

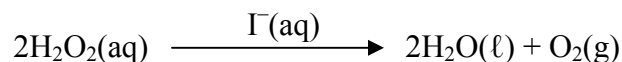
## CHAPTER 11

## HANDOUT

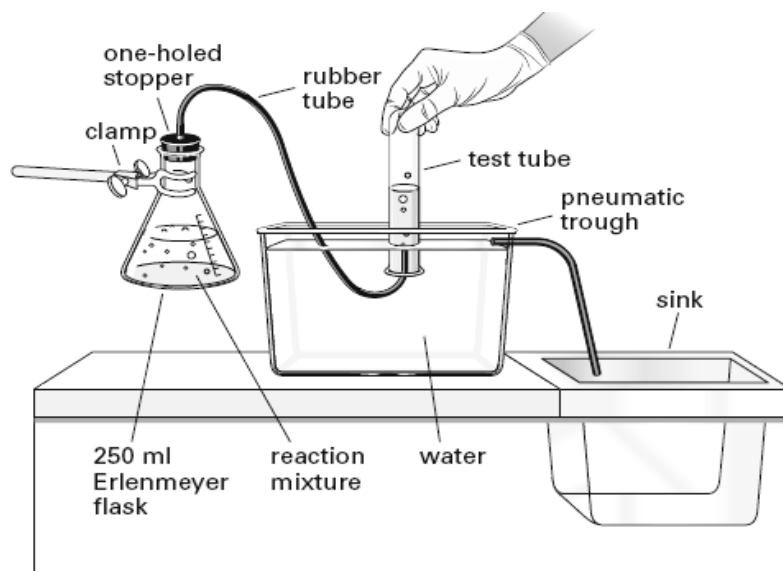
BLM 11.2.2

# Investigation 11.A: The Effect of a Catalyst on the Decomposition of Hydrogen Peroxide, $\text{H}_2\text{O}_2(\text{aq})$

Hydrogen peroxide,  $\text{H}_2\text{O}_2(\text{aq})$ , can be purchased as a dilute solution in a pharmacy or supermarket. It is used as a topical antiseptic for minor cuts, among other things. In this investigation, you will investigate the effect of the  $\text{I}^-(\text{aq})$  ion as a catalyst on the decomposition of  $\text{H}_2\text{O}_2(\text{aq})$ . Hydrogen peroxide decomposes as shown in the equation below:



The gas produced can be measured as a decrease in mass of the system (caused by the release of oxygen gas) or by the downward displacement of water, as shown.



The downward displacement of water: To invert a test tube filled with water, place a piece of paper over the mouth of the filled test tube before inverting it.

## Prediction

Predict how the addition of a catalyst will affect the rate of decomposition of hydrogen peroxide.

## Safety Precautions



- The reaction mixture will get hot. Handle all glassware with care.
- 6% hydrogen peroxide,  $\text{H}_2\text{O}_2(\text{aq})$ , is an irritant. Wear safety glasses, gloves, and a laboratory apron.

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### Materials

- 60 mL 6% (m/v)  $\text{H}_2\text{O}_2(\text{aq})$
- 60 mL 1.0 mol/L  $\text{NaI}(\text{aq})$
- masking tape or grease pencil
- 100 mL beakers
- 10 mL graduated cylinders
- 250 mL Erlenmeyer flask
- clock with a second hand or stopwatch
- water
- one-holed stopper, fitted with a piece of glass tubing (must be airtight)
- rubber tubing to fit glass tubing (must be airtight)
- large test tube
- pneumatic trough or large beaker
- electronic balance accurate to 0.001 g

### Experimental Plan

1. From your prediction, provide a list of variables (manipulated, responding, and controlled).
2. Using these variables, write a detailed procedure to test your prediction. Your procedure should:
  - control all necessary variables
  - provide sufficient data for analysis
  - use no more than the quantities of materials provided



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### Data and Observations

11. Perform the experiment and record your data.

### Analysis

1. How did the addition of a catalyst affect the volume or mass of gas produced (as measured by a decrease in the mass of the system)? How does this relate to the rate of reaction?
2. Construct a graph illustrating the effect of a catalyst on the rate of reaction.
3. What changes or additions would you make to your procedure if you were to repeat this experiment? Why?

### Conclusion

4. Describe the effect of iodide on the rate of the decomposition of hydrogen peroxide. Be as specific as possible.

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### Application

5. The rate of decomposition of  $\text{H}_2\text{O}_2(\text{aq})$  can be increased using other catalysts, such as  $\text{Mn}^{2+}(\text{aq})$  and  $\text{Fe}^{2+}(\text{aq})$ . How do you expect  $\Delta H$  for the decomposition reaction to change if different catalysts are used?

### Extension

6. Perform an Internet search to verify your findings. **ICT**