Chamistry	1101 Sprin	-2024 L -2024 L -202	ming Obio	otivo Motrix
Chemistry	i i u spin	ig 2024 Lea	uning Objev	

Week	Topics	Objectives	Readings/Preparation	Laboratory Activity	Assessment			
1	Syllabus/Ch 1	1a-1b	Ch 1.1-1.2	Lab 1: Laboratory Safety	Quiz 1/Lab Quiz 1			
2	Ch 1	1c-1e	Ch 1.3-1.5	Lab 2: Measurements and Significant Figures	Quiz 2/Lab Quiz 2			
3	Ch 1/Ch 2	1f-2a	Ch 1.6, 2.1	Lab 3: Dimensional Analysis	Quiz 3/Lab Quiz 3			
4	Ch 2	2b-2d	Ch 2.2-2.4	Lab 4: Density	Quiz 4/Lab Quiz 4			
5	Ch3	3a-3b	Ch 3.1-3.2	Lab 5: A Graphical Illustration of the Periodic Law	Quiz 5/ Lab Quiz 5/Unit I Exam			
6	Ch 3	3c-3g	Ch 3.3-3.7	No Lab	Quiz 6			
7	Ch 4	4a-4b	Ch 4.1-4.2	Lab 6: Does It Make Cents?	Quiz 7/Lab Quiz 6			
8	Ch 4	4c-4d	Ch 4.3-4.4	Lab 7: What's In a Name?	Quiz 8/Lab Quiz 7			
9	9 Spring Break							
10	Ch 6	6a-6b	Ch 6.1-6.2	Lab 8: Paper Chromatography	Quiz 9/Lab Quiz 8/ Unit II Exam			
11	Ch 6	6c-6d	Ch 6.3-6.4	Lab 9: A Little Sand and a Pinch of Salt	Quiz 10/Lab Quiz 9			
12	Ch 7	7a-7c	Ch 7.1-7.3	Lab 10: Percent Oxygen in Potassium Chlorate	Quiz 11/Lab Quiz 10			
13	Ch 7/Ch 11	7d-11b	Ch 7.4, 11.1-11.2	Lab 11: Stoichiometry	Quiz 12/Lab Quiz 11/ Unit III Exam			
14	Ch11	11c-11d	Ch 11.3-11.4	Lab 12: Which Solution is Which?	Quiz 13/Lab Quiz 12			
15	Ch 11/Ch 14	11e-14b	Ch 11.5, 14.1-14.3	No Lab	Quiz 14			
16	Ch 14	14c-14f	14.5-14.6	Lab 13: Straight from the Cabbage Patch	Quiz 15/Lab Quiz 13			
17	Review	None	None	No Lab	Unit IV Exam			
18	None	None	None	No Lab	Final Exam			

Course Learning Objectives (specific)

- 1) Chapter 1: Essential Ideas
 - a. <u>Section 1.1 Chemistry in Context</u>
 - i. Define science, chemistry, and technology.
 - **ii.** Describe the scientific method.
 - iii. Define law, theory, hypothesis, and fact.
 - iv. Interpret data given in a graph or table.
 - b. Section 1.2 Phases and Classification of Matter
 - i. Explain the difference between mass and weight.
 - ii. Define pure substances, elements, and compounds.
 - iii. Determine the classification of a substance given empirical evidence.
 - iv. Differentiate between homogeneous and heterogeneous mixtures.
 - v. Compare and contrast the three physical states (solid, liquids, and gases) at the both the macroscopic and molecular level.
 - c. Section 1.3 Physical and Chemical Properties
 - i. Define matter and classify it properties and changes as physical or chemical.
 - ii. Label a property as being intensive or extensive.
 - d. <u>Section 1.4 Measurements</u>
 - i. Covert numbers written in ordinary decimal notation to scientific notation and vice versa while maintaining the proper number of significant figures.
 - ii. Multiply, divide, add, and subtract numbers written in scientific notation.
 - iii. Properly use your calculator to carry out operations on numbers written in scientific notation.
 - **iv.** Use the density formula to solve for density, mass, and volume; use density as a conversion factor in dimensional analysis.
 - v. Explain how density can be used to identify an unknown substance.
 - e. Section 1.5 Measurement Uncertainty, Accuracy, and Precision
 - **i.** Compare accuracy versus precision in measurements and explain how it relates to significant figures.
 - ii. Record measurements to the proper precision.
 - iii. Determine the number of significant figures in any measured or reported number.
 - **iv.** Carry out addition, subtraction, multiplication, and division operations on measured values and retain the proper number of significant figures.
 - v. Correctly round values to the proper number of significant figures (no even-odd rule)
 - vi. Recognize the systemic nature of the metric and SI system and contrast that with the English system.
 - vii. State the base units for mass, length, time, temperature, volume, and quantity for the International and Metric Systems.
 - viii. Explain how the units of volume are derived for the SI and metric system.
 - ix. Write the names, symbols, and meaning for the prefixes (giga-, mega-, kilo-, deci-, centi-, milli-, micro-, nano-).
 - **x.** Write conversion factors from statements of equality.
 - **xi.** Interconvert temperatures in the Fahrenheit, Celsius, and Kelvin scales when given the relevant equations.
 - f. Section 1.6 Mathematical Treatment of Measurement
 - i. Convert units within and between the SI, metric, and English systems using the dimensional analysis.

2) Chapter 2: Atoms, Molecules, and Ions

- a. <u>Section 2.1 Early Ideas in Atomic Theory</u>
 - i. Explain how Dalton's atomic theory explains the law of conservation of matter and the law of constant composition (definite and multiple proportions).
- **b.** <u>Section 2.2 Evolution of Atomic Theory</u>
 - i. Know how charged particles interact with each other.
 - **ii.** State the subatomic particles and their properties (symbol, charge, relative mass (amu), and location).
- c. Section 2.3 Atomic Structure and Symbolism
 - i. Know the name and symbols for elements 1-20, 24-30, 35-36, 38, 47, 50, 53-54, 56, 74, 78-80, 82. Do NOT memorize location on periodic table or atomic mass. A periodic table will be given when taking in-class exams or quizzes.
 - ii. Define atomic number, mass number, and isotopes.
 - iii. Explain how atomic number and mass number are used to identify different isotopes.
 - iv. Compare and contrast the composition and properties of isotopes.
 - v. Represent an isotope using proper isotopic notation.
 - vi. Explain the difference between mass number and atomic mass.
 - vii. Given the masses and abundance of each isotope for an element, calculate its atomic mass. Report the answer with the proper number of significant figures.
- d. Section 2.4 Chemical Formulas
 - i. Recognize how counting can be accomplished through mass.
 - ii. State the origin of the mole as a counting unit.
 - iii. Define Avogadro's number and molar mass.
 - iv. Convert between the units of mass, moles, and number of particles using Avogadro's number and molar mass.

3) Chapter 3: Electronic Structure and Periodic Properties of Elements

- a. <u>Section 3.1 Electromagnetic Energy</u>
 - i. Define frequency and wavelength.
 - ii. State the relationship between wavelength, frequency, and energy.
 - iii. State how light and matter have a dual nature.
- **b.** Section 3.2 The Bohr Model
 - i. Describe the Bohr model of the atom.
 - ii. Use the Bohr model to explain emission spectra.
- c. Section 3.3 Development of Quantum Theory
 - i. Differentiate between the Bohr and quantum mechanical models of the atom.
 - ii. Explain how a shell is divided into subshells, and subshells are further divided into orbitals.
 - iii. Identify the generic shape of an *s*, *p*, *d*, and *f* orbitals.
- d. <u>Section 3.4 Electronic Structure of Atoms (Electron Configurations)</u>
 - i. Assign electron configurations for neutral atoms and ions.
 - ii. Know how the periodic table can be used to determine the proper filling order of electrons.
 - iii. Define valence electrons.
- e. <u>Section 3.5 Periodic Variations in Element Properties</u>
 - i. Identify the number of valence electrons for an atom or ion.
- f. <u>Section 3.6 The Periodic Table</u>
 - i. Describe how periodic law led to the development of the periodic table.
 - ii. Define periods and groups.
 - iii. Identify elements within the alkali metal, alkaline earth metal, halogen, and noble gas groups.
 - iv. Locate the metal, metalloid, and nonmetal regions on the periodic table.
 - v. Identify the regions where main group, transition, and inner transition elements are found.
 - vi. Describe the properties of metals, nonmetals, and metalloids.
- g. Section 3.7 Molecular and Ionic Compounds

- i. List the properties of ionic compounds.
- ii. Write the chemical formula for an ionic compound through charge balancing.
- iii. Contrast the properties of covalent compounds with those of ionic compounds.
- iv. Memorize list of polyatomic ions (NH₄⁺, H₃O⁺, CO₃²⁻, HCO₃⁻, OH⁻, SO₄²⁻, NO₃⁻, PO₄³⁻, ClO₃⁻, C₂H₃O₂⁻).

4) Chapter 4: Chemical Bonding and Molecular Geometry

- a. <u>Section 4.1 Ionic Bonding</u>
 - i. Explain the formation of ionic bonds through electron transfer.
 - ii. Explain why main group elements only form one stable ion.
 - iii. Define the terms cation and anion.
- b. Section 4.2 Covalent Bonding
 - i. Explain covalent bonding.
 - **ii.** Given a set of elements predict the trend in electronegativity.
 - iii. Identify polar versus nonpolar covalent bonding.
- c. Section 4.3 Chemical Nomenclature
 - i. Know the IUPAC name and charge of constant charge (Type I) monatomic cations.
 - ii. Know the IUPAC naming system for variable charge (Type II) monatomic cations.
 - **iii.** Recognize constant charge (Type I) versus various charge (Type II) cations by their location on the periodic table.
 - iv. Name monatomic anions.
 - v. Understand the prefixes and suffixes seen in polyatomic ions (-ate, -ite, per-, hypo-, bi-, thio-).
 - vi. Know the Greek prefixes mono- through deca- and properly use them to name binary covalent compounds.
 - vii. Use the IUPAC system to name ionic compounds.
 - viii. Discuss why different naming systems are required for ionic and covalent compounds.
 - ix. Name acids.
- d. Section 4.4 Lewis Symbols and Structures
 - i. Draw a Lewis Dot Symbol for an atom.
 - ii. State and apply the octet rule.
 - iii. Draw Lewis structure for molecules and polyatomic ions obeying the octet rule.

5) Chapter 6: Composition of Substances and Solutions

- a. Section 6.1 Formula Mass
 - i. Define formula weight, formula mass, molecular weight, and molecular mass.
 - **ii.** Calculate formula weights (in amu) for given compounds.
- b. Section 6.2 Determining Empirical and Molecular Formulas
 - i. Assign the mole ratio between atoms based on the chemical formula.
 - ii. Calculate the percent composition of a compound given its formula.
 - iii. Compare and contrast empirical and molecular formulas.
 - iv. Determine an empirical formula and molecular formula from percent composition data.
- c. <u>Section 6.3 Molarity</u>
 - i. Calculate the molarity of a solution.
 - **ii.** Use the dilution formula properly.
 - iii. Explain how a diluted solution can be made from a concentrated sample using appropriate glassware.
 - iv. Discuss how a solution can be made using appropriate glassware.
- d. <u>Section 6.4 Other Units for Solution Concentrations</u>
 - i. Calculate percent by mass, volume, mass/volume.

6) Chapter 7: Stoichiometry of Chemical Reactions

- a. Section 7.1 Writing and Balancing Chemical Equations
 - i. Define reactant, product, catalyst, and coefficient.
 - ii. From a molecular viewpoint, draw a representation of a chemical equation.
 - iii. Write and balance chemical equations.
 - iv. Explain why equations must be balanced.
- b. Section 7.2 Classifying Chemical Reactions
 - i. Classify chemical reactions as precipitation, acid-base, and oxidation-reduction reactions (combustion, combination, decomposition, single-replacement, or double-replacement reactions).
 - ii. Describe how a precipitation reaction occurs.
- c. <u>Section 7.3 Reaction Stoichiometry</u>
 - i. Determine the mole ratio between two substances in a chemical equation.
 - ii. Perform mass to mass stoichiometry problems.
 - iii. Understand when stoichiometry is an appropriate problem solving technique.
 - iv. Express the quantitative relationships in a chemical equation on both the molecular and macroscopic level.
- d. Section 7.4 Reaction Yields
 - i. Calculate the limiting reactant in a chemical reaction.
 - ii. Differentiate between actual yield and theoretical yield.
 - iii. Calculate the percent yield for a reaction.

7) Chapter 11: Solutions and Colloids

- a. <u>Section 11.1 The Dissolution Process</u>
 - i. Explain the differences in solvation of ionic versus molecular compounds in solution.
- **b.** <u>Section 11.2 Electrolytes</u>
 - i. Predict if a substance will ionize in solution and how many ions it will form.
- c. <u>Section 11.3 Solubility</u>
 - i. Define saturated, unsaturated, and supersaturated solutions.
 - **ii.** List variables which affect solubility.
- d. <u>Section 11.4 Colligative Properties</u>
 - i. Explain what colligative properties are.
 - ii. List the different colligative properties.
 - iii. Explain how colligative properties are useful.
- e. Section 11.5 Colloids
 - i. Explain what a colloid is.
 - ii. Give examples of different colloids.
 - iii. Explain how colloids are useful.

8) Chapter 14: Acid-Base Equilibria

- a. Section 14.1 Brønsted-Lowry Acids and Bases
 - i. List the general properties of acids and bases.
 - ii. Define Arrhenius and Brønsted-Lowry acids and bases.
 - iii. Describe the auto-ionization of water through a chemical equation.
- **b.** Section 14.2 pH and pOH
 - i. Understand the meaning and magnitude of the pH scale (power of 10).
 - **ii.** Calculate the pH of a solution from the hydronium ion concentration.
 - iii. Calculate the pOH of a solution from the hydroxide ion concentration.
- c. Section 14.3 Relative Strengths of Acids and Bases
 - i. Explain the difference between strong acid/bases and weak acid/bases.
 - ii. List the strong acids and bases.
 - iii. Identify the products of a neutralization reaction between a strong acid and base.

d. Section 14.5 Polyprotic Acids

- **i.** Extend previously introduced equilibrium concepts to acids and bases that may donate or accept more than one proton.
- ii. List examples of polyprotic acids.

e. Section 14.6 Buffers

- **i.** Describe the composition and function of acid–base buffers.
- **ii.** Explain buffer capacity.