Using Scientific Measurements

OBJECTIVES

- Distinguish between accuracy and precision.

- Determine the number of significant figures in measurements.

- Perform mathematical operations involving significant figures.

- Convert measurements into scientific notation.

- Distinguish between inversely and directly proportional relationships.

FIGURE 8 The sizes and locations of the areas covered by thrown darts illustrate the difference between precision and accuracy.
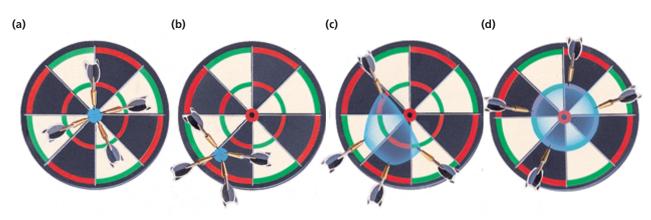
If you have ever measured something several times, you know that the results can vary. In science, for a reported measurement to be useful, there must be some indication of its reliability or uncertainty.

Accuracy and Precision

The terms *accuracy* and *precision* mean the same thing to most people. However, in science their meanings are quite distinct. **Accuracy** *refers to the closeness of measurements to the correct or accepted value of the quantity measured.* **Precision** *refers to the closeness of a set of measurements of the same quantity made in the same way.* Thus, measured values that are accurate are close to the accepted value. Measured values that are precise are close to one another but not necessarily close to the accepted value.

Figure 8 can help you visualize the difference between precision and accuracy. A set of darts thrown separately at a dartboard may land in various positions, relative to the bull's-eye and to one another. The

(a)	(b)	(c)	(d)
Darts within small area = High precision	Darts within small area = High precision	Darts within large area = Low precision	Darts within large area = Low precision
Area centered on bull's-eye = High accuracy	Area far from bull's-eye = Low accuracy	Area far from bull's-eye = Low accuracy	Area centered around bull's-eye = High accuracy (on average)