

Temperature and Reaction Rate

Reminder – Goggles must be worn at all times in the lab!

Introduction:

In this lab you will be examining the effect of temperature on the rate of the reaction between hydrochloric acid (HCl) and sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$). In aqueous solution, the reaction that occurs can be represented by



As the reaction proceeds, the production of insoluble sulfur will prevent visible light from passing through the solution. This provides us the opportunity to compare the length of time to reach this point at varying reaction temperatures.

Claim/Hypothesis

In your abstract, *before starting the lab*, state your claim. What effect do you predict that temperature will have on the rate of the reaction. Will it speed up the reaction? Slow it down? Have not effect? Also, be sure to include the reason for your prediction. What do you know or believe to be true that leads you to make your prediction?

Materials:

Large and medium test tubes
10 mL pipet and pump
2 Hot plates (instructor set up)

1 M HCl solution
Thermometer

0.20 M $\text{Na}_2\text{S}_2\text{O}_3$
Stop watch/Cell phone

Caution!

The reaction we are studying produces sulfur dioxide gas, SO_2 , which is a know respiratory irritant. In addition to the room ventilation, we will have the doors open while performing this lab. We will also remove products to the fume hood in the back room as each trial is completed.

However, if at any time you experience breathing difficulties, please excuse yourself from the classroom to get some fresh air. Alert your instructor if you think your symptoms require the attention of the nurse. Sulfur dioxide gas may be especially problematic for students with asthma.

Procedure:

Part 1 – Room temperature

1. Carefully clean a large test tube and a medium test tube from your lab drawer. Check carefully for cracks. If a test tube is damaged, have your instructor replace it.
2. Pipet 2 mL of the 1 M HCl into a medium test tube. Set the tube aside in your test tube rack.
3. Pipet 8 mL of distilled water into your large test tube.
4. Pipet 2 mL of 0.20 M sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$) solution into the SAME large test tube.
5. Carefully clean and dry the thermometer from your lab drawer. Place the thermometer in the solution in your large test tube. Record the temperature, and then remove and clean the thermometer.
6. Get your stopwatch (cellphone) ready.
7. Add the 2 mL of HCl in the test tube, while at the same time starting your stop watch (cell phone!), and immediately stir the solution in the flask for a few seconds with a clean glass stir rod.
8. Hold the test tube at the top, and look through the solution in the test tube while holding this lab paper right behind the solution in the tube. When you can no longer see the cross through the test tube, stop the stop watch and record the time elapsed.



9. Have a member of your group take the large test tube to the fume hood in the back room. Dispose of the contents of the test tube into the waste container located there. This will help keep SO_2 from building up in the room.

Part 2 – Room temperature + 15°C

10. Repeat Steps 1 through 4 from Part 1.
11. Place your large test tube with the water and sodium thiosulfate solution in the medium heat water bath on the hot plate set up by your instructor. Leave it in for several minutes, and then check the temperature.
12. When the temperature is slightly above the desired “Room temperature + 15°C”, return the test tube to your lab table.
13. Record the temperature
14. Now, repeat steps 6 through 9 from Part 1.

Part 3 – Room temperature + 30°C

15. Repeat the procedure from Part 2, except this time, heat the contents in the large test tube to as close to 30°C above the temperature from Trial #1 as is possible.

Be certain that all glassware is thoroughly cleaned at the end of the lab. Always wear your goggles during the cleaning of glassware, as the “splash back” from cleaning is when many instances of chemical contamination of the eye occur.

RESULTS

Data and Observations:

	Initial temperature, °C	Time to completion, s
Trial #1 (room temp)		
Trial #2 (room temp + 15°C)		
Trial #3 (room temp + 30°C)		