

Things That Go Bump in the Night Exploration

Problem:

What factors affect the rate of formation of a product from two reactants?

Materials:

hula hoop or 6' length of tubing
magnetic marbles
glass marbles
watch or timer
strong magnet

Procedure:

One theory in chemistry which addresses the rate at which reactions occur suggests that reaction rate depends on two factors: the number of collisions between reacting particles and the fraction of these collisions which results in a product formed by the reactants "sticking" together. In this activity, magnetic marbles will simulate reactant particles. Your task is to explore how the rate of forming a product ("stuck-together" marble pairs) may be maximized.

Each team of four experimenters is to place a hula hoop (or length of tubing shaped into a circle) onto the floor. In the various two-minute trials described below, team members are to roll their marbles from behind the circle toward marbles of other group members for the purpose of producing pairs of "stuck-together" marbles. Pair formation simulates reactant collisions resulting in product molecules. Marbles failing to "react" by pairing may be retrieved and rolled again, and reacting pairs may be broken up and re-rolled. It is important to record data regarding the variable being tested and the number of "product molecules" formed in each two-minute trial.

The conditions for each trial are as follows:

- Trial 1: Two magnetic marbles per team member. Release at 10-second intervals.
- Trial 2: Two magnetic marbles and two glass marbles per team member. Release at 10-second intervals.
- Trial 3: Four magnetic marbles per team member. Release at 10-second intervals.
- Trial 4: Four magnetic marbles per team member. Release as quickly as possible.
- Trial 5: Four magnetic marbles per team member. Release as quickly as possible and aim at a strong magnet placed in the center of the hoop/tubing enclosure.

Remember to accurately record and display data for the five trials!

Summing Up:

1. Magnetic marbles simulated reactant particles and marble pairs represented products in this activity. State the factor being modeled by each of the following: marble type, number of marbles, rate of release, presence of the strong magnet.
2. What set of conditions would result in maximum pair formation?
3. How would releasing the magnetic marbles from inside the circle affect pair formation?
4. What additional factors not listed in Question 1 affect pair formation?