Name: Class: Date:

COLLISION THEORY

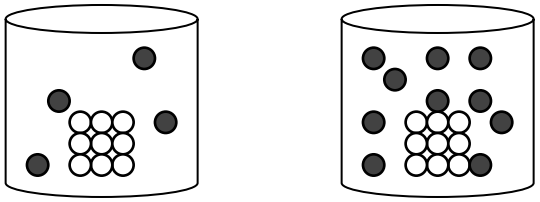
Chemical reactions don't all happen at the same **rate**. How fast a chemical reaction happens depends on how fast and how often the atoms of the reactants come together. This idea is summarized in a scientific concept called collision theory.

Collision theory states that chemical reactions can only happen if reactant atoms collide together with enough energy. The more frequently atoms collide with enough energy, the greater the rate of reaction. The number of collisions can be controlled by factors such as surface area, temperature, concentration and substances called catalysts.

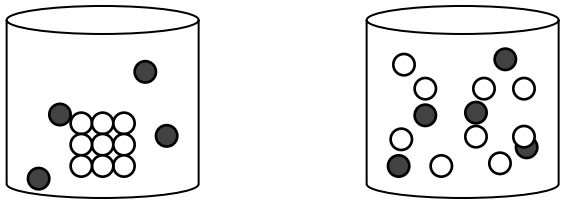
Reactant 1 Reactant 2

The first way to increase the rate of reaction is to increase the **temperature** of the reactants. When you heat any substance, the atoms move faster. Faster moving atoms have more energy and therefore collide more often, which means that more reactions can occur.

A second way to increase the rate of reaction is to increase the **concentration** of the reactants. The concentration is the amount of a substance in a certain volume. Increasing the concentration of reactants makes more atoms available to react. More atoms means more collisions, increasing the rate.


Low concentration High concentration

A third way to increase the rate of reaction is to increase the **surface area** of one or both of the reactants. When a solid reacts with a liquid, only the atoms on the surface of the solid come in contact with the liquid. To increase the rate of reaction, you can break the solid into smaller pieces or grind it into a powder, which increases the total surface area available to react. As more solid is exposed, the reaction will happen faster. This explains why powdered Alka-Seltzer reacts faster in water than a whole tablet.


Low surface area High surface area

A final way to control the rate of reaction is to use a substance called a **catalyst**. A catalyst is a material that increases the rate of reaction by bringing the reactants closer together. Catalysts affect the rate, but they do not participate in the reaction itself. The cells in your body contain biological catalysts called **enzymes**. Enzymes increase the rate of chemical reactions useful for life.

REVIEW QUESTIONS – COLLISION THEORY

1. What are four factors that affect the rate of a chemical reaction?

2. How does surface area of a reactant influence the rate of reaction?

3. How can we increase the surface area of a solid, like an Aspirin® tablet?

4. In what way is temperature related to chemical reaction rates?

5. Circle the letter of each of the following that would increase the rate of reaction.

   a. Put the reactants in a bigger container
   b. Warm the reactants
   c. Break the reactants into smaller pieces
   d. Add extra water to the reactants

6. The amount of substance in a given volume is called its _____.

7. What is a catalyst?

8. True or false? The amount of a catalyst changes at the end of a reaction. _____

9. A biological catalyst is called a(n) _____.

10. Think about it! Why must living things rely on thousands of catalysts for chemical reactions necessary for life?