# CHEM 101 Learning Objectives

## Chapter 1

1. Learning the definitions of science, technology, alchemy, and natural philosophy
2. Understanding the definitions and relationships of hypothesis, scientific law, scientific theory, causation and correlation, and experimental variables.
3. Differentiating between applied and basic research.
4. Learning the definitions of chemistry, matter, mass/weight.
5. Differentiating between physical and chemical properties and changes.
6. Defining the properties of the three common states of matter
7. Differentiating between pure substances, heterogeneous mixtures, homogeneous mixtures, elements, compounds, atoms and molecules.
8. identifying Significant Figures in a measured quantity
9. performing calculations using Significant Figures rules.
10. reviewing the use of Scientific Notation with a calculator
11. identifying the SI base units
12. memorizing metric system equalities
13. performing metric system unit conversions with correct Significant Figures
14. defining and calculating density
15. utilizing density as a conversion factor
16. learning the basic definitions and units of energy, heat, and temperature.
17. interconverting between Celsius, Fahrenheit, and Kelvin using formulas

## Chapter 2

1. learning the history of atomic theory
2. defining and applying the Laws of conservation of mass, definite proportions, and multiple proportions
3. understand and explain Dalton’s atomic theory
4. learning the history of the Periodic Table
5. distinguishing atoms and molecules
6. listing the diatomic elements

## Chapter 3

1. learning the history of the discovery of subatomic particles
2. understanding the charge, mass, and location of the subatomic particles
3. describe the subatomic particles in terms of their charges, masses, locations, and numbers present in an atom
4. compose and interpret isotopic symbol (isotope notation)
5. understand the concepts of excitation and relaxation of an electron
6. Distinguish between Main Group and Transition Metals and know the common Group Names for Groups 1, 2, 3, and 4A.
7. identify the metal, nonmetal, and metalloid regions of the periodic table and the definitions of these
8. Identify the number of valence electrons for Main Group Elements

## Chapter 4

1. write the Lewis Dot Symbol for any representative (Main-Group) element
2. understand the formation of cations and anions from atoms
3. use Lewis dot symbols to represent ions and ionic bonds
4. use the Periodic Table to predict common monoatomic ion charge
5. compose and interpret the empirical formula and name of ionic compounds composed of Main Group Ions
6. compose and interpret the empirical formula and name of ionic compounds that include Transition metals
7. memorizing a list of Polyatomic Ions
8. compose and interpret the empirical formula and name of ionic compounds that include Polyatomic Ions
9. understanding the difference between ionic and covalent bonding
10. compose and interpret the names of molecular (covalent) compounds
11. use electronegativity to identify polar covalent bonds
12. memorizing the bonding patterns of nonmetals in polyatomic molecules
13. learning how to write Electron Dot Structures (Lewis Structures) of covalent compounds
14. applying the VSEPR theory to determine molecular shape and bond angles
15. relate molecular geometry and electronegativity in identifying polar and nonpolar molecules

## Chapter 5

1. Recognizing the parts of a chemical equation
2. Balancing chemical equations
3. Understanding the concept of the mole and Avogadro's Number
4. obtain atomic mass and formula mass from the periodic table
5. calculate the Percent Composition of an element within a compound
6. perform stoichiometric calculations involving grams and/or moles
7. Learning the basic definitions of solutions and solubility
8. Calculating molarity of a solution
9. Utilizing Molarity as a conversion factor in solution analysis
10. Using the formula for mass, volume and mass/volume % concentrations of solutions to solve for all variables

## Chapter 6

1. defining the states of matter and the changes between those states
2. understanding the attractive forces between molecules
3. assessing the attractive forces between components of a solution
4. Understanding the Kinetic Molecular Theory
5. Learning the concepts of Charles' Law, Boyle's Law, and Avogadro's Law
6. Solving mathematical problems using Charles' Law, Boyle's Law, and Avogadro's Law
7. Performing calculations using the Combined Gas Equation
8. Performing calculations using the ideal Gas Equation

## Chapter 7

1. Recognizing the properties of acids and bases
2. Identifying the behavior of Arrhenius and Bronsted-Lowry Acids and Bases in solution
3. Understanding the behavior of Strong Acids and Bases versus Weak Acids and Bases in solution
4. Defining and completing neutralization reactions
5. Calculating and interpreting pH values of solutions
6. Predicting the formulas of conjugate acids and bases
7. Learning the behavior of buffer solutions
8. Understanding acids and bases in industry, the home, and in medicine

## Chapter 8

1. Defining oxidation and reduction
2. Labeling what is being oxidized and reduced a Redox reaction
3. Identifying oxidizing and reducing agents in a Redox reaction
4. Detailing the occurrence, reactions, and functions of Oxygen
5. Detailing the occurrence, reactions, and functions of Hydrogen
6. Defining photosynthesis and metabolism as oxidation and reduction

# (Optional Topics)

## Chapter 12

1. Understanding the elemental components of the earth and abundances
2. Describe the arrangement of silica in minerals
3. Differentiating the structures of glass from other silicates
4. Studying common metals, their ores, and how they are extracted

## Chapter 13

1. Understanding the elemental components of the atmosphere and abundances
2. Describing the Oxygen and Nitrogen cycles
3. Understanding the origin and effects of temperature inversion
4. Listing the natural and man-made sources of air pollution
5. Understanding the emissions of automobiles
6. Distinguishing between photochemical and sulfurous smog
7. Listing the causes of acid rain
8. Identifying the identity and causes of indoor air pollution
9. Discussing the functions of the ozone layer and the causes of the ozone layer hole

## Chapter 14

1. Relate the properties of water to the interparticle attractive forces acting on water
2. Describe how the Earth’s water regulates Earth’s temperature
3. List the major uses of water by humans
4. List the major contaminants of water
5. Describe purification and treatment of water