

Two: Hypotheses are formulated based on observations ...

In a teacher-led class discussion, students will formulate a research question and hypothesis about the effect of substrate concentration on catalase activity (approximately 30 minutes)

- Make a record for the class of observations that students recorded during their exploration of the floating disc assay. Solicit observations from each student or pair of students. Each observation should have two parts: what I/we did and what I/we observed. Record the student observations without comment or discussion.
- Examine and discuss the student observations:
 - What are some quantitative observations?
 - What are some of the qualitative observations?
 - Give examples of some similar observations made by different teams.
 - Are some of the observations contradictory? Which ones?
 - How can we account for the contradictory observations?
 - What are some generalizations that can be made based on these observations?
 - What are some questions that arise?
- Elicit student ideas about the difference between *amount* of hydrogen peroxide and *concentration* of hydrogen peroxide. (Refer to amount vs. concentration background information on the opposite page.)
- Direct the students to look closely at generalization(s) that relate the time it took the disc to rise to the concentration of hydrogen peroxide, and ask students to formulate a research question and hypothesis for an experiment that uses this floating disc assay. The experiment will relate hydrogen peroxide concentration to the time that it takes for a disc to rise.

Get the students' ideas about the best way to word the research question and hypothesis. Consider that the time it takes for the disc to rise is inversely related to the rate of the decomposition of the peroxide. The rate of decomposition of peroxide is directly related to the activity of the enzyme. Based on the sophistication and experience of your group of students, consider alternative wordings for the research question and hypothesis.

What are some different ways of making a class data record:

On a spreadsheet to copy and distribute.

On a transparency sheet to use on the overhead projector.

On a pad of chart paper that can serve as a "class data book."

On the chalkboard as a temporary record.

Students confuse the terms catalyst, catalyze and catalase: Enzymes are the *catalysts* in living cells. Enzymes *catalyze* the chemical reactions that occur in cells. *Catalase* is the name of one of the enzymes produced by cells. *Catalase catalyzes* the decomposition of hydrogen peroxide.

What is the mathematical relationship between time it takes for the disc to rise and the rate of the reaction? The rate is a constant divided by the time it takes the disc to rise.