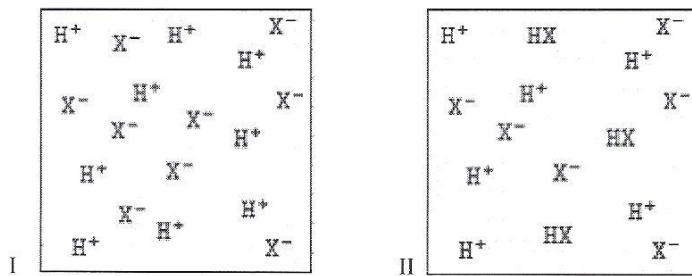


Name Key (print) Name \_\_\_\_\_ (sign)  
 Please show work for partial credit on the Long Answers and in some of the Short Answer Questions. Multiple choice questions have no partial credit. Please write anything you want graded legibly. If I cannot read your work, I obviously cannot grade it. (2 pts print AND sign exam)

**Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (No Partial Credit for MC) (3 pts per question, 21 pts total)**

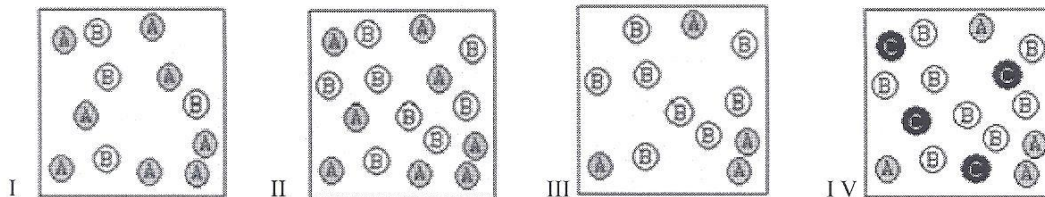
- 1) The empirical formula of a group of compounds is  $\text{CHCl}$ . Lindane, a powerful insecticide, is a member of this group. The molar mass of lindane is 290.8 g/mol. How many atoms of carbon does a molecule of lindane contain? 1) D
- A) 3                                      B) 2                                      C) 4                                      D) 6
- 2) Which of the following is paired incorrectly? 2) A
- A)  $\text{HNO}_3$  — weak acid                                      B)  $\text{NH}_3$  — weak base  
 C)  $\text{Ba}(\text{OH})_2$  — strong base                                      D)  $\text{H}_2\text{SO}_4$  — strong acid
- 3) A solid acid  $\text{HX}$  is mixed with water. Two possible solutions can be obtained. Which of the following is true? 3) B



- A) In both cases,  $\text{HX}$  is acting like a strong acid
- B) In case I,  $\text{HX}$  is acting like a strong acid, and in case II,  $\text{HX}$  is acting like a weak acid.
- C) In both cases,  $\text{HX}$  is acting like a weak acid.
- D) In case I,  $\text{HX}$  is acting like a weak acid. In case II,  $\text{HX}$  is acting like a strong acid.

4) A chemical reaction has the equation:  $2A + B \rightarrow C$ . Which of the following figures best illustrates a stoichiometric ratio of A and B?

4) D



- A) II only                      B) IV only                      C) III only                      D) I only

5) Chlorous acid,  $\text{HClO}_2$ , contains what percent hydrogen by mass?

5) B

- A) 25.0%                      B) 1.47%                      C) 23.4%                      D) 1.92%

6) In balancing an equation, we change the \_\_\_\_\_ to make the number of atoms on each side of the equation balance.

6) D

- A) subscripts of compounds  
 B) formulas of compounds in the reactants  
 C) formulas of compounds in the products  
 D) coefficients of compounds

7) Adipic acid contains 49.32% C, 6.85% H, and 43.84% O, by mass. What is the empirical formula?

7) A

- A)  $\text{C}_3\text{H}_5\text{O}_2$                       B)  $\text{C}_2\text{HO}_3$                       C)  $\text{C}_3\text{H}_3\text{O}_4$                       D)  $\text{C}_2\text{H}_5\text{O}_4$

$\%C \quad 49.32 \div 12.01 = 4.1$   
 $\%H \quad 6.85 \div 1.01 = 6.8$   
 $\%O \quad 43.84 \div 16 = 2.74$

$\div$  by <sup>den</sup> <sub>comm</sub>      get integers \* 2  
 1.5                      3  
 2.5                      5  
 1                          2



**Part II: Short Answers** (43 pts) Show work on all questions for partial and full credit even on questions which do not specify.

1. What % is the element Cl in the molecule  $\text{AlCl}_3$  (FW  $\text{AlCl}_3 = 133.5 \text{ g/mol}$ ) (10 pts)

$$\left[ \frac{3(35.5)}{133.5} \right] * 100 = 79.8\% \quad \text{attempt - 2} \quad \text{BA-5}$$

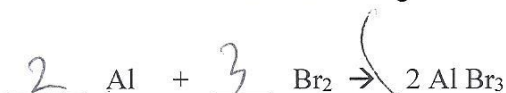
2. Give the molecular formula for a compound with empirical formula of CH (empirical formula mass = 13.02 g/mol) with a molecular formula mass of 79.02 g/mol. Show work. (8 pts)

both BA - 4

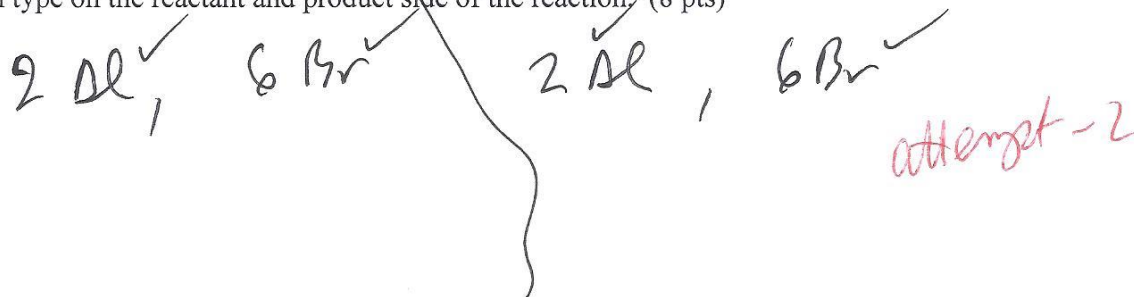
$$\frac{79.02}{13.02} = 6.1 \quad \text{4pt} \quad \text{attempt - 1}$$

$\text{C}_6\text{H}_6$  — 4pt  
BA-2

3 a. Balance the following reaction by filling in the blanks with NUMBERS. (6 pts)



b. After you balance the reaction show that you balanced the reaction by showing all of the atoms of each type on the reactant and product side of the reaction. (8 pts)



4. If you made up a solution of HCl (FW HCl = 36.51 grams/mol) in water by dissolving 250.2 milli grams to make up 15.7 Liters of solution, what is the molarity of the solution? (Molarity = moles solute / liter solution) (11 pts)

$$250.2 \text{ mg HCl} \times \frac{1 \text{ g HCl}}{1000 \text{ mg}} \times \frac{1 \text{ mol HCl}}{36.51 \text{ g HCl}} = 6.853 \times 10^{-3} \text{ mol}$$

$$M = \frac{6.853 \times 10^{-3} \text{ mol}}{15.7 \text{ L}} = 4.365 \times 10^{-4} \text{ M} \quad \text{BA-55}$$

attempt - 2

**Part III: Long Answer** (34 pts) Show work for partial credit and full credit even on questions which do not specify.

1. Given the following balanced chemical reaction, (19 pts)



- a. If I start with 45.2 grams of the  $\text{O}_2$  (FW  $\text{O}_2 = 32.00 \text{ g/mol}$ ) how many grams of the  $\text{FeO}$  (71.85 g/mol) will I make? Show work. (16 pts)

$$45.2 \text{ g } \overset{3}{\text{O}_2} \times \frac{1 \text{ mol } \overset{1}{\text{O}_2}}{32.00 \text{ g } \overset{1}{\text{O}_2}} \times \frac{2 \text{ mol } \overset{2}{\text{FeO}}}{7 \text{ mol } \overset{1}{\text{O}_2}} \times \frac{71.85 \text{ g } \overset{3}{\text{FeO}}}{1 \text{ mol } \overset{1}{\text{FeO}}}$$

= 28,999 <sup>2</sup> g FeO      BA-8

29.0 g FeO s.f.      attempt-2

- b. If I obtain from grams  $\text{Cu}_3\text{FeS}_3$  2.5 moles of  $\text{FeO}$  and from grams  $\text{O}_2$  1.2 moles of  $\text{FeO}$ , which is the limiting reagent? [( $\text{Cu}_3\text{FeS}_3$ ) or ( $\text{O}_2$ )] (circle the limiting reagent) (3 pts)

2. If I have 25.7 mL of a 0.250 M solution of  $\text{HCl}$ , how many grams of  $\text{HCl}$  (FW  $\text{HCl} = 36.06 \text{ g/mol}$ ) do I have? (15 pts)

$$25.7 \text{ mL } \overset{2}{\text{HCl soln}} \times \frac{0.250 \text{ mol } \overset{5}{\text{HCl}}}{1000 \text{ mL } \overset{5}{\text{HCl soln}}} \times \frac{36.06 \text{ g } \overset{5}{\text{HCl}}}{1 \text{ mol } \overset{5}{\text{HCl}}} =$$

0.232 g HCl <sup>2</sup>

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. (2 pts print AND sign exam)

*green*

**Part I MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (No Partial Credit for MC) (3 pts per question, 21 pts total)**

1) Adipic acid contains 49.32% C, 6.85% H, and 43.84% O, by mass. What is the empirical formula? 1) B

A)  $C_2H_3O_3$

B)  $C_3H_5O_2$

C)  $C_2H_5O_4$

D)  $C_3H_3O_4$

2) The empirical formula of a group of compounds is  $CHCl$ . Lindane, a powerful insecticide, is a member of this group. The molar mass of lindane is 290.8 g/mol. How many atoms of carbon does a molecule of lindane contain? 2) B

A) 4

B) 6

C) 2

D) 3

3) Which of the following is paired incorrectly? 3) D

A)  $H_2SO_4$  — strong acid

B)  $Ba(OH)_2$  — strong base

C)  $NH_3$  — weak base

D)  $HNO_3$  — weak acid

4) In balancing an equation, we change the \_\_\_\_\_ to make the number of atoms on each side of the equation balance. 4) A

A) coefficients of compounds

B) formulas of compounds in the reactants

C) subscripts of compounds

D) formulas of compounds in the products

5) Chlorous acid,  $HClO_2$ , contains what percent hydrogen by mass? 5) C

A) 1.92%

B) 23.4%

C) 1.47%

D) 25.0%

$$\% C \quad 49.32\% \div 12.01 = 4.1$$

$$\% H \quad 6.85 \div 1.01 = 6.8$$

$$\% O \quad 43.84 \div 16 = 2.74$$

$\div$  by denominator  
common

1.5

2.5

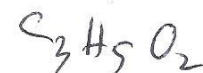
1

get \*2  
in integer

3 - C

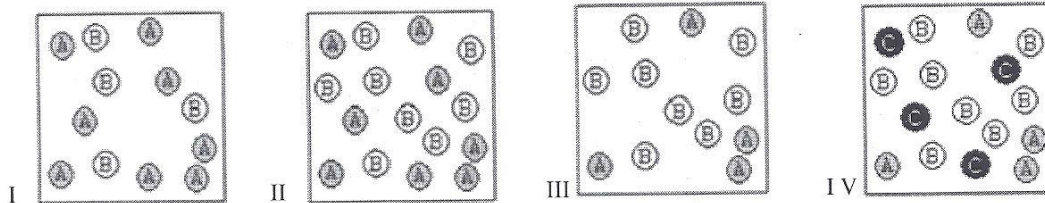
5 - H

2 - O



6) A chemical reaction has the equation:  $2A + B \rightarrow C$ . Which of the following figures best illustrates a stoichiometric ratio of A and B?

6) D



A) III only

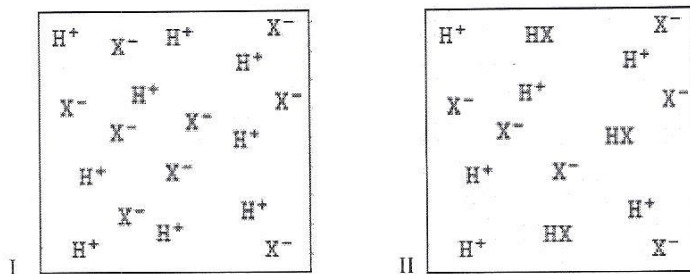
B) IV only

C) II only

D) I only

7) A solid acid HX is mixed with water. Two possible solutions can be obtained. Which of the following is true?

7) C



A) In case I, HX is acting like a weak acid. In case II, HX is acting like a strong acid.

B) In both cases, HX is acting like a strong acid

C) In case I, HX is acting like a strong acid, and in case II, HX is acting like a weak acid.

D) In both cases, HX is acting like a weak acid.

**Part II: Short Answers** (43 pts) Show work on all questions for partial and full credit even on questions which do not specify.

1. What % is the element Fe in the molecule  $\text{Fe}_2\text{O}_3$  (FW  $\text{Fe}_2\text{O}_3 = 159.7 \text{ g/mol}$ ) (10 pts)

$$\left[ \frac{2(55.85)}{159.7} \right] * 100 = 69.9\% \quad \text{attempt - 2}$$

BA-5

2. Give the molecular formula for a compound with empirical formula of  $\text{NH}_2$  (empirical formula mass =  $16.03 \text{ g/mol}$ ) with a molecular formula mass of  $33.01 \text{ g/mol}$ . Show work. (8 pts)

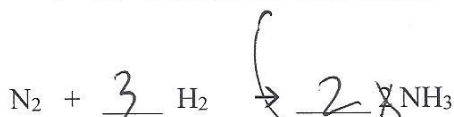
$$\frac{33.01}{16.03} = 2.1 \quad \text{attempt - 1}$$

$$(\text{NH}_2)_2 = \text{N}_2\text{H}_4 \quad \text{4pt}$$

BA-2

BA both - 4

3 a. Balance the following reaction by filling in the blanks with NUMBERS. (6 pts)



b. After you balance the reaction show that you balanced the reaction by showing all of the atoms of each type on the reactant and product side of the reaction. (8 pts)

2 N, 6 H

2 N, 6 H

attempt - 2

4. If you made up a solution of  $\text{HBr}$  (FW  $\text{HBr} = 80.91 \text{ grams/mol}$ ) in water by dissolving  $72.52 \text{ kilograms}$  to make up  $2.7 \text{ Liters}$  of solution, what is the molarity of the solution? (Molarity = moles solute / liter solution) (11 pts)

$$72.52 \text{ kg} \times \frac{1000 \text{ g HBr}}{1 \text{ kg}} \times \frac{1 \text{ mol HBr}}{80.9 \text{ g HBr}} = 896.4 \text{ mol HBr}$$

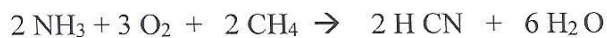
$$\frac{896.4 \text{ mol HBr}}{2.7 \text{ L}} = 332 \text{ M}$$

BA 5.5

attempt - 2

**Part III: Long Answer** (34 pts) Show work for partial credit and full credit even on questions which do not specify.

1. Given the following balanced chemical reaction, (19 pts)



a. If I start with 78.2 grams of the  $\text{O}_2$  (FW  $\text{O}_2 = 32.00 \text{ g/mol}$ ) how many grams of the  $\text{H}_2\text{O}$  (18.02 g/mol) will I make? Show work. (16 pts)

$$78.2 \text{ g O}_2 \times \frac{3 \text{ mol O}_2}{32.00 \text{ g O}_2} \times \frac{6 \text{ mol H}_2\text{O}}{3 \text{ mol O}_2} \times \frac{18.02 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} =$$

$$88.1 \text{ g H}_2\text{O}$$

BA-8  
attempt - 2

b. If I obtain from the grams  $\text{NH}_3$  1.2 moles of  $\text{HCN}$  and from grams  $\text{O}_2$  2.5 moles of  $\text{HCN}$ , which is the limiting reagent? [ $\text{NH}_3$ ] or [ $\text{O}_2$ ] (circle the limiting reagent)] (3 pts)

2. If I have 1.5 Liter of a 1.50 M solution of  $\text{NaOH}$ , how many milligrams of  $\text{NaOH}$  (FW  $\text{NaOH} = 40.01 \text{ g/mol}$ ) do I have? (15 pts)

$$1.5 \text{ L NaOH soln.} \times \frac{1.50 \text{ mol NaOH}}{1 \text{ L NaOH soln.}} \times \frac{40.01 \text{ g NaOH}}{1 \text{ mol NaOH}} \times \frac{1000 \text{ mg}}{1 \text{ g NaOH}} =$$

$$900225 \text{ mg NaOH} \rightarrow 9.0 \times 10^5 \text{ mg NaOH}$$

BA-6