

# Iodine Clock Reaction

## Student Worksheet

Name \_\_\_\_\_

**Overview:** Today you'll witness a mini battle between molecules, and see a cool reaction when one wins!

**What to Learn:** You should understand that sometimes in a mixture, more than one chemical reaction takes place. The rate of this reaction can vary depending on the pH and the concentrations of your solutions.

### Materials

- sodium thiosulfate,  $\text{Na}_2\text{S}_2\text{O}_3$  ([MSDS](#))
- potassium iodide, KI ([MSDS](#))
- 2 plastic test tubes
- test tube caps
- test tube rack
- cornstarch packing peanut
- 5 disposable droppers (or 5 measuring spoons)
- 3 % hydrogen peroxide,  $\text{H}_2\text{O}_2$  ([MSDS](#))
- acetic acid,  $\text{C}_2\text{H}_4\text{O}_2$  (distilled white vinegar) ([MSDS](#))
- distilled water
- funnel
- 4 disposable cups
- popsicle sticks
- clock
- measuring spoons and cups
- goggles and gloves
- table protection
- clock or stopwatch

### Lab Time

1. Rinse everything out very thoroughly with water three times, to ensure that nothing is contaminated. You can use droppers or measuring spoons (dedicated just to chemistry, not used for cooking) to measure your chemicals. For droppers, make sure you're using one dropper per chemical, and leave the dropper in the chemical when not in use to decrease the chances of cross-contamination.
2. Into cup #1, add:
  - a. 1 cup of distilled water.
  - b.  $\frac{1}{2}$  teaspoon sodium thiosulfate,  $\text{Na}_2\text{S}_2\text{O}_3$ . Stir with a popsicle stick until all the crystals are dissolved. Touch the cup to feel the temperature change. Is it hotter or colder?
  - c. Label this cup "sodium thiosulfate."
3. Into cup #2, add:
  - a. 1 cup of distilled water.
  - b. 1 cornstarch packing peanut. Stir it around until it dissolves. Packing peanuts can be made of cornstarch (as yours is, which is why it "melts" in water) or polystyrene (which melts in acetone, not water).

- c. Label this cup "starch."
4. Into cup #3, add:
  - a. 1 cup of hydrogen peroxide.
  - b. Label this cup "hydrogen peroxide."
5. Into cup #4, add:
  - a. 1 cup of distilled white vinegar.
  - b. Label this cup "vinegar."
6. Put a clean medicine dropper into each cup so there is no cross-contamination. This is a very sensitive reaction. Open your potassium iodide container and place a clean dropper in this as well.
7. Put two clean, dry test tubes in a test tube rack.
8. It is time to use your medicine droppers to add chemicals. To do this, squeeze out all the air, dunk the dropper into the solution, and let go of the bulb, pulling out as much solution as possible. In the first test tube, add:
  - a. 3 parts starch
  - b. 2 parts vinegar
  - c. 2 parts potassium iodide
  - d. If this solution turns colors, there was contamination and you must clean all your equipment and begin again.
9. In a second test tube, add:
  - a. 3 parts starch
  - b. 2 parts hydrogen peroxide
  - c. 2 parts sodium thiosulfate
  - d. This solution should also be clear!
10. Pour one solution into the other and cap it, rocking it gently to mix the solution. While you're doing this, have someone clock the time from when the two solutions touch to when you see a major change.
11. To accelerate this reaction (make it go faster), try decreasing the pH (making it more acidic) or increasing the iodide or hydrogen peroxide strength.
12. To slow down the reaction, add more sodium thiosulfate.
13. Experiment with changing the rate of the reaction and record your results in the data table.

## Iodine Clock Reaction Data Table

Test Tube #1	Test Tube #2	How Long did the Reaction Take? <i>(measure in seconds)</i>
3 parts starch 2 parts vinegar 2 parts potassium iodide	3 parts starch 2 parts hydrogen peroxide 2 parts sodium thiosulfate	


**Exercises** Answer the questions below:

1. Explain the two reactions that happen in this experiment.
2. Why does the solution change color?
3. When sodium thiosulfate mixes with water, it produces heat. What type of reaction is this?
4. What caused this reaction to happen the quickest? The slowest?

## Exercises

1. Explain the two reactions that happen in this experiment. (Hydrogen peroxide combines with iodide ions and hydrogen to produce triiodide. Then, sodium thiosulfate reacts with triiodide as soon as it is produced.)
2. Why does the solution change color? (At some point, the sodium thiosulfate can't keep up with the triiodide production, and the triiodide turns the solution an inky black color.)
3. When sodium thiosulfate mixes with water, it produces heat. What type of reaction is this? (exothermic)
4. What caused this reaction to happen the quickest? The slowest? (Answers will vary, but can be checked by looking at the data table.)

**Closure:** Before moving on, ask your students if they have any recommendations or unanswered questions that they can work out on their own. Brainstorming extension ideas is a great way to add more science studies to your class time.