

Chapter 1
Matter and Measurement

1.1 The Study of Chemistry

- Chemistry is the study of properties of matter and the changes it undergoes.
- What is matter?
- Has mass; occupies space; made up of ~100 elements; elements combine to form molecules (compounds if they contain more than one element)
- Which are elements and which are compounds?
- Compounds contain more than one element. They always have the same composition, regardless of source (law of constant composition; law of definite proportions).

1.2 Classifications of Matter

- Make a list of things (and their parts) found in the classroom. Classify these as
 - solid, liquid, or gas
 - homogeneous or heterogeneous
 - pure substances and mixtures
 - elements or compounds
- How do you place them into these classifications?

Classifications of Matter

- Are these mixtures or pure substances?
- Heterogeneous or homogeneous?
- Matter can be placed in these classes both on the basis of macroscopic properties, and by considering their atomic/molecular distributions.
- Method to classify matter
- Classify
 - mixtures
 - pure substances
 - elements
 - compounds

1.3 Properties of Matter

- Physical properties (or changes): no change in identity or composition of the substance
- Chemical properties (or changes): involve changes in identity or composition; describe the reactions of a substance
- Consider a copper coin. Make a list of its chemical and physical properties. Consider these photos for clues.

The Scientific Method

- How do we learn about the things that we cannot see? Can science prove anything? How does science operate?

1.4 Units of Measurement

- What is the size of an atom? of Earth? How do we express such numbers conveniently?
- Place the following numbers in order of increasing value: 10, 0.001, 0.00001, 1×10^4 , 1×10^{-3} , 1×10^{-5} , 1×10^5 , 100000.
- Multiply and divide 5×10^3 and 2×10^{-4} .

Derived Units: Density

- Why does regular soda sink, while diet soda floats in water?
- Density: $d = m/V$, units of g/mL or g/cm^3
- What causes substances to have different densities? Draw pictures of matter to support your explanation.
- Carbon dioxide gas is more dense than helium gas. Why?
- Water is more dense than ice. Why?
- Why is the density of a solid greater than that of its liquid, which is greater than that of its gas?

1.5 Uncertainty in Measurement

- What is the difference between precision and accuracy?
- What are significant figures? Why are they important? When do you need to worry about them?
- Procedure for significant figures: Count all non-zero digits.
- What about zeros?

Dimensional Analysis

- How can you use units to solve problems? Work some of the problems at the end of the chapter.
- Dimensional analysis helps to verify correct set-ups; but you must first develop a proper approach to solving a problem.