**Structured Discovery Lesson Plan Draft 2**

Enzyme Discovery

11-30-12

**Preplanning Tasks**

TEKS:  9C – identify and investigate the role of enzymes

Definition: Enzymes are biological catalyst used in our chemical reactions to help speed up the rate of the reactions

Examples:  Amylase, lactase, maltase

Related Concepts:  Digestion, chemical reactions

Objective:  STWBAT🡪 identify and explain enzyme characteristics and functions by completing an exit ticket before they leave the classroom.

Objective Rationale:  Students will understand that if we did not have enzymes our typical and necessary biological reactions would either take a very long time to occur or possibly not happen at all, leading to illness or disease.

Key Terms:

* Activation energy – the energy required to start a chemical reaction.
* Catalyst – substance that speed up the rates of chemical reaction
* Enzymes – catalyst that speed up the chemical reactions found that take place in cells.
* Substrate – the reactants, or what goes into an enzyme reaction.
* Product – what is produced, or comes out of an enzyme reaction.
* Active site – location on the enzyme where the substrates bind.
* Enzyme-substrate complex – the combination of the enzyme and the substrate when they are bound.

Prerequisites: understanding of the reactants and productschemical reactions

Critical Management Skills: Students work in pairs and whole class instruction, regular classroom arrangement will work fine.

**Lesson Setup**

 Gaining Attention: “Pineapple!” – a pre-set signal that gains the attention of the students and tells then its time to start class

Behavior expectations: I want everyone to participate in class when instructed and keep your eyes on the speaker, listening.

**Lesson Opening**

Objective: After today we will be able to demonstrate several characteristics of enzymes and how they work. You will be doing different activities that will help you to see why enzymes are necessary to our lives

Objective purpose: Your body would not work properly if enzymes were not available to help our biological reactions in our cells.

Bell ringer🡪 Compare and contrast the two ingredient labels. There are two ingredient labels, one for Saltine crackers and the other for Matzo crackers on the smart board to use.

* Make a note of the nutrient differences
* The teacher should create a T chart on the white board of differences and similarities and then take examples from volunteer students
* The teacher should be looking for differences in the nutrients of the two labels, such as which label has what and the amount in each

Teacher explanation

* Amylase is found in the saliva
* Have the students predict which of the crackers will be digested faster in your mouth, the saltines or the matzos
* Ask students why they believe their predictions are correct, have them write down their predictions

**Lesson Body**

Subject matter outline

* Everything that happens in an organism is based on chemical reactions
  + A chemical reaction is a process that changes one set of chemicals into another set of chemicals
* Reactants are the elements or compounds that go into a chemical reaction
* Products are the elements or compounds produced by the chemical reaction
  + Always involves breaking the bonds in reactants and forming new bonds in products
  + Example:  in the blood stream, carbon dioxide reacts with water to form carbonic acid, which is more soluble and easier to transfer
* Energy is either released or captured when chemical bonds are broken or formed
* Chemical reactions that release energy often occur spontaneously, but ones that absorb energy will not occur without a source of energy
* Why is this important?  To stay alive organisms need to carry out reactions that require energy, so they need to have a source of energy
* Activation energy is the amount of energy needed to get a reaction started
  + The cellulose in paper burns in the presence of oxygen and release heat and light, but only if you light a match to it.  The lighted match provides the energy needed to start the reaction
* Enzymes
  + Some reactions either take too long or their activation energies are too high to make them practical
  + How can we fix this?  Our cells make catalysts, which are substances that speed up the rates of chemical reactions
    - How do catalyst do this?  By lowering the reaction's activation energy
  + Enzymes are proteins that act as biological catalysts
  + Enzymes speed up reactions that take place in the cell
    - Example: carbonic a hydrate speeds up the reaction of carbon dioxide and water
  + Enzymes are specific
* Enzyme Action
  + Enzymes provide a site where the reactants can be brought together to react.  This reduces the energy needed
  + Substrates are the reactants of an enzyme-catalyst reaction
* The substrate binds to a specific site on the enzyme called the active site
* They have complementary shapes (lock and key)
  + Enzyme-substrate complexes are when the enzyme and substrates are bound together
* Regulation of enzyme activity
  + Enzymes work by a specific pH value and can be affected by a change in temperature, and the concentration of substrate and product

Digesting crackers

1. Explain and demonstrate directions

Discovery rule: enzyme rates are affected by the concentration of substrates and products

Directions

* The teacher will hand out a piece of saltine cracker and a piece of matzo cracker
  + Do not do anything with the cracker until instructed
* When directed students will place the saltine cracker in the mouth
  + Tell students to use their tongue to press the cracker against the roof of the mouths and then cover it with their saliva, but not to do any other mechanical digestion (using teeth or tongue movement
* A stopwatch will be set up on the smart-board
  + Tell the students that whenever they start to feel the cracker becoming soft and mushy that chemical digestion has begun and to note how long it took in their journals. CFU=ask students their times
* When done, tell students to swallow the cracker and then get ready to do the same with the Matzo cracker piece.
* Note the time of how long it took for the Matzo cracker in students’ journals. CFU=ask the same students to share their times and note the difference

2. Monitor discovery

Walk around the class to observe

AP=students test crackers

CFU=asking questions

* Ask: “What type of digestion are the performing?” *Chemical*
* Ask: “what enzyme in their saliva is working here?” *Amylase*
  + Ask: “What does amylase help react?” *Starches and sugars*

3. Review discovery

* Ask which cracker took longer for chemical digestion to occur? Almost if not all should be the matzo cracker
* Ask why they think the matzo cracker took longer? Varied answers
* Direct students to their bell ringer answers
  + What in their bell ringer was different between the two crackers that might give some evidence about the matzo cracker taking longer to digest? Amount of carbohydrates, the matzo cracker had more
* Ask students what concept do they see here? The higher concentration of substrate the longer it will take amylase to digest all the carbohydrates

4. Supervised practice found at the end of the enzyme matching activity

Enzyme matching activity

1.  Explain and demonstrate directions

Discovery:  the rule of enzymes being specific and the lock and key rule

Directions

* Teacher will hand you either an enzyme or substrate card
  + Each enzyme card has an active site and will have a substrate that will fit to that active site
* Students will need to find their match to their card, if you are an enzyme then you will have to find a substrate, and vise versa
* Once students have found their match, return to their seats and fill in the four boxes (enzyme, substrate, product, factoid) on their handout
* When all students have their match and written down their information, have them return to their original seats and have them switch cards with another student that they did not have the first time
* Repeat the process with the new card

2.  Monitor discovery

Walk around room checking for understanding and prompting questions when necessary

* Why are the cards fitting correctly?  The substrates fit the active site
* Why aren't the cards fitting together?  The substrates do not match the active sites

3.   Review discovery

Ask questions over the findings

* What common trend did you see during the activity?  The enzymes and substrate wont fit unless they are the right shape

CFU=asking questions

* Can any enzyme fit any substrate?  No
* How many substrates fit a single enzyme? Only one, typically enzymes are specific for only one reaction

Supervised practice for both

* Exit ticket over the energy involved with enzyme reactions
* Go over the concept that enzymes lower the activation energy of a reaction
  + Use the chart found on the front of the exit ticket
  + Compare the reaction to a person pushing a boulder up a hill
* Students complete the back of the exit ticket independently and then turn it in to the wire basket up front

**Extended practice**

Enzyme handprint activity

VS=real lock and key, five finger facts, triangle effects

AP=pair and share

* Give example of the lock and key characteristics of enzymes with a real lock and key
* Pass out handout and paper, remind students that these are classroom sets so they should not write on them
* Have students pair and share about the five important concepts about enzymes found on the handout
* The handout will have the students make visual notes using an outlined handprint and triangles
* Have the students work up to step 8 then stop
* Discussion over the three effects on enzyme reactions
  + Key ideas to discuss are the three effects on enzyme reactions: temperature, pH, and substrate and product concentration

**Lesson Closing**

Review concepts

* Have the students share with their desk buddies one important fact about enzymes that they learned today

AP=pair and share

* Pass out a small sheet of paper to have the students write down one thing they learned about enzymes and one question they have about enzymes
* Collect sheets
  + The exit card should have at least one concept about enzymes that the student learned

**Evaluation**

The following class period have the student write in their journals the characteristics of enzymes.