

What do Enzymes Do and How Do They Do It?

Engagement Activity

Silent Demonstration of Catalysis

Materials required: two test tubes, test tube rack, wooden splints, matches, manganese dioxide, 3% hydrogen peroxide, weighing scale, and filtering apparatus (funnel, funnel stand, filter paper, and waste beaker).

Teacher Activity	Student activity
The teacher announces that a <i>silent demonstration</i> is about to take place. Students may neither ask questions of the teacher nor talk to one another once the demonstration begins. Students should move to where they can see the demonstration and record their observations as the demonstration takes place.	Move to where you can see; get materials out so that a record of the demonstration can be made. Students log on to Blackboard.com and enter the discussion thread.
The teacher simulates the weighing of a piece of filter paper. A <i>very</i> small amount of manganese dioxide (MnO_2) is then placed on the filter paper and weighed. The masses are written on the chalkboard. The molecular formula for MnO_2 is written on the board. The MnO_2 is placed in a test tube.	Students record masses. Students record the molecular formula for manganese dioxide.
The teacher pours hydrogen peroxide (H_2O_2) into a second test tube, filling the tube about a third of the way. The teacher points to the tube and writes the molecular formula for hydrogen peroxide on the chalkboard.	Students record the molecular formula for hydrogen peroxide. Students record the approximate amount of liquid in the test tube.
The teacher performs the glowing splint test on each tube (the test is negative – it does not burst into flames).	Observations are recorded
The hydrogen peroxide is added to the MnO_2 (furious bubbling is observed).	Observations are recorded
The glowing splint test is performed on the tube. The splint ignites (this a positive test for the presence of oxygen gas).	Observations are recorded
The teacher pours the solution into the filtering apparatus. The filter paper is weighed. This is simulated in such a way that the mass of MnO_2 remains the same. The mass is written on the chalkboard.	Observations are recorded
End of silent demonstration	
<i>Closure Option 1.</i> This presumes that the students have been exposed to fundamental chemistry.	Write the equation for the reaction that you observed.
<i>Closure Option 2.</i> Students can analyze the demonstration and come to conclusions with minimal teacher direction.	Write an abstract or summary of the demonstration.
<i>Closure Option 3.</i> The teacher directs a class discussion to guide students in making inferences.	Verbal summation

Closure for the Activity

There are three options for the teacher to use in achieving closure of the demonstration. Regardless of the method used, the teacher should present a summary of the concepts. The summary should

- ∑ identify the difference between an inference and an observation.
- ∑ make a link between a catalyst (inorganic MnO_2) and an enzyme (organic catalyst). This link should introduce terms such as active site, activation energy, and substrate.

Use of Technology

This activity is enhanced for the students and the teacher by employing Blackboard, a free service that teachers can use to create a web-based course (or activity). The benefits of using this service are

- ∑ the students and teacher can view the observations made by all members of the class immediately.
- ∑ the students get immediate feedback on their work.
- ∑ the teacher can quickly direct a discussion to distinguish between observations and inferences using the students' own work.
- ∑ the teacher can award points for the activity without collecting papers from students.
- ∑ the teacher has a permanent record of student performances on the activity.

Teachers can access Blackboard by going to www.blackboard.com and signing on as an instructor. The service allows the user to create a course. The directions are reasonably intuitive and easy to follow.