

will probably have to add water—a little hydrogen peroxide goes a long way.

4. Fill seven beakers each about two-thirds full with the hydrogen peroxide solution from step 3 and label these "pH 2, pH 4, pH 6, pH 7, pH 8, pH 10 and pH 12." Using hydrochloric acid and sodium hydroxide, adjust each to the desired pH value (Lennox & Kuchera 1986). Adding acid and base in this step will slightly lower the concentration of the hydrogen peroxide solutions. To correct this, add an approximately equal volume of tap water to each to maintain the dilution concentration.

Procedure

1. Use forceps to dip a filter paper square into the catalase solution.
2. Drop the square into the first beaker. It will sink to the bottom.
3. Start the stopwatch immediately.

Record the time required for the filter paper square to float to the surface (i.e. horizontal). Record this time data.

4. Repeat twice more for the first beaker (to obtain an average for that beaker).
5. Repeat steps 1 through 4 for the remaining beakers.
6. Have the students graph the results with pH as the horizontal axis and rate (i.e. $1/t$) as the vertical axis. Rate is determined by taking the inverse of time (e.g. 40 seconds becomes 0.025).

Results & Discussion

The graph of this demonstration resembles a normal distribution (i.e. bell-shaped curve). Like all enzymes, catalase must be in a specific form or shape for the enzymatic reaction to progress. This specific shape alters at different pH levels, thus rendering the enzyme less effective. The optimal pH of an enzyme depends upon its loca-

tion within living organisms. For example, certain digestive enzymes work best in acidic environments. In life, there is always a remarkable matching of function and form even at the molecular level. This demonstration may help your students to grasp this fundamental concept of life as well as observe experimentally the results of the mechanism of enzymatic reactions.

Acknowledgment

The author has developed a computer simulation of this experiment/demonstration for Apple II computers. Clariana will make these available for the cost of a disk plus postage.

Reference

- Lennox, J.E. & Kuchera, M.J. (1986). pH and microbial growth. *The American Biology Teacher*, 48(4), 239-241.

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