

VARYING REACTION RATES

How does temperature affect the rate of a chemical reaction?

Objectives

- Observe and compare the lengths of time it takes for a reaction to run its course under different temperature conditions.

Materials and Equipment

- Data collection system
- Fast Response Temperature Probe
- Graduated cylinder, 100-mL
- Alka-Seltzer® tablets
- Clear plastic cups or beakers (3), 300-mL (10 oz)
- Spoon or stirring stick
- Water, room temperature
- Ice water

Safety

Follow these important safety precautions in addition to your regular classroom procedures:

- Do not use water hotter than 40°C.
- Wear safety goggles at all times.

Procedure

Part 1 – What is the effect of room temperature water on reaction rate?

Trial 1

1. Select Sensor Data in SPARKvue.
2. Connect the temperature probe to your device.
3. Create a graph of Temperature (°C) versus Time (s).
4. Fill a clear plastic cup or beaker with 200 mL of room temperature water.
5. Place the temperature sensor in the plastic cup or beaker.
6. Start recording the first run of temperature data.
7. Drop the Alka-Seltzer® tablet into the water at the same time you start recording.
8. Continue collecting data until the Alka-Seltzer® tablet has completely finished fizzing and then immediately stop recording.
9. Pour out the water and dissolved Alka-Seltzer® tablet according to your teacher's instructions.
10. Rinse out the clear plastic cup or beaker.

Trial 2

- Repeat steps #4 - 10 to get a second run at room temperature. SPARKvue will automatically hide the first graph line when you start the second run.

Part 2 – What is the effect of ice-cold temperature water on reaction rate?**Trial 1**

- Fill a clear plastic cup or beaker with 200 mL of water. Add five ice cubes to the cup, stir to mix, and wait one minute. Measure exactly 200 mL of the chilled water into another cup or beaker.
- Place the temperature sensor in the plastic cup or beaker.
- Using the same graph as in Part 1, start recording the next run of temperature data. Note: This will be your third run of temperature data overall.
- Drop the Alka-Seltzer® tablet into the water at the same time you start recording.
- Continue collecting data until the Alka-Seltzer® tablet has completely finished fizzing and then immediately stop recording the run of data.
- Pour out the water and dissolved Alka-Seltzer® tablet according to your teacher's instructions and rinse out the cup or beaker.

Trial 2

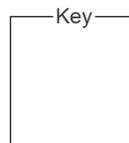
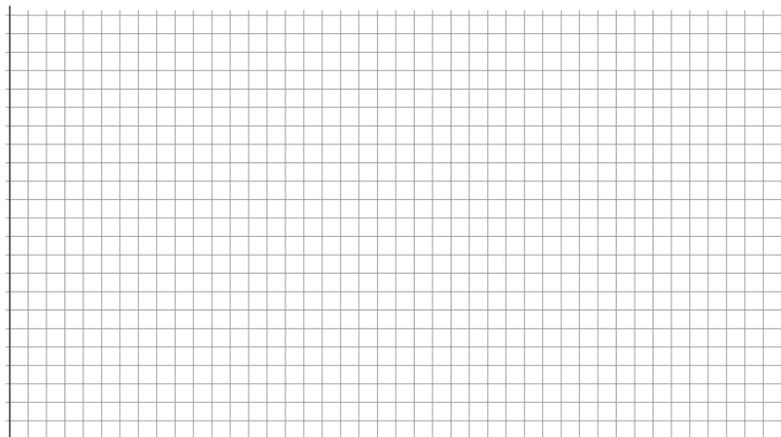
- Repeat Trial 1 with ice cold water to get a second cold run.
- Save your experiment.

Data Collection

Table 1: Effect of different temperatures on reaction rate

Factor	First Run Time (s)	Second Run Time (s)
Room Temp.		
Cold Temp.		

- Using your saved experiment, sketch a graph of Temperature ($^{\circ}\text{C}$) versus Time (s) for your four runs of data. Give your graph a title and be sure to label both axes with the correct scale and units.



Questions and Analysis

- Determine the average time it took the Alka-Seltzer[®] to finish fizzing in Part 1.

Average time to finish fizzing in room temperature water: _____ seconds

- Determine the average time it took the Alka-Seltzer[®] to finish fizzing in Part 2.

Average time to finish fizzing in ice-cold water: _____ seconds

- Review the average time needed for the Alka-Seltzer[®] tablet to finish fizzing in each part. How many times faster is the reaction rate in room temperature water than it is in ice-cold water?
- How does temperature affect the rate of this chemical reaction?