺ ions can the acid, H₂SO₄, donate per molecule? 1) C
 A) 1 B) 0 C) 2 D) 3

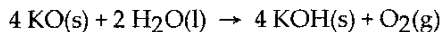
2) Which of the following compounds is insoluble in water? 2) B
 A) (NH₄)₂CO₃
 B) Hg₂I₂
 C) BaS
 D) MgSO₄
 E) All of these compounds are soluble in water.

3) Determine the molarity of a solution formed by dissolving 97.7 g LiBr in enough water to yield 750.0 mL of solution. (molar mass of LiBr = 86.845 g LiBr/mol LiBr) 3) A
 A) 1.50 M B) 1.18 M C) 2.30 M D) 0.768 M E) 0.130 M

4) Identify NaCl. 4) A
 A) strong electrolyte
 B) strong acid
 C) weak electrolyte
 D) nonelectrolyte
 E) weak acid

5) What is the volume of 0.175 mol of O₂ at 7.78 atm and 415K? 5) B
 A) 565 L B) 0.766 L C) 1.53 L D) 25.0 L E) 24.5 L

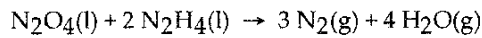
6) According to the following balanced reaction, how many moles of KOH will be formed from 5.44 moles of H₂O? Assume an excess of KO. 6) A



- A) 10.9 moles KOH
 B) 2.72 moles KOH
 C) 4.87 moles KOH
 D) 16.7 moles KOH
 E) 8.33 moles KOH

$$5.44 \text{ mol H}_2\text{O} \times \frac{4 \text{ mol KOH}}{2 \text{ mol H}_2\text{O}} = 10.88$$

- 7) Determine the limiting reactant (LR) and the mass (in g) of nitrogen that can be formed from 50.0 g N_2O_4 and 45.0 g N_2H_4 . Some possibly useful molar masses are as follows: $N_2O_4 = 92.02$ g/mol, $N_2H_4 = 32.05$ g/mol. $(1 \text{ mol } N_2 = 28.02 \text{ g } N_2)$ 7) A



- (A) LR = N_2O_4 , 45.7 g N_2 formed
 B) LR = N_2O_4 , 105 g N_2 formed
 C) No LR, 45.0 g N_2 formed
 D) LR = N_2H_4 , 59.0 g N_2 formed
 E) LR = N_2H_4 , 13.3 g N_2 formed

$$50.0 \text{ g } N_2O_4 \times \frac{1 \text{ mol } N_2O_4}{92.02 \text{ g } N_2O_4} \times \frac{3 \text{ mol } N_2}{1 \text{ mol } N_2O_4} \times \frac{28.02 \text{ g } N_2}{1 \text{ mol } N_2}$$

$$45.0 \text{ g } N_2H_4 \times \frac{1 \text{ mol } N_2H_4}{32.05 \text{ g } N_2H_4} \times \frac{3 \text{ mol } N_2}{2 \text{ mol } N_2H_4} \times \frac{28.02 \text{ g } N_2}{1 \text{ mol } N_2}$$

- 8) A mixture of 0.220 moles CO , 0.350 moles H_2 and 0.640 moles He has a total pressure of 2.95 atm. What is the pressure of CO ? 8) A

- (A) 0.536 atm B) 0.955 atm C) 0.649 atm D) 1.86 atm E) 1.54 atm

$$n_T = 0.220 + 0.350 + 0.640 =$$

- 9) Which of the following solutions will have the highest concentration of chloride ions? 9) C

- A) 0.05 M $CaCl_2$ 0.09×2
 B) 0.10 M $NaCl$ 0.10
 C) 0.10 M $AlCl_3$ 0.10×3
 D) 0.10 M $MgCl_2$ 0.10×2

$$\frac{0.220 \text{ mol } CO}{2.95 \text{ atm}} = \frac{x}{2.95 \text{ atm}}$$

- E) All of these solutions have the same concentration of chloride ions.

- 10) Determine the concentration of a solution prepared by diluting 20.0 mL of a 0.200 M $NaCl$ to 250.0 mL. ($M_1V_1 = M_2V_2$) 10) D

- A) 0.0320 M B) 2.50 M C) 0.00800 M D) 0.0160 M E) 0.160 M

- 11) Give the temperature and pressure at STP.

- (A) $0^\circ C$ and 1.00 atm
 B) 0K and 1.00 atm
 C) 300K and 1 torr Hg
 D) $25^\circ C$ and 30.00 in Hg
 E) $0^\circ C$ and 1 mm Hg

$$(20.0 \text{ mL})(0.200 \text{ M}) = (250.0 \text{ mL})(\frac{A}{M_2})$$

- 12) What volume will 0.780 moles of He occupy at STP? 12) A

- (A) 17.5 L B) 22.4 L C) 70.0 L D) 15.6 L E) 43.7 atm

- 13) Convert 1.25 atm to mm Hg.

- (A) 950 mm Hg
 B) 875 mm Hg
 C) 760 mm Hg
 D) 1520 mm Hg
 E) 1000 mm Hg

$$0.780 \text{ mol} \times \frac{22.4 \text{ L}}{1 \text{ mol gas}} =$$

$$1.25 \text{ atm} \times \frac{760 \text{ mm Hg}}{1 \text{ atm}} =$$

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answer the question. (43 pts)

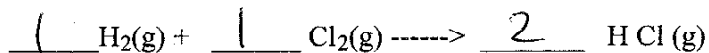
- 14) 1. To calculate mass percent of sulfur in H_2S the formula is (8 pts total , 4 pt s top, 4 pts bottom)

$$\text{mass \% sulfur} = \frac{\text{(a) } 32.0 \text{ g (b) } 2 \times 16.0 \text{ g (c) } 2 \times 1.01 \text{ g (d) } [(2 \times 1.01) + 32.0] \text{ g (circle one letter)}}{\text{(a) } 32.0 \text{ g (b) } 2 \times 16.0 \text{ g (c) } 2 \times 1.01 \text{ g (d) } [(2 \times 1.01) + 32.0] \text{ g (circle one letter)}} \times 100$$

2. The definition of molarity (M) is (8 pts, 4 pts top, 4 pts bottom)

$$\text{molarity (M)} = \frac{\# \text{ moles of solute}}{\# \text{ liter of solution}}$$

3. For the following reaction complete the balancing of the equation by filling in a number into each of blanks for the missing coefficients. Note to balance chemical reactions, you change coefficients but you leave the subscripts alone. (9 ts, 3 pts each blank)



4. Oxidation States: (10 pts total, 2 pts per blank)

a. What is the oxidation state of O in O_2 0

b. What is the oxidation state of elemental Mg 0

c. What is the oxidation state of nitrogen in NO_2 Show work below by filling in the following blanks.

oxidation state of O is -2 charge on NO_2 is 0

oxidation state of N is +4

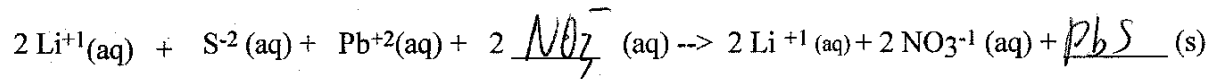
$$N + 2(-2) = 0$$

$$N = +4$$

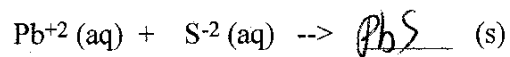
5. For the following reactants given the following balanced precipitation molecular reactions:
(9 pts total, 3 pts per blank)



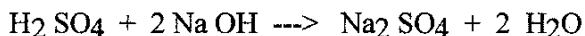
a. Give the complete ionic equation for the precipitation molecular equation above.
by filling in the blanks.



b. Give the net ionic equation for the precipitation molecular equation above. by filling i
the blanks.



Part III Long Answer (30 pts, 15 pts per letter) Please show all work for full credit and you will get partial credit for any work shown. Both parts refer to the same balanced reaction.



- a. For the above balanced chemical reaction (assuming complete reaction and a large excess of the other reactant), if you start the reaction with 95.2 grams of NaOH (molar mass NaOH = 40.01 g NaOH / mol NaOH) how many grams of Na₂SO₄ (molar mass Na₂SO₄ = 142.1 g Na₂SO₄/mol Na₂SO₄) would you get? (15 pts, show work)

$$95.2 \text{ g NaOH} \times \frac{1 \text{ mol NaOH}}{40.01 \text{ g NaOH}} \times \frac{1 \text{ mol Na}_2\text{SO}_4}{2 \text{ mol NaOH}} \times \frac{142.1 \text{ g Na}_2\text{SO}_4}{1 \text{ mol Na}_2\text{SO}_4} = 169 \text{ g Na}_2\text{SO}_4$$

- b. For the above balanced chemical reaction, if you have 83.7 mL of 1.5 M of NaOH, how many moles of H₂O will you make assuming complete reaction and a large excess of the other reactant. (15 pts, show work)

$$83.7 \text{ mL NaOH} \times \frac{1.5 \text{ mol NaOH}}{1000 \text{ mL NaOH}} \times \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol NaOH}} = 0.126 \text{ mol H}_2\text{O}$$

Name Key (print) Name _____ (sign)

Please show work for partial credit on the Long Answers and in some of the Short Answer Questions. Multiple 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) 7 page Exam, 5 page exam + periodic table & solubility rules chart (count pages to make sure you have the entire exam)

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 26 pts total)

1) Convert 1.25 atm to mm Hg.

- A) 950 mm Hg
 B) 1520 mm Hg
 C) 1000 mm Hg
 D) 760 mm Hg
 E) 875 mm Hg

$$1.25 \text{ atm} \times \frac{760 \text{ mm Hg}}{1 \text{ atm}} = ?$$

1) A2) Which of the following compounds is insoluble in water?

- A) MgSO₄
 B) Hg₂I₂
 C) (NH₄)₂CO₃
 D) BaS
 E) All of these compounds are soluble in water.

2) B

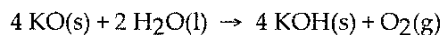
3) Give the temperature and pressure at STP.

- A) 25°C and 30.00 in Hg
 B) 300K and 1 torr Hg
 C) 0°C and 1.00 atm
 D) 0°C and 1 mm Hg
 E) 0K and 1.00 atm

3) C4) Determine the concentration of a solution prepared by diluting 20.0 mL of a 0.200 M NaCl to 250.0 mL. ($M_1V_1 = M_2V_2$)

- A) 0.160 M B) 0.0160 M C) 0.00800 M D) 0.0320 M E) 2.50 M

$$(20.0 \text{ mL})(0.200 \text{ M}) = (250.0 \text{ mL})(?)$$

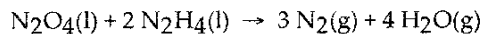
4) B5) According to the following balanced reaction, how many moles of KOH will be formed from 5.44 moles of H₂O? Assume an excess of KO.

- A) 4.87 moles KOH
 B) 16.7 moles KOH
 C) 8.33 moles KOH
 D) 10.9 moles KOH
 E) 2.72 moles KOH

$$5.44 \text{ mol H}_2\text{O} \times \frac{4 \text{ mol KOH}}{2 \text{ mol H}_2\text{O}} = ?$$

5) D

- 6) Determine the limiting reactant (LR) and the mass (in g) of nitrogen that can be formed from 50.0 g N_2O_4 and 45.0 g N_2H_4 . Some possibly useful molar masses are as follows: $N_2O_4 = 92.02 \text{ g/mol}$, $N_2H_4 = 32.05 \text{ g/mol}$. $(1 \text{ mol } N_2 = 28.02 \text{ g } N_2)$ 6) D



- A) No LR, 45.0 g N_2 formed
 B) LR = N_2H_4 , 59.0 g N_2 formed
 C) LR = N_2H_4 , 13.3 g N_2 formed
D) LR = N_2O_4 , 45.7 g N_2 formed
 E) LR = N_2O_4 , 105 g N_2 formed

$$50.0 \text{ g } N_2O_4 \times \frac{1 \text{ mol } N_2O_4}{92.02 \text{ g } N_2O_4} \times \frac{3 \text{ mol } N_2}{1 \text{ mol } N_2O_4} \times \frac{28.02 \text{ g } N_2}{1 \text{ mol } N_2}$$

$$45.0 \text{ g } N_2H_4 \times \frac{1 \text{ mol } N_2H_4}{32.05 \text{ g } N_2H_4} \times \frac{3 \text{ mol } N_2}{2 \text{ mol } N_2H_4} \times \frac{28.02 \text{ g } N_2}{1 \text{ mol } N_2}$$

- 7) What is the volume of 0.175 mol of O_2 at 7.78 atm and 415K? 7) E
 A) 24.5 L B) 565 L C) 1.53 L D) 25.0 L E) 0.766 L

- 8) How many H^+ ions can the acid, H_2SO_4 , donate per molecule? 8) B
 A) 0 B) 2 C) 1 D) 3

- 9) Determine the molarity of a solution formed by dissolving 97.7 g LiBr in enough water to yield 750.0 mL of solution. (molar mass of LiBr = 86.845 g LiBr/mol LiBr) 9) E
 A) 2.30 M B) 1.18 M C) 0.130 M D) 0.768 M E) 1.50 M

- 10) A mixture of 0.220 moles CO , 0.350 moles H_2 and 0.640 moles He has a total pressure of 2.95 atm. What is the pressure of CO ? 10) B
 A) 0.955 atm B) 0.536 atm C) 0.649 atm D) 1.54 atm E) 1.86 atm
 $n_T = 0.220 + 0.350 + 0.640$
 $\frac{0.220}{n_T} = \frac{P_{CO}}{2.95}$

- 11) Identify NaCl.
 A) nonelectrolyte
 B) weak electrolyte
 C) weak acid
D) strong electrolyte
 E) strong acid

$$PV = nRT$$

$$V = \frac{nRT}{P} = \frac{(0.175)(0.08206)(415K)}{7.78 \text{ atm}}$$

- 12) Which of the following solutions will have the highest concentration of chloride ions? 12) D
 A) 0.10 M NaCl 0.10
 B) 0.05 M $CaCl_2$ 0.05 x 2
 C) 0.10 M $MgCl_2$ 0.10 x 2
D) 0.10 M $AlCl_3$ 0.10 x 3
 E) All of these solutions have the same concentration of chloride ions.

- 13) What volume will 0.780 moles of He occupy at STP? 13) D
 A) 43.7 atm B) 15.6 L C) 22.4 L D) 17.5 L E) 70.0 L

0.780

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answer the question. (43 pts)

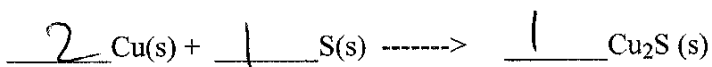
- 14) 1. To calculate mass percent of carbon in CH₄ the formula is (8 pts total , 4 pt s top, 4 pts bottom)

$$\text{mass \% carbon} = \frac{\text{(a) } 12.0 \text{ g (b) } 2 \times 12.0 \text{ g (c) } 4 \times 1.01 \text{ g (d) } [(4 \times 1.01) + 12.0] \text{ g}}{\text{(a) } 12.0 \text{ g (b) } 2 \times 12.0 \text{ g (c) } 4 \times 1.01 \text{ g (d) } [(4 \times 1.01) + 12.0] \text{ g}} \times 100$$

2. The definition of molarity (M) is (8 pts, 4 pts top, 4 pts bottom)

$$\text{molarity (M)} = \frac{\# \text{ moles of solute}}{\# \text{ liter of solution}}$$

3. For the following reaction complete the balancing of the equation by filling in a number into each of blanks for the missing coefficients. Note to balance chemical reactions, you change coefficients but you leave the subscripts alone. (9 ts, 3 pts each blank)



4. Oxidation States: (10 pts total, 2 pts per blank)

a. What is the oxidation state of Cl in Cl₂ 0

b. What is the oxidation state of elemental Ca 0

c. What is the oxidation state of Sn in SnO₂ Show work below by filling in the following blanks.

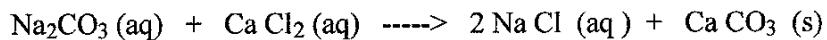
oxidation state of O is -2 charge on SnO₂ is 0

oxidation state of Sn is +4

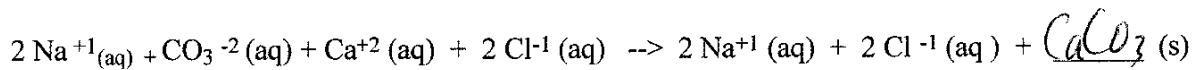
$$\text{Sn} + 2(-2) = 0$$

$$\text{Sn} = +4$$

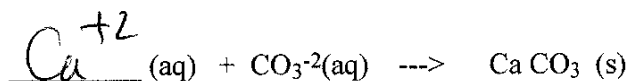
5. For the following reactants given the following balanced precipitation molecular reactions:
(9 pts total, 3 pts per blank)



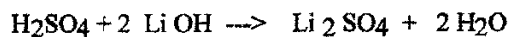
a Give the complete ionic equation for the precipitation molecular equation above. by filling in the blanks



b. Give the net ionic equation for the precipitation molecular equation above. by filling in the blanks.



Part III Long Answer (30 pts, 15 pts per letter) Please show all work for full credit and you will get partial credit for any work shown. Both parts refer to the same balanced reaction.



- a. For the above balanced chemical reaction (assuming complete reaction and a large excess of the other reactant), if you start the reaction with 14.7 grams of LiOH (molar mass LiOH = 23.95 g LiOH/mol LiOH) how many grams of Li₂SO₄ (molar mass Li₂SO₄ = 109.98 g Li₂SO₄ / mol Li₂SO₄) would you get? (15 pts, show work)

$$\begin{array}{l}
 14.7 \text{ g} \\
 \text{LiOH}
 \end{array}
 \times \frac{\text{mol LiOH}}{23.95 \text{ g LiOH}} \times \frac{1 \text{ mol Li}_2\text{SO}_4}{2 \text{ mol LiOH}} \times \frac{109.98 \text{ g Li}_2\text{SO}_4}{1 \text{ mol Li}_2\text{SO}_4}$$

$$= 33.8 \text{ g Li}_2\text{SO}_4$$

- b. For the above balanced chemical reaction, if you have 83.7 mL of 1.3 M of LiOH, how many moles of H₂O will you make assuming complete reaction and a large excess of the other reactant. (15 pts, show work)

$$\begin{array}{l}
 83.7 \text{ mL} \\
 \text{LiOH} \\
 90 \text{ mL}
 \end{array}
 \times \frac{1.3 \text{ mol LiOH}}{1000 \text{ mL LiOH}} \times \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol LiOH}} = 0.1088$$

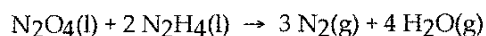
} mol H₂O
 0.11 mol
 (w sig. fig.)

Name _____ (print) Name _____ (sign)

Please show work for partial credit on the Long Answers and in some of the Short Answer Questions. Multiple 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) 7 page Exam, 5 page exam + periodic table & solubility rules chart (count pages to make sure you have the entire exam)

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 26 pts total)

- 1) Determine the limiting reactant (LR) and the mass (in g) of nitrogen that can be formed from 50.0 g N_2O_4 and 45.0 g N_2H_4 . Some possibly useful molar masses are as follows: $\text{N}_2\text{O}_4 = 92.02 \text{ g/mol}$, $\text{N}_2\text{H}_4 = 32.05 \text{ g/mol}$. 1) _____



- A) LR = N_2H_4 , 13.3 g N_2 formed
 B) LR = N_2O_4 , 45.7 g N_2 formed
 C) No LR, 45.0 g N_2 formed
 D) LR = N_2H_4 , 59.0 g N_2 formed
 E) LR = N_2O_4 , 105 g N_2 formed
- 2) Give the temperature and pressure at STP. 2) _____
 A) 25°C and 30.00 in Hg
 B) 300K and 1 torr Hg
 C) 0°C and 1.00 atm
 D) 0K and 1.00 atm
 E) 0°C and 1 mm Hg
- 3) Determine the concentration of a solution prepared by diluting 20.0 mL of a 0.200 M NaCl to 250.0 mL. ($M_1V_1 = M_2V_2$) 3) _____
 A) 0.160 M B) 0.0160 M C) 0.00800 M D) 2.50 M E) 0.0320 M
- 4) Identify HCl. 4) _____
 A) nonelectrolyte
 B) weak electrolyte, strong acid
 C) weak electrolyte, weak acid
 D) strong electrolyte, weak acid
 E) strong electrolyte, strong acid
- 5) Calculate the temperature, in K, of 2.20 moles of gas occupying 3.50 L at 3.30 atm. 5) _____
 A) 64.0 K B) 28.0 K C) 5.25 K D) 337 K

- 6) Which of the following compounds is soluble in water? 6) _____
 A) BaSO₄
 B) MgCO₃
 C) PbCl₂
 D) CaS
 E) None of these compounds is soluble in water.
- 7) Convert 1.25 atm to mm Hg. 7) _____
 A) 1000 mm Hg
 B) 875 mm Hg
 C) 760 mm Hg
 D) 950 mm Hg
 E) 1520 mm Hg
- 8) How many H⁺ ions can the acid, H₂SO₄, donate per molecule? 8) _____
 A) 3 B) 1 C) 2 D) 0
- 9) What volume will 0.780 moles of He occupy at STP? 9) _____
 A) 17.5 L B) 22.4 L C) 43.7 atm D) 15.6 L E) 70.0 L
- 10) According to the following balanced reaction, how many moles of HNO₃ are formed from 8.44 moles of NO₂ if there is plenty of water present? 10) _____

$$3 \text{NO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow 2 \text{HNO}_3(\text{aq}) + \text{NO}(\text{g})$$

 A) 25.3 moles HNO₃
 B) 2.81 moles HNO₃
 C) 5.63 moles HNO₃
 D) 8.44 moles HNO₃
 E) 1.83 moles HNO₃
- 11) A mixture of 0.220 moles CO, 0.350 moles H₂ and 0.640 moles He has a total pressure of 2.95 atm. 11) _____
 What is the pressure of H₂?
 A) 1.17 atm B) 0.853 atm C) 0.649 atm D) 0.969 atm E) 1.03 atm
- 12) Which of the following solutions will have the highest concentration of chloride ions? 12) _____
 A) 0.10 M AlCl₃
 B) 0.10 M MgCl₂
 C) 0.10 M NaCl
 D) 0.05 M CaCl₂
 E) All of these solutions have the same concentration of chloride ions.
- 13) How many moles of NaCl are required to make 250 mL of a 3.00 M solution? 13) _____
 A) 3 moles B) 750 moles C) 0.250 moles D) 0.750 moles

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answer the question. (43 pts)

- 14) 1. To calculate mass percent of ~~oxygen~~^N in NO₂ the formula is (8 pts total , 4 pt s top, 4 pts bottom)

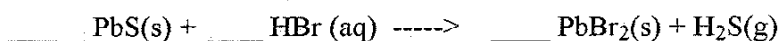
$$\text{mass \%} = \frac{\text{oxygen} \cdot \text{N}}{\text{(a) 16.0 g (b) 2 x 14.0 g (c) 2 x 16.0 g (d) [(2 x 16.0) + 14.0] g}} \times 100$$

(a) 16.0 g (b) 2 x 14.0 g (c) 2 x 16.0 g (d) [(2 x 16.0) + 14.0] g (circle one letter)

2. The definition of molarity (M) is (8 pts, 4 pts top, 4 pts bottom)

$$\text{molarity (M)} = \frac{\# \text{ of solute}}{\# \text{ of solution}}$$

3. For the following reaction complete the balancing of the equation by filling in a number into each of blanks for the missing coefficients. Note to balance chemical reactions, you change coefficients but you leave the subscripts alone. (9 ts, 3 pts each blank)



4. Oxidation States: (10 pts total, 2 pts per blank)

a. What is the oxidation state of N in N₂ _____

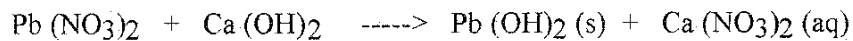
b. What is the oxidation state of elemental Na _____

c. What is the oxidation state of nitrogen in NH₃ Show work below by filling in the following blanks.

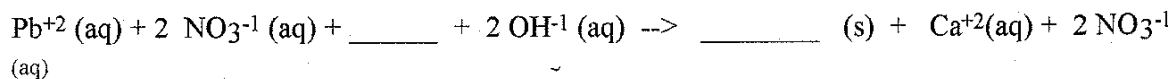
oxidation state of H is _____ charge on NH₃ is _____

oxidation state of N is _____

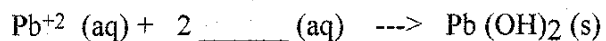
5. For the following reactants given the following balanced precipitation molecular reactions:
(9 pts total, 3 pts per blank)



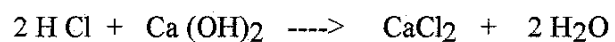
a. Give the complete ionic equation for the precipitation molecular equation above.
by filling in the blanks.



b. Give the net ionic equation for the precipitation molecular equation above.
by filling in the blanks.



Part III Long Answer (30 pts, 15 pts per letter) Please show all work for full credit and you will get partial credit for any work shown. Both parts refer to the same balanced reaction.



- a. For the above balanced chemical reaction (assuming complete reaction and a large excess of the other reactant), if you start the reaction with 12.7 grams of HCl (molar mass HCl = 36.51 g HCl / mol HCl) how many grams of CaCl₂ (molar mass of CaCl₂ = 111.08 g CaCl₂ / mol CaCl₂) would you get? (15 pts, show work)

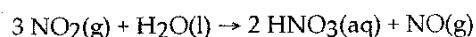
- b. For the above balanced chemical reaction, if you have 83.7 mL of 0.25 M of HCl, how many moles of H₂O will you make assuming complete reaction and a large excess of the other reactant. (15 pts)

Name _____ (print) Name _____ (sign)

Please show work for partial credit on the Long Answers and in some of the Short Answer Questions. Multiple 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) 7 page Exam, 5 page exam + periodic table & solubility rules chart (count pages to make sure you have the entire exam)

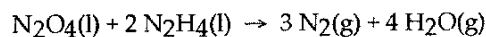
Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 26 pts total)

- 1) According to the following balanced reaction, how many moles of HNO₃ are formed from 8.44 moles of NO₂ if there is plenty of water present? 1) _____



- A) 25.3 moles HNO₃
B) 2.81 moles HNO₃
C) 1.83 moles HNO₃
D) 8.44 moles HNO₃
E) 5.63 moles HNO₃
- 2) What volume will 0.780 moles of He occupy at STP? 2) _____
A) 70.0 L B) 43.7 atm C) 22.4 L D) 17.5 L E) 15.6 L
- 3) Determine the concentration of a solution prepared by diluting 20.0 mL of a 0.200 M NaCl to 250.0 mL. ($M_1V_1 = M_2V_2$) 3) _____
A) 0.00800 M B) 0.0320 M C) 2.50 M D) 0.160 M E) 0.0160 M
- 4) How many moles of NaCl are required to make 250 mL of a 3.00 M solution? 4) _____
A) 3 moles B) 0.750 moles C) 750 moles D) 0.250 moles
- 5) Convert 1.25 atm to mm Hg. both 5) _____
A) 760 mm Hg
B) 1520 mm Hg
C) 875 mm Hg
D) 1000 mm Hg
E) 950 mm Hg
- 6) A mixture of 0.220 moles CO, 0.350 moles H₂ and 0.640 moles He has a total pressure of 2.95 atm. 6) _____
What is the pressure of H₂?
A) 0.969 atm B) 0.649 atm C) 1.03 atm D) 0.853 atm E) 1.17 atm

- 7) Determine the limiting reactant (LR) and the mass (in g) of nitrogen that can be formed from 50.0 g N_2O_4 and 45.0 g N_2H_4 . Some possibly useful molar masses are as follows: $\text{N}_2\text{O}_4 = 92.02 \text{ g/mol}$, $\text{N}_2\text{H}_4 = 32.05 \text{ g/mol}$. 7) _____



- A) LR = N_2O_4 , 105 g N_2 formed
B) LR = N_2H_4 , 59.0 g N_2 formed
C) LR = N_2O_4 , 45.7 g N_2 formed
D) No LR, 45.0 g N_2 formed
E) LR = N_2H_4 , 13.3 g N_2 formed
- 8) Calculate the temperature, in K, of 2.20 moles of gas occupying 3.50 L at 3.30 atm. 8) _____
A) 5.25 K B) 28.0 K C) 337 K D) 64.0 K
- 9) Which of the following solutions will have the highest concentration of chloride ions? 9) _____
A) 0.05 M CaCl_2
B) 0.10 M MgCl_2
C) 0.10 M NaCl
D) 0.10 M AlCl_3
E) All of these solutions have the same concentration of chloride ions.
- 10) Which of the following compounds is soluble in water? 10) _____
A) BaSO_4
B) CaS
C) MgCO_3
D) PbCl_2
E) None of these compounds is soluble in water.
- 11) Identify HCl. 11) _____
A) weak electrolyte, weak acid
B) nonelectrolyte
C) weak electrolyte, strong acid
D) strong electrolyte, strong acid
E) strong electrolyte, weak acid
- 12) Give the temperature and pressure at STP. 12) _____
A) 0°C and 1 mm Hg
B) 0K and 1.00 atm
C) 25°C and 30.00 in Hg
D) 0°C and 1.00 atm
E) 300K and 1 torr Hg
- 13) How many H^+ ions can the acid, H_2SO_4 , donate per molecule? 13) _____
A) 2 B) 1 C) 3 D) 0

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answer the question. (43 pts)

- 14) 1. To calculate mass percent of oxygen in SO_2 the formula is (8 pts total , 4 pts top, 4 pts bottom)

$$\text{mass \% oxygen} = \frac{\text{(a) } 16.0 \text{ g (b) } 2 \times 16.0 \text{ g (c) } 2 \times 32.0 \text{ g (d) } [(2 \times 16.0) + 32.0] \text{ g (circle one letter)}}{\text{(a) } 16.0 \text{ g (b) } 2 \times 16.0 \text{ g (c) } 2 \times 32.0 \text{ g (d) } [(2 \times 16.0) + 32.0] \text{ g (circle one letter)}} \times 100$$

2. The definition of molarity (M) is (8 pts, 4 pts top, 4 pts bottom)

$$\text{molarity (M)} = \frac{\# \text{ of solute}}{\# \text{ of solution}}$$

3. For the following reaction complete the balancing of the equation by filling in a number into each of blanks for the missing coefficients. Note to balance chemical reactions, you change coefficients but you leave the subscripts alone. (9 ts, 3 pts each blank)



4. Oxidation States: (10 pts total, 2 pts per blank)

a. What is the oxidation state of H in H_2 _____

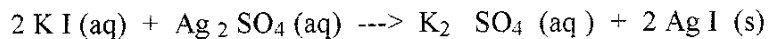
b. What is the oxidation state of elemental Li _____

c. What is the oxidation state of nitrogen in NO_3 (any charges may have been left off so that you can answer the question below) Show work below by filling in the following blanks.

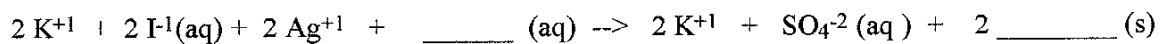
oxidation state of O is _____ charge on NO_3 is _____

oxidation state of N is _____

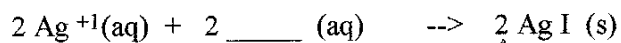
5. For the following reactants given the following balanced precipitation molecular reactions:
(9 pts total, 3 pts per blank)



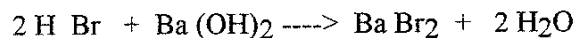
- a. Give the complete ionic equation for the precipitation molecular equation above. by filling in the blanks.



- b. Give the net ionic equation for the precipitation molecular equation above. by filling in the blanks.



Part III Long Answer (30 pts, 15 pts per letter) Please show all work for full credit and you will get partial credit for any work shown. Both parts refer to the same balanced reaction.



- a. For the above balanced chemical reaction (assuming complete reaction and a large excess of the other reactant), if you start the reaction with 37.5 grams of HBr (molar mass HBr = 80.91 g HBr / mol HBr) how many grams of BaBr₂ (molar mass of BaBr₂ = 297.13 g BaBr₂ / mol BaBr₂) would you get? (15 pts, show work)

- b. For the above balanced chemical reaction, if you have 83.7 mL of 0.11 M of HBr, how many moles of H₂O will you make assuming complete reaction and a large excess of the other reactant. (15 pts)

Name _____ (print) Name _____ (sign)

Please show work for partial credit on the Long Answers and in some of the Short Answer Questions. Multiple 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) 7 page Exam, 5 page exam + periodic table & solubility rules chart (count pages to make sure you have the entire exam)

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 26 pts total)

1) How many H⁺ ions can the acid, H₂SO₄, donate per molecule? 1) _____
A) 1 B) 0 C) 2 D) 3

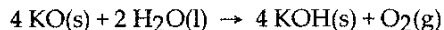
2) Which of the following compounds is insoluble in water? 2) _____
A) (NH₄)₂CO₃
B) Hg₂I₂
C) BaS
D) MgSO₄
E) All of these compounds are soluble in water.

3) Determine the molarity of a solution formed by dissolving 97.7 g LiBr in enough water to yield 750.0 mL of solution. (molar mass of LiBr = 86.845 g LiBr/mol LiBr) 3) _____
A) 1.50 M B) 1.18 M C) 2.30 M D) 0.768 M E) 0.130 M

4) Identify NaCl. 4) _____
A) strong electrolyte
B) strong acid
C) weak electrolyte
D) nonelectrolyte
E) weak acid

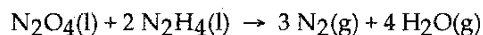
5) What is the volume of 0.175 mol of O₂ at 7.78 atm and 415K? 5) _____
A) 565 L B) 0.766 L C) 1.53 L D) 25.0 L E) 24.5 L

6) According to the following balanced reaction, how many moles of KOH will be formed from 5.44 moles of H₂O? Assume an excess of KO. 6) _____



- A) 10.9 moles KOH
B) 2.72 moles KOH
C) 4.87 moles KOH
D) 16.7 moles KOH
E) 8.33 moles KOH

- 7) Determine the limiting reactant (LR) and the mass (in g) of nitrogen that can be formed from 50.0 g N_2O_4 and 45.0 g N_2H_4 . Some possibly useful molar masses are as follows: $\text{N}_2\text{O}_4 = 92.02 \text{ g/mol}$, $\text{N}_2\text{H}_4 = 32.05 \text{ g/mol}$. 7) _____



- A) LR = N_2O_4 , 45.7 g N_2 formed
B) LR = N_2O_4 , 105 g N_2 formed
C) No LR, 45.0 g N_2 formed
D) LR = N_2H_4 , 59.0 g N_2 formed
E) LR = N_2H_4 , 13.3 g N_2 formed
- 8) A mixture of 0.220 moles CO , 0.350 moles H_2 and 0.640 moles He has a total pressure of 2.95 atm. What is the pressure of CO ? 8) _____
A) 0.536 atm B) 0.955 atm C) 0.649 atm D) 1.86 atm E) 1.54 atm
- 9) Which of the following solutions will have the highest concentration of chloride ions? 9) _____
A) 0.05 M CaCl_2
B) 0.10 M NaCl
C) 0.10 M AlCl_3
D) 0.10 M MgCl_2
E) All of these solutions have the same concentration of chloride ions.
- 10) Determine the concentration of a solution prepared by diluting 20.0 mL of a 0.200 M NaCl to 250.0 mL. ($M_1V_1 = M_2V_2$) 10) _____
A) 0.0320 M B) 2.50 M C) 0.00800 M D) 0.0160 M E) 0.160 M
- 11) Give the temperature and pressure at STP. 11) _____
A) 0°C and 1.00 atm
B) 0K and 1.00 atm
C) 300K and 1 torr Hg
D) 25°C and 30.00 in Hg
E) 0°C and 1 mm Hg
- 12) What volume will 0.780 moles of He occupy at STP? 12) _____
A) 17.5 L B) 22.4 L C) 70.0 L D) 15.6 L E) 43.7 atm
- 13) Convert 1.25 atm to mm Hg. 13) _____
A) 950 mm Hg
B) 875 mm Hg
C) 760 mm Hg
D) 1520 mm Hg
E) 1000 mm Hg

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answer the question. (43 pts)

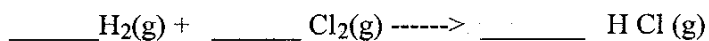
- 14) 1. To calculate mass percent of sulfur in H_2S the formula is (8 pts total , 4 pt s top, 4 pts bottom)

$$\text{mass \% sulfur} = \frac{\text{(a) 32.0 g (b) } 2 \times 16.0 \text{ g (c) } 2 \times 1.01 \text{ g (d) } [(2 \times 1.01) + 32.0] \text{ g (circle one letter)}}{\text{(a) 32.0 g (b) } 2 \times 16.0 \text{ g (c) } 2 \times 1.01 \text{ g (d) } [(2 \times 1.01) + 32.0] \text{ g (circle one letter)}} \times 100$$

2. The definition of molarity (M) is (8 pts, 4 pts top, 4 pts bottom)

$$\text{molarity (M)} = \frac{\# \text{ of solute}}{\# \text{ of solution}}$$

3. For the following reaction complete the balancing of the equation by filling in a number into each of blanks for the missing coefficients. Note to balance chemical reactions, you change coefficients but you leave the subscripts alone. (9 ts, 3 pts each blank)



4. Oxidation States: (10 pts total, 2 pts per blank)

a. What is the oxidation state of O in O_2 _____

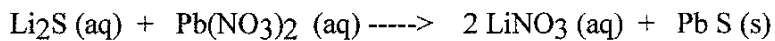
b. What is the oxidation state of elemental Mg _____

c. What is the oxidation state of nitrogen in NO_2 Show work below by filling in the following blanks.

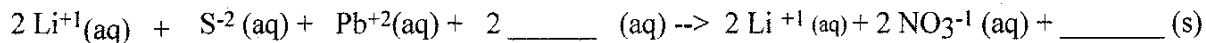
oxidation state of O is _____ charge on NO_2 is _____

oxidation state of N is _____

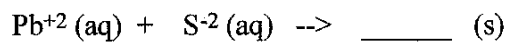
5. For the following reactants given the following balanced precipitation molecular reactions:
(9 pts total, 3 pts per blank)



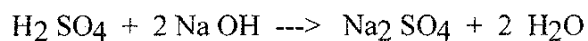
a. Give the complete ionic equation for the precipitation molecular equation above.
by filling in the blanks.



b. Give the net ionic equation for the precipitation molecular equation above. by filling i
the blanks.



Part III Long Answer (30 pts, 15 pts per letter) Please show all work for full credit and you will get partial credit for any work shown. Both parts refer to the same balanced reaction.



a. For the above balanced chemical reaction (assuming complete reaction and a large excess of the other reactant), if you start the reaction with 95.2 grams of NaOH (molar mass NaOH = 40.01 g NaOH / mol NaOH) how many grams of Na₂SO₄ (molar mass Na₂SO₄ = 142.1 g Na₂SO₄/mol Na₂SO₄) would you get? (15 pts, show work)

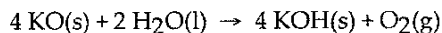
b. For the above balanced chemical reaction, if you have 83.7 mL of 1.5 M of NaOH, how many moles of H₂O will you make assuming complete reaction and a large excess of the other reactant. (15 pts, show work)

Name _____ (print) Name _____ (sign)

Please show work for partial credit on the Long Answers and in some of the Short Answer Questions. Multiple 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) 7 page Exam, 5 page exam + periodic table & solubility rules chart (count pages to make sure you have the entire exam)

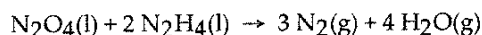
Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (2 pts per question, 26 pts total)

- 1) Convert 1.25 atm to mm Hg. 1) _____
A) 950 mm Hg
B) 1520 mm Hg
C) 1000 mm Hg
D) 760 mm Hg
E) 875 mm Hg
- 2) Which of the following compounds is insoluble in water? 2) _____
A) $MgSO_4$
B) Hg_2I_2
C) $(NH_4)_2CO_3$
D) BaS
E) All of these compounds are soluble in water.
- 3) Give the temperature and pressure at STP. 3) _____
A) 25°C and 30.00 in Hg
B) 300K and 1 torr Hg
C) 0°C and 1.00 atm
D) 0°C and 1 mm Hg
E) 0K and 1.00 atm
- 4) Determine the concentration of a solution prepared by diluting 20.0 mL of a 0.200 M NaCl to 250.0 mL. ($M_1V_1 = M_2V_2$) 4) _____
A) 0.160 M B) 0.0160 M C) 0.00800 M D) 0.0320 M E) 2.50 M
- 5) According to the following balanced reaction, how many moles of KOH will be formed from 5.44 moles of H_2O ? Assume an excess of KO. 5) _____



- A) 4.87 moles KOH
B) 16.7 moles KOH
C) 8.33 moles KOH
D) 10.9 moles KOH
E) 2.72 moles KOH

- 6) Determine the limiting reactant (LR) and the mass (in g) of nitrogen that can be formed from 50.0 g N_2O_4 and 45.0 g N_2H_4 . Some possibly useful molar masses are as follows: $\text{N}_2\text{O}_4 = 92.02 \text{ g/mol}$, $\text{N}_2\text{H}_4 = 32.05 \text{ g/mol}$. 6) _____



- A) No LR, 45.0 g N_2 formed
B) LR = N_2H_4 , 59.0 g N_2 formed
C) LR = N_2H_4 , 13.3 g N_2 formed
D) LR = N_2O_4 , 45.7 g N_2 formed
E) LR = N_2O_4 , 105 g N_2 formed
- 7) What is the volume of 0.175 mol of O_2 at 7.78 atm and 415K? 7) _____
A) 24.5 L B) 565 L C) 1.53 L D) 25.0 L E) 0.766 L
- 8) How many H^+ ions can the acid, H_2SO_4 , donate per molecule? 8) _____
A) 0 B) 2 C) 1 D) 3
- 9) Determine the molarity of a solution formed by dissolving 97.7 g LiBr in enough water to yield 750.0 mL of solution. (molar mass of $\text{LiBr} = 86.845 \text{ g LiBr/mol LiBr}$) 9) _____
A) 2.30 M B) 1.18 M C) 0.130 M D) 0.768 M E) 1.50 M
- 10) A mixture of 0.220 moles CO , 0.350 moles H_2 and 0.640 moles He has a total pressure of 2.95 atm. What is the pressure of CO ? 10) _____
A) 0.955 atm B) 0.536 atm C) 0.649,atm D) 1.54 atm E) 1.86 atm
- 11) Identify NaCl . 11) _____
A) nonelectrolyte
B) weak electrolyte
C) weak acid
D) strong electrolyte
E) strong acid
- 12) Which of the following solutions will have the highest concentration of chloride ions? 12) _____
A) 0.10 M NaCl
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.
- 13) What volume will 0.780 moles of He occupy at STP? 13) _____
A) 43.7 atm B) 15.6 L C) 22.4 L D) 17.5 L E) 70.0 L

Part II Short Answer: Write the word or phrase or circle the choice that best completes each statement or answer the question. (43 pts)

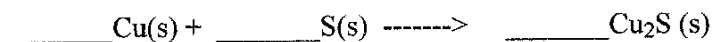
- 14) 1. To calculate mass percent of carbon in CH₄ the formula is (8 pts total , 4 pt s top, 4 pts bottom)

$$\text{mass \% carbon} = \frac{\text{(a) 12.0 g (b) 2 x 12.0 g (c) 4 x 1.01 g (d) [(4 x 1.01) + 12.0] g (circle one letter)}}{\text{(a) 12.0 g (b) 2 x 12.0 g (c) 4 x 1.01 g (d) [(4 x 1.01) + 12.0] g (circle one letter)}} \times 100$$

2. The definition of molarity (M) is (8 pts, 4 pts top, 4 pts bottom)

$$\text{molarity (M)} = \frac{\# \text{ of solute}}{\# \text{ of solution}}$$

3. For the following reaction complete the balancing of the equation by filling in a number into each of blanks for the missing coefficients. Note to balance chemical reactions, you change coefficients but you leave the subscripts alone. (9 ts, 3 pts each blank)



4. Oxidation States: (10 pts total, 2 pts per blank)

a. What is the oxidation state of Cl in Cl₂ _____

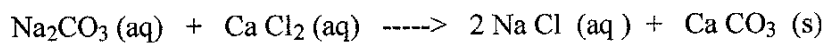
b. What is the oxidation state of elemental Ca _____

c. What is the oxidation state of Sn in SnO₂ Show work below by filling in the following blanks.

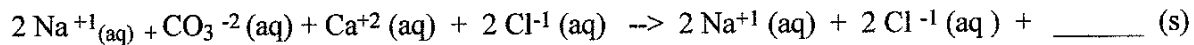
oxidation state of O is _____ charge on SnO₂ is _____

oxidation state of Sn is _____

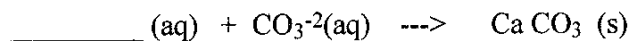
5. For the following reactants given the following balanced precipitation molecular reactions:
(9 pts total, 3 pts per blank)



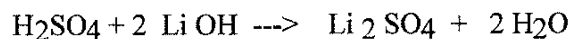
a Give the complete ionic equation for the precipitation molecular equation above. by filling in the blanks



b . Give the net ionic equation for the precipitation molecular equation above. by filling i the blanks.



Part III Long Answer (30 pts, 15 pts per letter) Please show all work for full credit and you will get partial credit for any work shown. Both parts refer to the same balanced reaction.



- a. For the above balanced chemical reaction (assuming complete reaction and a large excess of the other reactant), if you start the reaction with 14.7 grams of LiOH (molar mass LiOH = 23.95 g LiOH/mol LiOH) how many grams of $\text{Li}_2 \text{SO}_4$ (molar mass $\text{Li}_2\text{SO}_4 = 109.98 \text{ g Li}_2\text{SO}_4 / \text{mol Li}_2\text{SO}_4$) would you get? (15 pts, show work)

- b. For the above balanced chemical reaction, if you have 83.7 mL of 1.3 M of Li OH, how many moles of H_2O will you make assuming complete reaction and a large excess of the other reactant. (15 pts, show work)