

# Second Semester Final Exam Study Guide

## UNIT 6 - STOICHIOMETRY

Know how to name compounds and write chemical formulas.

- How do you determine if a compound is ionic or molecular?
- What do you need to keep in mind when writing chemical formulas for ionic compounds?
- What do you need to keep in mind when naming molecular compounds?
- When a polyatomic ion is involved, what type of bond is occurring?
- Write the chemical formulas for the following compounds.

\*You should identify if they are ionic or molecular first\*

copper (I) bromide	magnesium oxide
ammonium sulfate	diphosphorus trioxide
sulfur trichloride	manganese (III) cyanide

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

$\text{AlF}_3$	$\text{Fe}(\text{ClO}_4)_3$
$\text{NO}_3$	$\text{Li}(\text{OH})$
$\text{Sr}(\text{NO}_2)_2$	$\text{Cl}_5$

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.

- Sulfur burns in oxygen gas to produce sulfur dioxide.
- Sulfuric acid ( $\text{H}_2\text{SO}_4$ ) and sodium hydroxide reaction together for form sodium sulfate and water.
- Sodium oxide reacts with water to produce sodium hydroxide.
- Zinc sulfide reacts with oxygen gas to produce zinc oxide and sulfur dioxide.

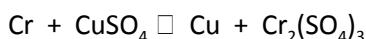
Balance the following chemical equations:

- $\_\_\_ \text{N}_2 + \_\_\_ \text{H}_2 \rightarrow \_\_\_ \text{NH}_3$
- $\_\_\_ \text{Zn} + \_\_\_ \text{MoO}_3 \rightarrow \_\_\_ \text{Mo}_2\text{O}_3 + \_\_\_ \text{ZnO}$
- $\_\_\_ \text{P}_2\text{O}_5 + \_\_\_ \text{H}_2\text{O} \rightarrow \_\_\_ \text{P}(\text{OH})_3$
- $\_\_\_ \text{Cd}(\text{NO}_3)_2 + \_\_\_ \text{Na}_2\text{S} \rightarrow \_\_\_ \text{CdS} + \_\_\_ \text{NaNO}_3$
- $\_\_\_ \text{Na}_2\text{O} + \_\_\_ \text{H}_2\text{O} \rightarrow \_\_\_ \text{NaOH}$

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

- $\text{C}_6\text{H}_{12} + \text{O}_2 \rightarrow$
- $\text{CuCl}_2 + \text{H}_2\text{S} \rightarrow$
- $\text{CaCl}_2 + \text{K}_2\text{CO}_3 \rightarrow$
- $\text{Al} + \text{O}_2 \rightarrow$
- $\text{Al}_2(\text{CO}_3)_3 \rightarrow$

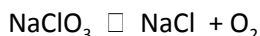
Balance the equations and use your mole map to convert from one substance to another (stoichiometry).



- How many grams of copper would be produced from 49.48 grams of chromium?
- How many grams of chromium are required to react with 125 mL of  $\text{CuSO}_4$ ?



- How many liters of sulfur dioxide are created when 12.6 L of oxygen gas reacts with zinc sulfide?
- If  $3.45 \times 10^{18}$  atoms of zinc sulfide react with oxygen gas, much many moles of zinc oxide are produced?
- When 54 grams of oxygen gas react with zinc sulfide, how many atoms of sulfur dioxide are produced?



- What is the mole ratio between  $\text{NaClO}_3$  and  $\text{NaCl}$ ?
- 12 moles of  $\text{NaClO}_3$  will produce how many grams of  $\text{O}_2$ ?
- If you have 24.7 grams  $\text{NaClO}_3$  how many grams of  $\text{NaCl}$  will be produced?

- i) If you have 10 grams  $\text{NaClO}_3$ , how many liters of oxygen gas will be produced?

**Know how to determine limiting and excess reactants.**



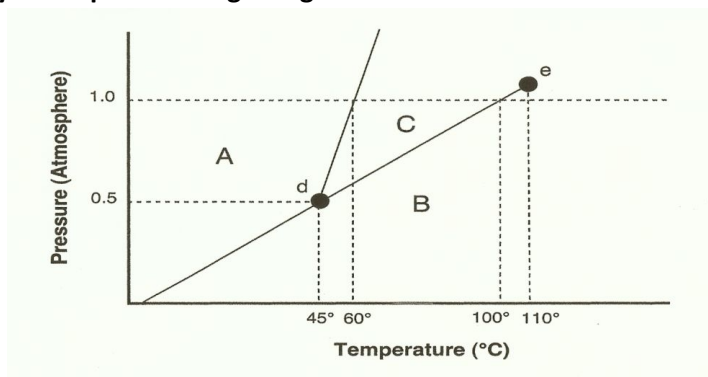
- a) 6.45 grams of zinc sulfide reacts with 9.20 grams of oxygen gas to produce zinc oxide. How many grams of ZnO are formed?  
 b) What is the limiting and excess reactant?  
 c) The actual yield of this reaction is 12.5 grams. What is the percent yield of this reaction?

**Know how to calculate the percentage composition of a substance.**

- a) What is the percentage composition of nitrogen in the compound  $\text{HNO}_3$ ?  
 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? *\*Hint: write out compound and find molar mass\**  
 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\**

## UNIT 7 - GASES

**Understand and be able to analyze the phase change diagram.**



- a) What phase change is happening when a substance goes from area A to C?  
 b) What state of matter is the substance in area A? Area B? Area C?  
 c) At standard pressure (1.0 atm) what temperature is need for the substance to vaporize?  
 d) At 100 °C and a pressure below standard, what phase is this substance in?  
 e) If that substance cooled from 100°C to 35°C, what phase change(s) would occur? Are these endothermic or exothermic?

**Know how to convert between temperatures and pressures.**

Convert the following pressures:

- a) Convert 475 mm Hg into atm.  
 b) The pressure of a tire is measured as 29.4 psi. What is this pressure in torr?  
 c) How is 2 atm expressed in kPa?

Convert the following temperatures:

- d) 48°C to Kelvin  
 e) 321.5 Kelvin to °C

**Know the basics about gases.**

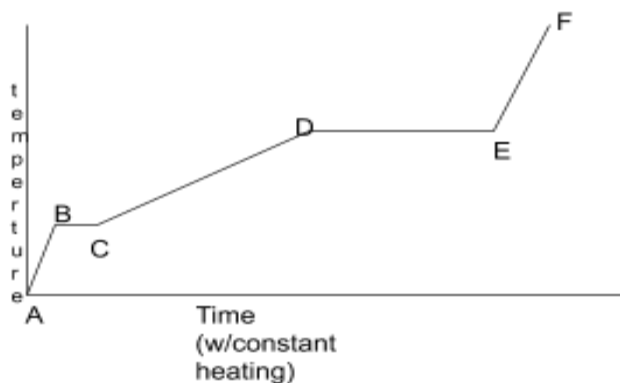
- a) What are the common characteristics of gases?  
 b) What is STP? What is the temperature and pressure?  
 c) Gases \_\_\_\_\_ to fill their containers.  
 d) Gases have greater/less density to their equivalent liquid or solid.  
 e) Gas particles, compared to liquid, are moving faster/slower.  
 f) A collision of gas particles with container walls is known as the \_\_\_\_\_ of the gas.  
 g) At the same temperature, small molecules move faster/slower than large molecules.

### Know how to identify the gas law and solve the problem.

- A sample of oxygen occupies a volume of 250.0 mL at 740.0 torr. What volume will it occupy at 2.4 atm?
- A gas has a pressure of 6.58 kPa at 540 K. What will the pressure be at 210 K if the volume remains constant?
- A gas with a volume of 4.0 L at 90.0 kPa expands until the pressure drops to 20.0 kPa. What is the new volume if the temperature remains constant?
- A gas with a volume of  $3.00 \times 10^2$  mL at  $150^\circ\text{C}$  and 1.7 atm is heated until its volume is  $6.00 \times 10^3$  mL. What is the new temperature of the gas if the pressure decreased to 1.0 atm during the heating?
- Calculate the quantity of gas, in moles, if 6.38 L is occupied at  $35^\circ\text{C}$  and 955 mm Hg.
- What is the volume of a gas, in liters, if 2.95 moles is at 0.76 atm and  $52^\circ\text{C}$ ?
- Compare the rate of effusion of sulfur dioxide with that of chlorine gas at the same temperature and pressure.
- What is the total pressure of a gas mixture if it contains 20 torr of HCl gas and 730 torr of Ne gas?

## UNIT 8 - THERMOCHEMISTRY

### Understand and be able to use a heating curve diagram.



- Label the line with the following: solid, liquid, vapor, melting, freezing, condensation, vaporization
- Why are the slopes in the graph different?
- Why do the plateaus have different lengths?
- When would you use a Q equation? What about a q equation?
- How would you determine if a phase change is endothermic and exothermic?

### Be able to identify when to use Q and q equations and how to calculate molar enthalpy, energy, and specific heat.

- How much heat is lost when a 640 gram piece of copper cools from  $375^\circ\text{C}$  to  $26^\circ\text{C}$ ? The specific heat of copper is  $0.385 \text{ J/g}^\circ\text{C}$ .
- 8750 J of heat are applied to a 170 grams sample of metal, causing a  $56^\circ\text{C}$  increase in its temperature. What is the specific heat of the metal?
- How many kilojoules of heat energy are required to heat all the aluminum in a roll of aluminum foil, 500 grams, from room temperature,  $22^\circ\text{C}$ , to the temperature of a hot oven,  $250^\circ\text{C}$ . Aluminum has a specific heat of  $0.902 \text{ J/g}^\circ\text{C}$ .
- Calculate the quantity of heat gained or lost when 3.50 moles of water freezes at  $0^\circ\text{C}$ .
- Calculate the energy gained or lost when 100 grams of water vaporizes from  $35^\circ\text{C}$  to  $120^\circ\text{C}$ .
- Calculate the molar enthalpy of condensation for ammonia when 50.0 grams of  $\text{NH}_3$  gas turns into a liquid at its boiling point when 68,500 Joules of energy are released in the process. Is this endothermic or exothermic?  
$$\text{CH}_4(\text{g}) + 2 \text{O}_2(\text{g}) \rightarrow 2 \text{H}_2\text{O}(\text{g}) + \text{CO}_2(\text{g}) \quad \Delta H = +802.7 \text{ KJ}$$
- Using the above equation, calculate the heat evolved when 3.05 grams of water is produced in the reaction.

## UNIT 9 - SOLUTIONS, ACIDS & BASES

### Be able to identify and solve for molarity, molality, and dilution calculations.

- How many grams of  $\text{AlCl}_3$  are required to make a 2.25 m solution in 30.0 grams of water?
- What volume of 12M HCl is needed to prepare 250 mL of 0.20 M HCl?
- What is the molality of 18 g NaCl in 200 g of  $\text{H}_2\text{O}$ ?
- Calculate the molarity of a 15 g NaCl in 250 ml solution.

### Know the fundamentals of acids and bases.

- List properties of acids.
- List properties of bases.
- What ions do acids produce? What ions do bases produce?
- What is the pH scale measuring?
- What happens when an acid and base combine? What's produced?