

Final Study Guide

Chapter 1

- Define distance, mass and volume.
 - Express these properties as a metric measurement
- Report a measured value to the correct number of digits
 - Interpret uncertainty in a measurement
 - Distinguish between precision and accuracy
- Convert distance, volume and mass measurements from one metric unit to another
- Convert measurement from one unit to another (feet to meters for instance)
- Use multiple conversion factors to carry out unit conversions
- Use compound units in calculations (density, dosages)
- Interconvert temperatures between Celsius, Kelvin and Fahrenheit scales

Chapter 2

- Intensive vs extensive properties
- Classification of matter
 - Pure – element and compound
 - Mixture – homogeneous and heterogeneous
- Structure of atoms; electrons, protons and neutrons; nucleus
 - Atomic number, mass number
- Electron arrangement in atoms
- Organization of the periodic table - metals, nonmetals and metalloids
 - Groups and periods
 - Representative elements, group # and valence electrons
- Isotopes of given elements and atomic mass
- Relationship between # of particles (atoms or molecules), mole and mass
 - Relationship between atoms in a chemical formula through subscripts
 - Molar mass

Chapter 3

- Draw Lewis structure of covalent molecules
- Use electronegativities to predict polar vs nonpolar bonds
- Nomenclature of binary covalent compounds
- Nomenclature of ionic compounds
- Distinguish between ionic and covalent compounds based on their components (metal – nonmetal for ionic compounds)

Chapter 4

- Apply relationships between pressure, volume and temperature for a gas (if one variable increases or decreases, what happens to another variable)
- Relationship between attractive forces between molecules or ions and relate these forces to physical properties (melting and boiling points; solubility)
- Hydrogen bonding (H-bond donor and acceptor) and its role in solubility in water

Chapter 5

- % concentration calculations
- Effect of temperature and pressure on solubility
- Recognize hydrophilic and hydrophobic regions in a molecule
- Molarity calculations
- Direction of osmosis and dialysis; hemolysis and crenation
- Dilution calculations

Chapter 6

- Distinguish between physical and chemical change
- Balance chemical equations
- Relate mole to mole, mole to mass and mass to mass quantities in a balanced chemical equation
- Understand relationships between the rate of a reaction and activation energy, temperature, concentration and catalysts – interpret energy diagram for endothermic and exothermic reactions
- Apply chemical equilibrium concept (LeChatelier's principle) when there is a change to the system (such as an increase or decrease to a reactant or a product)

Chapter 7

- Calculations involving K_w (ion product constant for water); calculate hydronium or hydroxide ion concentrations
 - Apply equilibrium concept to hydronium vs hydroxide concentrations
- pH calculations
- Write ionization equation of acid in water
 - Difference between strong and weak acids
 - Common structural features in acidic compounds
- Write ionization equation of base in water
 - Difference between strong vs weak bases
- Identify acid, base, conjugate acid and conjugate base in an acid-base reaction
- Define and identify amphiprotic substances

- Recognize buffer solutions, describe how buffers resist pH changes
- Describe the role of CO₂ in the carbonic acid buffer

Chapter 9

- Know the different covalent bonding patterns for carbon
- Know the names of the first 10 linear alkanes
- Be able to go from a Lewis structure to a condensed or skeletal structures
- Nomenclature of alkanes, branched alkanes, cycloalkanes, alkenes, alkynes and organic compounds with benzene rings
- Name and draw cis / trans alkenes
- Constitutional isomers
- Relationship between the structure and physical properties of hydrocarbons

Chapter 10

- Hydration reaction – predict the product(s) given the reactants
- Role of enzymes in biochemical reactions
- Relate physical properties (boiling point and solubility) of alcohols to their structure
- Recognize chiral carbons in molecules
- Predict the products formed when an alcohol is dehydrated
- Identify thiol and phenol functional groups in organic compounds and relate the physical properties of thiols and phenols to those of alcohols and alkanes

Chapter 11

- Recognize and identify oxidation and reduction reactions that involve hydrocarbons
- Classify alcohols as primary, secondary or tertiary;
 - predict the product of the oxidation of an alcohol
 - predict the product of the reduction of an aldehyde or ketone
- Relate physical properties of aldehydes and ketones to their structure
- Predict the product of oxidation and reduction reactions that involve thiols
- Predict the product of oxidation of aldehydes and relate the physical properties of carboxylic ,
- Describe in general terms the role of the common redox coenzymes in biological oxidation reduction reactions

Chapter 12

- Predict the products for the reactions of organic acids with water and with bases
- Recognize primary, secondary and tertiary amines and relate the structure of amines to their physical properties
- Write chemical equations for the reactions of amines with water and with acids; draw the zwitterion form of molecules that contain both acid and amine groups

- Draw the structures of organic acids and bases as they exist under physiological conditions

Chapter 13

- Predict the products of the condensation of two alcohols
- Predict the products of the condensation reactions that form esters and amides
- Predict the structures of polymers that are formed by the condensation reactions
- Predict the products of hydrolysis reactions of ethers, esters and amides
- Understand the effect of physiological buffers on the structures of the products of a hydrolysis reaction and predict the products of a saponification reaction
- Describe the role of ATP cycle in metabolism and predict whether ATP is formed or broken down in a reaction

Chapter 14

- Draw the structure of a typical amino acid under physiological conditions
 - Classify amino acids based on the structures of their side chains
- Draw the structure of a polypeptide
 - Amino acid structures will be given
- Describe and identify side chain interactions that produce tertiary structure of proteins
- Know factors that cause protein denaturation
- How does an enzyme catalyze a reaction?
 - Factors that affect enzyme activity

Chapter 15

- Structural features and typical physical properties of monosaccharides
- How anomers are related and how they are interconverted
- Identify and draw the structures of the most common glycosidic linkages in disaccharides
- Describe the building blocks, linkages and biological functions of the common disaccharides (sucrose, lactose, maltose) and polysaccharides

Chapter 16

- Classify fatty acids based on their structures
- Relate physical properties of fatty acids and triglycerides to their structures
- Predict the products of the hydrogenation and hydrolysis reactions of triglycerides
- Recognize the structure of a typical glycerophospholipid, relate the structures of glycerophospholipids to the structure and properties of a lipid bilayer

Chapter 17

- Biological role of nucleotides
- Identify the structure of a typical nucleotide
- Differences between DNA and RNA nucleotides
- Know how nucleotides are linked in a nucleic acid
- Know how complementary base-pairing produces the double-helix structure of DNA
- How much of this chapter will be on the final will depend on how much we will cover in class

Additional material

- Isomers
 - Develop structures of constitutional isomers given a molecular formula
 - Develop cis / trans isomers given the name of a compound
 - Identify constitutional vs cis / trans isomers
- Predict the type of intermolecular force (dispersion, dipole-dipole, hydrogen bonding) given a structure and the impact on physical properties
- Stoichiometry calculations in chemical equations