

Student worksheet

Date: _____

Speed It Up with Temperature!—Page 2

Name: _____

Directions: Follow the steps below to conduct your experiment.

2. Experiment

Experiment 1: Ice Water

- Prepare the dye solution for the first experiment using 500 mL of *ice water* and 8 drops of the yellow food dye. Mix the solution.
- Fill the beaker with 150 mL of dye solution. Measure and record the temperature of your solution in the data table given below. Average the temperature for each experimental condition.
- Suck up 2 mL of the pre-prepared 1:20 diluted bleach solution with the pipette and hold it above the dye solution.
- Then, start the stopwatch and immediately after, *add all of the bleach to the cup*. Use the pipette to stir the solution and *keep stirring* throughout the experiment. You will observe the food color fade in the reaction mixture.
- Stop the stopwatch as soon as the color has fully disappeared from the solution. Record the time in the table below.
- Repeat the ice water experiment for two more trials with the same temperature, following steps b.–e. again.
- Record all your results in the data table below and calculate the average reaction times from all your trials.

Experiment 1: Ice Water

Trial	Temperature [°C]	Reaction Time [s]	Reaction Rate [M/s]
1			
2			
3			
Average			

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Name: _____

Directions: Continue following the steps below to conduct your experiment.

Experiment 2: Room Temperature Water

- h. Once all trials for the first temperature have been completed, repeat steps a.–g. using *room temperature water* for the new dye solution. Make sure the difference between each temperature is at least 10°C.

Experiment 2: Room Temperature Water

Trial	Temperature [°C]	Reaction Time [s]	Reaction Rate [M/s]
1			
2			
3			
Average			

Experiment 3: Hot Water

- i. Once all trials for the room temperature experiment have been completed, repeat steps a.–g. using *hot water* for the new dye solution. Make sure the difference between each temperature is at least 10°C.

Experiment 3: Hot Water

Trial	Temperature [°C]	Reaction Time [s]	Reaction Rate [M/s]
1			
2			
3			
Average			

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Name: _____

Directions: Follow the steps below to analyze your data.

3. Analyze Your Data

- a. Convert the reaction time for each temperature into an average reaction rate using the equation given below. Record the results in your data tables and again calculate the average from all your trials for each experimental temperature.

$$\text{Reaction rate} = - \frac{\Delta \text{dye concentration [M]}}{\Delta \text{time [s]}}$$

Change in dye conc. [M] = Final dye conc. [M] – Initial dye conc. [M]

- Final conc. of dye [M] = 0 M
- Initial dye conc. [M] = 0.0005 M

Change in time [s] = Final time [s] – Initial time [s]

- Final time [s] = Time at end of reaction [s]
- Initial time [s] = 0 s

- b. Which temperature resulted in the fastest reaction rate? Which one resulted in the slowest?

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Name: _____

Directions: Answer the questions below.

4. Reflection

a. Explain, in your own words, what happens in the reaction solution on a molecular level when you change the reaction temperature.

b. Considering your answer in question 4.a, explain why the reaction rate is temperature-dependent.