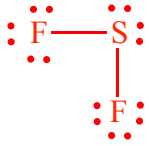
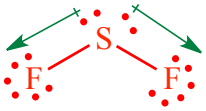
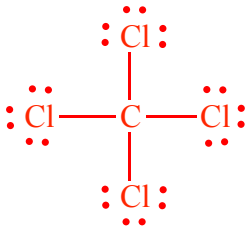
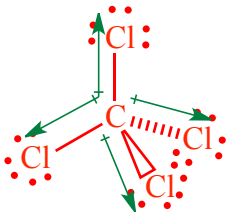
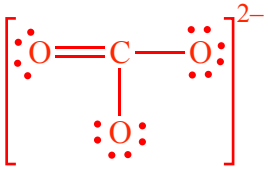
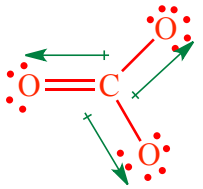
Dr. Casagrande's Chemistry 1 Final Exam Review Sheet 1 Answer Key

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 δ+/δ– symbols. If it is ionic, put in the charges.**

a ⟵+ F—N ΔEN= 4.0 – 3.0 = 1.0 Polarity: polar covalent	b S—C ΔEN= 2.5 – 2.5 = 0.0 Polarity: nonpolar covalent

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 (δ+/δ–) on any polar bond, and indicate whether the overall molecule is polar.

Formula	Lewis Structure (shape doesn't matter)	Electron Geometry	Molecular Geometry	3-D Drawing	Polar? (Y/N)
SF_2		Tetrahedral	Bent	 $\Delta EN_{F-S} = 4.0 - 2.5 = 1.5$	Y
CCl_4		Tetrahedral	Tetrahedral	 $\Delta EN_{Cl-C} = 3.0 - 2.5 = 0.5$	N
CO_3^{2-}		Trigonal Planar	Trigonal Planar	 $\Delta EN_{O-C} = 3.5 - 2.5 = 1.0$	N

Chapter 10 Problems

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

Reaction Type

3. __2__ C_7H_{14} (*l*) + __21__ O_2 (g) → __14__ CO_2 (g) + __14__ H_2O (g) combustion

4. ____ Li_2O (s) + ____ H_2O (*l*) → __2__ LiOH (s) synthesis

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. ~~Finally, write the net ionic equation (even if NR).~~

5. __2__ Au (s) + ___ $Fe_2(SO_4)_3$ (aq) → 2 Fe (s) + $Au_2(SO_4)_3$ (aq) (NR)

6. ___ F_2 (g) + ___ $CaCl_2$ (aq) → CaF_2 (s) + Cl_2 (g)

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

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) $\overset{3+\ 1-}{RuCl_3}$ b) $\overset{0}{Pd}$ c) $\overset{4+\ 1-}{MnF_4}$ d) $\overset{0}{I_2}$ e) $\overset{1+\ 1-}{HF}$ f) $\overset{0}{Cr}$ g) $\overset{1+\ 1-}{CsBr}$

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) $\overset{0}{3\ Ca} (s) + 2\ \overset{3+\ 1-}{AlF_3} (aq) \rightarrow 3\ \overset{2+\ 1-}{CaF_2} (aq) + 2\ \overset{0}{Al} (s)$
   Oxidized: Ca Product: Ca^{2+}
   Reduced: Al^{3+} Product: Al

   b) $\overset{0}{3\ F_2} (g) + 2\ \overset{3+\ 1-}{AuI_3} (aq) \rightarrow 2\ \overset{3+\ 1-}{AuF_3} (aq) + 3\ \overset{0}{I_2} (s)$
   Oxidized: I^- Product: I_2
   Reduced: F_2 Product: F^-

   c) $\overset{0}{3\ Sn} (s) + 2\ \overset{3+\ 1-}{RuCl_3} (aq) \rightarrow 3\ \overset{2+\ 1-}{SnCl_2} (aq) + 2\ \overset{0}{Ru} (s)$
   Oxidized: Sn Product: Sn^{2+}
   Reduced: Ru^{3+} Product: Ru

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. ~~Finally, write the net ionic equation.~~

10. ___ $K_2CO_3 (aq)$ + ___ $BaCl_2 (aq) \rightarrow 2\ KCl (aq) + BaCO_3 (s)$

11. ___ $Cd_3(PO_4)_2 (aq)$ + 3 $(NH_4)_2S (aq) \rightarrow 3\ CdS (s) + 2\ (NH_4)_3PO_4 (aq)$

Chapter 12 Problems

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

    ___ $Sb_2O_3 (s)$ + 3 $C (s) \rightarrow$ 2 $Sb (s)$ + 3 $CO (g)$

    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?

$$? \text{ g Sb} = 50.0 \text{ g } \cancel{Sb_2O_3} \times \frac{1 \text{ } \cancel{\text{mol } Sb_2O_3}}{291.52 \text{ g } \cancel{Sb_2O_3}} \times \frac{2 \text{ } \cancel{\text{mol Sb}}}{1 \text{ } \cancel{\text{mol } Sb_2O_3}} \times \frac{121.76 \text{ g Sb}}{1 \text{ } \cancel{\text{mol Sb}}} = \boxed{41.8 \text{ g Sb}}$$

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

$$\_2\_\ TbF_3\ (aq) + \_3\_\ Ca\ (s) \rightarrow \_3\_\ CaF_2\ (aq) + \_2\_\ Tb\ (s)$$

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.

Molar Mass $TbF_3 = 1\times158.93\text{ g} + 3\times19.00\text{ g} = 215.93\text{ g}$

$$27.5\text{ g } TbF_3 \times \frac{1\text{ mol } TbF_3}{215.93\text{ g } TbF_3} = 0.127\text{ mol } TbF_3;\ 6.96\text{ g Ca} \times \frac{1\text{ mol Ca}}{40.08\text{ g Ca}} = 0.174\text{ mol Ca}$$

$$\text{Eq. mol } TbF_3 = \frac{0.127\text{ mol } TbF_3}{2\text{ mol } TbF_3} = 0.0635\text{ eq. mol } TbF_3;\ \text{Eq. Mol Ca} = \frac{0.174\text{ mol Ca}}{3\text{ mol Ca}} = 0.0580\text{ eq. mol Ca}$$

Since $0.0580 < 0.0635$, **Ca is limiting**

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

$$\text{mass } TbF_3 \text{ used} = \underbrace{0.174\ \cancel{\text{mol Ca}} \times \frac{2\ \cancel{\text{mol } TbF_3}}{3\ \cancel{\text{mol Ca}}}}_{=0.116\text{ mol } TbF_3} \times \frac{215.93\text{ g } TbF_3}{1\ \cancel{\text{mol } TbF_3}} = 25.0\text{ g } TbF_3$$

2.5 g TbF_3 Remaining

Amount TbF_3 remaining = 27.5 g – 25.0 g used =

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

$$\_2\_\ C_3H_6\ (g) + \_2\_\ NH_3\ (g) + \_3\_\ O_2\ (g) \rightarrow \_2\_\ C_3H_3N\ (g) + \_6\_\ H_2O\ (g)$$

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?

$$\text{? g } C_3H_3N = \frac{850\ \cancel{\text{g } C_3H_6} \mid 1\ \cancel{\text{mol } C_3H_6} \mid 2\ \cancel{\text{mol } C_3H_3N} \mid 53.06\text{ g } C_3H_3N}{42.08\ \cancel{\text{g } C_3H_6} \mid 2\ \cancel{\text{mol } C_3H_6} \mid 1\ \cancel{\text{mol } C_3H_3N}} = \boxed{1070\text{ g } C_3H_3N}$$

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

$$\text{Percent Yield} = \frac{850\text{ g } C_3H_3N}{1072\text{ g } C_3H_3N} \times 100 = \boxed{79.3\%}$$

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?

$P_{CO_2} = P_{Total} - P_{O_2} = 1480\text{ mm Hg} - 890\text{ mm Hg} =$ **590 mm Hg**