

Use the Scantron for Questions 1-13. Mark only one answer unless instructed otherwise.

CHP 6

1. (6.6) What is the mass percent oxygen in the compound NO?

- A) .875% B) 87.5% C) 16.00% D) 46.68% **E) 53.32%**

$$\%O = \frac{16.00}{30.01} \times 100 = 53.32\%$$

$$N = 14.01$$

$$O = 16.00$$

$$30.01$$

2. (6.6) Methane, CH₄, is a molecular compound. Which of the following is the correct value and units of the molar mass of methane?

- A) 16.0 g/mol** B) 16.0 g/molecule C) 16.0 amu D) 16.0 amu/molecule E) 16.0 g/atom

$$C = 12 + 4H (4.04) = 16.04 \text{ g/mol}$$

3. (6.6) What is the molar mass of sodium phosphate?

- A) 226 g B) 119 g C) 354 g D) 308 g **E) 64 g**



$$3 \times 22.99 = 68.97$$

$$1 \times 30.97 = 30.97$$

$$4 \times 16.00 = 64.00$$

(6.7) (5 pt) Calculate the mass of silver in a 1.50 g sample of silver sulfide (Ag₂S, molar mass = 247.78 g)

$$1.50 \text{ g Ag}_2\text{S} \times \frac{1 \text{ mol}}{247.78 \text{ g}} \times \frac{2 \text{ mol Ag}}{1 \text{ mol Ag}_2\text{S}} \times \frac{107.87 \text{ g}}{1 \text{ mol}} = 1.31 \text{ g Ag}$$

$$163.94$$

(6.8)(2 pt) The simplest or smallest whole number ratio of the atoms in a compound formula is known as the

empirical formula

(6.8) (8 pt) An extremely explosive ionic compound is made from the reactions of silver compounds with ammonia. A sample of this compound is found to contain 17.261 g silver and 0.743 g nitrogen. What is the empirical formula for this compound. Show all work for complete credit.



$$17.261 \text{ g}$$

$$0.743 \text{ g}$$

$$\text{mol } 17.261 \text{ g} / 107.87 \text{ g} = 0.160 \text{ mol Ag}$$

$$0.743 \text{ g} / 14.01 \text{ g} = 0.0530 \text{ mol N}$$

$$0.160 \text{ mol Ag}$$

$$0.0530 \text{ mol N}$$

Mol ratio

$$\frac{0.160 \text{ mol Ag}}{0.0530 \text{ mol N}} = 3$$

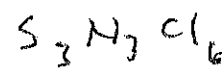
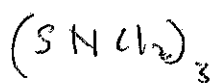
$$\frac{0.0530 \text{ mol N}}{0.0530 \text{ mol N}} = 1$$

emp formula Ag₃N

(6.8) (4 pt) What is the molecular formula of a compound with empirical formula SNCl_2 and molecular formula mass = 351 amu?

$$\begin{aligned} \text{S} &= 32.06 \\ \text{N} &= 14.01 \\ 2 \text{Cl} &= 70.90 \\ \text{E.F. mass} &= 116.97 \end{aligned}$$

$$n = \frac{351}{116.97} = 3$$



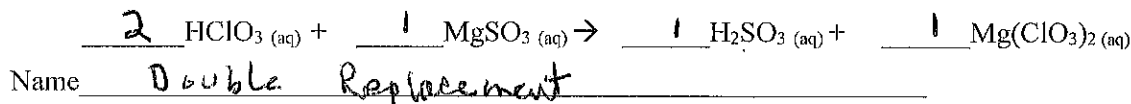
CHP 7

Use the following answers to fill in the blanks in Questions 4-7.

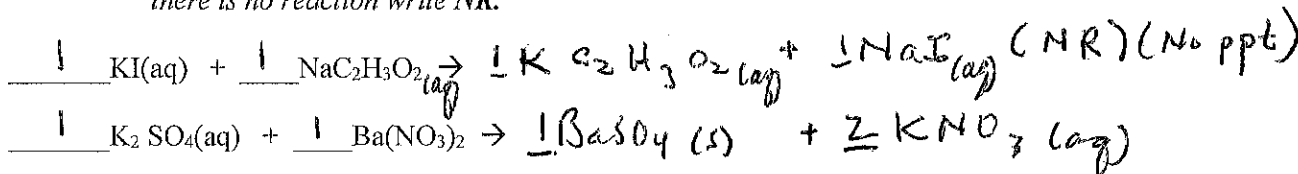
- A) Changed B) Created C) Coefficients D) Subscript E) There is no answer.

4. When balancing equations we do not change the D in the formulas.
5. The purpose of the C placed in front of formulas is to make the number of atoms on the reactant side equal to the number of atoms on the product side.
6. In a chemical reaction atoms are neither created nor destroyed they merely A partners.
7. When the product of a reaction is E it is called a precipitate.

(7.1 & 7.3) (6 pt) Balance and name the type of this chemical reaction.



(7.1 & 7.3) (8 pt) Complete and balance each of the following reactions. Hint: Predict if a precipitate will form. If there is no reaction write NR.



CHP 9

8. (9.1) When an atom loses an electron, the resulting particle is

- A) oxidized B) reduced C) neutral D) negatively charged E) positively charged (NOT ALWAYS)

9. (9.1) Identify the oxidation-reduction reactions among the following:

- $\text{Zn}(\text{s}) + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu}(\text{s})$
- $2\text{Na}(\text{s}) + \text{Cl}_2(\text{aq}) \rightarrow 2\text{NaCl}(\text{s})$
- $2\text{Mg}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2\text{MgO}$

- A) 1 and 2 only B) 1 and 3 only C) 2 and 3 only D) All of 1, 2, and 3 E) None of 1, 2, and 3

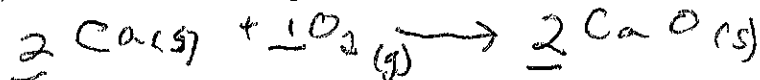
10. (9.2) The oxidation numbers of Mg and O in MgO are: A) 0,0 B) +2,-2 C) +2,0 D) 0,-2

11. (9.2) In the following reaction, $\overset{0}{\text{Zn}}(\text{s}) + \overset{+2}{\text{Cu}}\text{SO}_4(\text{aq}) \rightarrow \overset{+2}{\text{Zn}}\text{SO}_4(\text{aq}) + \overset{0}{\text{Cu}}(\text{s})$

- (A) Zn is oxidized and Cu^{2+} is reduced.
 (B) CuSO_4 is oxidized and Zn is reduced.
 (C) ZnSO_4 is oxidized and Cu is reduced.
 (D) Cu^{2+} is oxidized and Zn^{2+} is reduced.

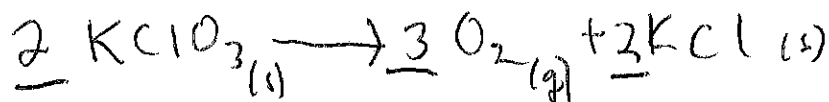
Solid calcium reacts with oxygen gas, forming solid calcium oxide.

(9.3) (6 pt) Write the balanced equation for this reaction.



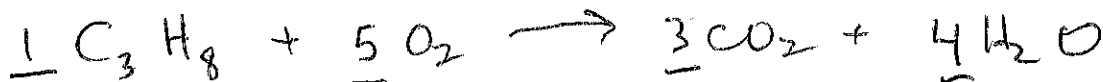
(9.3) (2 pt) What is the name of this reaction? Combination or synthesis

(9.3) (6 pt) When potassium chlorate is heated it produces oxygen and potassium chloride. Write the balanced equation for this reaction.



(2 pt) What is the name of this reaction? Decomposition

(9.3) (7 pt) Propane (C_3H_8) is used for heating and cooking in some homes. Write the balanced equation for the combustion of propane.



CHP 10

12. (10.1) For the reaction $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ How much water is produced when 2.5 moles of hydrogen react completely?

- a. 2.5 grams b. 18.0 grams c. 2.0 moles d. 2.5 moles $\frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol H}_2}$

$$? \text{ H}_2\text{O} = 2.5 \text{ mol H}_2 \times \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol H}_2} \times \frac{18.02 \text{ g H}_2\text{O}}{1 \text{ mol}} = 45.05 \text{ g H}_2\text{O}$$

13. (10.1) For the following reaction: $\text{Mg}_3\text{N}_2 + 6\text{H}_2\text{O} \rightarrow 3 \text{Mg}(\text{OH})_2 + 2\text{NH}_3$

When 2 moles of Mg_3N_2 are allowed to react, how many moles of H_2O also react?

- A) 4 moles B) 6 moles C) 8 moles D) 1 mole (E) 12 moles

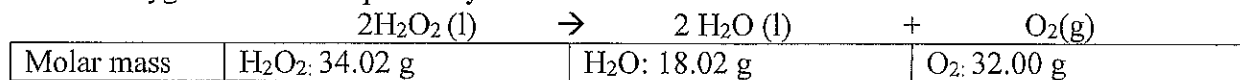
$$2 \text{ mol Mg}_3\text{N}_2 \times \frac{6 \text{ mol H}_2\text{O}}{1 \text{ mol Mg}_3\text{N}_2} = 12 \text{ mol H}_2\text{O}$$

(2 pt) The amount of product that a calculation indicates as possible for a chemical reaction is known as the

theoretical yield

Show all work for full credit in answering questions. Answers must contain correct significant figures for full credit.

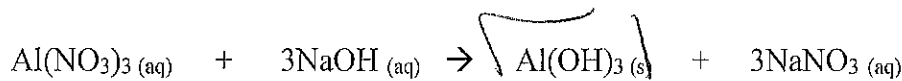
(10.2) (7 pt) Using the following equation, if 62.5 grams of hydrogen peroxide produce 0.550 mol of oxygen what is the percent yield?



$$62.5 \text{ g H}_2\text{O}_2 \times \frac{1 \text{ mol H}_2\text{O}_2}{34.02 \text{ g}} \times \frac{1 \text{ mol O}_2}{2 \text{ mol H}_2\text{O}_2} = 0.919 \text{ mol O}_2 (\text{theo.})$$

$$\% \text{ yield} = \frac{0.550 \text{ mol O}_2}{0.919 \text{ mol O}_2} \times 100 = \boxed{59.8\%}$$

(10.2 & 10.3) (10 pt) Calculate the grams of aluminum hydroxide obtained from reaction between 105 g sodium hydroxide and 205 g aluminum nitrate according to the following balanced equation:



Molar masses:	213.01 g	40.07 g	78.00 g	85.00 g
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$$\text{A) } 105 \text{ g NaOH} \times \frac{1 \text{ mol NaOH}}{40.07 \text{ g}} = 2.62 \text{ mol NaOH}$$

$$\text{B) } 205 \text{ g Al}(\text{NO}_3)_3 \times \frac{1 \text{ mol Al}(\text{NO}_3)_3}{213.01 \text{ g}} = 0.962 \text{ mol Al}(\text{NO}_3)_3$$

$$\left. \begin{array}{l} \text{mol NaOH} = 2.62 \\ \text{mol Al}(\text{NO}_3)_3 = 0.962 \end{array} \right\}$$

$$\text{Theo. } \frac{\text{mol NaOH}}{\text{mol Al}(\text{NO}_3)_3} = \frac{3}{1} \text{ and this is less than } \frac{3}{1} \text{ so } = \frac{2.7}{1}$$

NaOH is the limiting reactant.

$$\text{C) } 2.62 \text{ mol NaOH} \times \frac{1 \text{ mol Al}(\text{OH})_3}{3 \text{ mol NaOH}} \times \frac{78.00 \text{ g Al}(\text{OH})_3}{1 \text{ mol}} = \boxed{68.12 \text{ g}}$$

(2 pt) Which reactant is the limiting reactant? NaOH

(4 pt) How many grams of excess reactant will there be?

$$2.62 \text{ mol NaOH} \times \frac{1 \text{ mol Al}(\text{NO}_3)_3}{3 \text{ mol NaOH}} = 0.873 \text{ mol Al}(\text{NO}_3)_3 \text{ used.}$$

$$\text{excess} = 0.962 \text{ mol Al}(\text{NO}_3)_3 - 0.873 \text{ mol Al}(\text{NO}_3)_3 = 0.089 \text{ mol excess}$$

$$0.0890 \text{ mol excess} \times \frac{213.01 \text{ g}}{1 \text{ mol}} = \boxed{18.96 \text{ g excess Al}(\text{NO}_3)_3}$$

The following data was obtained from titration of 0.523 g KHP acid with a NaOH solution. Complete the following calculations to determine the molar concentration of the NaOH solution given the following data. The neutralization reaction is $\text{NaOH} + \text{KHP} \rightarrow \text{KNaP} + \text{H}_2\text{O}$. Molar masses are $\text{NaOH} = 40.00 \text{ g}$ and $\text{KHP} = 204.22 \text{ g}$

	TRIAL 1
Initial NaOH level in buret	0.00 mL
Final NaOH level in buret (End point)	20.55 mL
(2 pt) Volume (mL) of NaOH used (Show calculation)	$\begin{array}{r} 20.55 \\ - 0.00 \\ \hline 20.55 \text{ mL} \end{array}$
(2 pt) Volume in Liters of NaOH used (Show calculation)	$20.55 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 0.02055 \text{ L}$

(4 pt) Moles of KHP used in titration
(Show calculation)

0.00256 mole KHP

$$0.523 \text{ g KHP} \times \frac{1 \text{ mol}}{204.22 \text{ g}} \text{ KHP} = 0.00256 \text{ mol}$$

(2 pt) Moles of NaOH used in titration
(Show calculation)

0.00256 mole NaOH

$$\frac{1 \text{ mol NaOH}}{1 \text{ mol KHP}} \times 0.00256 \text{ mol KHP} = 0.00256 \text{ mol NaOH}$$

(6 pt) Molarity of NaOH solution
(Show calculation)

0.125 M NaOH

$$\text{molarity} = \frac{\text{mol NaOH}}{\text{L NaOH}} = \frac{0.00256 \text{ mol}}{0.02055 \text{ L}} = 0.125 \text{ M}$$

0.1246 M