

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. 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. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper but clearly label where the remaining answer can be found. (If I can't find your answer, I obviously cannot grade it).  
 $N_A = 6.022 \times 10^{23}$   $M_1 V_1 = M_2 V_2$  (FW = formula mass or formula weight)

**Part I MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, 26 pts total)

- 1) Determine the name for aqueous HF. 1) D  
 A) hydrofluorous acid  
 B) hydrogen fluorate  
 C) fluorous acid  
 D) hydrofluoric acid  
 E) fluoric acid

- 2) Give the name for  $H_2CO_3$ . 2) B  
 A) hydrocarbide acid  
 B) carbonic acid  
 C) dihydrogen carbonate  
 D) hydrocarbonic acid  
 E) carbonous acid

- 3) What is the empirical formula for  $C_{12}H_{24}O_6$ ? 3) C  
 A) CHO      B)  $C_2H_5O$        C)  $C_2H_4O$       D)  $CH_2O$       E)  $CHO_2$

$\begin{matrix} 2 & 4 & 1 \\ 12 \div 6, & 24 \div 6, & 6 \div 6 \end{matrix}$

- 4) Which of the following exists as a diatomic molecule? 4) E  
 A) carbon  
 B) phosphorus  
 C) lithium  
 D) krypton  
 E) hydrogen

- 5) The solid compound,  $K_2SO_4$ , contains 5) C  
 A)  $K_2^+$  and  $SO_4^{-2}$  ions.      B)  $K_2SO_4$  molecules.  
 C)  $K^+$  and  $SO_4^{-2}$  ions.      D)  $K^+$ ,  $S^{6+}$ , and  $O^{2-}$  ions.

- 6) What is the charge on the Sc ions in  $Sc_2O_3$ ? 6) A  
 A)  $3+$       B)  $2+$       C)  $1+$       D)  $3-$

$$2(Sc) + (-2)_3 = \text{zero}$$

$$Sc = +6/2 = +3$$

7) Choose the statement below that is TRUE.

- A) A molecular compound that does not ionize in solution is considered a strong electrolyte. *non*  
B) A weak acid solution consists of mostly nonionized acid molecules.  
C) The term "strong electrolyte" means that the substance is extremely reactive. *conductive*  
D) The term "weak electrolyte" means that the substance is *not* non conductive.  
E) A strong acid solution consists of only partially ionized acid molecules. *fully*

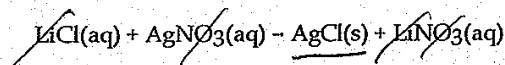
7) B

8) What is the name for  $P_4O_{10}$ .

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

8) D

9) Identify the spectator ions in the following molecular equation.



- A)  $Ag^+$  and  $NO_3^-$   
B)  $Li^+$  and  $Cl^-$   
C)  $Li^+$  and  $NO_3^-$   
D)  $Ag^+$  and  $Cl^-$   
E) There are no spectator ions in this reaction.

9) C

10) Give a possible molecular formula for  $C_3H_5ClO$ .

- A)  $C_6H_{10}O_2$   
B)  $C_5H_{10}Cl_2O_2$   
C)  $C_6H_{10}Cl_2O_2$   
D)  $C_6H_{10}ClO_2$   
E)  $C_6H_{12}Cl_2O_2$

10) C

11) An ionic bond is best described as

- A) the attraction between 2 nonmetal atoms.  
B) the transfer of electrons from one atom to another.  
C) the attraction that holds the atoms together in a polyatomic ion.  
D) the attraction between 2 metal atoms.  
E) the sharing of electrons.

11) B

12) Determine the molecular formula of a compound that has a molar mass of 183.2 g/mol and an empirical formula of  $C_2H_5O_2$  (FW of  $C_2H_5O_2 = 61.07$  g/mol).

- A)  $C_3H_7O_3$     B)  $C_2H_5O_2$     C)  $C_6H_{15}O_6$     D)  $C_8H_{20}O_8$     E)  $C_4H_{10}O_4$

12) C

13) Calculate the mass percent composition of sulfur in  $Al_2(SO_4)_3$ . (FW aluminum sulfate = 342.21 g/mol, S atomic mass = 32.07 g/mol)

- A) 35.97%    B) 28.12%    C) 21.38%    D) 42.73%    E) 9.372%

13) B

$$\left[ \frac{3(32.07)}{342.21} \right] * 100 \approx 28$$

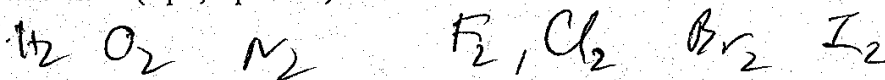
**Part II Short Answer:** Write the word or phrase or circle the choice that best completes each statement or answers the question. Some questions may require that you show work. If you do not show work, you may lose points. Even on questions which do not require work, if you legibly show work, you may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

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (39 pts)

1. Circle the following compounds which are ionic. You may circle one, many, all or none. (10 pts, 2 pts each)



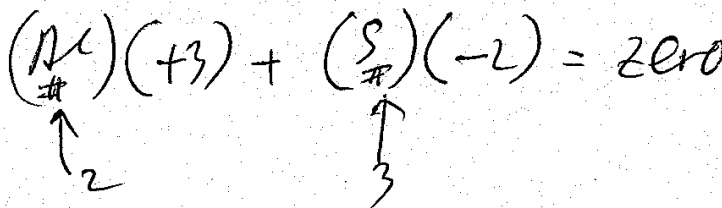
2. What are 2 diatomic elements (elements which in the most stable state is a diatomic)? Name any 2 diatomic elements. (4 pts, 2 pts each)



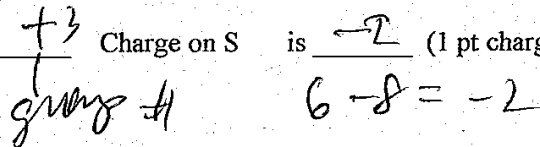
3. Write out the correct ionic formula for the following. Show work (4 pts total)

Between the elements:

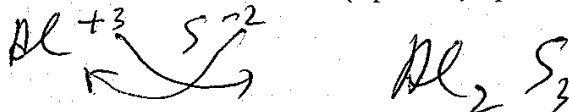
Al and S



Charge on Al is  $+3$  Charge on S is  $-2$  (1 pt charge) Explain your charges here. (1 pt explain)



Show work for coming up with the correct formula here (1 pt work, 1 pt correct formula)



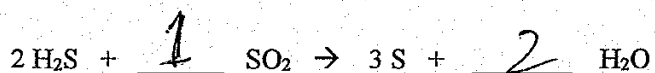
4 For the following formula, give the formula mass (or molar mass). Show work. (5 pts)

Ba<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>

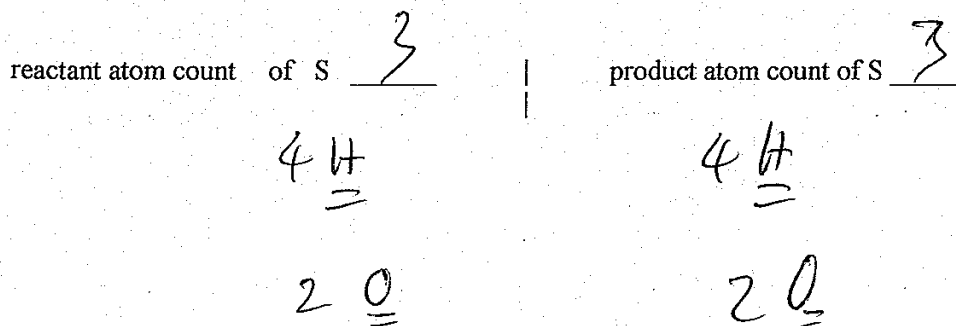
$$3 \begin{matrix} \text{Ba} \\ (137.33) \\ \underline{411.99} \end{matrix} + 2 \begin{matrix} \text{P} \\ (30.97) \\ \underline{61.94} \end{matrix} + 8 \begin{matrix} \text{O} \\ (16.00) \\ \underline{128} \end{matrix} = \frac{601.93\text{g}}{\text{mol}}$$

5. Balance the following reactions by: (6 pts)

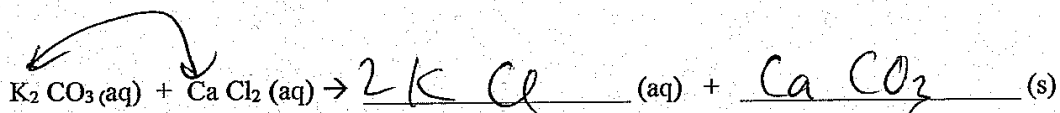
a. filling in the blanks. (you can fill the blank with a **one but not a zero**) (4 pts, 2 pt per blank)



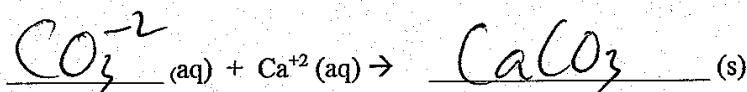
b. show the number count of every atom of each element separately for the reactant and products (2 pts, 1 pt per blank)



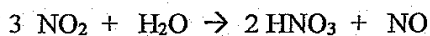
- 6 a. Given the following reactants, write out the products by filling in the blanks. You do not need to balance the reactions in either part of this question. (4 pt, 2 pts per blank)



- b. Complete the net ionic equation for the same reaction. (2 pts, 1 pt per blank)



- 7 For the following reactions, circle the limiting reagent. (4 pts)



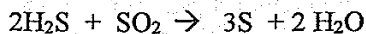
Is the limiting reagent [(3 moles of  $NO_2$ )] or (3 moles of  $H_2O$ ) (circle one) ?

↑  
3x excess  $H_2O$

**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.\*\*\*\*

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work otherwise, I obviously cannot grade work I cannot find.

1. Given the following reaction how many grams of  $\text{H}_2\text{S}$  [FW  $\text{H}_2\text{S} = 34.09 \text{ g/mol}$ ] will you need if you want to make 2.77 grams of  $\text{S}$  (FW  $\text{S} = 32.07 \text{ g/mol}$ ) ? Assume an excess of all other reagents for the reaction to proceed forward. (18 pts)



$$2.77 \text{ g S} \times \frac{\cancel{\text{mol S}}}{32.07 \text{ g}} \times \frac{2 \cancel{\text{mol H}_2\text{S}}}{3 \cancel{\text{mol S}}} \times \frac{34.09 \text{ g}}{\cancel{\text{mol H}_2\text{S}}}$$

$$= 1.96 \text{ g H}_2\text{S}$$

2. If you want the molarity of a solution to be 0.25 M and you have a flask which holds exactly 100.0 mL, how many grams of HCl will you need to make up the 100.0 mL of the solution? (FW HCl = 36.46 g/mol) (15 pts)

$$100.0 \text{ mL soln.} \times \frac{0.25 \text{ mol HCl}}{1000 \text{ mL HCl soln.}} \times \frac{36.46 \text{ g HCl}}{1 \text{ mol HCl}} =$$

0.91 g HCl

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$$N_A = 6.022 \times 10^{23} \quad M_1 V_1 = M_2 V_2 \quad (\text{FW} = \text{formula mass or formula weight})$$

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, 26 pts total)

- 1) The solid compound,  $K_2SO_4$ , contains 1) A  
 A)  $K^+$  and  $SO_4^{-2}$  ions. B)  $K_2^+$  and  $SO_4^{-2}$  ions.  
 C)  $K_2SO_4$  molecules. D)  $K^+$ ,  $S^{6+}$ , and  $O^{2-}$  ions.
- 2) Determine the molecular formula of a compound that has a molar mass of 183.2 g/mol and an empirical formula of  $C_2H_5O_2$  (FW of  $C_2H_5O_2 = 61.07$  g/mol). 2) A  
 A)  $C_6H_{15}O_6$  B)  $C_2H_5O_2$  C)  $C_3H_7O_3$  D)  $C_4H_{10}O_4$  E)  $C_8H_{20}O_8$
- 3) Calculate the mass percent composition of sulfur in  $Al_2(SO_4)_3$ . (FW aluminum sulfate = 342.21 g/mol, S atomic mass = 32.07 g/mol) 3) D  
 A) 42.73 % B) 21.38 % C) 9.372 %  D) 28.12 % E) 35.97 %
- 4) Choose the statement below that is TRUE. 4) D  
 A) A strong acid solution consists of only partially ionized acid molecules.  
 B) The term "weak electrolyte" means that the substance is inert.  
 C) The term "strong electrolyte" means that the substance is extremely reactive.  
 D) A weak acid solution consists of mostly nonionized acid molecules.  
 E) A molecular compound that does not ionize in solution is considered a strong electrolyte.
- 5) An ionic bond is best described as 5) C  
 A) the attraction between 2 metal atoms.  
 B) the sharing of electrons.  
 C) the attraction between 2 nonmetal atoms.  
 D) the attraction that holds the atoms together in a polyatomic ion.  
 E) the transfer of electrons from one atom to another.
- 6) Which of the following exists as a diatomic molecule? 6) A  
 A) hydrogen  
 B) phosphorus  
 C) lithium  
 D) krypton  
 E) carbon

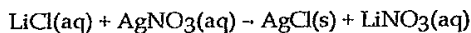


7) Determine the name for aqueous HF.

- A) hydrogen fluorate
- B) hydrofluorous acid
- C) hydrofluoric acid
- D) fluoric acid
- E) fluorous acid

7) C

8) Identify the spectator ions in the following molecular equation.



- A)  $\text{Ag}^+$  and  $\text{Cl}^-$
- B)  $\text{Li}^+$  and  $\text{Cl}^-$
- C)  $\text{Li}^+$  and  $\text{NO}_3^-$
- D)  $\text{Ag}^+$  and  $\text{NO}_3^-$
- E) There are no spectator ions in this reaction.

8) C

9) Give a possible molecular formula for  $\text{C}_3\text{H}_5\text{ClO}$ .

- A)  $\text{C}_5\text{H}_{10}\text{Cl}_2\text{O}_2$
- B)  $\text{C}_6\text{H}_{12}\text{Cl}_2\text{O}_2$
- C)  $\text{C}_6\text{H}_{10}\text{O}_2$
- D)  $\text{C}_6\text{H}_{10}\text{Cl}_2\text{O}_2$
- E)  $\text{C}_6\text{H}_{10}\text{ClO}_2$

9) D

10) What is the name for  $\text{P}_4\text{O}_{10}$ .

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

10) C

11) Give the name for  $\text{H}_2\text{CO}_3$ .

- A) hydrocarbonic acid
- B) dihydrogen carbonate
- C) hydrocarbide acid
- D) carbonic acid
- E) carbonous acid

11) D

12) What is the charge on the Sc ions in  $\text{Sc}_2\text{O}_3$ ?

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

12) A

13) What is the empirical formula for  $\text{C}_{12}\text{H}_{24}\text{O}_6$ ?

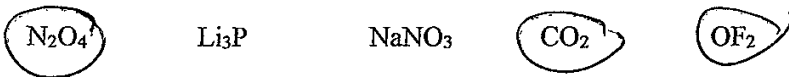
- A)  $\text{C}_2\text{H}_5\text{O}$
- B) CHO
- C)  $\text{C}_2\text{H}_4\text{O}$
- D)  $\text{CHO}_2$
- E)  $\text{CH}_2\text{O}$

13) C

**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.

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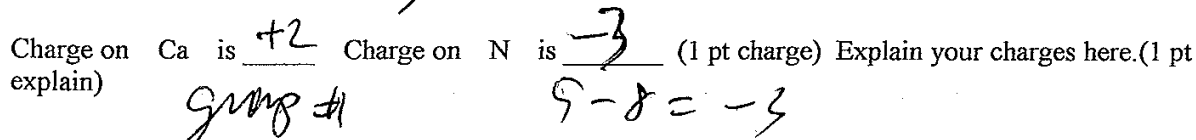
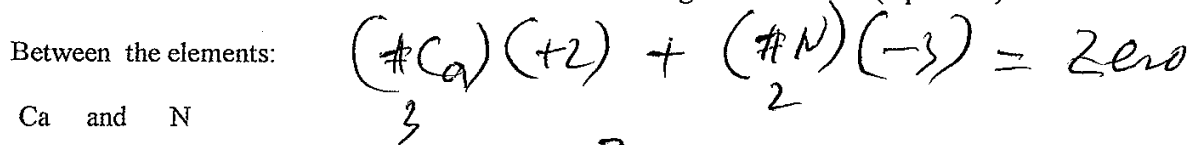
1. Circle the following compounds which are covalent You may circle one, many, all or none. (10 pts, 2 pts each)



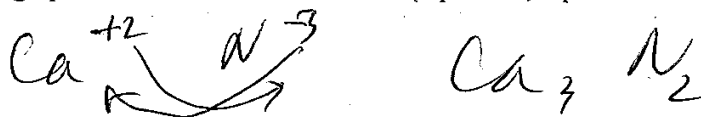
2. What are 2 diatomic elements (elements which in the most stable state is a diatomic)? Name any 2 diatomic elements. (4 pts, 2 pts each)



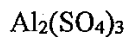
3. Write out the correct ionic formula for the following. Show work (4 pts total)



Show work for coming up with the correct formula here (1 pt work, 1 pt correct formula)



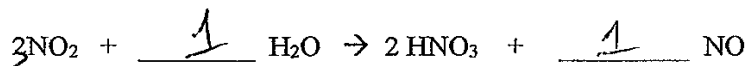
4 For the following formula, give the formula mass (or molar mass). Show work. (5 pts)



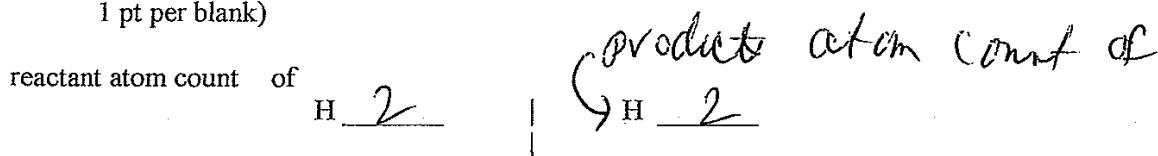
$$\begin{array}{r} \text{Al} \\ 2(26.98) \\ 53.96 \end{array} + \begin{array}{r} \text{S} \\ 3(32.07) \\ 96.41 \end{array} + \begin{array}{r} \text{O} \\ 12(16.00) \\ 192 \end{array} = \underline{342.17\text{g}} \\ \text{mol} \\ \text{Al}_2(\text{SO}_4)_3$$

5. Balance the following reactions by: (6 pts)

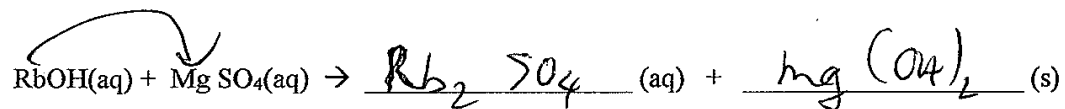
a. filling in the blanks. (you can fill the blank with a one but not a zero) (4 pts, 2 pt per blank)



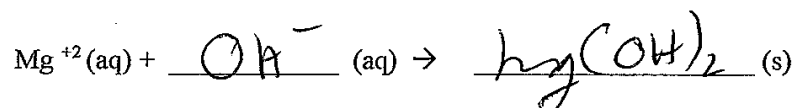
b. show the number count of every atom of each element separately for the reactant and products (2 pts, 1 pt per blank)



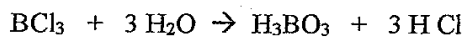
- 6 a. Given the following reactants, write out the products by filling in the blanks. You do not need to balance the reactions in either part of this question. (4 pt, 2 pts per blank)



- b. Complete the net ionic equation for the same reaction. (2 pts, 1 pt per blank)



- 7 For the following reactions, circle the limiting reagent. (4 pts)



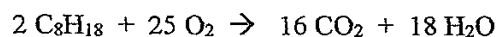
Is the limiting reagent [(3 moles of  $\text{BCl}_3$ ) or (3 moles of  $\text{H}_2\text{O}$ )] (circle one) ?

**Part III. Long Answer** Please show work for full credit and to receive partial credit. (33 pts)

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1. Given the following reaction how many grams of  $C_8H_{18}$  [FW  $C_8H_{18} = 114.26 \text{ g/mol}$ ] will you need if you want to make 370.2 grams of  $H_2O$  (FW  $H_2O = 18.02 \text{ g/mol}$ )? Assume an excess of all other reagents for the reaction to proceed forward. (18 pts)



$$370.2 \text{ g } H_2O \times \frac{1 \text{ mol } H_2O}{18.02 \text{ g } H_2O} \times \frac{2 \text{ mol } C_8H_{18}}{18 \text{ mol } H_2O} \times \frac{114.26 \text{ g } C_8H_{18}}{1 \text{ mol } C_8H_{18}} = 260.8 \text{ g } C_8H_{18}$$

2. If you want the molarity of a solution to be 1.55 M and you have a flask which holds exactly 250.0 mL, how many grams of NaOH will you need to make up the 250.0 mL of the solution? (FW NaOH = 40.00 g/mol) (15 pts)

$$250.0 \text{ mL soln.} \times \frac{1.55 \text{ mol NaOH}}{1000 \text{ mL soln.}} \times \frac{40.00 \text{ g NaOH}}{1 \text{ mol NaOH}} =$$

15.50 g NaOH

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$$N_A = 6.022 \times 10^{23} \quad M_1 V_1 = M_2 V_2 \quad (\text{FW} = \text{formula mass or formula weight})$$

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, 26 pts total)

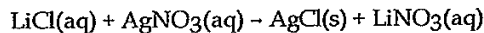
- 1) Determine the molecular formula of a compound that has a molar mass of 92.0 g/mol and an empirical formula of  $\text{NO}_2$ . (FW of  $\text{NO}_2 = 46.01 \text{ g/mol}$ ) 1) D
- A)  $\text{NO}_2$      
  B)  $\text{N}_3\text{O}_6$      
  C)  $\text{N}_2\text{O}_5$      
  D)  $\text{N}_2\text{O}_4$      
  E)  $\text{N}_2\text{O}_3$
- 2) The solid compound,  $\text{K}_2\text{SO}_4$ , contains 2) A
- A)  $\text{K}^+$  and  $\text{SO}_4^{2-}$  ions.     
  B)  $\text{K}^+$ ,  $\text{S}^{6+}$ , and  $\text{O}^{2-}$  ions.
- C)  $\text{K}_2\text{SO}_4$  molecules.     
  D)  $\text{K}_2^+$  and  $\text{SO}_4^{2-}$  ions.
- 3) Give the name for  $\text{PBr}_3$ . 3) E
- A) phosphorus (II) bromide      *covalent*  
 B) phosphorus bromide  
 C) phosphorus (III) bromide  
 D) potassium tribromide  
 E) phosphorus tribromide
- 4) Write the name for  $\text{Ca}_3(\text{PO}_4)_2$ . 4) C
- A) calcium (II) phosphite  
 B) tricalcium phosphorustetraoxide  
 C) calcium phosphate      *binary ionic*  
 D) calcium (III) phosphite  
 E) calcium phosphite
- 5) Give the name for  $\text{HNO}_3$ . 5) D
- A) nitrous acid  
 B) hydrogen nitrite  
 C) hydrogen nitrate  
 D) nitric acid  
 E) hydrogen nitride

- 6) A covalent bond is best described as
- A) a bond between a metal and a polyatomic ion.
  - B) the sharing of electrons between atoms.
  - C) a bond between a metal and a nonmetal.
  - D) the transfer of electrons.
  - E) a bond between two polyatomic ions.

6) B

- 7) Identify the spectator ions in the following molecular equation.

7) A



- A)  $\text{Li}^+$  and  $\text{NO}_3^-$
- B)  $\text{Ag}^+$  and  $\text{Cl}^-$
- C)  $\text{Ag}^+$  and  $\text{NO}_3^-$
- D)  $\text{Li}^+$  and  $\text{Cl}^-$
- E) There are no spectator ions in this reaction.

- 8) What is the empirical formula for  $\text{C}_{12}\text{H}_{24}\text{O}_6$ ?  $\frac{1}{6} =$
- A)  $\text{CH}_2\text{O}$
  - B)  $\text{CHO}$
  - C)  $\text{C}_2\text{H}_4\text{O}$
  - D)  $\text{CHO}_2$
  - E)  $\text{C}_2\text{H}_5\text{O}$

8) C

- 9) Choose the statement below that is TRUE.

9) C

- A) The term "strong electrolyte" means that the substance is extremely reactive.
- B) A strong acid solution consists of only partially ionized acid molecules.
- C) A weak acid solution consists of mostly nonionized acid molecules.
- D) A molecular compound that does not ionize in solution is considered a strong electrolyte.
- E) The term "weak electrolyte" means that the substance is inert.

- 10) Which of the following exists as a diatomic molecule?

10) E

- A) krypton
- B) phosphorus
- C) carbon
- D) lithium
- E) hydrogen

- 11) What is the charge on the Sc ions in  $\text{Sc}_2\text{O}_3$ ?

11) B

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

- 12) Calculate the mass percent composition of lithium in  $\text{Li}_3\text{PO}_4$ . (FW of lithium phosphate = 115.79

12) B

g/mol, atomic mass of Li = 6.94 g/mol)

- A) 30.72 %
- B) 17.98 %
- C) 55.27 %
- D) 20.82 %
- E) 26.75 %

- 13) What is the empirical formula for  $\text{Hg}_2(\text{NO}_3)_2$ ?

13) E

- A)  $\text{Hg}_2(\text{NO}_3)_2$
- B)  $\text{Hg}(\text{NO}_3)_2$
- C)  $\text{Hg}_4(\text{NO}_3)_4$
- D)  $\text{Hg}_2\text{NO}_3$
- E)  $\text{HgNO}_3$

$$\frac{3(6.94)}{115.79} * 100 = 17.98$$



**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.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (39 pts)

1. Circle the following compounds which are **ionic**. You may circle one, many, all or none. (10 pts, 2 pts each)

PBr<sub>3</sub>

CCl<sub>4</sub>

BaCl<sub>2</sub>

SiO<sub>2</sub>

Rb<sub>3</sub>N

2. Give the name or the formula and charge (for the polyatomic ions) or number for the following. (4 pts, 2 pts each)

carbonate CO<sub>3</sub><sup>-2</sup>      H<sub>2</sub>SO<sub>4</sub> sulfuric acid

- 2 Write out the correct ionic formula for the following. Show work (4 pts total)

Between the elements:

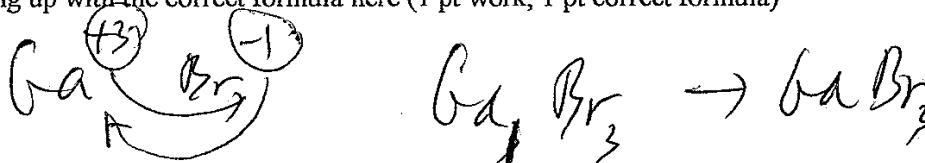
Ga and Br

$$\underset{1}{(\#Ga)} (+3) + \underset{3}{(\#Br)} (-1) = zero$$

Charge on Ga is +3 Charge on Br is -1 (1 pt charge) Explain your charges here. (1 pt explain)

group # = 3      → 3 - 4 = -1

Show work for coming up with the correct formula here (1 pt work, 1 pt correct formula)



3 If you have the following ionic compound, is the reagent soluble or insoluble in water. Circle the correct choices below to answer this question. (5 pts)

Sr SO<sub>4</sub>

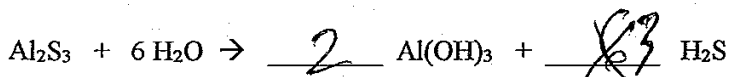
The anion is [(soluble)] or (insoluble) (circle one) (2.5 pt)

The ionic compound is [(soluble) or (insoluble)] (circle one) (2.5 pt)

*Sr is exception*

5. Balance the following reactions by: (6 pts)

a. filling in the blanks. (you can fill the blank with a **one but not a zero**) (4 pts, 2 pt per blank)



b. show the number count of every atom of each element separately for the reactant and products (2 pts, 1 pt per blank)

reactant atom count of

Al 2

3 S

12 H

6 O

product atom count of

Al 2

3 S

3 H + 3 \* 2 = 6 H

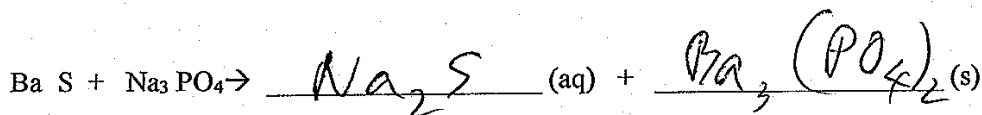
\* 2

6

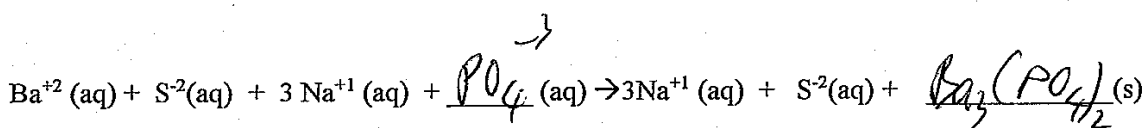
6

3 \* 2 = 6 O

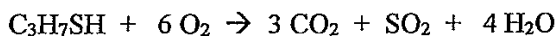
- 6 a. Given the following reactants, write out the products by filling in the blanks. You do not need to balance the reactions in either part of this question. (4 pt, 2 pts per blank)



- b. Complete the following complete ionic equation for the same reaction (2 pts, 1 pt per blank)



- 7 For the following reactions, circle the limiting reagent. (4 pts)



Is the limiting reagent [(6 moles of  $\text{C}_3\text{H}_7\text{SH}$ ) or (6 moles of  $\text{O}_2$ )] (circle one) ?

**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. \*\*\*\*

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work otherwise, I obviously cannot grade work I cannot find.

1. How many atoms of H in the molecule  $(\text{NH}_4)_2\text{O}$  is in 235.2 grams of the  $(\text{NH}_4)_2\text{O}$  [FW of  $(\text{NH}_4)_2\text{O} = 52.10 \text{ g/mol}$  ]? (18 pts)

1 molecule  
 $(\text{NH}_4)_2\text{O}$  has  $4 \times 2 = 8 \text{ H atoms}$

1 mol  $(\text{NH}_4)_2\text{O} \cong 8 \text{ mol H}$

$$235.2 \text{ g } (\text{NH}_4)_2\text{O} \times \frac{1 \text{ mol } (\text{NH}_4)_2\text{O}}{52.10 \text{ g } (\text{NH}_4)_2\text{O}} \times \frac{8 \text{ mol H}}{1 \text{ mol } (\text{NH}_4)_2\text{O}}$$

$$\times \frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mol H}} = 2.179 \times 10^{25} \text{ atoms H}$$

2. If you have 85.2 mL of a solution of concentration 1.5 M and want the new molarity to be 0.75 M, how many mL will the new diluted solution have to be? ( $M_1V_1 = M_2V_2$ ) (15 pts)

$$V_1 = 85.2$$

$$M_1 = 1.5 \text{ M}$$

$$V_2 = ?$$

$$M_2 = 0.75 \text{ M}$$

$$(1.5 \text{ M})(85.2 \text{ mL}) = (0.75 \text{ M})(V_2 \text{ mL})$$

$$V_2 \text{ mL} = \frac{(1.5 \text{ M})(85.2 \text{ mL})}{(0.75 \text{ M})} = 170.4 \text{ mL}$$

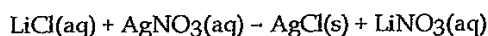
Name Kelly (print) Name \_\_\_\_\_ (sign)

Please show work for partial credit and full 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. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper but clearly label where the remaining answer can be found. (If I can't find your answer, I obviously cannot grade it).

$$N_A = 6.022 \times 10^{23} \quad M_1 V_1 = M_2 V_2 \quad (\text{FW} = \text{formula mass or formula weight})$$

Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, 26 pts total)

1) Identify the spectator ions in the following molecular equation.

1) B

- A)  $\text{Ag}^+$  and  $\text{Cl}^-$   
 B)  $\text{Li}^+$  and  $\text{NO}_3^-$   
 C)  $\text{Li}^+$  and  $\text{Cl}^-$   
 D)  $\text{Ag}^+$  and  $\text{NO}_3^-$   
 E) There are no spectator ions in this reaction.

2) Calculate the mass percent composition of lithium in  $\text{Li}_3\text{PO}_4$ . (FW of lithium phosphate = 115.79 g/mol, atomic mass of Li = 6.94 g/mol)2) A

- A) 17.98 %      B) 20.82 %      C) 55.27 %      D) 30.72 %      E) 26.75 %

3) Give the name for  $\text{HNO}_3$ .3) E

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

4) Determine the molecular formula of a compound that has a molar mass of 92.0 g/mol and an empirical formula of  $\text{NO}_2$ . (FW of  $\text{NO}_2 = 46.01$  g/mol)4) E

- A)  $\text{NO}_2$       B)  $\text{N}_3\text{O}_6$       C)  $\text{N}_2\text{O}_5$       D)  $\text{N}_2\text{O}_3$        E)  $\text{N}_2\text{O}_4$

5) Which of the following exists as a diatomic molecule?

5) D

- A) krypton  
 B) carbon  
 C) lithium  
 D) hydrogen  
 E) phosphorus

6) What is the empirical formula for  $\text{C}_{12}\text{H}_{24}\text{O}_6$ ?6) C

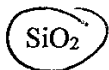
- A)  $\text{CHO}_2$       B)  $\text{CHO}$        C)  $\text{C}_2\text{H}_4\text{O}$       D)  $\text{C}_2\text{H}_5\text{O}$       E)  $\text{CH}_2\text{O}$

- 7) Give the name for  $\text{PBr}_3$ . 7) D
- A) phosphorus (III) bromide
  - B) potassium tribromide
  - C) phosphorus bromide
  - D) phosphorus tribromide
  - E) phosphorus (II) bromide
- 8) Write the name for  $\text{Ca}_3(\text{PO}_4)_2$ . 8) B
- A) calcium (III) phosphite
  - B) calcium phosphate
  - C) calcium (II) phosphite
  - D) tricalcium phosphorustetraoxide
  - E) calcium phosphite
- 9) Choose the statement below that is TRUE. 9) B
- A) A strong acid solution consists of only partially ionized acid molecules.
  - B) A weak acid solution consists of mostly nonionized acid molecules.
  - C) The term "weak electrolyte" means that the substance is inert.
  - D) The term "strong electrolyte" means that the substance is extremely reactive.
  - E) A molecular compound that does not ionize in solution is considered a strong electrolyte.
- 10) The solid compound,  $\text{K}_2\text{SO}_4$ , contains 10) A
- A)  $\text{K}^+$  and  $\text{SO}_4^{-2}$  ions.
  - B)  $\text{K}_2^+$  and  $\text{SO}_4^{-2}$  ions.
  - C)  $\text{K}_2\text{SO}_4$  molecules.
  - D)  $\text{K}^+$ ,  $\text{S}^{6+}$ , and  $\text{O}^{2-}$  ions.
- 11) A covalent bond is best described as 11) B
- A) a bond between a metal and a polyatomic ion.
  - B) the sharing of electrons between atoms.
  - C) a bond between a metal and a nonmetal.
  - D) the transfer of electrons.
  - E) a bond between two polyatomic ions.
- 12) What is the empirical formula for  $\text{Hg}_2(\text{NO}_3)_2$ ? 12) C
- A)  $\text{Hg}_4(\text{NO}_3)_4$
  - B)  $\text{Hg}_2(\text{NO}_3)_2$
  - C)  $\text{Hg}_2\text{NO}_3$
  - D)  $\text{Hg}(\text{NO}_3)_2$
  - E)  $\text{HgNO}_3$
- 13) What is the charge on the Sc ions in  $\text{Sc}_2\text{O}_3$ ? 13) C
- A)  $1+$
  - B)  $2+$
  - C)  $3+$
  - D)  $3-$

**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.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (39 pts)

1. Circle the following compounds which are covalent. You may circle one, many, all or none. (10 pts, 2 pts each)

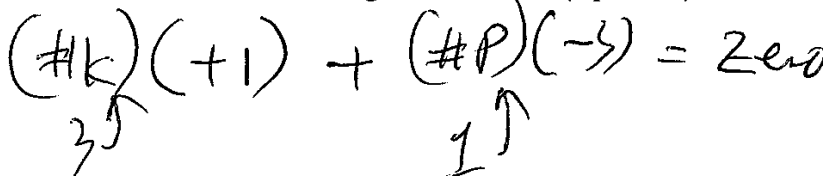


2. Give the name or the formula and charge (for the polyatomic ions) or number for the following. (4 pts, 2 pts each)

3 (as number prefix) tri phosphate  $\text{PO}_4^{-3}$

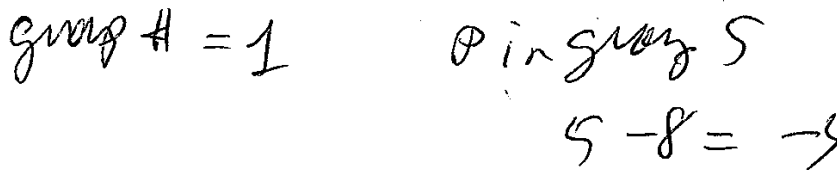
- 2 Write out the correct ionic formula for the following. Show work (4 pts total)

Between the elements:



K and P

Charge on K is +1 Charge on P is -3 (1 pt charge) Explain your charges here. (1 pt explain)

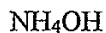


Show work for coming up with the correct formula here (1 pt work, 1 pt correct formula)





3 If you have the following ionic compound, is the reagent soluble or insoluble in water. Circle the correct choices below to answer this question. (5 pts)



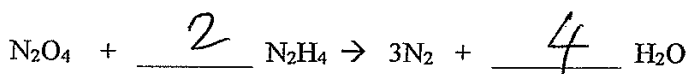
The anion is [(soluble) or (insoluble)] (circle one) (2.5 pt)

The ionic compound is [(soluble) or (insoluble)] (circle one) (2.5 pt)

$\text{NH}_4^+$  is excepted

5. Balance the following reactions by: (6 pts)

a. filling in the blanks. (you can fill the blank with a **one but not a zero**) (4 pts, 2 pt per blank)



$2 * 4 = 8H$

b. show the number count of every atom of each element separately for the reactant and products (2 pts, 1 pt per blank)

reactant atom count of

N 6

4 O

8 H

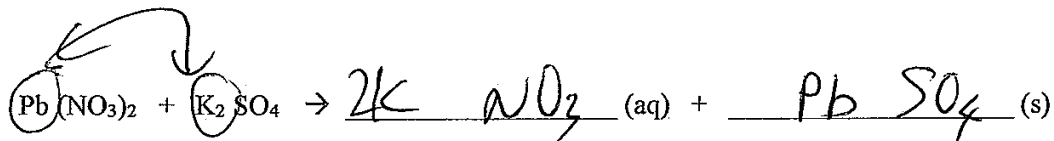
product atom count of

6 N

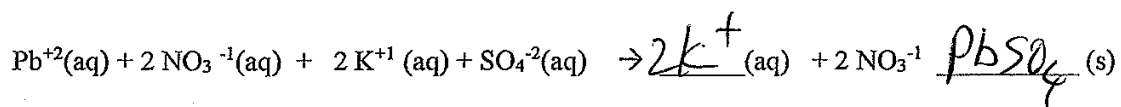
4 O

8 H

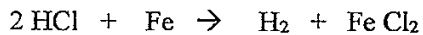
- 6 a. Given the following reactants, write out the products by filling in the blanks. You do not need to balance the reactions in either part of this question. (4 pt, 2 pts per blank)



- b. Complete the following complete ionic equation for the same reaction (1 pt) (2 pts, 1 pt per blank)



- 7 For the following reactions, circle the limiting reagent. (4 pts)



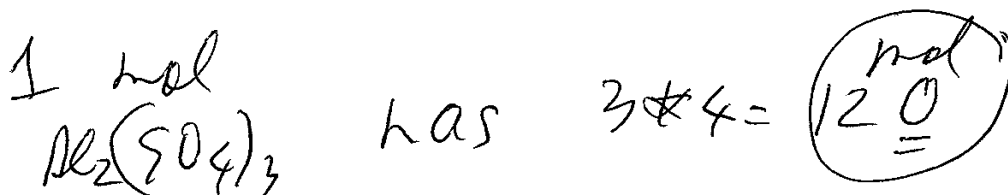
Is the limiting reagent (2 moles of HCl) or (2 moles of Fe) (circle one) ?

**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.\*\*\*\*

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work otherwise, I obviously cannot grade work I cannot find.

1. How many atoms of O in the molecule  $\text{Al}_2(\text{SO}_4)_3$  is in 789.2 grams of the  $\text{Al}_2(\text{SO}_4)_3$  [FW of  $\text{Al}_2(\text{SO}_4)_3 = 342.17 \text{ g/mol}$ ] ? (18 pts)



$$789.2 \text{ g } \text{Al}_2(\text{SO}_4)_3 \times \frac{1 \text{ mol } \text{Al}_2(\text{SO}_4)_3}{342.17 \text{ g } \text{Al}_2(\text{SO}_4)_3} \times \frac{12 \text{ mol O}}{1 \text{ mol } \text{Al}_2(\text{SO}_4)_3}$$

$$\times \frac{6.022 \times 10^{23} \text{ atoms O}}{1 \text{ mol O}} = 1.667 \times 10^{25} \text{ atoms O}$$

- 2 If you have 25.4 mL of a solution of concentration 0.25 M and want the new molarity to be 0.10 M, how many mL will the new diluted solution have to be? ( $M_1V_1 = M_2V_2$ ) (15 pts)

$$V_1 = 25.4 \text{ mL}$$

$$V_2 = ?$$

$$M_1 = 0.25 \text{ M}$$

$$M_2 = 0.10 \text{ M}$$

$$(0.25 \text{ M})(25.4 \text{ mL}) = (0.10 \text{ M})(V_2 \text{ mL})$$

$$V_2 \text{ mL} = \frac{(0.25 \text{ M})(25.4 \text{ mL})}{(0.10 \text{ M})}$$

$$V_2 = 63.5 \text{ mL}$$

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. 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. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper but clearly label where the remaining answer can be found. (If I can't find your answer, I obviously cannot grade it).

$$N_A = 6.022 \times 10^{23} \quad M_1 V_1 = M_2 V_2 \quad (\text{FW} = \text{formula mass or formula weight})$$

**Part I MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, 26 pts total)

- 1) Determine the name for aqueous HF. 1) \_\_\_\_\_
  - A) hydrofluorous acid
  - B) hydrogen fluorate
  - C) fluorous acid
  - D) hydrofluoric acid
  - E) fluoric acid
  
- 2) Give the name for  $\text{H}_2\text{CO}_3$ . 2) \_\_\_\_\_
  - A) hydrocarbide acid
  - B) carbonic acid
  - C) dihydrogen carbonate
  - D) hydrocarbonic acid
  - E) carbonous acid
  
- 3) What is the empirical formula for  $\text{C}_{12}\text{H}_{24}\text{O}_6$ ? 3) \_\_\_\_\_
  - A) CHO
  - B)  $\text{C}_2\text{H}_5\text{O}$
  - C)  $\text{C}_2\text{H}_4\text{O}$
  - D)  $\text{CH}_2\text{O}$
  - E)  $\text{CHO}_2$
  
- 4) Which of the following exists as a diatomic molecule? 4) \_\_\_\_\_
  - A) carbon
  - B) phosphorus
  - C) lithium
  - D) krypton
  - E) hydrogen
  
- 5) The solid compound,  $\text{K}_2\text{SO}_4$ , contains 5) \_\_\_\_\_
  - A)  $\text{K}_2^+$  and  $\text{SO}_4^{-2}$  ions.
  - B)  $\text{K}_2\text{SO}_4$  molecules.
  - C)  $\text{K}^+$  and  $\text{SO}_4^{-2}$  ions.
  - D)  $\text{K}^+$ ,  $\text{S}^{6+}$ , and  $\text{O}^{2-}$  ions.
  
- 6) What is the charge on the Sc ions in  $\text{Sc}_2\text{O}_3$ ? 6) \_\_\_\_\_
  - A) 3+
  - B) 2+
  - C) 1+
  - D) 3-

- 7) Choose the statement below that is TRUE. 7) \_\_\_\_\_
- A) A molecular compound that does not ionize in solution is considered a strong electrolyte.
  - B) A weak acid solution consists of mostly nonionized acid molecules.
  - C) The term "strong electrolyte" means that the substance is extremely reactive.
  - D) The term "weak electrolyte" means that the substance is inert.
  - E) A strong acid solution consists of only partially ionized acid molecules.

- 8) What is the name for  $P_4O_{10}$ . 8) \_\_\_\_\_
- A) phosphorus oxide
  - B) diphosphorus pentoxide
  - C) phosphorus (II) oxide
  - D) tetraphosphorus decoxide
  - E) phosphorus (IV) oxide

- 9) Identify the spectator ions in the following molecular equation. 9) \_\_\_\_\_
- $$LiCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + LiNO_3(aq)$$

- A)  $Ag^+$  and  $NO_3^-$
- B)  $Li^+$  and  $Cl^-$
- C)  $Li^+$  and  $NO_3^-$
- D)  $Ag^+$  and  $Cl^-$
- E) There are no spectator ions in this reaction.

- 10) Give a possible molecular formula for  $C_3H_5ClO$ . 10) \_\_\_\_\_
- A)  $C_6H_{10}O_2$
  - B)  $C_5H_{10}Cl_2O_2$
  - C)  $C_6H_{10}Cl_2O_2$
  - D)  $C_6H_{10}ClO_2$
  - E)  $C_6H_{12}Cl_2O_2$

- 11) An ionic bond is best described as 11) \_\_\_\_\_
- A) the attraction between 2 nonmetal atoms.
  - B) the transfer of electrons from one atom to another.
  - C) the attraction that holds the atoms together in a polyatomic ion.
  - D) the attraction between 2 metal atoms.
  - E) the sharing of electrons.

- 12) Determine the molecular formula of a compound that has a molar mass of 183.2 g/mol and an empirical formula of  $C_2H_5O_2$  (FW of  $C_2H_5O_2 = 61.07$  g/mol ). 12) \_\_\_\_\_
- A)  $C_3H_7O_3$       B)  $C_2H_5O_2$       C)  $C_6H_{15}O_6$       D)  $C_8H_{20}O_8$       E)  $C_4H_{10}O_4$

- 13) Calculate the mass percent composition of sulfur in  $Al_2(SO_4)_3$ . (FW aluminum sulfate = 342.21 g/mol, S atomic mass = 32.07 g/mol) 13) \_\_\_\_\_
- A) 35.97 %      B) 28.12 %      C) 21.38 %      D) 42.73 %      E) 9.372 %

**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.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (39 pts)

1. Circle the following compounds which are ionic. You may circle one, many, all or none. (10 pts, 2 pts each)



2. What are 2 diatomic elements (elements which in the most stable state is a diatomic)? Name any 2 diatomic elements. (4 pts, 2 pts each)

3. Write out the correct ionic formula for the following. Show work (4 pts total)

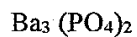
Between the elements:

Al and S

Charge on Al is \_\_\_\_\_ Charge on S is \_\_\_\_\_ (1 pt charge) Explain your charges here.(1 pt explain)

Show work for coming up with the correct formula here (1 pt work, 1 pt correct formula)

4 For the following formula, give the formula mass (or molar mass). Show work. (5 pts)



5. Balance the following reactions by: (6 pts)

a. filling in the blanks. (you can fill the blank with a **one but not a zero**) (4 pts, 2 pt per blank)



b. show the number count of every atom of each element separately for the reactant and products (2 pts, 1 pt per blank)

reactant atom count of S        | product atom count of S       

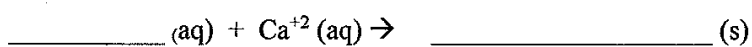




- 6 a. Given the following reactants, write out the products by filling in the blanks. You do not need to balance the reactions in either part of this question. (4 pt, 2 pts per blank)



- b. Complete the net ionic equation for the same reaction. (2 pts, 1 pt per blank)



- 7 For the following reactions, circle the limiting reagent. (4 pts)



Is the limiting reagent [(3 moles of  $\text{NO}_2$ ) or (3 moles of  $\text{H}_2\text{O}$ )] (circle one) ?

**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.\*\*\*\*

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work otherwise, I obviously cannot grade work I cannot find.

1. Given the following reaction how many grams of H<sub>2</sub>S [FW H<sub>2</sub>S = 34.09 g/mol ] will you need if you want to make 2.77 grams of S (FW S = 32.07 g/mol) ? Assume an excess of all other reagents for the reaction to proceed forward. (18 pts)



2. If you want the molarity of a solution to be 0.25 M and you have a flask which holds exactly 100.0 mL, how many grams of HCl will you need to make up the 100.0 mL of the solution? (FW HCl = 36.46 g/mol) (15 pts)

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. 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. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper but clearly label where the remaining answer can be found. (If I can't find your answer, I obviously cannot grade it).

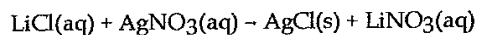
$$N_A = 6.022 \times 10^{23} \quad M_1 V_1 = M_2 V_2 \quad (\text{FW} = \text{formula mass or formula weight})$$

**Part I MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, 26 pts total)

- 1) The solid compound,  $K_2SO_4$ , contains \_\_\_\_\_  
 A)  $K^+$  and  $SO_4^{-2}$  ions. B)  $K_2^+$  and  $SO_4^{-2}$  ions.  
 C)  $K_2SO_4$  molecules. D)  $K^+$ ,  $S^{6+}$ , and  $O^{2-}$  ions.
- 2) Determine the molecular formula of a compound that has a molar mass of 183.2 g/mol and an empirical formula of  $C_2H_5O_2$  (FW of  $C_2H_5O_2 = 61.07$  g/mol ). \_\_\_\_\_  
 A)  $C_6H_{15}O_6$  B)  $C_2H_5O_2$  C)  $C_3H_7O_3$  D)  $C_4H_{10}O_4$  E)  $C_8H_{20}O_8$
- 3) Calculate the mass percent composition of sulfur in  $Al_2(SO_4)_3$ . (FW aluminum sulfate = 342.21 g/mol, S atomic mass = 32.07 g/mol) \_\_\_\_\_  
 A) 42.73 % B) 21.38 % C) 9.372 % D) 28.12 % E) 35.97 %
- 4) Choose the statement below that is TRUE. \_\_\_\_\_  
 A) A strong acid solution consists of only partially ionized acid molecules.  
 B) The term "weak electrolyte" means that the substance is inert.  
 C) The term "strong electrolyte" means that the substance is extremely reactive.  
 D) A weak acid solution consists of mostly nonionized acid molecules.  
 E) A molecular compound that does not ionize in solution is considered a strong electrolyte.
- 5) An ionic bond is best described as \_\_\_\_\_  
 A) the attraction between 2 metal atoms.  
 B) the sharing of electrons.  
 C) the attraction between 2 nonmetal atoms.  
 D) the attraction that holds the atoms together in a polyatomic ion.  
 E) the transfer of electrons from one atom to another.
- 6) Which of the following exists as a diatomic molecule? \_\_\_\_\_  
 A) hydrogen  
 B) phosphorus  
 C) lithium  
 D) krypton  
 E) carbon

- 7) Determine the name for aqueous HF. 7) \_\_\_\_\_
- A) hydrogen fluoride
  - B) hydrofluorous acid
  - C) hydrofluoric acid
  - D) fluoric acid
  - E) fluorous acid

- 8) Identify the spectator ions in the following molecular equation. 8) \_\_\_\_\_



- A)  $\text{Ag}^+$  and  $\text{Cl}^-$
  - B)  $\text{Li}^+$  and  $\text{Cl}^-$
  - C)  $\text{Li}^+$  and  $\text{NO}_3^-$
  - D)  $\text{Ag}^+$  and  $\text{NO}_3^-$
  - E) There are no spectator ions in this reaction.
- 9) Give a possible molecular formula for  $\text{C}_3\text{H}_5\text{ClO}$ . 9) \_\_\_\_\_
- A)  $\text{C}_5\text{H}_{10}\text{Cl}_2\text{O}_2$
  - B)  $\text{C}_6\text{H}_{12}\text{Cl}_2\text{O}_2$
  - C)  $\text{C}_6\text{H}_{10}\text{O}_2$
  - D)  $\text{C}_6\text{H}_{10}\text{Cl}_2\text{O}_2$
  - E)  $\text{C}_6\text{H}_{10}\text{ClO}_2$

- 10) What is the name for  $\text{P}_4\text{O}_{10}$ . 10) \_\_\_\_\_
- A) phosphorus (IV) oxide
  - B) diphosphorus pentoxide
  - C) tetraphosphorus decoxide
  - D) phosphorus (II) oxide
  - E) phosphorus oxide

- 11) Give the name for  $\text{H}_2\text{CO}_3$ . 11) \_\_\_\_\_
- A) hydrocarbonic acid
  - B) dihydrogen carbonate
  - C) hydrocarbide acid
  - D) carbonic acid
  - E) carbonous acid

- 12) What is the charge on the Sc ions in  $\text{Sc}_2\text{O}_3$ ? 12) \_\_\_\_\_
- A) 3+                      B) 2+                      C) 3-                      D) 1+

- 13) What is the empirical formula for  $\text{C}_{12}\text{H}_{24}\text{O}_6$ ? 13) \_\_\_\_\_
- A)  $\text{C}_2\text{H}_5\text{O}$               B) CHO                      C)  $\text{C}_2\text{H}_4\text{O}$               D)  $\text{CHO}_2$                       E)  $\text{CH}_2\text{O}$

**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.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (39 pts)

1. Circle the following compounds which are covalent. You may circle one, many, all or none. (10 pts, 2 pts each)



2. What are 2 diatomic elements (elements which in the most stable state is a diatomic)? Name any 2 diatomic elements. (4 pts, 2 pts each)

3. Write out the correct ionic formula for the following. Show work (4 pts total)

Between the elements:

Ca and N

Charge on Ca is \_\_\_\_\_ Charge on N is \_\_\_\_\_ (1 pt charge) Explain your charges here.(1 pt explain)

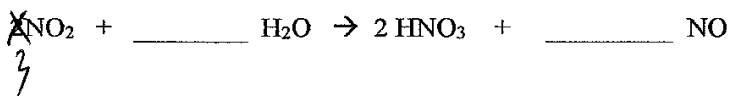
Show work for coming up with the correct formula here (1 pt work, 1 pt correct formula)

4 For the following formula, give the formula mass (or molar mass). Show work. (5 pts)



5. Balance the following reactions by: (6 pts)

a. filling in the blanks. (you can fill the blank with a **one but not a zero**) (4 pts, 2 pt per blank)



b. show the number count of every atom of ~~each element~~ separately for the reactant and products (2 pts, 1 pt per blank)

reactant atom count of

H         

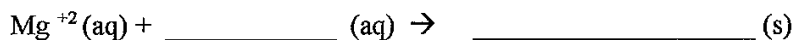
~~product~~ atom count of

H

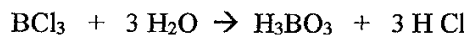
- 6 a. Given the following reactants, write out the products by filling in the blanks. You do not need to balance the reactions in either part of this question. (4 pt, 2 pts per blank)



- b. Complete the net ionic equation for the same reaction. (2 pts, 1 pt per blank)



- 7 For the following reactions, circle the limiting reagent. (4 pts)



Is the limiting reagent [(3 moles of  $\text{BCl}_3$ ) or (3 moles of  $\text{H}_2\text{O}$ )] (circle one) ?

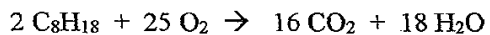


**Part III. Long Answer** Please show work for full credit and to receive partial credit. (33 pts)

\*\*\*\* Please attempt every problem for partial credit. You will get no partial credit if you just rewrite the question with no change in anything.\*\*\*\*

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work otherwise, I obviously cannot grade work I cannot find.

1. Given the following reaction how many grams of  $C_8H_{18}$  [FW  $C_8H_{18} = 114.26 \text{ g/mol}$ ] will you need if you want to make 370.2 grams of  $H_2O$  (FW  $H_2O = 18.02 \text{ g/mol}$ )? Assume an excess of all other reagents for the reaction to proceed forward. (18 pts)



2. If you want the molarity of a solution to be 1.55 M and you have a flask which holds exactly 250.0 mL, how many grams of Na OH will you need to make up the 250.0 mL of the solution ? ( FW Na OH = 40.00 g/mol ) (15 pts)

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. 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. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper but clearly label where the remaining answer can be found. (If I can't find your answer, I obviously cannot grade it).

$$N_A = 6.022 \times 10^{23} \quad M_1 V_1 = M_2 V_2 \quad (\text{FW} = \text{formula mass or formula weight})$$

**Part I MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, 26 pts total)

- 1) Determine the molecular formula of a compound that has a molar mass of 92.0 g/mol and an empirical formula of  $\text{NO}_2$ . (FW of  $\text{NO}_2 = 46.01 \text{ g/mol}$ ) 1) \_\_\_\_\_  
 A)  $\text{NO}_2$                       B)  $\text{N}_3\text{O}_6$                       C)  $\text{N}_2\text{O}_5$                       D)  $\text{N}_2\text{O}_4$                       E)  $\text{N}_2\text{O}_3$
- 2) The solid compound,  $\text{K}_2\text{SO}_4$ , contains 2) \_\_\_\_\_  
 A)  $\text{K}^+$  and  $\text{SO}_4^{-2}$  ions.                      B)  $\text{K}^+$ ,  $\text{S}^{6+}$ , and  $\text{O}^{2-}$  ions.  
 C)  $\text{K}_2\text{SO}_4$  molecules.                      D)  $\text{K}_2^+$  and  $\text{SO}_4^{-2}$  ions.
- 3) Give the name for  $\text{PBr}_3$ . 3) \_\_\_\_\_  
 A) phosphorus (II) bromide  
 B) phosphorus bromide  
 C) phosphorus (III) bromide  
 D) potassium tribromide  
 E) phosphorus tribromide
- 4) Write the name for  $\text{Ca}_3(\text{PO}_4)_2$ . 4) \_\_\_\_\_  
 A) calcium (II) phosphite  
 B) tricalcium phosphorustetraoxide  
 C) calcium phosphate  
 D) calcium (III) phosphite  
 E) calcium phosphite
- 5) Give the name for  $\text{HNO}_3$ . 5) \_\_\_\_\_  
 A) nitrous acid  
 B) hydrogen nitrite  
 C) hydrogen nitrate  
 D) nitric acid  
 E) hydrogen nitride

- 6) A covalent bond is best described as \_\_\_\_\_
- a bond between a metal and a polyatomic ion.
  - the sharing of electrons between atoms.
  - a bond between a metal and a nonmetal.
  - the transfer of electrons.
  - a bond between two polyatomic ions.
- 7) Identify the spectator ions in the following molecular equation. \_\_\_\_\_
- $$\text{LiCl(aq)} + \text{AgNO}_3\text{(aq)} \rightarrow \text{AgCl(s)} + \text{LiNO}_3\text{(aq)}$$
- $\text{Li}^+$  and  $\text{NO}_3^-$
  - $\text{Ag}^+$  and  $\text{Cl}^-$
  - $\text{Ag}^+$  and  $\text{NO}_3^-$
  - $\text{Li}^+$  and  $\text{Cl}^-$
  - There are no spectator ions in this reaction.
- 8) What is the empirical formula for  $\text{C}_{12}\text{H}_{24}\text{O}_6$ ? \_\_\_\_\_
- $\text{CH}_2\text{O}$
  - $\text{CHO}$
  - $\text{C}_2\text{H}_4\text{O}$
  - $\text{CHO}_2$
  - $\text{C}_2\text{H}_5\text{O}$
- 9) Choose the statement below that is TRUE. \_\_\_\_\_
- The term "strong electrolyte" means that the substance is extremely reactive.
  - A strong acid solution consists of only partially ionized acid molecules.
  - A weak acid solution consists of mostly nonionized acid molecules.
  - A molecular compound that does not ionize in solution is considered a strong electrolyte.
  - The term "weak electrolyte" means that the substance is inert.
- 10) Which of the following exists as a diatomic molecule? \_\_\_\_\_
- krypton
  - phosphorus
  - carbon
  - lithium
  - hydrogen
- 11) What is the charge on the Sc ions in  $\text{Sc}_2\text{O}_3$ ? \_\_\_\_\_
- 1+
  - 3+
  - 2+
  - 3-
- 12) Calculate the mass percent composition of lithium in  $\text{Li}_3\text{PO}_4$ . (FW of lithium phosphate = 115.79 g/mol, atomic mass of Li = 6.94 g/mol) \_\_\_\_\_
- 30.72 %
  - 17.98 %
  - 55.27 %
  - 20.82 %
  - 26.75 %
- 13) What is the empirical formula for  $\text{Hg}_2(\text{NO}_3)_2$ ? \_\_\_\_\_
- $\text{Hg}_2(\text{NO}_3)_2$
  - $\text{Hg}(\text{NO}_3)_2$
  - $\text{Hg}_4(\text{NO}_3)_4$
  - $\text{Hg}_2\text{NO}_3$
  - $\text{HgNO}_3$

**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.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (39 pts)

1. Circle the following compounds which are **ionic**. You may circle one, many, all or none. (10 pts, 2 pts each)

PBr<sub>3</sub>      CCl<sub>4</sub>      BaCl<sub>2</sub>      SiO<sub>2</sub>      Rb<sub>3</sub>N

2. Give the name or the formula and charge (for the polyatomic ions) or number for the following. (4 pts, 2 pts each)

carbonate \_\_\_\_\_ H<sub>2</sub>SO<sub>4</sub> \_\_\_\_\_

- 2 Write out the correct ionic formula for the following. Show work (4 pts total)

Between the elements:

Ga and Br

Charge on Ga is \_\_\_\_\_ Charge on Br is \_\_\_\_\_ (1 pt charge) Explain your charges here. (1 pt explain)

Show work for coming up with the correct formula here (1 pt work, 1 pt correct formula)

- 3 If you have the following ionic compound, is the reagent soluble or insoluble in water. Circle the correct choices below to answer this question. (5 pts)

Sr SO<sub>4</sub>

The anion is [(soluble) or (insoluble)] (circle one) (2.5 pt)

The ionic compound is [(soluble) or (insoluble)] (circle one) (2.5 pt)

5. Balance the following reactions by: (6 pts)

a. filling in the blanks. (you can fill the blank with a one but not a zero) (4 pts, 2 pt per blank)



- b. show the number count of every atom of each element separately for the reactant and products (2 pts, 1 pt per blank)

reactant atom count of

Al

\_\_\_\_\_

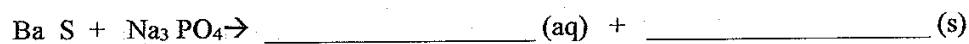
|

Al

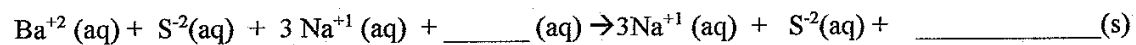
\_\_\_\_\_

*product atom count of*

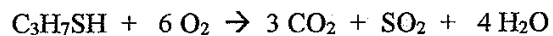
- 6 a. Given the following reactants, write out the products by filling in the blanks. You do not need to balance the reactions in either part of this question. (4 pt, 2 pts per blank)



- b. Complete the following complete ionic equation for the same reaction (2 pts, 1 pt per blank)



- 7 For the following reactions, circle the limiting reagent. (4 pts)



Is the limiting reagent [(6 moles of  $\text{C}_3\text{H}_7\text{SH}$ ) or (6 moles of  $\text{O}_2$ )] (circle one) ?

**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.\*\*\*\*

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work otherwise, I obviously cannot grade work I cannot find.

1. How many atoms of **H** in the molecule  $(\text{NH}_4)_2\text{O}$  is in 235.2 grams of the  $(\text{NH}_4)_2\text{O}$  [FW of  $(\text{NH}_4)_2\text{O} = 52.10 \text{ g/mol}$  ]? (18 pts)



2. If you have 85.2 mL of a solution of concentration 1.5 M and want the new molarity to be 0.75 M, how many mL will the new diluted solution have to be? ( $M_1V_1 = M_2V_2$ ) (15 pts)

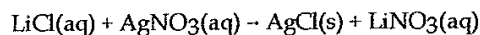
Name \_\_\_\_\_ (print) Name \_\_\_\_\_ (sign)

Please show work for partial credit and full credit on the Long Answers and in some of the Short Answer Questions. 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. (2 pts print and sign exam) If you run out of space, please continue on the scratch paper but clearly label where the remaining answer can be found. (If I can't find your answer, I obviously cannot grade it).

$$N_A = 6.022 \times 10^{23} \quad M_1V_1 = M_2V_2 \quad (\text{FW} = \text{formula mass or formula weight})$$

**Part I MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question. No partial credit for MC. (2 pts per question, 26 pts total)

1) Identify the spectator ions in the following molecular equation. 1) \_\_\_\_\_



- A)  $\text{Ag}^+$  and  $\text{Cl}^-$
- B)  $\text{Li}^+$  and  $\text{NO}_3^-$
- C)  $\text{Li}^+$  and  $\text{Cl}^-$
- D)  $\text{Ag}^+$  and  $\text{NO}_3^-$
- E) There are no spectator ions in this reaction.

2) Calculate the mass percent composition of lithium in  $\text{Li}_3\text{PO}_4$ . (FW of lithium phosphate = 115.79 g/mol, atomic mass of Li = 6.94 g/mol) 2) \_\_\_\_\_

- A) 17.98 %
- B) 20.82 %
- C) 55.27 %
- D) 30.72 %
- E) 26.75 %

3) Give the name for  $\text{HNO}_3$ . 3) \_\_\_\_\_

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

4) Determine the molecular formula of a compound that has a molar mass of 92.0 g/mol and an empirical formula of  $\text{NO}_2$ . (FW of  $\text{NO}_2$  = 46.01 g/mol) 4) \_\_\_\_\_

- A)  $\text{NO}_2$
- B)  $\text{N}_3\text{O}_6$
- C)  $\text{N}_2\text{O}_5$
- D)  $\text{N}_2\text{O}_3$
- E)  $\text{N}_2\text{O}_4$

5) Which of the following exists as a diatomic molecule? 5) \_\_\_\_\_

- A) krypton
- B) carbon
- C) lithium
- D) hydrogen
- E) phosphorus

6) What is the empirical formula for  $\text{C}_{12}\text{H}_{24}\text{O}_6$ ? 6) \_\_\_\_\_

- A)  $\text{CHO}_2$
- B)  $\text{CHO}$
- C)  $\text{C}_2\text{H}_4\text{O}$
- D)  $\text{C}_2\text{H}_5\text{O}$
- E)  $\text{CH}_2\text{O}$

- 7) Give the name for  $\text{PBr}_3$ . 7) \_\_\_\_\_  
A) phosphorus (III) bromide  
B) potassium tribromide  
C) phosphorus bromide  
D) phosphorus tribromide  
E) phosphorus (II) bromide
- 8) Write the name for  $\text{Ca}_3(\text{PO}_4)_2$ . 8) \_\_\_\_\_  
A) calcium (III) phosphite  
B) calcium phosphate  
C) calcium (II) phosphite  
D) tricalcium phosphorustetraoxide  
E) calcium phosphite
- 9) Choose the statement below that is TRUE. 9) \_\_\_\_\_  
A) A strong acid solution consists of only partially ionized acid molecules.  
B) A weak acid solution consists of mostly nonionized acid molecules.  
C) The term "weak electrolyte" means that the substance is inert.  
D) The term "strong electrolyte" means that the substance is extremely reactive.  
E) A molecular compound that does not ionize in solution is considered a strong electrolyte.
- 10) The solid compound,  $\text{K}_2\text{SO}_4$ , contains 10) \_\_\_\_\_  
A)  $\text{K}^+$  and  $\text{SO}_4^{-2}$  ions. B)  $\text{K}_2^+$  and  $\text{SO}_4^{-2}$  ions.  
C)  $\text{K}_2\text{SO}_4$  molecules. D)  $\text{K}^+$ ,  $\text{S}^{6+}$ , and  $\text{O}^{2-}$  ions.
- 11) A covalent bond is best described as 11) \_\_\_\_\_  
A) a bond between a metal and a polyatomic ion.  
B) the sharing of electrons between atoms.  
C) a bond between a metal and a nonmetal.  
D) the transfer of electrons.  
E) a bond between two polyatomic ions.
- 12) What is the empirical formula for  $\text{Hg}_2(\text{NO}_3)_2$ ? 12) \_\_\_\_\_  
A)  $\text{Hg}_4(\text{NO}_3)_4$   
B)  $\text{Hg}_2(\text{NO}_3)_2$   
C)  $\text{Hg}_2\text{NO}_3$   
D)  $\text{Hg}(\text{NO}_3)_2$   
E)  $\text{HgNO}_3$
- 13) What is the charge on the Sc ions in  $\text{Sc}_2\text{O}_3$ ? 13) \_\_\_\_\_  
A) 1+ B) 2+ C) 3+ D) 3-

**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.

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work. (39 pts)

1. Circle the following compounds which are covalent. You may circle one, many, all or none. (10 pts, 2 pts each)

PBr<sub>3</sub>      CCl<sub>4</sub>      BaCl<sub>2</sub>      SiO<sub>2</sub>      Rb<sub>3</sub>N

2. Give the name or the formula and charge (for the polyatomic ions) or number for the following. (4 pts, 2 pts each)

3 (as number prefix) \_\_\_\_\_ phosphate \_\_\_\_\_

- 2 Write out the correct ionic formula for the following. Show work (4 pts total)

Between the elements:

K and P

Charge on K is \_\_\_\_\_ Charge on P is \_\_\_\_\_ (1 pt charge) Explain your charges here.(1 pt explain)

Show work for coming up with the correct formula here (1 pt work, 1 pt correct formula)

3. If you have the following ionic compound, is the reagent soluble or insoluble in water. Circle the correct choices below to answer this question. (5 pts)

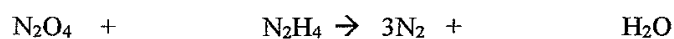
$\text{NH}_4\text{OH}$

The anion is [(soluble) or (insoluble)] (circle one) (2.5 pt)

The ionic compound is [(soluble) or (insoluble)] (circle one) (2.5 pt)

5. Balance the following reactions by: (6 pts)

- a. filling in the blanks. (you can fill the blank with a **one but not a zero**) (4 pts, 2 pt per blank)



- b. show the number count of every atom of each element separately for the reactant and products (2 pts, 1 pt per blank)

reactant atom count of

N

|

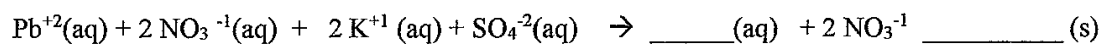
product atom count of

N

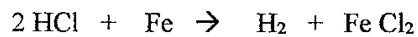
- 6 a. Given the following reactants, write out the products by filling in the blanks. You do not need to balance the reactions in either part of this question. (4 pt, 2 pts per blank)



- b. Complete the following complete ionic equation for the same reaction (1 pt) (2 pts, 1 pt per blank)



- 7 For the following reactions, circle the limiting reagent. (4 pts)



Is the limiting reagent [(2 moles of HCl) or (2 moles of Fe)] (circle one) ?

**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.\*\*\*\*

Please show all work on this exam itself. If you are going to show work on the scratch paper and want me to grade it, clearly indicate where I can find your work otherwise, I obviously cannot grade work I cannot find.

1. How many atoms of O in the molecule  $\text{Al}_2(\text{SO}_4)_3$  is in 789.2 grams of the  $\text{Al}_2(\text{SO}_4)_3$  [FW of  $\text{Al}_2(\text{SO}_4)_3 = 342.17 \text{ g/mol}$ ] ? (18 pts)

- 2 If you have 25.4 mL of a solution of concentration 0.25 M and want the new molarity to be 0.10 M, how many mL will the new diluted solution have to be ? ( $M_1V_1 = M_2V_2$ ) (15 pts)