Chapter 1

Supplementary *Check for Understanding* Problems

Scientific Method

1. Do you agree with the following statement: "A scientific law is a mathematical statement of a scientific theory."? Briefly explain your answer.

2. "Heat flows from a hotter object to a cooler one". Is this statement a scientific law or a theory? Explain.

3. Imagine you want to see what color of bird feeder your local birds prefer and you plan a series of experiments. What would be the independent variable in your experiments. What would be the dependent variable? What factors should you keep constant?

4. Suppose you want to test the effectiveness of various materials such as sunscreen lotions, clothing and sunglasses in shielding you from the ultraviolet (UV) radiation in sunlight. Describe an experiment you could do to test the effectiveness of these materials. What would serve as your control experiment? Will this be a quantitative or qualitative determination of the effectiveness of the sunscreen materials?

5. Your friend Anna wanted to see if a new gasoline would give more miles per gallon so she filled up her car's gas tank and went for a long drive. When she figured the gas mileage she discovered that she went 25 miles further on a tank of this gas than she did on a tank of her regular gas when she drove around town as usual. She decided to buy the new gas (same price as other gas) in order to get better mileage. Do you agree with her decision? Explain your thinking.

6. Provide an alternative hypothesis to the one listed below to account for the evidence observed.

    Evidence: Children from high socioeconomic households have, on the average, higher grades in school.

    Hypothesis: Money causes good grades.

7. Identify two advantages (strengths) associated with the use of the scientific method.

8. In a television interview an individual claims to have "developed a new theory about the health effects of long-term mobile phone use". Explain what is wrong with this statement? How would you correct this statement?

Pseudoscience

1.   Suppose as a parent of a newborn you hear from television programs and Internet articles that there is a link between childhood immunizations and type 1 and type 2 diabetes. Meanwhile, your child's pediatrician claims there is no scientific basis for these claims. What would be your response in order to make an informed decision about this matter?

Representing Quantitative Information

1.   For a rectangle of constant area, how would you describe the relationship between the length and width of the rectangle? Explain.

2.   A car was purchased in 2001 for $24,000 and the market value of the car as a function of age (year after purchase) is listed below. Is there a linear relationship between market value and the age of the car? Explain why or why not.

Year	Market value
2001	$24,000
2002	$22,500
2003	$19,700
2004	$17,500
2005	$14,500
2006	$10,000
2007	$5,800

3.   For each of the following data sets, which quantity should be plotted on the *x*-axis. Explain.

   a)   temperature (°C) and density of water

   b)   for several countries, cigarette consumption (per person per year) and deaths from lung cancer (per million persons per year)

4.   Assume you need a rental truck and have a choice between Truck A, at a cost of $4.25/mile, and Truck B, at a cost of $200 + $2.00/mile. Approximately how far must you travel in order for Truck B to begin to be the more economical choice? Show all work.

5.   a)   The local convenience store sells bottles of soda for $1.50 each. Write an equation to represent how much you spend at the store for some soda and a single bag of chips. Define all terms.

      b)   Use the information provided by the graph below to determine the cost of a bag of chips at this store. Show all work.

Cost of purchase at convenience store

Total dollars spent vs *Number of bottles of soda*
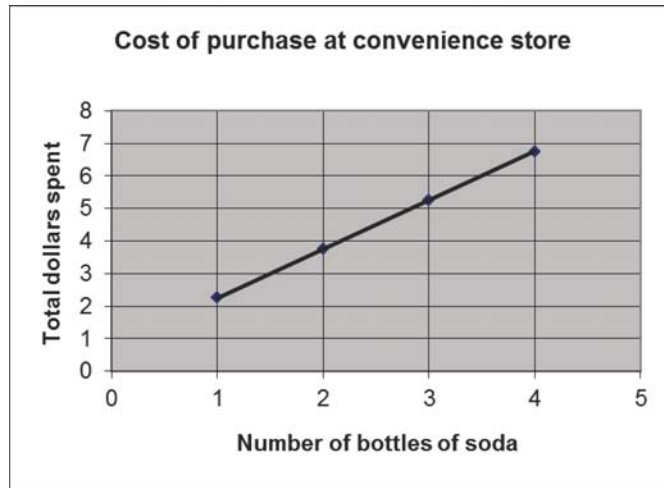
6.   a)   Assume the perimeter of a rectangle is 100 ft and the length of the rectangle is x ft. Write a mathematical expression for the width (y) of this rectangle.

      b)   If you plot the rectangle width versus the rectangle length, what is the numerical value of the slope of the straight line through the data?

Solutions to Chapter 1 Supplementary *Check for Understanding* Problems