### Practice Problems

16. Mount Everest is 8847 m high. How many centimeters high is the mountain?
17. Your friend is 1.56 m tall. How many millimeters tall is your friend?
18. A family consumes 2.5 gallons of milk per week. How many liters of milk do they need to buy for one week? (Hint: 1 L = 0.908 quart; 1 gallon = 4 quarts.)
19. How many hours are there in one week? How many minutes are there in one week?

## 2.3 How reliable are measurements?

When scientists look at measurements, they want to know how accurate as well as how precise the measurements are. **Accuracy** refers to how close a measured value is to an accepted value. **Precision** refers to how close a series of measurements are to one another. Precise measurements might not be accurate, and accurate measurements might not be precise. When you make measurements, you want to aim for both precision and accuracy.

▸ **Percent error** Quantities measured during an experiment are called experimental values. The difference between an accepted value and an experimental value is called an error. The ratio of an error to an accepted value is called **percent error.** The equation for percent error is as follows.

$$\text{Percent error} = \frac{\text{error}}{\text{accepted value}} \times 100$$

When you calculate percent error, ignore any plus or minus signs because only the size of the error counts.

### Example Problem 2-8

*Calculating Percent Error*

Juan calculated the density of aluminum three times.

Trial 1: 2.74 g/cm$^3$

Trial 2: 2.68 g/cm$^3$

Trial 3: 2.84 g/cm$^3$







Aluminum has a density of 2.70 g/cm$^3$. Calculate the percent error for each trial.

First, calculate the error for each trial by subtracting Juan's measurement from the accepted value (2.70 g/cm$^3$).

Trial 1: error = 2.70 g/cm$^3$ − 2.74 g/cm$^3$ = −0.04 g/cm$^3$

Trial 2: error = 2.70 g/cm$^3$ − 2.68 g/cm$^3$ = 0.02 g/cm$^3$

Trial 3: error = 2.70 g/cm$^3$ − 2.84 g/cm$^3$ = −0.14 g/cm$^3$

Then, substitute each error and the accepted value into the percent error equation. Ignore the plus and minus signs.

$$\text{Trial 1: percent error} = \frac{0.04\ \text{g/cm}^3}{2.70\ \text{g/cm}^3} \times 100 = 1.48\%$$

$$\text{Trial 2: percent error} = \frac{0.02\ \text{g/cm}^3}{2.70\ \text{g/cm}^3} \times 100 = 0.741\%$$

$$\text{Trial 3: percent error} = \frac{0.14\ \text{g/cm}^3}{2.70\ \text{g/cm}^3} \times 100 = 5.19\%$$

### Practice Problems

20. Suppose you calculate your semester grade in chemistry as 90.1, but you receive a grade of 89.4. What is your percent error?
21. On a bathroom scale, a person always weighs 2.5 pounds less than on the scale at the doctor's office. What is the percent error of the bathroom scale if the person's actual weight is 125 pounds?
22. A length of wood has a labeled length value of 2.50 meters. You measure its length three times. Each time you get the same value: 2.35 meters.
    a. What is the percent error of your measurements?
    b. Are your measurements precise? Are they accurate?

Show work on next page

20.

21

22.

Chemistry
Percent Error Practice Problems

Find the percent error in each of the following problems. Use a separate sheet of paper.

1. The literature value of the atomic mass of an isotope of nickel is 57.9 g/mol. If a laboratory experimenter determined the mass to be 59.6 g/mol, what is the percent error?

2. The mass of one mole of oxygen gas is determined in an experiment to be 31.4 g/mol. Calculate the percent error, given that the literature value for this mass is 32.0 g/mol.

3. At 20° C, the solubility of potassium chloride is actually 34.7 grams per 100 $cm^3$ water. A laboratory experiment yielded 30.3 grams per 100 $cm^3$ water at the value. What is the percent error?

4. The solubility product constant for silver oxide at 25°C is actually $1.51 \times 10^{-8}$. An experimental value obtained in a lab was $1.47 \times 10^{-8}$. What is the percent error?