

4. Which of the four factors affecting reaction rate is most important in each example below? Choose from among concentration, temperature, surface area, and catalyst.
- Extra dish soap is added to help cut the grease when washing a frying pan.
  - Firewood is chopped up into kindling (small pieces) to help start a fire.
  - A lighted match is brought near a candlewick in order to light the candle.
  - Lemon juice is rubbed on an iron sink to help remove rust.
  - The accelerator pedal in a car is pressed, resulting in a faster consumption of fuel in the engine.
  - The reaction of oxygen with sucrose in human cells takes place in the presence of an enzyme.
  - In order to release the fragrance of garlic when frying it in oil, the garlic is crushed and ground.
  - A mild skin disinfectant containing hydrogen peroxide is prepared in a 1 percent solution, while a stronger formulation is prepared in a 3 percent solution.

- barium hydroxide + lead(IV) bromide  $\rightarrow$  barium bromide + lead(IV) hydroxide
  - glycerine ( $C_3H_8O_3$ ) + oxygen  $\rightarrow$  carbon dioxide + water
  - nitrogen + oxygen  $\rightarrow$  nitrogen dioxide
6. Some chemical reactions are affected by surface area, whereas others are not. Explain why this is so.

### Applying Your Understanding

7. Suppose a chemist performed an experiment dissolving equal masses of marble in hydrochloric acid. The results of the three trials are shown in the table below.

| Trial | Hydrochloric Acid | Marble        | Temperature |
|-------|-------------------|---------------|-------------|
| 1.    | Dilute            | Finely ground | 20°C        |
| 2.    | Concentrated      | Lump          | 20°C        |
| 3.    | Dilute            | Lump          | 40°C        |

The marble dissolved fastest in Trial 1. and slowest in Trial 2. List concentration, surface area, and temperature in decreasing order of their importance in increasing the rate of this reaction.

### Understanding Key Ideas

5. Classify each of the following reactions, and write a balanced formula equation for each.
- lithium + oxygen  $\rightarrow$  lithium oxide
  - magnesium + aluminum chloride  $\rightarrow$  magnesium chloride + aluminum
  - butane ( $C_4H_{10}$ ) + oxygen  $\rightarrow$  carbon dioxide + water
  - hydrochloric acid + lithium hydroxide  $\rightarrow$  lithium chloride + water
  - aluminum oxide  $\rightarrow$  aluminum + oxygen
  - tin + gold(III) nitrate  $\rightarrow$  tin(IV) nitrate + gold

### Pause and Reflect

Many chemical reactions happen in your daily life. When might it be important for you to use your knowledge of speeding up or slowing down chemical reactions? How could you use your knowledge?