Pearson

# Chapter Summary and Review

## Key Learning Outcomes

| CHAPTER OBJECTIVES | ASSESSMENT |
|---|---|
| **Convert between Temperature Scales (E.2)** | • Example E.1<br>For Practice E.1<br>Exercises 19, 20, 21, 22 |
| **Report Scientific Measurements to the Correct Digit of Uncertainty (E.3)** | • Example E.2<br>For Practice E.2<br>Exercises 35, 36, 37, 38 |
| **Determine the Number of Significant Figures in a Number (E.4)** | • Example E.3<br>For Practice E.3<br>Exercises 39, 40, 41, 42, 43, 44, 45, 46 |
| **Follow Significant Figure Rules in Calculations (E.4)** | • Example E.4<br>For Practice E.4<br>Exercises 47, 48, 49, 50, 51, 52 |
| **Calculate the Density of a Substance (E.5)** | • Example E.5<br>For Practice E.5<br>For More Practice E.5<br>Exercises 53, 54, 55, 56, 57, 58, 59, 60 |
| **Use Conversion Factors to Convert Quantities from One Unit to Another (E.7, E.8)** | • Examples E.6, E.7, E.8, E.9<br>For Practice E.6, E.7, E.8, E.9,<br>For More Practice E.8, E.9<br>Exercises 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80 |
| **Solve Problems Involving Equations (E.9)** | • Examples E.10, E.11<br>For Practice E.10, E.11<br>Exercises 81, 82, 85, 86, 91, 92 |

# Key Terms

## Section E.1

units

## Section E.2

metric system
English system
International System of Units (SI)
meter (m)
kilogram (kg)
mass
second (s)
kelvin (K)
temperature
Fahrenheit (°F) scale
Celsius (°C) scale
Kelvin scale
prefix multipliers
derived unit
volume
liter (L)
milliliter (mL)

## Section E.3

accuracy
precision
random error
systematic error

## Section E.4

significant figures (significant digits)
exact numbers

## Section E.5

density ($d$)
intensive property
extensive property

## Section E.6

energy
work
kinetic energy
potential energy
thermal energy
law of conservation of energy
joule (J)
calorie (cal)
Calorie (Cal)
kilowatt-hour (kWh)

exothermic
endothermic

### Section E.7

dimensional analysis
conversion factor

## Key Concepts

### The Units of Measurment (E.2)

- Scientists use SI units, which are based on the metric system. The SI base units include the meter (m) for length, the kilogram (kg) for mass, the second (s) for time, and the kelvin (K) for temperature.
- Derived units are formed from a combination of other units. Common derived units include those for volume ($\mathrm{cm^3}$ or $\mathrm{m^3}$) and density ($\mathrm{g/cm^3}$).

### The Reliability of a Measurement and Significant Figures (E.3, E.4)

- Measurements usually involve the use of instruments, which have an inherent amount of uncertainty.
- In reported measurements, every digit is certain except the last, which is estimated. The precision of a measurement refers to its reproducibility.
- The accuracy of a measurement refers to how close a measurement is to the actual value of the quantity being measured.
- The precision of a measurement must be maintained in calculations by using established rules for significant figures.

### Density (E.5)

- The density of a substance is the ratio of its mass to its volume.
- Density is an intensive property, which means it is independent of the amount of the substance.

### Energy and Its Units (E.6)

- Energy is the capacity to do work and is often reported in units of joules. Systems with high potential energy tend to change in the direction of lower potential energy, releasing energy into the surroundings.
- In chemical and physical changes, matter often exchanges energy with its surroundings. In these exchanges, the total energy is always conserved; energy is neither created nor destroyed.
- A process in which a system transfers energy to the surroundings is exothermic, while a process in which a system gains energy from the surroundings is endothermic.

### Converting between Units and Problem Solving (E.7, E.9)

- Dimensional analysis—solving problems by using units as a guide—is useful in solving many chemical problems.
- An approach to solving many chemical problems involves four steps: sorting the information in the problem; strategizing about how to solve the problem; solving the problem; and checking the answer.

## Key Equations and Relationships

**Relationship between Kelvin (K) and Celsius Temperature Scales (E.2)**

$$\mathrm{K} = {}^{\circ}\mathrm{C} + 273.15$$

**Relationship between Celsius and Fahrenheit Temperature Scales (E.2)**

$$^{\circ}\mathrm{C} = \frac{(^{\circ}\mathrm{F} - 32)}{1.8}$$

**Relationship between Density ($d$), Mass ($m$), and Volume ($V$) (E.5)**

$$d = \frac{m}{V}$$