

Objectives

- state the fundamental SI units for time, length, and mass.
- demonstrate an ability to use scientific notation.
- identify and use common metric prefixes.
- be able to perform arithmetic operations using scientific notation.

2.1 THE MEASURE OF SCIENCE

The science of physics is based on a few principles and involves the development of concepts. The application of these principles and concepts usually involves the measurement of one or more quantities. In almost every country except the United States, the metric system is used in everyday life. The world-wide scientific community, including the United States, uses an adaptation of the metric system, the SI, to make measurements.

The Metric System

The metric system of measurement was created by French scientists in 1795. It is convenient to use because units of different sizes are related by powers of ten. An international committee determines the standards of the metric system. This committee has set up the International System of Units (SI). The SI is used throughout the world. SI units are emphasized throughout this text. The National Institute of Standards and Technology (NIST) keeps the official standards for the units of length, mass, and time for the United States. Because other quantities can be described using these three units, they are called **fundamental units**.

The standard unit of time is the **second (s)**. The second was first defined as 1/86 400 of the mean solar day. A mean solar day is the average length of the day over a period of one year. In 1967, the second was redefined in terms of the frequency of one type of radiation emitted by a cesium-133 atom.

The standard SI unit of length is the **meter (m)**. The meter was first defined as one ten-millionth (10^{-7}) of the distance from the north pole to the equator, measured along a line passing through Lyons, France.

The metric system is based on powers of ten.

The SI unit of time, the second, is based on the oscillation time of an atom.

FIGURE 2-1. Several countries have issued stamps to help the general public become familiar with SI units of measurement.

