Chapter 1: The Science of Chemistry

1. Distinguish between matter, molecules, element, compounds, homogeneous mixtures and heterogeneous mixtures, and solutions to describe common materials.
2. Write the names and chemical symbols of the more common elements, including the first thirty-six: Rb, Cs, Fr, Sr, Ba, Ra, W, Au, Ag, Hg, Sn, Pb, Sb, I, Br, U, Pu (e.g., B = Boron)
3. Distinguish between physical and chemical properties and simple physical and chemical changes of matter
4. Express base units and derived units of the SI substance.
5. Know common units in the English system, and the relationships between them. [1 ft = 12 in]
6. For the metric system, state the basic units of mass, length, and volume, and the common prefixes.
7. State the relationships between English and metric units.
8. Be able to convert between Fahrenheit and Celsius temperatures.
9. Distinguish between mass and weight
10. Be able to solve for the density of a substance, given the volume and mass and visa versa
11. Distinguish between precision and accuracy.
12. Determine the number of significant figures in a value.
13. Express the result of a calculation with the appropriate number of significant figures.
14. Express numbers in scientific notation.
15. Correctly use round off rules
16. Write a conversion factor from a relationship between two quantities, and use conversion factors to solve problems.
17. Express and use density in the form of a conversion factor.
18. Express and use percent compositions in terms of conversion factors.
19. Solve algebraic equations that arise in the course of working chemistry problems.

Definitions and Terms to Know

Preparing To Learn Chemistry

Physical change	Change of form
Chemical change	Change of composition
Law	Statement that summarizes observations
Hypothesis	Statement of a possible explanation of a law
Theory	Hypotheses that is trusted because it has been confirmed by tests
Characteristics of chemistry	Special vocabulary, high standards of exactness; cumulative structure
Guidelines for learning chemistry	Building notes from your books; practice; test yourself

Unit analysis	
Outline for dimensional analysis	State problem (what quantities are given and to be found?)
	Write the unit map—what conversions should I make to go from the given units to the units to be found?
	Write the equations relating the units—mathematical relationships between units for each conversion
	Multiply by the correct factors and decide on significant figures
	Check answers for reasonable
Unit map	Diagram of unit conversions to be made in solving a problem by dimensional analysis (e.g. miles → feet → in)
Factor	Fraction or ratio that show relationship between two units (e.g. 1 in/ 2.54 cm)
Conversion factor	A factor expressed as an equality (e.g., 1 in = 2.54 cm)
Mathematical background	
Positive power of ten	Multiply by ten that many times; move the decimal that many places to the right
Negative power of ten	Divide by ten that many times; move the decimal that many places to the left
Scientific notation	Numbers expressed as powers of ten, with one non-zero digit to the left of the decimal
Before adding or subtracting numbers with exponential notation	Express them to the same exponent
$10^a x 10^b =$	$10^{(a+b)}$
$10^a \div 10^b =$	$10^{(a-b)}$
$10^a - 10^b =$	Exponents must be in the same power to add or subtract
Reason for label on measured value	Show unit of measurement
Significant figures	Digits in a measured value that show how precisely the measurement was made
Measuring matter and energy	
Matter	Anything that takes up space and has mass
Energy	Capacity to move matter
Mixture	Sample of matter that can be separated into two or more substances by physical means
Heterogeneous mixture	Mixture in which two or more substances can be seen
Homogeneous mixture	Mixture with uniform appearance, as if only one substance were present
Solution	Usual term for homogeneous mixture that's a liquid or a gas (solid solutions are called alloys)
Compound	Pure substance that can be decomposed into simpler substances

Element	Pure substance that cannot be decomposed into simpler substances
States of matter	Solid, liquid, gas
Temperature	Temperature is a measure of heat intensity, not energy
Lowest limits, freezing points and boiling points of water	Fahrenheit: –459°F, 32°F, 212 °F Celsius: –273°C, 0°C, 100°C Kelvin: 0K, 273K, 373K
Convert between °C and °F	$T_{°F} = 1.8T_{°C} + 32°F$
Convert between °C and K	$T_K = 273.15K + T_{°C}$
Notation used in an equation to show that a substance is a:	solid (s) liquid (l) gas (g) aqueous (aq)

# of Interest:

- Be sure to use the correct capitalization and abbreviations throughout your study of chemistry. Small differences can completely change the meaning of a term. For example, Co and CO are different substances.
- The word homogeneous does not necessarily refer to a homogeneous mixture. Pure substances are also homogeneous.
- Intensive properties, such as color and brittleness, do not depend on the size of the sample, but extensive properties, such as volume or mass, do. Intensive properties are more important in identifying substances.
- Energy cannot be created or destroyed, but it can be converted from one form to another.
- Make sure the exponents are the same when adding numbers.
- Significant numbers refer to accuracy and precision of instrument, not importance.
- Precision describes whether repeated measurements of the same quantity agree; it refers to reproducibility.
- Accuracy describes how closely a measurement agrees with some standard or accepted value of the same quantity.