

# General Chemistry 2nd Semester Final Review

Name: \_\_\_\_\_

## PART I : FREE RESPONSE PROBLEMS

### Unit 6/7 - Chemical Formulas and Reactions

1. Write the general equation for each type of reaction. Give an example of each.

Reaction Type	General Equation	Example
Synthesis/Combination		
		$2K + CuCl_2 \rightarrow 2KCl + Cu$
	$AB \rightarrow A + B$	
Combustion		
Double Replacement		

2. Write a balanced equation for the following reactions:

a. iron metal + copper(II) Sulfate  $\Rightarrow$  Iron(II)sulfate and copper metal

\_\_\_\_\_ (type).

b. chlorine gas and aluminum bromide yields aluminum chloride and bromine gas.

\_\_\_\_\_ (type)

3. Predict the products of the reaction and balance the equation.

a. Butane (C<sub>4</sub>H<sub>10</sub>) + oxygen  $\Rightarrow$

b. zinc metal + copper (II) nitrate  $\Rightarrow$

4. Circle all of the formulas that would be empirical, put a box around those that are molecular formulas?



5. Write the empirical formula for any of the above compounds that are molecular formulas.

6. Determine the molecular formula of a compound with an empirical formula of CH that has a molar mass of 78.11 g/mol.
7. A compound contains 36.48% Na, 25.41% S and 38.11% O. Find its empirical formula.
8. Determine the percent composition of **each** element in  $\text{Mg}_3(\text{SO}_4)_2$ .
9. Predict the products and balance the following equations
- a.  $\text{Na} + \text{CaCl}_2 \rightarrow$
  - b.  $\text{LiF} + \text{Ba} \rightarrow$
  - c.  $\text{FeCO}_3 + \text{LiNO}_3 \rightarrow$
  - d.  $\text{C}_4\text{H}_8 + \text{O}_2 \rightarrow$
  - e.  $\text{Al} + \text{O}_2 \rightarrow$
  - f. Look at the activity series and determine if reaction in a, b and e will occur.
  - g. How do you know if a single replacement reaction will occur by looking at the activity series?

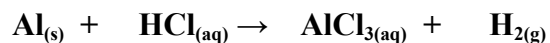
### Unit 8 Stoichiometry

1. Balance the reaction below and answer questions below

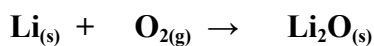


- a. How many grams of  $\text{O}_2$  is produced if 2.50 g of  $\text{KClO}_3$  is completely decomposed by heating?
- b. How many grams of  $\text{KCl}$  is produced if 2.50 g of  $\text{KClO}_3$  decomposes?
- c. How many moles of  $\text{KClO}_3$  is used to produce 10 moles of  $\text{O}_2$ ?

2. a. In the following equation, which is the **limiting** reactant if 2.6 moles of aluminum are reacted with 5.2 moles of HCl? Balance the equation!

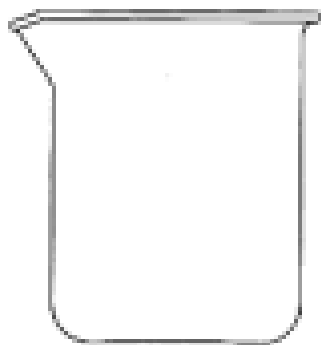


- a. Determine the limiting reactant (you can compare moles).
- b. How much excess reactant is left over?
3. a. Calculate the mass of lithium oxide formed when 4.2 grams of lithium reacts with oxygen.



4. What is the maximum amount of  $\text{BaSO}_4$  that can be produced from a solution containing 2.84 grams of  $\text{Na}_2\text{SO}_4$  and 5.0 grams of  $\text{BaCl}_2$ ?
- a. Write the balanced equation including state symbols (think solutions!)
- b. Determine the number of moles of each reactant and compare to determine the limiting reactant.
- d. Use your limiting reactant to determine the mass of barium sulfate produced.

e. Draw a model representing the reaction (think about what the state symbols mean!).



Reactants



Products

### **Unit 9 Solutions**

1. Calculate molarity for the following problems:

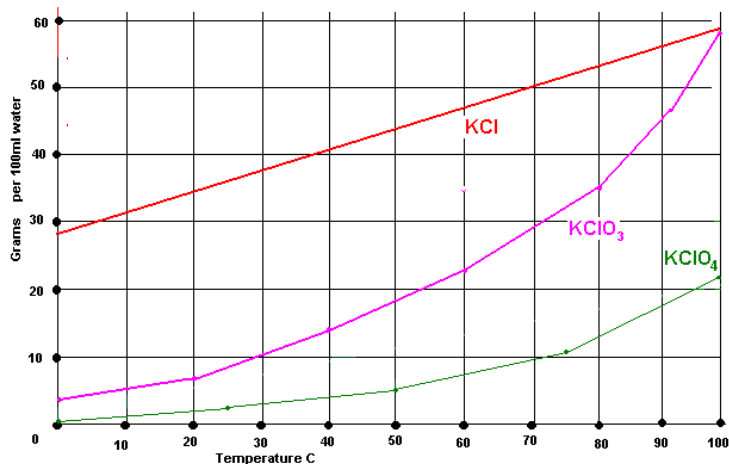
a. 57 g  $\text{Al}_2(\text{SO}_4)_3$  in 500 mL

b. 45 g  $\text{C}_6\text{H}_{12}\text{O}_6$  in 500 mL

2. What mass of sucrose  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ , is needed to make 300 mL of 0.50 M solution?

3. What volume of 1.25 M HCl is required to prepare 180 mL of 0.500 M HCl solution?

Solubility Curve of Different Salts



Using the graph above, answer the following questions:

4. How many grams of KCl can dissolve in 100mL of water at 70°C? \_\_\_\_\_
5. If there is 10 grams of KClO<sub>4</sub> dissolved in 100mL of water at 40°C is the solution saturated, unsaturated or supersaturated? \_\_\_\_\_
6. A solution of KCl at 85° C contains 50g of dissolved solute in 100 cm<sup>3</sup> water. The solution is allowed to cool. At what new temperature would crystals begin to start forming? \_\_\_\_\_
7. How do gases and solids differ in solubility when raising or lowering the temperature of the solution?
8. What does the term “like dissolves like” refer to?
9. Which of the following would dissolve in water?  
CCl<sub>4</sub>                                      NH<sub>3</sub>                                      LiNO<sub>3</sub>
10. What do you need to look at to determine the solubility of an ionic compound? \_\_\_\_\_

11. Determine if the following substances will be soluble (aq) or insoluble (s) in water:

$\text{KNO}_3$                        $(\text{NH}_4)_2\text{CO}_3$                        $\text{LiOH}$                        $\text{CuSO}_4$

$\text{PbSO}_4$                        $\text{CaCO}_3$                        $\text{MgS}$                        $\text{AgCl}$

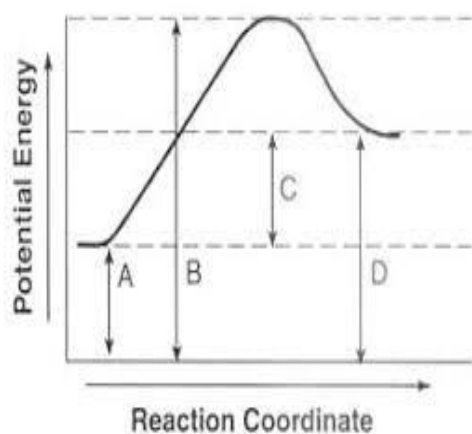
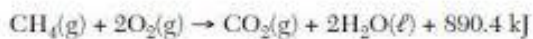
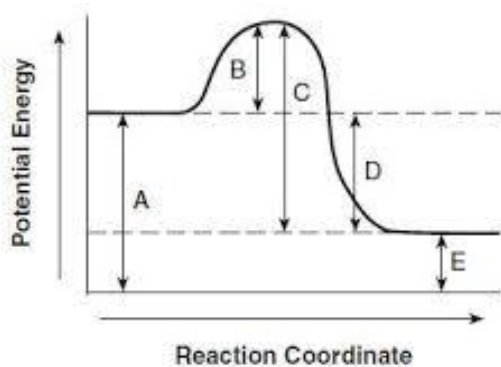
$\text{NaF}$                        $\text{Zn}(\text{OH})_2$                        $\text{BaSO}_4$                        $\text{Ca}_3(\text{PO}_4)_2$

### Unit 10 Thermochemistry

1. Carbon dioxide and water react to form methane ( $\text{CH}_4$ ) and Oxygen gas. The enthalpy of the reaction is +890.8 kJ.

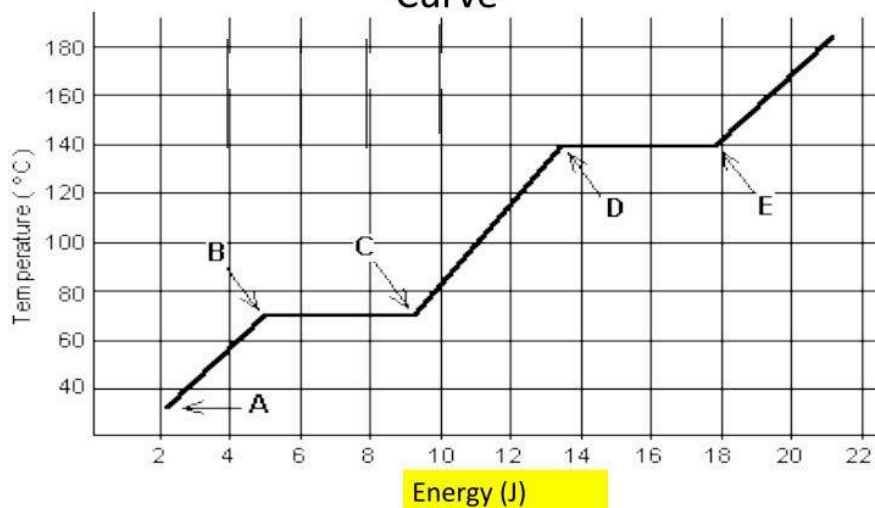
- Write the thermochemical equation (includes the energy).
- How much energy was absorbed when 4.5mol of carbon dioxide reacts?
- How much energy is needed to form 5.20 g of methane?

2. Label the following potential energy diagrams



### 3. Draw and label the Phase Change Diagram

Freezing and Boiling Point Graph  
aka Phase Change Diagram or Heating/Cooling  
Curve



4. How much energy would 45.2g of water absorb as it is heated from 22.0°C to 50.0°C? (Remember that the specific heat of water is 4.18J/g°C.)

Determine the specific heat capacity of a substance if a 35.0g sample absorbs 96J of energy as it was heated from 293K to 313K.

### Unit 11 Behavior of Gases

1. Determine the volume when the pressure of 359 mL of O<sub>2</sub> at 82.0 kPa is increased to 101.3 kPa. What gas law did you use to solve the problem?
2. Determine the new volume of 950 mL at 19°C if the temperature is reduced to standard temperature. What gas law did you use to solve the problem?
3. A gas in a container has a pressure of 150 kPa at 35°C. What is the pressure when the temperature is -120°C? What gas law did you use to solve the problem?

4. Correct the volume of 101 mL at 27°C and 90.9 kPa to STP. What gas law did you use to solve the problem?

5. How many moles of gas will occupy a 252 mL flask at -25.0°C and 68.7 kPa pressure? What gas law did you use to solve the problem?

6. If 22.0g of aluminum reacted with excess acid, how much hydrogen was produced at STP?



**Unit 12 Acids and Bases** (seniors stop here)

1. List the properties of acids and bases.

2. List the six acids and their respective names that we've asked you to memorize.

3. The  $\text{H}^+/\text{H}_3\text{O}^+$  concentration of a solution is  $1.23 \times 10^{-10}$  mol/L. What is the pH?

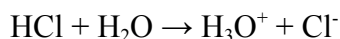
4. The pH of a solution is 6.5. Find the  $[\text{H}^+]$  for this solution.

5. What is the pH of a solution if the  $[\text{OH}^-]$  is  $4.7 \times 10^{-11}$  mol/L?

6. What is the  $[\text{OH}^-]$  concentration of a solution if the pH is 3.9?

7. Identify the acid, conj acid, base and conj base in this reaction.





8. What can you use to detect pH?

9. (Fill in the blanks)

a. in a neutral soln the [      ] = [      ]

b. in an acidic soln the [      ] > [      ]

c. in a basic soln the [      ] < [      ]

10. Write complete balanced equations for these neutralization reactions:

a.  $\text{H}_2\text{SO}_4 + \text{KOH} \rightarrow$

b.  $\text{HCl} + \text{Ba}(\text{OH})_2 \rightarrow$

c.  $\text{H}_3\text{PO}_4 + \text{Ca}(\text{OH})_2 \rightarrow$

11. What is the molarity of sodium hydroxide if 20.0 mL of the solution is neutralized by 28.0 mL of 1.00 M HCl

12. What is the molarity of sodium hydroxide if 15.0 mL of the solution is neutralized by 29.0 mL of 1.00 M  $\text{H}_3\text{PO}_4$ ?

## **Part II: Vocabulary Review. Please match the word with the appropriate definition.**

*NOTE: You might not use all of the answers. Some choices could be used more than once*

### **Unit 5 - Bonding**

- |                                  |  |
|----------------------------------|--|
| _____ 1. Ionic bond              | a. electrons are shared equally                    |
| _____ 2. Covalent bond           | b. shares 2 electrons                              |
| _____ 3. polar covalent          | c. overlapping of p orbitals                       |
| _____ 4. nonpolar covalent       | d. more than 1 way of drawing Lewis Structure      |
| _____ 5. sigma bond              | e. metal transfers electron(s) to nonmetal         |
| _____ 6. pi bond                 | f. sharing 4 or 6 electrons to complete octets     |
| _____ 7. resonance structures    | g. atoms are surrounded by 8 valence electrons     |
| _____ 8. multiple covalent bonds | h. nonmetal shares electrons with another nonmetal |
| _____ 9. octet rule              | i. unequal sharing of electrons                    |

## Unit 8 - Stoichiometry

- |                             |   |
|-----------------------------|---|
| _____ 1. Reaction Stoich    | a. ratio of actual to theoretical yield x 100                   |
| _____ 2. Theoretical Yield  | b. mass relationships of elements in compounds                  |
| _____ 3. Actual Yield       | c. maximum amount of product produced                           |
| _____ 4. Limiting reagent   | d. conversion factor determined using balanced equation         |
| _____ 5. Excess Reagent     | e. amount of product measured in the lab                        |
| _____ 6. Mole Ratio         | f. reactant not totally used up in the lab                      |
| _____ 7. Molar Mass         | g. involves mass relationships in a chemical reaction           |
| _____ 8. Percentage Yield   | h. combined mass of all the atoms in a compound.                |
| _____ 9. Composition Stoich | i. this determines the maximum amount of product that will form |

## Unit 9 - Solutions

- |                                |   |
|--------------------------------|---|
| _____ 1. melting point         | a. A substances resistance to flow <b>(na)</b>                                    |
| _____ 2. solvent               | b. The substance being dissolved  |
| _____ 3. homogeneous mixture   | c. Solutions that have solutes that settle out, more than one phase               |
| _____ 4. heterogeneous mixture | d. Substances that can interfere with H bonds, i.e. soap <b>(na)</b>              |
| _____ 5. solute                | e. Temp at which a liquid turns to a vapor/gas                                    |
| _____ 6. suspension            | f. A substance that contain reflective particles that display the Tyndall effect. |
| _na_ 7. hydrogen bonds         | g. Intermolecular forces that cause surface tension <b>(na)</b>                   |
| _____ 8. Tyndall effect        | h. The substance doing the dissolving   |
| _____ 9. colloid               | i. Causes adhesion and cohesion <b>(na)</b>                                       |
| _____ 10. boiling point        | j. solid turns to liquid  |
| _na_ 11. surfactant            | k. beam of light indicates mixture type   |
| _na_ 12. viscosity             | l. homogeneous mixture that shows no beam.  |
| _____ 13. solution             | m. uniform in composition, hard to separate.                                      |
| _na_ 14. surface tension       | n. not uniform in composition, easy to separate                                   |

## More Solutions

- |                         |  |
|-------------------------|--|
| _____ 1. saturated      | a. a solid that falls out of solution when two aqueous solutions are mixed together                    |
| _____ 2. concentrated   | b. A solution that holds more solute that it theoretically hold at a given temp                        |
| _____ 3. supersaturated | c. Amount of solute that dissolves in a solvent at a given temperature to produce a saturated solution |
| _____ 4. precipitate    | d. Contains less solute that a saturated solution  |
| _____ 5. unsaturated    | e. Maximum amount of solvent dissolved in a solute at a certain temperature                            |
| _____ 6. solubility     | e. Maximum amount of solvent dissolved in a solute at a certain temperature                            |
| _____ 7. dilute         | f. small amount of solute in large amount of solvent   |
| _____ 8. molarity       | g. Moles per liter, represents solution concentration  |
|                         | h. large amount of solute in small amount of solvent   |

## Chapter Thermochemistry

- |                                 |  |
|---------------------------------|--|
| _____ 1. Activation energy      | a. energy is released, beaker gets hot             |
| _____ 2. Conservation of energy | b. total change in heat during a chemical reaction |
| _____ 3. Enthalpy               | c. energy is absorbed, beaker gets cold            |
| _____ 4. endothermic            | d. energy needed to break the bonds                |
| _____ 5. Exothermic             | e. Energy is neither created nor destroyed         |

## Unit 10: Gas Laws

- |                           |  |
|---------------------------|--|
| _____ 1. kinetic theory   | a. 101.3 kPa, zero degrees Celsius   |
| _____ 2. STP              | b. All matter composed of atoms/molecules, particles move in random motion, elastic collisions |
| _____ 3. Boyle's Law      | c. Gas escaping through a tiny hole  |
| _____ 4. Charles Law      | d. Volume inversely proportional to pressure   |
| _____ 5. Gay-Lussac's Law | e. Volume directly proportional to temperature   |
| _____ 6. effusion         | f. Moving from high to low concentration   |
| _____ 7. diffusion        | g. Pressure directly proportional to temperature   |

## Unit 11 Acids and Bases-

- |                          |  |
|--------------------------|--|
| _____ 23. Arrhenius acid | <b><u>Not sure how far we will get in this unit</u></b><br>a. A solution that keeps a constant neutral pH when small amounts of acid or base are added |
| _____ 24. Arrhenius base | b. Solution of known concentration   |
| _____ 25. Indicator      | c. Acid contains one $H^{1+}$  |
| _____ 26. endpoing       | d. Acid contains three or more $H^{1+}$  |
| _____ 27. monoprotic     | e. The point at which the indicator changes color  |
| _____ 28. Stock          | f. Substance that changes color depending on pH  |
| _____ 29. polyprotic     | g. Can be an acid or a base  |
| _____ 30. amphoteric     | h. Any substance that releases $H^{+}$   |
| _____ 31. buffer         | i. The addition of a known amount of solution of known concentration to determine the concentration of another solution                                |
| _____ 32. salt           |  |
| _____ 33. neutralization |  |