

## Investigating the Effect of Temperature on Enzyme Activity

Almost all chemical reactions that occur in living organisms are catalyzed by enzymes. Many factors in a cell's environment affect the action of an enzyme. In this investigation, you will design an experiment to determine the effect of temperature on an enzyme-catalyzed reaction.

### Problem

How does temperature affect the rate of an enzyme-catalyzed reaction?

### Materials

- raw liver
- petri dish
- dropper pipette
- 1% hydrogen peroxide solution
- liver puree
- 25-mL graduated cylinder
- 5 50-mL beakers
- filter-paper disks
- forceps
- glass-marking pencil
- ice bath
- 3 thermometers
- warm-water bath
- clock or watch with second hand

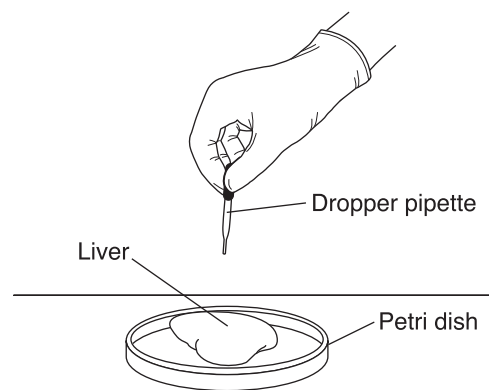
**Skills** Formulating Hypotheses, Predicting

### Design Your Experiment



#### Part A: Observe the Catalase Reaction

- Place a small piece of raw liver in an open petri dish. Use a dropper pipette to put a drop of hydrogen peroxide solution on the liver. **CAUTION:** *Hydrogen peroxide can be irritating to skin and eyes. If you spill any on yourself or your clothes, wash it off immediately and tell your teacher.* Observe what happens. Liver contains the enzyme catalase, which breaks down hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) formed in cells to water ( $\text{H}_2\text{O}$ ) and oxygen gas ( $\text{O}_2$ ). When hydrogen peroxide is broken down by catalase, bubbles of oxygen gas are released.
- To measure the activity of catalase, use a graduated cylinder to place 25 mL of hydrogen peroxide solution in a 50-mL beaker.
- Use forceps to dip a filter-paper disk in liver puree. Place the filter-paper disk on a paper towel for 4 seconds to remove any excess liquid.
- Use the forceps again to place the filter-paper disk at the bottom of the beaker of hydrogen peroxide solution. Observe the filter-paper disk, and record the number of seconds it takes to float to the top of the liquid on the line to the right. Number of seconds: \_\_\_\_\_





7. Construct a data table similar to the one below in which to record the results of your experiment. Perform your experiment only after you have obtained your teacher's approval of your plan. Use a separate sheet of paper if you need more room.

Data Table		
Temperature (°F)	Time (secs)	Observations

8. Make a graph of the results of your experiment. Plot temperature on the *x*-axis and the variable by which you measured catalase activity on the *y*-axis.

### Analyze and Conclude

1. **Inferring** How does the time required for a catalase-soaked filter-paper disk to float reflect the amount of catalase activity in the solution?

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2. **Evaluating and Revising** How did temperature affect catalase activity? Was your prediction confirmed?

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3. **Drawing Conclusions** Many mammals, including cattle and pigs, have body temperatures close to 37°C. Does your graph indicate that catalase is most active when it is close to the temperature at which it exists in a living animal?

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