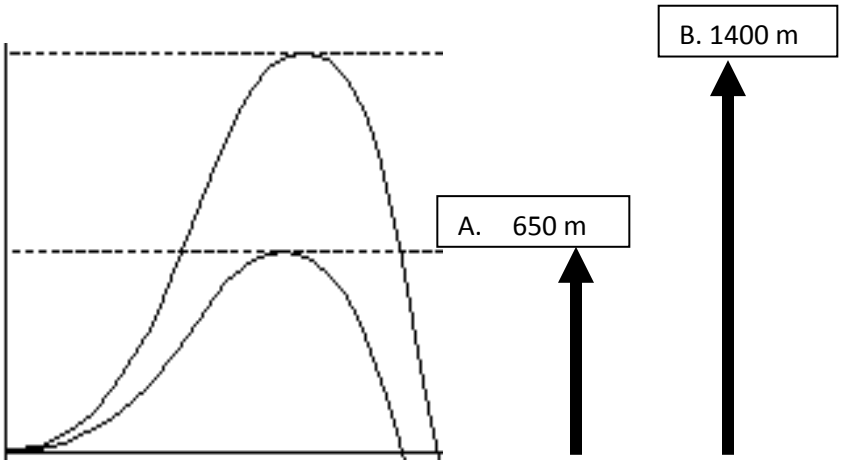
Enzyme POGIL

How does an enzyme influence chemical reactions?
What roles do enzymes play in living things?

Figure 1



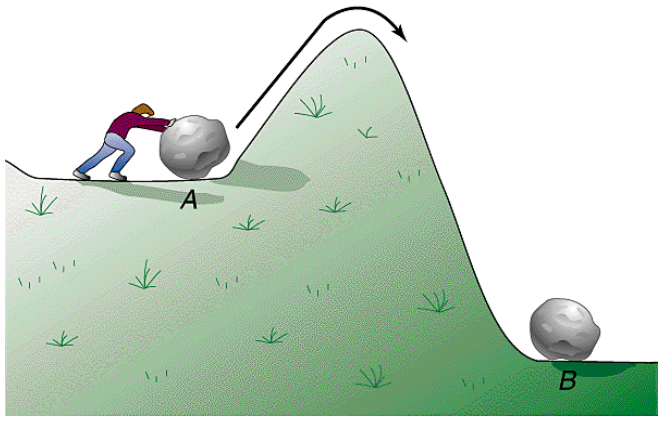
INTRODUCTORY SITUATION QUESTIONS:

1. If you're going hiking this weekend and you have the option of hiking a mountain that is 1400 meters in height and a mountain that is 650 meters in height, BUT you know that you have limited time because of other plans – which mountain would you choose to hike, A or B?

2. If you are hiking at the same pace, which of these mountains would require MORE energy to hike up (A or B)?

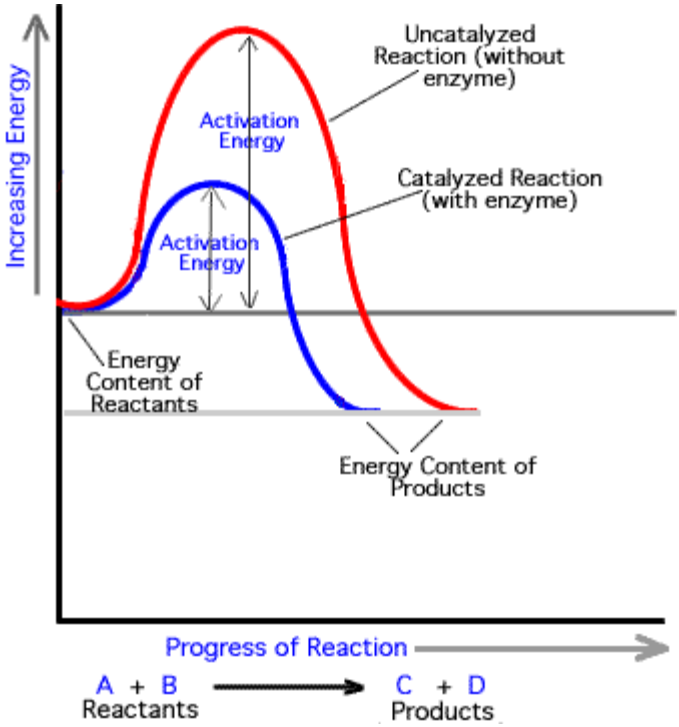
INFORMATION SECTION 1: ACTIVATION ENERGY

Figure 2



The picture above shows someone trying to push a boulder up a hill. In order for the boulder to reach its final destination at point B, it must be pushed to the top of the hill because once it reaches the top of the hill it will roll down the rest of the way. A similar scenario exists in chemistry, before a chemical reaction will take place, energy must be put into the system. The energy needed for a chemical reaction to move from point A to the top of the hill is known as *activation energy*, also written as E_a

Figure 3



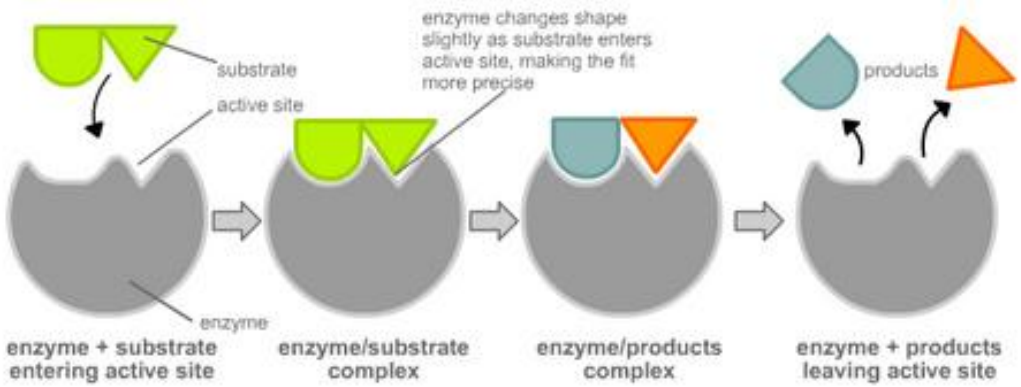
3. Comparing Figure 3 above to the figure 1 (comparing the heights of 2 mountains), how does using an enzyme in a chemical reaction impact the reaction?
   a. Does it speed up or slow down the reaction?
   b. How does the enzyme impact activation energy?
   c. Based on your answers to questions a and b, what do you think the term "catalyzed" means?
   d. Do you know of any other examples of things that "catalyze" chemical reactions?

INFORMATION SECTION 2: LOCK AND KEY THEORY

Figure 4

4. What do you know about keys?
   a. What are the characteristics that distinguish one key from another?
   b. Where are some places that you use keys?
   c. Can a key from one place open the lock of a different key?
   d. If you had to choose from the word "specific" or "general" to describe a key, which would you choose?

Figure 5



5. Looking at Figure 5 above, how is the enzyme similar to a lock and a key?
6. What terms are used in the picture of the enzyme that could be used in the following analogy. lock:key as ….what:what in the picture above?
7. If the substrate in the first image in the left of the series is a disaccharide such as sucrose, that is the enzyme doing to the disaccharide?
8. The picture above is showing what is known in biochemistry as the "***lock and key theory***." Explain why you think this theory is used to describe enzymes.
9. What are some examples from biology/chemistry class or from other areas of your life where the specific shape of something is important for it to work correctly.

INFORMATION SECTION 3: FUNCTION AND ENVIRONMENTAL CONDITIONS

Image A: Before

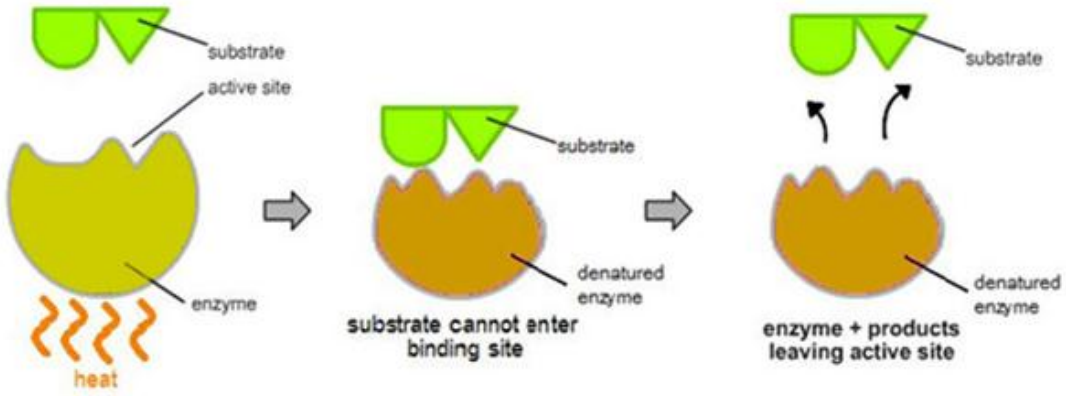
Image B: After

Figure 6

The other day I was really excited about my new coloring book, so I bought a new pack of Crayola crayons and forgot that I left them in my pocket. When I went to do my laundry later in the week, you can see what happened to the stack of crayons after they were put through the dryer.

10. How would you describe what happened to my crayons between image A to image B?
11. Will I be able to accurately color my coloring book if the crayons are like this? Explain.
12. What caused my crayons to be changed?
13. What are some other things that you have seen "melted" or change shape which impacted their ability to work correctly. Come up with *at least* 3 other examples.

Figure 7

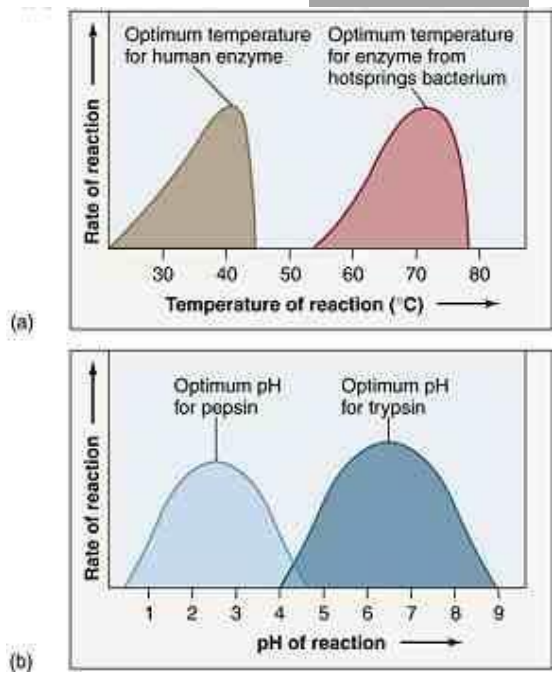


14. Figure 7 above shows what happens to an enzyme when exposed to heat. How is this similar to what happened to my crayons?
15. What term is used to describe when the shape of the enzyme has been altered?
16. Predict how this alteration will affect the enzyme's ability to function properly.

Figure 8

CONDITIONS AFFECTING ENZYME FUNCTION

17. Using Figure 8(a) and 8(b): What are two conditions that affect enzyme function?
18. Provide an explanation for why human enzymes function best at 40 °C but enzymes from hotsprings bacterium works best at 70 °C.
19. What do you think happens to the human enzyme when the temperature increases to 45 °C.
20. In figure 8(b) you can see two different enzymes, why do you think they work best at different pH levels?



INFORMATION SECTION 4: ENZYME USES

Enzymes are complex proteins produced by all living thing. Enzymes are substances that help carry out a number of the body's function like transforming food and chemical elements into other needed substances. Enzymes help eliminate toxins in the colon, kidneys, liver, lungs and skin. Your body has millions of enzymes controlling millions of tiny reactions. Under normal circumstances, each enzyme is able to catalyze many reactions before they stop working.

Like all proteins, enzymes consist of chains of amino acids linked together. The amino acids within each kind of enzyme have a characteristic arrangement. The bonds between the different amino acids in the chains are weak and may be broken by such conditions as high temperature or changes in pH. When the bonds are broken, the enzymes become non-functional, sometimes this results from diseases.

The most well known and important enzymes are the digestive enzymes:

1. **Amylase - contained in saliva. Splits the carbohydrates in order to be assimilated by the intestine.**
2. **Protease - contained in the gastric juices. Splits proteins so they can be digested.**
3. **Lipase - secreted by the pancreas. Split fats into fatty acids so that it can be digested.**

21. What are some uses for enzymes?
22. Can you think of things that enzymes would be used for in living things that are not listed in the examples above?
23. Low grade fevers are healthy because they help our body get rid of harmful bacteria/viruses, but when fevers reach of temperature of 105 degrees Fahrenheit it is extremely dangerous – using your knowledge of enzymes explain why. (*note: be sure to use the scientific terms throughout to help explain what happens)
24. Do you feel you understand the role of enzymes in living things and how they work? What questions do you still have about enzymes?