

Chapter 1 Matter and Energy

Learning Objectives

Introduction

- Relate the experiences described in the introduction to experiences you encounter around your campus. Consider ways in which you might classify them.

1.1 Matter and Its Classification

- Describe characteristics that distinguish different types of matter.
- Classify matter by distinguishing among pure substances, mixtures, elements, compounds, homogeneous mixtures, and heterogeneous mixtures.
- Use element symbols as a shorthand notation to represent the elements.
- Describe how chemical formulas are used to represent elements and compounds.
- Distinguish between atoms and molecules.
- Distinguish between elements, compounds, and mixtures using molecular-level representations.
- Characterize the various states of matter in terms of shape, volume, and structural organization.
- Use symbols – (*s*), (*l*), (*g*), (*aq*) – to represent various physical states.

1.2 Physical and Chemical Changes and Properties of Matter

- Describe some properties of matter
- Describe various types of physical properties.
- Explain how mass is measured.
- Know symbols and prefixes for metric units.
- Explain how volume is measured for liquids and variously shaped objects.
- Explain density and describe how it is determined.
- Know the density of water (1 g/mL at room temperature) and relate its density to those of other substances.
- Understand the difference between the three temperature scales
- Give examples of physical changes.
- Describe how substances can change into different physical states and how these states differ at the molecular level.
- Distinguish between chemical and physical properties and chemical and physical changes.

Master these skills:

Convert between units (dimensional analysis).

Solve problems using density.

Convert between temperature scales

1.3 Energy and Energy Changes

- Describe various forms of energy and how it differs from matter.
- Distinguish kinetic energy and potential energy and how they can be converted.
- From molecular-level representations, determine which of two samples has more kinetic energy.
- Identify examples of potential and kinetic energy.

Math Toolbox 1.1 Scientific Notation

Master these skills

- Use scientific notation to express numerical values.
- Convert values from decimal form to scientific notation and vice versa.
- Know how to use your calculator to express numbers in scientific notation and solve numerical problems involving numbers expressed in scientific notation.
 - **Please ask if you don't know how!
- Use rules of exponents to solve problems involving numbers expressed in scientific notation.

Math Toolbox 1.2 Significant Figures

Master these skills

- Distinguish between precision and accuracy in collecting experimental data. Distinguish between random and systematic errors.
- Determine the proper number of significant figures when working with measured quantities.
- Determine the proper number of significant figures when manipulating experimental values.

Math Toolbox 1.3 Units and Conversions

Master these skills

- Convert between metric units.
- Convert between English units.
- Convert between metric and English units.
- Distinguish between metric base units and derived units.
- Solve proportionality problems using dimensional analysis or other means; keep track of units when calculations involve proportional relations.