Name _KEY_

~~125~~ ~~105~~ points total

**Answer Questions 1-30 on your scantron. Each question is worth 2 pt**

$Al = 26.98$ 26.98
$3 Cl = 3(35.45) = 106.35$
$3O = 3(16.00) = \underline{48.00}$

CHP 6.6-6.8

1. (6.6) What is the formula mass of $Al(ClO)_3$
   A) 78.43   B) 110.43   C) 132.39   **D) 181.33**   E) 235.29

2. (6.6) A 0.123 mol sample of a pure substance has a mass of 5.904 g. What is the molar mass of the substance?
   A) 0.0208 g/mol   B) 0.726 g/mol   C) 5.904 g/mol   **D) 48.0 g/mol**

$$\frac{5.904 \, g}{0.123 \, mol} = 48.0 \, g/mol$$

3. (6.6) A compound contains sodium and fluorine in the ratio 1.21 sodium : 1 fluorine. How much sodium is there in a sample of this compound that contains 34.5 g of fluorine?
   A) 15.6 g   B) 28.5 g   **C) 41.8 g**   D) 76.2 g

$$34.5 g \, F \times \frac{1.21 \, Na}{1 \, F} = 41.74$$

4. (6.6) A 2.45 g sample of strontium completely reacts with 0.44 g oxygen to make 2.89 g strontium oxide. What is the percent oxygen in strontium oxide?
   A) 15.2 %   ~~B) 18.0%~~   C) 45.9%   D) 54.12%   E) 84.8%

$$\frac{.44 \, g \, O}{2.89 \, g} \times 100 = 18.0\% \quad 15.2$$

5. (6.6) How many grams are there in 1.55 mol of water (18.02 g/mol)?
   A) 11.6   **B) 27.9**   C) 2.57×10^{-24} D) 9.33×10^{23}

$$1.55 \, mol \times \frac{18.02 \, g}{mol} = 27.9 \, g$$

6. (6.6) How many moles are there in 100.0 g of Fe_2O_3 (159.70 g/mol)?
   A) 15970 mol   B) 6.022×10^{25} **C) 0.6262 mol**   D) 0.626 mol   E) 1.597 mol

$$100.0 \, g \, Fe_2O_3 \times \frac{1 \, mol}{159.70 \, g} = 0.6262$$

7. (6.7) Which of the following pairs of mole amounts of compounds contain the same mol of _nitrogen atoms_?
   A) 0.5 mol NH_3 / 0.5 mol N_2O_5 **B) 1.0 mol NH_3 / 0.5 mol N_2O_5**   C) 0.5 mol NH_3 / 1.0 mol N_2O_5
   .5   1.0   1   1   .5   2

should be 149.12g

(6.7, 6 pt) Calculate the grams of nitrogen in 6.34 mol $(NH_4)_3PO_4$ (_molar mass = 146.06 g_). _**Show all work for complete credit.**_
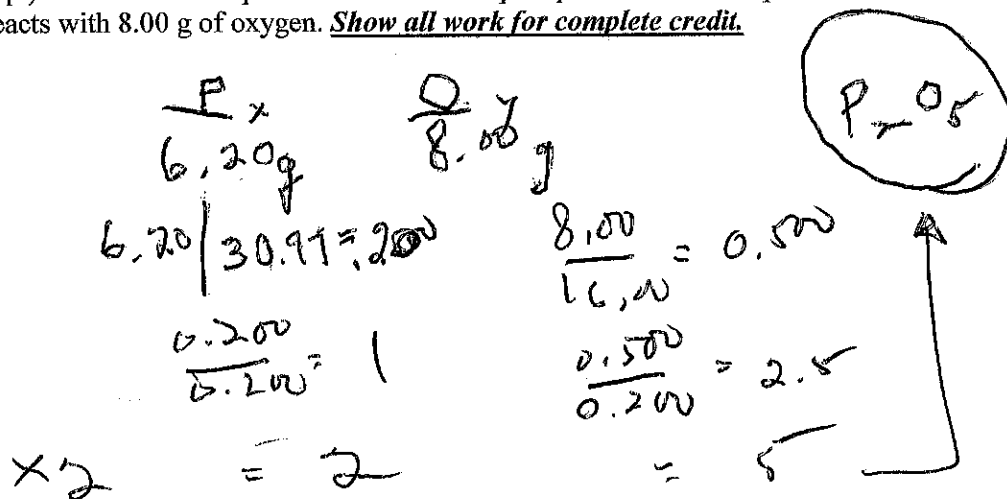
$3 \times 14.01 = 42.03$
$12 \times 1.01 = 12.12$
$1 \times 30.97 = 30.97$
$4 \times 16.00 = 64.00$

$$6.34 \, mol \, (NH_4)_3PO_4 \times \frac{3 \, mol \, N}{1 \, mol \, (NH_4)_3PO_4} \times \frac{14.01 \, g}{1 \, mol} = \boxed{266 g \, N}$$

8. (6.8) In which of the following (_**mark all that apply**_) are empirical / molecular formulas correctly matched?
   A) CH_4 / C_2H_8   B) NO_2 / N_2O_2 **C) BF_3 / BF_3**   **D) CH_2O / $C_6H_{12}O_6$**   E) $MnCl_2$ / $MnCl_5$

_**22 pt**_

(6.8, 7 pt) Calculate the empirical formula of the phosphorus oxide compound that forms when 6.20 g of phosphorus reacts with 8.00 g of oxygen. ***Show all work for complete credit.***

[handwritten work:]

P_2O_5

$\dfrac{P}{6.20 g} \times \dfrac{O}{8.00 g}$

$6.20 | 30.97 = .200$

$\dfrac{0.200}{0.200} = 1$

$\times 2 = 2$

$\dfrac{8.00}{16.00} = 0.500$

$\dfrac{0.500}{0.200} = 2.5$

$= 5$

9. (6.8) What is the value of n (*the multiplier between the empirical formula and molecular formula*) when the empirical formula is C_3H_5 and the molecular mass is 205.4 g/mol?
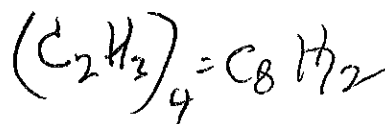
     A) 0.02   **B) 5**   C) 10   D) 140

[handwritten:] $12 \times 3 = 36$ $\dfrac{}{5} = 41$ $\dfrac{205.4}{41} = 5$

10. (6.8) What is the molecular formula of a compound given the molar mass of the compound is 108.2 gram and the empirical formula is C_2H_3?

     A) C_2H_3 B) C_4H_6 C) C_6H_9 **D) C_8H_{12}**   E) $C_{10}H_{15}$

[handwritten:] $2 \times 12 + 3 \times 1 = 27$ $\dfrac{108.2}{27} = 4$ $(C_2H_3)_4 = C_8H_{12}$

CHP

11. (7.1) Indicate the missing words in the following statement: "For an ordinary chemical reaction the mass of the products is ___**D**___ the mass of the reactants."

     A) usually more than   B) always less than   C) usually less than   **D) always equal to**

12. (7.1) Which of the following elements is represented by a diatomic molecule in a chemical equation?

     A) beryllium   B) boron   **C) chlorine**   D) krypton   E) phosphorous

13. (7.1) In a valid chemical equation ___**D**___ . *Which one is a correct statement?*
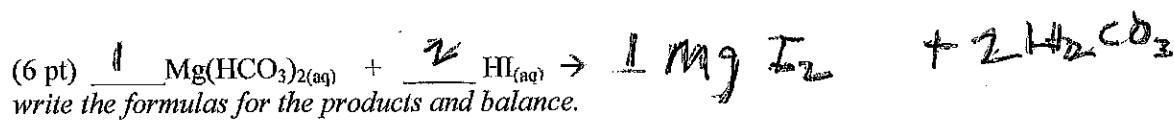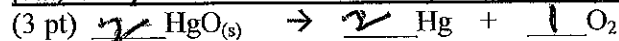
     A) only reactants and products that are solids or liquids are listed
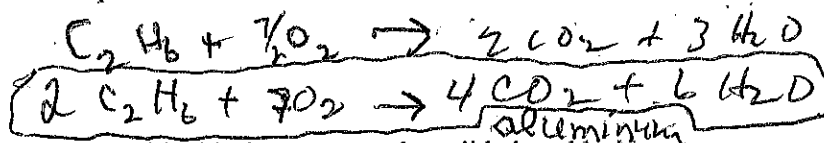   B) the number of products must equal the number of reactants
     C) the total number of molecules on each side of the equation must be equal
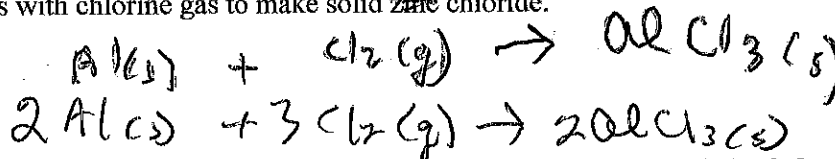   **D) the reactants always appear on the left-hand side of the equation**

(7.1) Complete and balance each of the following chemical equations

(3 pt) __2__ $HgO_{(s)}$ → __2__ Hg + __1__ O_2

(6 pt) __1__ $Mg(HCO_3)_{2(aq)}$ + __2__ $HI_{(aq)}$ → __1__ MgI_2 + __2__ H_2CO_3
write the formulas for the products and balance.

26 pt

(6 pt)   Write the balanced equation for the combustion of C_2H_6 .

$$C_2H_6 + \frac{7}{2}O_2 \rightarrow 2CO_2 + 3H_2O$$

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$$

(6 pt) Aluminum metal reacts with chlorine gas to make solid zinc chloride. aluminum

$$Al(s) + Cl_2(g) \rightarrow AlCl_3(s)$$

$$2Al(s) + 3Cl_2(g) \rightarrow 2AlCl_3(s)$$

(13.) Complete and balance the following equations. If no reaction occurs write NO REACTION.
   Hint: Remember to first write the correct formulas before trying to balance the equations.
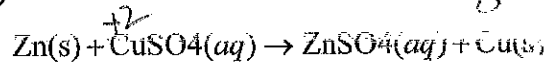
(4 pt) $BaCl_2(aq) + Na_2SO_4(aq) \rightarrow$ $BaSO_4(s) + 2NaCl(aq)$

(4 pt) $2NaC_2H_3O_2(aq) + CaSO_4(aq) \rightarrow$ $2Na_2SO_4(aq) + Ca(C_2H_3O_2)_2(aq)$ (NR)
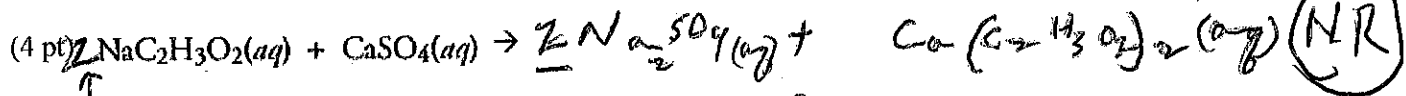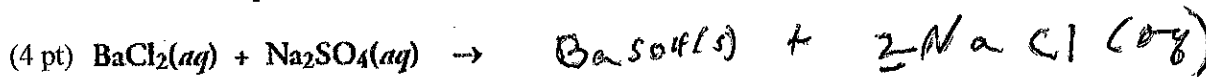
CHP 9

14. (9.1) When an atom gains an electron, the resulting particle is _____ **B** _____ AND

   A) oxidized   B) reduced   C) neither

15. (9.1) The oxidation number _____ **B** _____   A) increases   B) decreases   C) doesn't change

   Use this equation to answer the following questions: $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$

16. (9.1) In the above reaction, zinc is   A) oxidized   B) reduced   C) neither

17. (9.1) In the above reaction, copper is   A) oxidized   B) reduced   C) neither

18. (9.1) In the above reaction, sulfur is   A) oxidized   B) reduced   C) neither

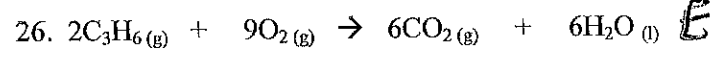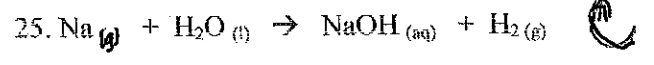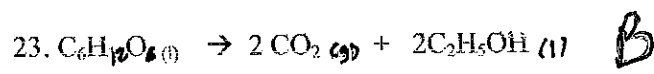19. (9.1) In the above reaction, oxygen is   A) oxidized   B) reduced   C) neither

20. (9.1) In the above reaction the reducing agent is   A) Zn   B) Cu   C) S   D) O

21. (9.1) In the above reaction the oxidizing agent is   A) Zn   B) Cu   C) S   D) O

22. (9.2) The oxidation numbers of Mg and O in MgO are: A) 0,0   B) +2,-2   C) +2,0   D) 0,-2

(9.3) Identify each of the following reactions (Question 23-27) according to these types:
   A) Synthesis or Combination reaction
   B) Decomposition reaction
   C) Single replacement reaction
   D) Double replacement reaction
   E) Combustion reaction

23. $C_6H_{12}O_6(l) \rightarrow 2CO_2(g) + 2C_2H_5OH(l)$ **B**

24. $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$ **A**

25. $Na(s) + H_2O(l) \rightarrow NaOH(aq) + H_2(g)$ **C**

26. $2C_3H_6(g) + 9O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l)$ **E**

27. $Al(NO_3)_3(aq) + 3NaOH(aq) \rightarrow Al(OH)_3(s) + 3NaNO_3(aq)$ **D**

48 28 pt

CHP 10

28. (10.1) Which one of the following conversion factors is not consistent with the equation

$$4NH_3 + 5 O_2 \longrightarrow 4NO + 6H_2O$$
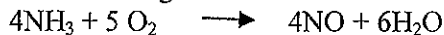
   A) (5 moles O_2/6 moles H_2O)
   B) (4 moles NO/5 moles O_2)
   C) (4 moles NH_3/5 moles H_2O)   *NOT correct*
   D) (4 moles NO/4 moles NH_3)

29. (10.2) Which of the following statements is true?
   A) The limiting reactant is completely consumed in a chemical reaction.
   B) The theoretical yield is the amount of product that can be made based on the amount of limiting reagent.
   C) The actual yield is the amount of product actually produced by a chemical reaction.
   D) All of the above are true statements.

30. (10.2) The theoretical yield of a reaction is 75.0 grams of product and the actual yield is 42.0 g. What is the percent yield?
   A) 1.79 %   B) 56.0 %   C) 33 %   D) 0.56 %   E) 179%

(10.1 & 10.2) Use the following equation and molar masses to do the calculations below. ***Show all work for full credit and use correct number of significant figures.***

$$Al(NO_3)_{3\ (aq)} + 3NaOH_{(aq)} \rightarrow Al(OH)_{3\ (s)} + 3NaNO_{3\ (aq)}$$

Molar masses:	213.01 g/mole	40.07 g/mole	78.00 g/mole	85.00 g/mole

A) (7 pt) Calculate the grams of aluminum hydroxide obtained from reaction between excess aluminum nitrate and 45.9 grams NaOH according to the balanced equation above:

$$?_g\ Al(OH)_3 = 45.9_g\ NaOH \times \frac{1\ mol\ NaOH}{40.07\ g\ NaOH} \times \frac{1\ mol\ Al(OH)_3}{3\ mol\ NaOH} \times \frac{78.00\ g\ Al(OH)_3}{1\ mol\ Al(OH)_3} =$$

$$\frac{45.9 \times 78.00}{40.07 \times 3}\ g\ Al(OH)_3 = \boxed{29.8_g\ Al(OH)_3}$$

B) (9 pt) Calculate maximum grams of aluminum hydroxide obtained from reaction between 65.00 grams aluminum nitrate and 45.9 grams NaOH according to the balanced equation above: *HINT: To make your calculation shorter, use your answer from Part A (above) because the quantity of NaOH is the same.*

$$45.9\ g\ NaOH \rightarrow \underline{29.8\ g\ Al(OH)_3}$$

$$?\ Al(OH)_3 = 65.00\ g\ Al(NO_3)_3 \times \frac{1\ mol\ Al(NO_3)_3}{213.01\ g\ Al(NO_3)_3} \times \frac{1\ mol\ Al(OH)_3}{1\ mol\ Al(NO_3)_3} \times \frac{78.00\ g\ Al(OH)_3}{1\ mol\ Al(OH)_3} =$$

$$\frac{65.00 \times 78.00}{213.01}\ g\ Al(OH)_3 = \underline{23.80\ g\ Al(OH)_3}\ smallest$$

C) (2 pt) Which reactant is the limiting reactant?   Al(NO_3)_3 limiting

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

excess: $45.9\ g\ NaOH - \left(\frac{23.80}{29.8}\right) \cdot 45.9 = \boxed{9.24\ g\ excess\ NaOH}$

OR

24 pt + 4 bonus $\left[29.8_g\ Al(OH)_3 - 23.80\ g\ Al(OH)_3\right] \times \frac{1\ mol\ Al(OH)_3}{78.00\ g\ Al(OH)_3} \times \frac{3\ mol\ NaOH}{1\ mol\ Al(OH)_3} \times \frac{40.07\ g}{1\ mol} =$

(10.3, 12 pt) The following data was obtained from titration of 15.00 mL HCl with 0.51423 M NaOH to determine the molarity of HCl. Complete the calculations indicated using the following data. *Show all work and use the correct number of significant figures.*

	TRIAL 1	Calculations
Initial NaOH level in buret	0.00 mL	
Final NaOH level in buret (End point)	30.55 mL	
(2 pt) Volume of NaOH used in mL *(Show calculation)*	30.55	
(2 pt) Volume of NaOH used in L *(Show calculation)*	.03055	
(2 pt) Moles of NaOH used	.015771	
(2 pt) Moles of HCl neutralized	.01571	
(2 pt) Volume of HCl in L	.015	
(2 pt) Molarity of HCl	1.047 M	

Calculations:

$$30.55 - 0.00 = 30.55 \text{ mL}$$

$$30.55 \text{ mL} \times \frac{1 L}{1000 \text{ mL}} = 0.03055 L$$

$$0.03055 L \times 0.51423 \frac{mol}{L} = 0.01571 \text{ mol}$$

$$0.01571 \frac{mol}{NaOH} \times \frac{1 \text{ mol}}{1 \text{ mol}} = 0.01571 \text{ mol } HCl$$

$$15.00 \text{ mL} \times \frac{1 L}{1000 \text{ mL}} = 0.01500 L$$

$$\frac{0.01571 \text{ mol}}{0.01500 L} = 1.047 \frac{mol}{L}$$