CHM1025
Final Exam Review

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Welcome!

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- Please have your periodic table and a calculator!

Limiting Reagent

What is limiting reagent?

- Two reagents react, you need to find out how much of each reacted
- There will be less of one reagent available to react, this will be your limiting reagent
- Use dimensional analysis to:
  - Determine how much of each reagent reacts
    - Determine limiting reagent
  - Use limiting reagent to determine how much product is formed

Consider the following reaction: $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$. If 3.25 g NH_3 are allowed to react with 3.50 g O_2, how many grams of NO are formed?

Consider the following reaction: $N_2 + 3H_2 \rightarrow 2NH_3$. If you use 30g of N_2 and 10 g of H_2, what is the mass of the excess reagent?

Redox Reactions

Finding Oxidation Numbers

- Oxidation number
  - The hypothetical charge of an atom if all of its bonds to different atoms were fully ionic
- Group 1 metals: always +1
- Group 2 metals: always +2
- Oxygen: usually -2
- Hydrogen: usually +1
- Halogens: usually -1
- Elements by themselves= 0!

What is the oxidation number of each atom in Fe_2O_3?

What is the oxidation number of each atom in H_2CO_3?

How Oxidation Numbers Relate to Redox

- Loss of electrons: oxidation
  - Charge gets more positive
- Gain of electrons: reduction
  - Charge gets more negative
- Remember: LEO the lion goes GER!
  - (Loss of Electrons=Oxidation, Gain of Electrons=Reduction)

In the reaction, $2HCl + Zn \rightarrow H_2 + ZnCl_2$, which reactant is oxidized and which reactant is reduced?

In the reaction, $Au + 4H^+ + NO_3^- + 4Cl^- \rightarrow AuCl_4 + 2H_2O + NO$, which reactant is the oxidizing agent?

Balancing Redox Reactions

- Half reaction method
  - Balance each species individually
  - Electrons are included
  - Ensure that electrons lost= electrons gained
  - Combine half reactions

Balance $MnO_4^- + SO_3^{2-} \rightarrow MnO_2 + SO_4^{2-}$ using the half reaction method

Titration

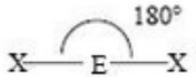
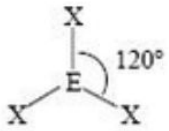
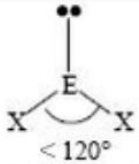
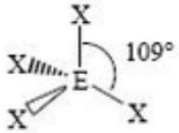
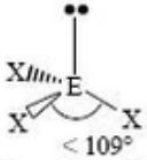
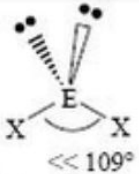
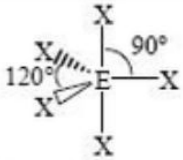
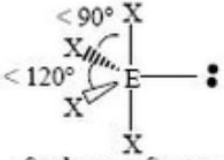
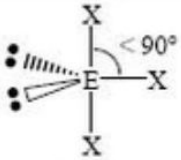
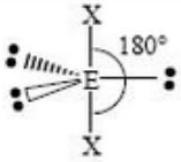
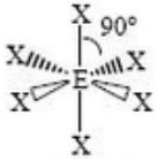
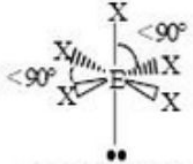
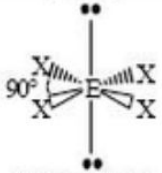
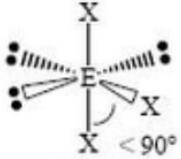
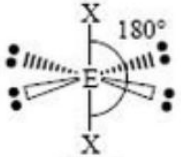
Titration

- You will have an acidic/basic solution
- You want it to become neutral, so you add base (acidic solution) or acid (basic solution)
- Titration stops when the solution is neutral

It takes 83 mL of a 0.45 M NaOH solution to neutralize 235 mL of an HCl solution. What was the initial concentration of the HCl solution?

It takes 38 mL of 0.75 M NaOH solution to completely neutralize a 0.092 M solution of sulfuric acid (H_2SO_4). What was the initial volume of the sulfuric acid solution, in mL?

Molecular Geometry

Steric No.	Basic Geometry 0 lone pair	1 lone pair	2 lone pairs	3 lone pairs	4 lone pairs
2	 Linear				
3	 Trigonal Planar	 Bent or Angular			
4	 Tetrahedral	 Trigonal Pyramid	 Bent or Angular		
5	 Trigonal Bipyramid	 Sawhorse or Seesaw	 T-shape	 Linear	
6	 Octahedral	 Square Pyramid	 Square Planar	 T-shape	 Linear

What is the molecular geometry of NH_3?

What is the molecular geometry of SF_6?

Naming

Ionic Compounds

- Cation, then anion
- Normal ending for cation, -ide ending for anion
- Remember: polyatomic anion names may not adhere to this, use THEIR name
  - Ex. sulfate ion
- Transitions metals' charge indicated in name
  - Determine using deductive reasoning with anion
  - Ex. $FeCl_2$ is iron (II) chloride

Covalent Compounds

- Name non-metal furthest to the left by its elemental name
- Name the other non-metal by its elemental name and -ide ending
- Use prefixes to indicate the number of that element in the molecule
  - 1-mono, 2-di, 3-tri, 4-tetra, 5-penta, 6-hexa, 7-hepta, 8-octa, 9-nona, 10-deca-
- If mono is the first prefix, you do not need to include it
- Example: N_2O_4 is dinitrogen monoxide

What is the molecular formula of iron (III) oxide?

What is the molecular formula of carbon tetrachloride?

Empirical vs. Molecular Formula

Empirical vs. Molecular Formula

- Empirical formula
  - The simplest formula that shows the combination of atoms
  - No associated molar mass
- Molecular formula
  - Variant of empirical formula
  - Must be given molar mass in order to determine

A compound is 40.3% carbon, 6.7% hydrogen, and 53% oxygen by mass, and has a molar mass of 60.05 g/mol. What is it's molecular formula?

Specific Heat

Specific Heat (c)

- Characteristic of a substance
  - Not dependent on total mass!
- Amount of heat per unit mass required to raise the temperature by 1ºC
- Equation: $q=mc\Delta t$
  - Question types
    - Can be asked about q, m, or Δt, and you will be given c and 2 variables
    - Can be asked to find c, given 2 variables (one of them being q)

Given that the specific heat of water is 4.184 J/g*C, if a water sample increases 3°C when given 50 J of heat, how much water was in the sample, in grams?