CHAPTER 1 Review

REFLECTING ON CHAPTER 1

- Physics is the study of the relationships between matter and energy. As a scientific process, physics helps us provide explanations for things we observe. Physicists investigate phenomena ranging from subatomic particles, to everyday occurrences, to astronomical events.
- Like all science, physics is:
  1. a search for understanding through inquiry;
  2. a process of crafting that understanding into laws applicable to a wide range of phenomena; and
  3. a vehicle for testing those laws through experimentation.
- Aspects of physics are found in a wide range of careers. Engineering and academic research positions may be the first to come to mind, but medical and technological professions, science journalism, and computer science, are other fields that may require a physics background.
- A theory is a collection of ideas that fits together to describe and predict a particular natural phenomenon. New theories often grow out of old ones, providing fresh, sometimes radical ways of looking at the universe. A theory's value is determined by its ability to accurately predict the widest range of phenomena.
- A model is the representation of a theory. Models may take different forms, including mathematical formulas, sketches, and physical or computer simulations.
- An observation is information gathered by using one or more of the five senses. Models and theories attempt to predict observations.
- Changes in science and technology can have huge impacts on our society and on the global environment. An understanding of physics can help you assess some of the risks associated with those changes, and thus help guide your decision-making process. Since most real-world problems involve economic, political, and social components, applying scientific knowledge to the issues may help you separate fact from fiction.
- A learned skill, problem solving is a thought process specific to each of us and to each problem. Several problem-solving techniques are modelled in this chapter, each illustrating the conceptual thinking involved in framing the parameters within which the solution must fit.
- Experimental design requires a clear understanding of the hypothesis that is to be tested. Whenever you are designing your own experiments, your challenge will be to ensure that only one variable at a time is being tested. The number of trials that you run depends on the results. Enough trials have been run when there is a clear trend in the data. If, during your analyses, a clear trend is not evident, more data must be collected. Refer to the Skill Sets at the back of this textbook to help you with data analysis.

Knowledge and Understanding

1. Describe how nanotechnology is the product of both scientific inquiry and technology.
2. In general terms, describe the factors involved in the study of physics.
3. Describe how the Black Box activity can be used to explain the process of scientific inquiry.
4. State one definition of scientific inquiry.
5. Who first discussed the concept of nanotechnology?
6. What observation caused Aristotle to assume that the planets and the Moon were made of material different than Earth?
7. Why was Galileo able to observe the mountains and craters on the Moon, and four moons orbiting Jupiter?

Inquiry

8. While stargazing with friends, you observe a strange light in the sky. The following list of observations details information collected by you and your friends.

- The light moved from that distant hilltop in the east to the TV tower over there to the west.
- As the light moved, it seemed to be hovering just above the ground.
- As it moved from east to west, it got really bright and then faded again.
- It took about 3.0 s for it to move from the hilltop to the TV tower.
- The hilltop is about 15 km from the TV tower.
- It moved at a constant speed from point to point, and then stopped instantaneously.

What was the source of this light? Frame the problem using two different methods; incorporate the data provided and include any other parameters that you feel are relevant. You do not need to reach a solution.

Communication

9. Define scientific inquiry.

10. Generate two specific questions that you would like to have answered during this Physics course. Flip through the text to determine which unit(s) might contain the answers.

11. Briefly describe the purpose of a theory, a model, and an observation.

12. Describe how physics has evolved and continues to evolve.

13. Refer to Table 1.1. Provide one type of activity (for example, test, lab, presentation, debate) that would best allow you to demonstrate your strengths in each category (Knowledge and Understanding; Inquiry; Communication; and Making Connections).

Making Connections

14. Are there any currently accepted scientific theories or models that you believe will eventually be proven false? Explain.

Problems for Understanding

15. A student conducts an experiment to determine the density of an unknown material. Use the data collected from both trials to calculate the percent difference in the density measurements.

Trial 1 19.6 g/mL

Trial 2 19.1 g/mL

16. A student decides to compare the theoretical acceleration due to gravity at her location ($g = 9.808\ m/s^2$) to experimental data that she collects using very sensitive equipment. She runs 15 trials and then averages her results to find $g = 9.811 m/s^2$.

(a) Calculate the percent deviation in her calculation.

(b) Is the percent deviation reasonable? Explain.

17. The following data are collected during an experiment.

Trial #	1	2	3	4	5	6	7	8	9	10	11
Frequency (Hz)	12	11	13	9	12	11	11	14	13	11	10

Refer to Skill Set 4 for reference on the following calculations:

(a) Find the mean of the data.

(b) Find the median of the data.

(c) Find the mode of the data.