Dr. Casagrande's Chemistry 1 Final Exam Review Sheet 1

Chapter 9: Covalent Bonding
- Drawing Lewis Structures of complex molecules & polyatomic ions
- Explain electronegativity and bond polarity
- Bond polarity and molecular shape contribute to molecular polarity
- Lab: Build a Molecule PhET, Molecular Models, Computer Chips Article

Chapter 10: Reactions
- Recognize and describe evidence of a chemical reaction.
- Represent a chemical reaction with a chemical equation.
- Balance chemical equations.
- Classify chemical reactions as synthesis, combustion, decomposition, single- or double-replacement.
- Identify the characteristics of the different classes of chemical reactions.
- Use the activity series to determine if a single-replacement reaction will take place and determine the products if it does.
- Determine the oxidation # of atoms as elements or in binary ionic compounds and determine the atoms that have been oxidized or reduced in a single-replacement reaction [LEO-GER].
- Determine the products of a double-replacement reaction and which product is insoluble (solid) using the solubility table provided.
- Labs: Chemical Reactions; Activities of Metals, Explosive History of Nitrogen Article

Chapter 12: Stoichiometry
- Identify the mole ratios in a balanced chemical equation.
- Use the stoichiometry flowchart to solve stoichiometry problems.
- Identify the limiting reactant in a chemical equation.
- Identify the excess reactant in a chemical reaction and calculate the amount remaining after the reaction is complete.
- Calculate the mass of a product given the limiting reactant.
- Calculate the theoretical yield of a chemical equation given the limiting reactant.
- Determine the percent yield of a chemical reaction given the actual yield.
- Lab: Stoichiometry of $Cu_3(PO_4)_2$

Chapter 13: States of Matter
- Use the kinetic-molecular theory to explain the behavior of gases.
- Describe how the mass of a gas affects the rates of diffusion and effusion of the gas.
- Explain how gas pressure is measured and calculate the partial pressure of a gas.
- Describe and compare intramolecular and intermolecular forces.
- Distinguish among the different intermolecular forces: dispersion forces, dipole-dipole forces, and hydrogen bonds.
- Apply the kinetic-molecular theory to the behavior of liquids and solids.
- Relate properties such as viscosity and surface tension to intermolecular forces.
- Compare and contrast the densities of solids, liquids, and gases in general, and the densities of solid and liquid water specifically.
- Explain how the different intermolecular forces control the melting and boiling points of a substance.
- Describe the differences between crystalline and amorphous solids.
- Explain how the addition and removal of energy can cause a phase change.
- Identify which phase changes absorb energy (endothermic) and which release energy (exothermic).
- Interpret phase diagrams.
- Labs: Polarity & Solubility; Melting Points & Freezing Points

Chapter 9 Problems

1. For the following bonds, use the electronegativity table to indicate ΔEN for each bond (SHOW WORK!) and indicate its polarity. If the bond is polar covalent, indicate the presence of the dipole using either the arrow or the ä+/ä– symbols. If it is ionic, put in the charges.

F—N ΔEN= _____ Polarity: _____	S—C ΔEN= _____ Polarity: _____

2. Draw the Lewis structures for the following molecules or polyatomic ions. Determine the electron and molecular geometries, and draw the 3-dimensional structure. On the 3-D drawing, put an arrow or the partial charges (d+/d–) on any polar bond, and indicate whether the overall molecule is polar.

Formula	Lewis Structure	Electron Geometry	Molecular Geometry	3-D Drawing	Polar? (Y/N)
SF_2					
CCl_4					
CO_3^{2-}					

Chapter 10 Problems

Balance each of the following reactions and indicate the reaction type in the blank at right.

Reaction Type

3. ____ C_7H_{14} (*l*) + ____ O_2 (g) → ____ CO_2 (g) + ____ H_2O (g) _____

4. ____ Li_2O (s) + ____ H_2O (*l*) → ____ LiOH (s) _____

Assuming the reaction occurs, determine the products and write the COMPLETE BALANCED EQUATION for the following single-replacement reactions, including state symbols. Based on the element activity series in Chart E, determine if the reaction occurs & write N.R. after the reaction if it cannot occur.

5. ___ Au (s) + ___ $Fe_2(SO_4)_3$ (aq) →

6. ___ F_2 (g) + ___ $CaCl_2$ (aq) →

7. Label these changes as either oxidation or reduction:
   a) $2\ Cl^- (aq) \rightarrow Cl_2 (g)$ _____ c) $Ni^{2+} (aq) \rightarrow Ni (s)$ _____
   b) $Au (s) \rightarrow Au^{3+} (aq)$ _____ d) $Br_2 (s) \rightarrow 2\ Br^- (aq)$ _____

8. Put in all charges (oxidation numbers) in the following substances. *(Remember: The charge on pure elements is zero. Also, when H is in a compound, its charge is +1)*

   a) $RuCl_3$ b) Pd c) MnF_4 d) I_2 e) HF f) Cr g) CsBr

9. Put in all charges (oxidation numbers). Then indicate which substance is being oxidized, which is being reduced, and what their products are. [Remember LEO-GER!]

   a) $3\ Ca (s) + 2\ AlF_3 (aq) \rightarrow 3\ CaF_2 (aq) + 2\ Al (s)$
   Oxidized: _____ Product: _____
   Reduced: _____ Product: _____

   b) $3\ F_2 (g) + 2\ AuI_3 (aq) \rightarrow 2\ AuF_3 (aq) + 3\ I_2 (s)$
   Oxidized: _____ Product: _____
   Reduced: _____ Product: _____

   c) $3\ Sn (s) + 2\ RuCl_3 (aq) \rightarrow 3\ SnCl_2 (aq) + 2\ Ru (s)$
   Oxidized: _____ Product: _____
   Reduced: _____ Product: _____

COMPLETE and BALANCE the following double-replacement equation, including state symbols. Write the correct formulas for the products and use the solubility rules in Chart F to determine the product solubility.

10. ___ $K_2CO_3 (aq)$ + ___ $BaCl_2 (aq) \rightarrow$

11. ___ $Cd_3(PO_4)_2 (aq)$ + ___ $(NH_4)_2S (aq) \rightarrow$

Chapter 12 Problems

12. Antimony can be produced by the reaction of antimony(III) oxide with carbon:

    ___ $Sb_2O_3 (s)$ + ___ $C (s) \rightarrow$ ___ $Sb (s)$ + ___ $CO (g)$

    Balance the equation first. How many grams of antimony would be produced by reaction of 50.0 g of Sb_2O_3 with excess C?

13. The rare-earth metal terbium is produced from terbium(III) fluoride and calcium metal by the following single-replacement reaction:

$$\_\_\_ \ TbF_3\ (aq) + \_\_\_ \ Ca\ (s) \rightarrow \_\_\_ \ CaF_2\ (aq) + \_\_\_ \ Tb\ (s)$$

a) Balance the equation.
b) If 27.5 g of TbF_3 and 6.96 g of Ca are used, what is the limiting reactant? Justify your answer with calculations.

c) How much of the excess reactant in part (a) remains when the reaction is finished?

14. Acrylonitrile, C_3H_3N (g), is an important ingredient in the production of fibers and plastics, and is produced as follows:

$$\_\_\_ \ C_3H_6\ (g) + \_\_\_ \ NH_3\ (g) + \_\_\_ \ O_2\ (g) \rightarrow \_\_\_ \ C_3H_3N\ (g) + \_\_\_ \ H_2O\ (g)$$

Balance the equation. What is the theoretical yield of C_3H_3N if 850 g of C_3H_6 reacts with an excess of NH_3?

15. What is the percent yield in the previous problem if the actual amount of C_3H_3N obtained is 850 g?

Chapter 13 Problem

16. A mixture of oxygen and carbon dioxide gases exerts a total pressure of 1480 mm Hg. The partial pressure of the oxygen alone is 890 mm Hg, what is the partial pressure of the carbon dioxide?

Answers to chapter problems

Ch. 9—#1a. ΔEN=1.0, polar covalent, **ↆ**; #1b. ΔEN = 0, nonpolar covalent; #2. tetrahedral bent no yes, tetrahedral tetrahedral no no, trigonal planar trigonal planar yes no; **Ch. 10**—#3. 2, 21, 14, 14, combustion; #4. 1, 1, 2, synthesis; #5. 2, 1, $Au_2(SO_4)_3$ + 2 Fe (s) (NR); #6. 1, 1, CaF_2 (aq) + Cl_2 (g); #10. 1, 1, 2 KCl (aq) + $BaCO_3$ (s); #11. 1, 3, 3 CdS (s) + 2 $(NH_4)_3PO_4$ (aq) ; **Ch. 12**—#12. 1, 3, 2, 3, 41.8 g Sb; #13a. 2, 3, 3, 2; #13b. Ca limiting (Eq. mol TbF_3 = 0.0635; Eq. mol Ca = 0.0580); #13b. 2.5 g TbF_3 remain. #14. 2, 2, 3, 2, 6, 1074 g C_3H_3N; #15. 79.3%; **Ch. 13**—#16. P_{CO_2} = 590 mm Hg.