CHM 1025 Exam 2 Review

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Academic Resources Reminders

- Chemistry Drop-in Tutoring in TUR1315
  - Mondays and Tuesdays: 1-5pm
  - Fridays: 1-3pm
- Private appointments via tutor trac
- CHM 1025 Exam 3 Review: 11/17 7-9pm
- CHM 1025 Final Exam Review: 12/8 time TBA

Ionic Compound Nomenclature

- Cation first, anion second
- Metal + nonmetal = ionic compound
- Replace end of anion name with "-ide" if it's not a polyatomic ion
- Ammonium Sulfide

- Magnesium acetate

- $Pb(NO_3)_2$

- Li_3PO_4

Molecular Compound Nomenclature

- More than one nonmetal/metalloid = molecular compound
- Name element farthest to the left first
- Second element ends in "-ide"
- Use prefixes to specify the number of atoms (exception: don't put mono on first atom, i.e. CO_2 is carbon dioxide NOT monocarbon dioxide)
  - Mono: 1
  - Di: 2
  - Tri: 3
  - Tetra: 4
  - Penta: 5
  - Hexa: 6
  - Hepta: 7
  - Octa: 8
  - Nona: 9
  - Deca: 10

Molecular Compound Practice

- Dinitrogen monoxide
- Phosphorous pentafluoride
- $XeBr_4$
- SO_2

Acid Nomenclature

- Acid: anion with one or more H^+ (number of H^+ depends on charge of anion)
- Case 1: anion ends in "-ide"
  - Replace "-ide" with "-ic" and add "hydro-" to the beginning
  - Examples: HCl H_2S HBr HF
- Case 2: anion ends in "-ate"
  - Replace "-ate" with "-ic", no prefix!
  - Examples: HNO_3 H_2SO_4 H_3PO_4 $HClO_3$ $HClO_4$
- Case 3: anion ends in "-ite"
  - Reaplce "-ite" with "-ous", no prefix!
  - Examples: HClO $HClO_2$ H_2SO_3 H_3PO_3

Percent Composition

- % composition of atom X in compound XYZ:
  - $\frac{mass\ of\ X}{mass\ of\ XYZ} x100\%$
- What is the % by mass of fluorine in carbon tetrafluoride?

- What is the % by mass of oxygen in glucose ($C_6H_{12}O_6$)?

Moles and Avogadro's Number

- Avogadro's number: 6.022×10^{23} (anything you want)/mol
  - How many O atoms are in 4.5 moles of O_2?
  - How many fluorine atoms are in 7 moles of magnesium fluoride?
  - How many CO_2 molecules are in 5.2 grams of carbon dioxide?

Determining Empirical and Molecular Formulas

- A sample of a compound was found to be 40% carbon by mass, 53% oxygen by mass, and the rest hydrogen. If the molar mass of the compound is known to be 60.05 g/mol, what are the empirical and molecular formulas for this compound?
- Step 1: Assume 100g of the sample
- Step 2: Convert grams to moles
- Step 3: Divide all by the smallest number of moles

Empirical/Molecular Formulas cont.

- Step 4: Multiply/divide to get integers
- Step 5: Write the empirical formula and determine the molar mass of the empirical formula
- Step 6: Divide the actual molar mass by the empirical formula molar mass and multiply all subscripts by that number

Chemical Composition of Solutions

- 2.7 moles of sodium chloride are dissolved in 50 mL of water (d=1 g/mL).
  - What is the % by mass of sodium chloride in this solution?
  - What is the % by mass of sodium ions in this solution?
- 43 mg of lithium perchlorate are dissolved in 2.0 L of water.
  - What is the molarity of lithium perchlorate in this solution?

Dilutions

- Dilution equation: $M_1V_1=M_2V_2$
- 3.0 mL of a stock solution that is 0.60 M in glucose is diluted with 22 mL of water. What is the concentration (in M) of the diluted solution?

- You have 10.0 mL of a stock solution that is 1.3 M in sodium acetate. What volume of water (in mL) must be added to the 10.0 mL stock solution to create a final solution that is 1.0 M in sodium acetate?

Types of Chemical Reactions

- Decompisition
  - One reactant, multiple products
  - Ex. $ZnCO_3 \rightarrow ZnO + CO_2$
- Combination
  - Multiple reactants, one product
  - $SO_3 + H_2O \rightarrow H_2SO_4$
- Single Displacement
  - An ion (cation or anion) goes from one compound to another
  - Cation replacement: $Zn + CuCl_2 \rightarrow ZnCl_2 + Cu$
  - Anion replacement: $Br_2 + 2KI \rightarrow 2KBr + I_2$

Chemical Reactions cont.

- Double Displacement
  - 2 ionic compounds switch cations and anions
  - Look for precipitates!
  - $2KOH_{(aq)} + Mg(NO_3)_{2(aq)} \rightarrow Mg(OH)_{2(s)} + 2KNO_{3(aq)}$
- Combustion
  - Hydrocarbon reacts with O_2 and forms CO_2 and H_2O
  - $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
- Acid-base neutralization
  - Same as double displacement but the reactants are one acid and one base
  - Products are water and an ionic compound
  - $HCl + NaOH \rightarrow H_2O + NaCl$

Balancing Chemical Reactions

- Write a balanced chemical reaction for the combustion of benzene (C_6H_6).
- $Na_3PO_4 + KOH \rightarrow NaOH + K_3PO_4$
- $N_2 + H_2 \rightarrow NH_3$
- $P_2O_3 \rightarrow P_4 + O_2$
- $NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$

Stoichiometry

- For the following **unbalanced** chemical reaction, how many grams of aluminum can be produced from 10.0 g of $AlBr_3$?
  - $AlBr_3 + K \rightarrow KBr + Al$

- For the following **unbalanced** chemical reaction, how many moles of hydroiodic acid are needed to produce10.0 g of manganese (III) iodide?
  - $Mn + HI \rightarrow H_2 + MnI_3$

Limiting Reactants

- Consider the following **unbalanced** reaction. What mass (in g) of the excess reactant are left over if 10.0g of LiCl are allowed to react with 7.0g of Br_2?
  - $LiCl + Br_2 \rightarrow LiBr + Cl_2$

- Consider the following **unbalanced** reaction. What mass (in g) of sodium carbonate can be produced if 9.0g of NaCN are allowed to react with 15.0g of of $CuCO_3$?
  - $NaCN + CuCO_3 \rightarrow Na_2CO_3 + Cu(CN)_2$

Percent Yield

- Percent yield = $\frac{actual\ yield}{theoretical\ yield} x100\%$
- Consider the following balanced reaction. What is the percent yield if 8.00 g of KF are produced from the reaction of 3.30 g of F_2 and 7.80 g of K?
  - $2K + F_2 \rightarrow 2KF$

$q=mc\Delta T$

- q=heat (J or kJ), m=mass (g), c=specific heat capacity(J/mol K), ΔT=change in temperature (K or C)
- A 12.50 g sample of an unknown liquid absorbs 209.1 J of heat and the temperature rises from 298.0 K to 311.6 K. What is the specific heat capacity of the liquid?

q=mcΔT cont.

- A 10.0 g cube of hot lead (c=0.128 J/g C) with in initial temperature of 98.2 C is placed in a calorimeter filled with an unknown amount of water (c=4.184 J/g C) at 25.0 C and the temperature of the water and lead rises to 27.0 C. What mass of water (in g) is in the calorimeter?

q=mcΔT and ΔH

- ΔH: change in enthalpy
  - For a reaction or process, $\Delta H = \frac{q}{moles}$
- 4.30 g of NaCl are dissolved in 20.0 g of water and the temperature of the water drops from 25.8 C to 28.1 C. What is ΔH, in kJ/mol, of the dissolution of NaCl in water? (C_{water}=4.184 J/g K)

Questions?