

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

- ▶ $\text{Pb}(\text{NO}_3)_2$

- ▶ 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. CO₂ 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”

- ▶ Replace “-ite” with “-ous”, no prefix!

- ▶ Examples: $HClO$ $HClO_2$ H_2SO_3 H_3PO_3

Percent Composition

- ▶ % composition of atom X in compound XYZ:
 - ▶ $\frac{\text{mass of } X}{\text{mass of } XYZ} \times 100\%$
- ▶ What is the % by mass of fluorine in carbon tetrafluoride?
- ▶ What is the % by mass of oxygen in glucose (C₆H₁₂O₆)?

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 ($d=1 \text{ g/mL}$).
 - ▶ 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

- ▶ Decomposition

- ▶ One reactant, multiple products

- ▶ Ex. $\text{ZnCO}_3 \rightarrow \text{ZnO} + \text{CO}_2$

- ▶ Combination

- ▶ Multiple reactants, one product

- ▶ $\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$

- ▶ Single Displacement

- ▶ An ion (cation or anion) goes from one compound to another

- ▶ Cation replacement: $\text{Zn} + \text{CuCl}_2 \rightarrow \text{ZnCl}_2 + \text{Cu}$

- ▶ Anion replacement: $\text{Br}_2 + 2\text{KI} \rightarrow 2\text{KBr} + \text{I}_2$

Chemical Reactions cont.

- ▶ Double Displacement

- ▶ 2 ionic compounds switch cations and anions
- ▶ Look for precipitates!
- ▶ $2\text{KOH}_{(aq)} + \text{Mg}(\text{NO}_3)_{2(aq)} \rightarrow \text{Mg}(\text{OH})_{2(s)} + 2\text{KNO}_3(aq)$

- ▶ Combustion

- ▶ Hydrocarbon reacts with O_2 and forms CO_2 and H_2O
- ▶ $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

- ▶ Acid-base neutralization

- ▶ Same as double displacement but the reactants are one acid and one base
- ▶ Products are water and an ionic compound
- ▶ $\text{HCl} + \text{NaOH} \rightarrow \text{H}_2\text{O} + \text{NaCl}$

Balancing Chemical Reactions

▶ Write a balanced chemical reaction for the combustion of benzene (C_6H_6).

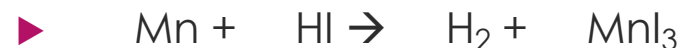


Stoichiometry

- ▶ For the following **unbalanced** chemical reaction, how many grams of aluminum can be produced from 10.0 g of AlBr_3 ?

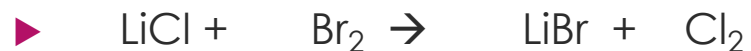


- ▶ For the following **unbalanced** chemical reaction, how many moles of hydroiodic acid are needed to produce 10.0 g of manganese (III) iodide?

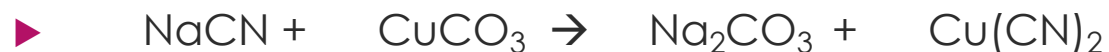


Limiting Reactants

- ▶ 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 Br₂?



- ▶ 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 CuCO₃?



Percent Yield

- ▶ Percent yield = $\frac{\text{actual yield}}{\text{theoretical yield}} \times 100\%$
- ▶ 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 F₂ and 7.80 g of K?
 - ▶ $2\text{K} + \text{F}_2 \rightarrow 2\text{KF}$

$$q=mc\Delta T$$

- ▶ 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?

$$q=mc\Delta T \text{ cont.}$$

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

$q=mc\Delta T$ and ΔH

- ▶ ΔH : change in enthalpy
 - ▶ For a reaction or process, $\Delta H = \frac{q}{\text{moles}}$
- ▶ 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? ($C_{\text{water}}=4.184 \text{ J/g K}$)

Questions?