



Name \_\_\_\_\_

Date \_\_\_\_\_

### What factors might affect the way Enzymes work? By Beth Mick

Hydrogen Peroxide is produced in small quantities in living tissue. As it can damage cells it needs to be broken down. Enzymes can break it down. In plants, the enzyme is generally called peroxidase. In animals the enzyme is generally called catalase. Hydrogen Peroxide is written  $H_2O_2$ . Take a moment to think of some molecular possibilities that could result from  $H_2O_2$  being broken down. (Hint: It may be easier to visualize if you try to use two molecules of it –  $2 H_2O_2$ ).

In this activity, you will examine some properties of catalase in liver. You will observe what happens when catalase reacts with hydrogen peroxide. We are interested in finding out the effects of pH, temperature and substrate availability on enzymes. Another characteristic of enzymes is that they are reusable, which will be observed in part of the experiment.



#### MATERIALS:

Catalase (liver extract – from teacher)

3%  $H_2O_2$  (peroxide)

Vinegar – check the pH

Test tubes

Hot plate

#### GENERAL PROCEDURE:

##### I. PROCEDURE

- 1) Big Surprise - make a data table
- 2) Make a hypothesis for the effects of pH, temperature and substrate availability.
- 3) Label 5 test tubes – 1-5
- 4) Pour 2 ml of the blended liver into each test tube.
- 5) In test tube 1 add 2 ml of  $H_2O_2$ . Observe, time and record the reaction. For ease of data collection you could use a scale of 0-5 or 0-10 on how much reaction you observe. This first tube could be your “optimum reaction” - so give it your highest number.
- 6) Take test tube 2 and place in boiling  $H_2O$  for 4 minutes. Try to swirl a little. Add 2 ml of  $H_2O_2$ . Observe, time and record the reaction.
- 7) Take test tube 3 and add 2 ml of Vinegar. Swirl several time while waiting 5 minutes and then add 2 ml of  $H_2O_2$ . Observe, time and record the reaction.
- 8) In test tube 4 add 2 ml of  $H_2O_2$ . After the initial reaction wait 5 minutes and swirl several times during this time period. Add 2 ml more of  $H_2O_2$ . Observe, time and record the reaction.



Teacher Notes:

Tube 1: Should act as the control with lots of bubbling

Tube 2: Usually there is no reaction – on occasion there may be a tiny amount – discuss how heat changed shape of active site and deactivated the enzyme. If there was some reaction – discuss how some sites may not have been destroyed – perhaps not cooked long enough.

Tube 3: There may be little or no reaction - discussion – the same as tube 2.

Tube 4: There may be a little or no reaction. Discussion about if the substrate is used – adding extra enzyme won't cause extra reaction.

Tube 5: There should be a reaction – may be equal to or a little less than #1 – discussion on reusability of enzymes.

Liver concentrations may vary – a small amount of fresh chicken liver found at the grocery store and blended has always worked well – or frozen liver too.

Checking the pH of the Vinegar will reinforce pH information.

HCL may be used instead of vinegar – dependent on your classes.