

Second Semester Final Exam Study Guide

Unit 6

Know how to name compounds and write chemical formulas.

a) How do you determine if a compound is ionic or molecular?

Ionic: between a cation and an anion (metal and non-metal, metal and polyatomic, polyatomic and polyatomic)

Molecular: between two nonmetals

b) What do you need to keep in mind when writing chemical formulas for ionic compounds?

Writing chemical formulas for ionic – you need to make sure you criss-cross charges to create neutral compounds

c) What do you need to keep in mind when naming molecular compounds?

Naming molecular compounds – you need to identify the number of each atom in the compound and use prefixes for both the first and second element (first element does not use mono-)

d) When a polyatomic ion is involved, what type of bond is occurring?

Compounds that involve polyatomic IONS are always ionic compounds.

e) Write the chemical formulas for the following compounds.

You should identify if they are ionic or molecular first

copper (I) bromide - **Ionic: CuBr**

ammonium sulfate - **Ionic: (NH₄)₂SO₄**

sulfur trichloride - **Molecular: SCl₃**

magnesium oxide - **Ionic: MgO**

diphosphorous trioxide - **Molecular: P₂O₃**

manganese (III) cyanide - **Ionic: Mn(CN)₃**

f) Write the names for the following compounds. ***You should identify if they are ionic or molecular first***

AlF₃ - **Ionic: Aluminum Fluoride**

NO₃ - **Molecular: Nitrogen trioxide**

Sr(NO₂)₂ - **Ionic: Strontium nitrite**

Fe(ClO₄)₃ - **Ionic: Iron (III) perchlorate**

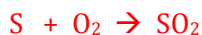
Li(OH) - **Ionic: Lithium hydroxide**

Cl₅ - **Molecular: Carbon pentiodide**

Know how to translate chemical reactions, balance equations, and predict chemical reactions.

Write the following chemical reactions into chemical formulas and a full chemical equation.

a) Sulfur burns in oxygen gas to produce sulfur dioxide.



b) Sulfuric acid (H₂SO₄) and sodium hydroxide reaction together for form sodium sulfate and water.



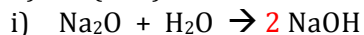
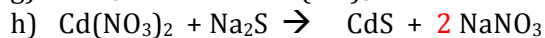
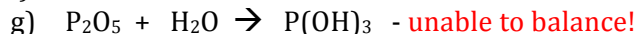
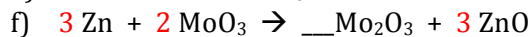
c) Sodium oxide reacts with water to produce sodium hydroxide.



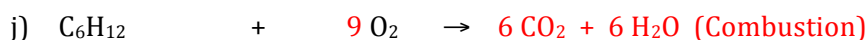
d) Zinc sulfide reacts with oxygen gas to produce zinc oxide and sulfur dioxide.

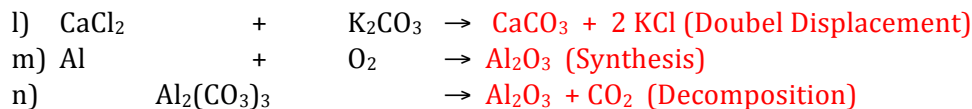


Balance the following chemical equations:

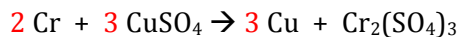


Identify the type of equation that will occur using the reactants. Then predict the products and balance the equation.





Know how to use a balanced equation and a mole map to convert from one substance to another (stoichiometry).

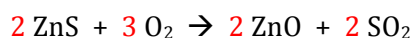


a) How many grams of copper would be produced from 49.48 grams of chromium?

$$\frac{49.48 \text{ grams Cr}}{1} \times \frac{1 \text{ mol Cr}}{52.0 \text{ grams}} \times \frac{3 \text{ mol Cu}}{2 \text{ mole Cr}} \times \frac{63.55 \text{ grams Cu}}{1 \text{ mol Cu}} = 82.46 \text{ grams Cu}$$

b) How many grams of chromium are required to react with 125 mL of CuSO_4 ?

$$\frac{125 \text{ mL of CuSO}_4}{1} \times \frac{1 \text{ L}}{1000 \text{ ml}} \times \frac{1 \text{ mol CuSO}_4}{22.4 \text{ L}} \times \frac{2 \text{ mol Cr}}{3 \text{ mole CuSO}_4} \times \frac{52.0 \text{ grams Cr}}{1 \text{ mol Cr}} = 0.1934 \text{ grams Cr}$$



c) How many liters of sulfur dioxide are created when 12.6 L of oxygen gas reacts with zinc sulfide?

$$\frac{12.6 \text{ L O}_2}{1} \times \frac{1 \text{ mol O}_2}{22.4 \text{ L}} \times \frac{2 \text{ mol SO}_2}{3 \text{ mole O}_2} \times \frac{22.4 \text{ L SO}_2}{1 \text{ mol SO}_2} = 8.4 \text{ L of SO}_2$$

d) If 3.45×10^{18} atoms of zinc sulfide react with oxygen gas, how many moles of zinc oxide are produced?

$$\frac{3.45 \times 10^{18} \text{ atoms ZnS}}{1} \times \frac{1 \text{ mol ZnS}}{6.022 \times 10^{23} \text{ atoms ZnS}} \times \frac{2 \text{ mol ZnO}}{2 \text{ mole ZnS}} = 0.57 \times 10^{-5} \text{ atoms} = 5.7 \times 10^{-6} \text{ atoms}$$

e) When 54 grams of oxygen gas react with zinc sulfide, how many atoms of sulfur dioxide are produced?

$$\frac{54 \text{ grams O}_2}{1} \times \frac{1 \text{ mol O}_2}{32.0 \text{ grams O}_2} \times \frac{2 \text{ mol SO}_2}{3 \text{ mole O}_2} \times \frac{6.022 \times 10^{23} \text{ atoms SO}_2}{1 \text{ mol SO}_2} = 6.77 \times 10^{23} \text{ atoms SO}_2$$



f) What is the mole ratio between NaClO_3 and NaCl ?



g) 12 moles of NaClO_3 will produce how many grams of O_2 ?

$$\frac{12 \text{ moles NaClO}_3}{1} \times \frac{3 \text{ mol O}_2}{2 \text{ mole NaClO}_3} \times \frac{32.0 \text{ grams O}_2}{1 \text{ mol O}_2} = 576 \text{ grams O}_2$$

h) If you have 24.7 grams NaClO_3 how many grams of NaCl will be produced?

$$\frac{24.7 \text{ grams NaClO}_3}{1} \times \frac{1 \text{ mol NaClO}_3}{106.44 \text{ grams NaClO}_3} \times \frac{2 \text{ mol NaCl}}{2 \text{ mole NaClO}_3} \times \frac{58.44 \text{ grams NaCl}}{1 \text{ mol NaCl}} = 13.56 \text{ grams NaCl}$$

i) If you have 10 grams NaClO_3 , how many liters of oxygen gas will be produced?

$$\frac{10 \text{ grams NaClO}_3}{1} \times \frac{1 \text{ mol NaClO}_3}{106.44 \text{ grams NaClO}_3} \times \frac{3 \text{ mol O}_2}{2 \text{ mole NaClO}_3} \times \frac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} = 3.16 \text{ L O}_2$$

Know how to determine limiting and excess reactants.



- a) 6.45 grams of zinc sulfide reacts with 9.20 grams of oxygen gas to produce zinc oxide. How many grams of ZnO are formed?

$$\frac{6.45 \text{ grams ZnS}}{1} \times \frac{1 \text{ mol ZnS}}{97.46 \text{ grams ZnS}} \times \frac{2 \text{ mol ZnO}}{2 \text{ mole ZnS}} \times \frac{81.39 \text{ grams NaCl}}{1 \text{ mol ZnO}} = 5.39 \text{ grams NaCl}$$

$$\frac{9.20 \text{ grams O}_2}{1} \times \frac{1 \text{ mol O}_2}{32.0 \text{ grams O}_2} \times \frac{2 \text{ mol ZnO}}{3 \text{ mole O}_2} \times \frac{81.39 \text{ grams NaCl}}{1 \text{ mol ZnO}} = 15.6 \text{ grams NaCl}$$

- b) What is the limiting and excess reactant?

The limiting reactant is zinc sulfide (ZnS).

- c) The actual yield of this reaction is 12.5 grams. What is the percent yield of this reaction?

$$\frac{5.39 \text{ grams}}{12.5 \text{ grams}} \times 100 = 43.12\% \text{ yield}$$

Know how to calculate the percentage composition of a substance.

- a) What is the percentage composition of nitrogen in the compound HNO₃?

$$\text{H: } 1 \times 1.01 = 1.01 \text{ grams}$$

$$\frac{1.01 \text{ grams}}{63.02 \text{ grams}} \times 100 = 1.6\% \text{ hydrogen}$$

$$\text{N: } 1 \times 14.01 = 14.01 \text{ grams}$$

$$\frac{14.01 \text{ grams}}{63.02 \text{ grams}} \times 100 = 22.2\% \text{ nitrogen}$$

$$\text{O: } 3 \times 16.0 = 48 \text{ grams}$$

$$\frac{48 \text{ grams}}{63.02 \text{ grams}} \times 100 = 76.2\% \text{ oxygen}$$

$$\text{HNO}_3 = 63.02 \text{ grams total}$$

- b) An 8.20 grams piece of Mg combines completely with 5.40 grams of O to form a compound. What is the percentage composition on Mg and O in this compound?

$$8.20 \text{ grams} + 5.40 \text{ grams} = 13.6 \text{ grams}$$

$$\frac{8.20 \text{ grams}}{13.6 \text{ grams}} \times 100 = 60.3\% \text{ Mg}$$

$$\frac{5.40 \text{ grams}}{13.6 \text{ grams}} \times 100 = 39.7\% \text{ O}$$

- c) 9.03 grams of Mg combines completely with 3.48 grams of N to form a compound. What is the percentage composition of Mg and N in the compound? **Hint: write out compound and find molar mass**

$$\text{Mg}_2\text{N}_3 = 90.65 \text{ grams}$$

$$\text{Mg} = 48.62 \text{ grams}$$

$$\frac{48.62 \text{ grams}}{90.65 \text{ grams}} \times 100 = 53.6\% \text{ Mg}$$

$$\text{N} = 42.03 \text{ grams}$$

$$\frac{42.03 \text{ grams}}{90.65 \text{ grams}} \times 100 = 46.4\% \text{ N}$$