Summary

THE BIG IDEA **Science is the study of nature's rules.**

1.1 The Basic Science—Physics

Physics is about the nature of basic things such as motion, forces, energy, matter, heat, sound, light, and the composition of atoms.

- The study of science today branches into the study of living things and nonliving things—the life sciences and the physical sciences.
- The life sciences branch into areas such as biology, zoology, and botany.
- The physical sciences branch into areas such as geology, astronomy, chemistry, and physics.

1.2 Mathematics—The Language of Science

When scientific findings in nature are expressed mathematically, they are easier to verify or to disprove by experiment.

- Science was transformed in the 1600s when it was learned that nature can be analyzed, modeled, and described mathematically.
- The equations of science provide compact expressions of relationships between concepts.

1.3 Scientific Methods

Scientific methods generally include some, if not all, of the following:

1. **Recognize a problem.**
2. **Make an educated guess—a hypothesis—about the answer.**
3. **Predict the consequences of the hypothesis.**
4. **Perform experiments to test predictions.**
5. **Formulate the simplest general rule that organizes the main ingredients: hypothesis, prediction, and experimental outcome.**
   - Galileo Galilei and Francis Bacon are usually credited as the principal founders of the scientific method.
   - **Scientific methods** are extremely effective in gaining, organizing, and applying new knowledge.

1.4 The Scientific Attitude

If a scientist finds evidence that contradicts a hypothesis, law, or principle, then the hypothesis, law, or principle must be changed or abandoned.

- A **fact** is a close agreement by competent observers who make a series of observations of the same phenomenon.
- A scientific **hypothesis** is an educated guess that is not fully accepted until demonstrated by experiment.

- When hypotheses about the relationship among natural quantities are tested over and over again and not contradicted, they may become **laws** or **principles.**
- A scientific **theory** is a synthesis of a large body of information that encompasses well-tested and verified hypotheses about certain aspects of the natural world.

1.5 Scientific Hypotheses

To determine whether a hypothesis is scientific or not, look to see if there is a test for proving it wrong.

- A scientific hypothesis must be testable. If there is no test for possible wrongness, then an idea is not a scientific hypothesis.
- In science, it is more important that there be a way of proving a hypothesis *wrong* than there be a way of proving it correct.

1.6 Science, Technology, and Society

Science is a method of answering theoretical questions; technology is a method of solving practical problems.

- Science has to do with discovering facts and relationships between observable phenomena in nature and with establishing theories that organize and make sense of these facts and relationships.
- Technology has to do with tools, techniques, and procedures for putting the findings of science to use.

1.7 Science, Art, and Religion

Science is mostly concerned with discovering and recording natural phenomena, the arts are concerned with the value of human interactions as they pertain to the senses, and religion is concerned with the source, purpose, and meaning of everything.

- The arts describe emotions and suggest what may be in store for us. Similarly, science tells us what is possible in nature.
- The domain of science is natural order; the domain of religion is nature's purpose.

1.8 In Perspective

Progress in our age is much quicker than it was thousands of years ago.

- Thousands of years ago, the building of great structures generally took a very long time. Such structures were probably inspired by a vision that went beyond world concerns.
- Today, efforts are directed toward building spaceships. The time required to build these spaceships is extremely brief compared with the time spent building the structures of the past.