Enzyme Action! *Name* _____

Enzymes are important chemicals in cells that help to increase the rate of its chemical reactions. Suppose your cell wanted to put together a large starch, for example. An enzyme will bring the tiny sugars that the starch will be made of and will quickly perform the chemical reaction that links them together. The substance the enzyme works on, in this case sugar, is called the ***substrate***. An enzyme has a special place on it called the ***active site*** . This site needs to match the shape of the substrate so that it can quickly pick it up and perform the reaction . Today you are going to be an enzyme! Follow the directions below and keep track of your group's success in making the final product.

Trial I- Baseline Normal Enzyme Action- Do this in groups of THREE.
GROUP MEMBER'S NAMES - _____, _____, _____

One group member is the enzyme and their hand is the active site that matches the substrate. Today we will use colored beads as the substrate. What color is your enzyme after? _____ The teacher will spread approximately 200 blue and 200 yellow pop beads on the ground. The enzyme must use its hand to pick up a correctly colored bead and to quickly pop it into a growing chain! Your teacher will stop you every 10 seconds and your group recorder will write down the number you have linked. What will the other group member do? Count the number of beads you have put together! Record the information on the data table on the next page under Trial number I - Baseline.

Trial II- Denaturation

Your original enzyme person must be pretty tired so change the person who is playing the enzyme. (Real enzymes never get tired!) Another group member will count and the other will record. The enzyme this time will be after the same color bead as before but we are going to tape their fingers together! This shows how enzymes can be partially *denatured.* This means that the enzyme shape has changed. How will this effect the enzyme? Try it and see! Put your data on the table in the column marked Trial II- Den.

Trial III- Coenzyme

Now it is the last persons turn to be the enzyme! This time the enzyme is not taped (it is in its normal shape) but this time the enzyme will have a helper called a *coenzyme* ! The coenzyme will now do the job of connecting the new bead to the growing chain. So the enzyme needs only to find the beads and toss them to the coenzyme. Do you understand what your role is? Record your data on the table under the column marked trial III- COEZ.

Trial IV Competitive Inhibitors

In this trial the enzyme (whoever you choose) will have a plastic tube taped to their hand! This models a *Competitive Inhibitor* that competes for and blocks the active site of the enzyme (in this case your hand). Record your data under Trial IV- Inhib.

Your teacher will decide if you should graph your own data or you should compile your classes data to have a class data graph. Your teacher will explain how to make the four graphs that will display how enzymes work in these situations.

TIME IN SEC.	TRIAL1 BASE.	TRIAL 2 DENAT.	TRIAL 3 COENZ	TRIAL 4 INHIB.
0	0	0	0	0
10				
20				
30				
40				
50				
60				
70				
80				
90				
100				
110				
120				
130				
140				
150				
160				
170				
180				
190				
200				
210				
220				

CONCLUSION (use class data to answer these questions!)

1. In this activity, what represented the enzyme? _____
The coenzyme? _____ The substrate? _____ The inhibitor? _____

2. Find the rate or speed of the enzyme for Trial 1 between the time periods 10 and 30 seconds. This is the **initial** rate of the enzyme reaction.

a. $\frac{\text{\_\_\_\_\_ beads - \_\_\_\_\_ beads}}{\text{30 sec - 10 sec}} =$ beads /sec

b. Find the rate or speed of the enzyme working in trial 1 between the last two time periods for your class.

$\frac{\text{Beads - Beads}}{\text{Last time- next to last time}} =$ beads/sec (rate on enzyme at the end of 1)

c. Why did the rate change between the beginning of the activity and the end for trial 1? (Think about what the enzymes were experiencing at the beginning and end!)

3. Find the rate of activity for trial 3 between 10 and 30 sec.

4. In what trial did we have a faster **initial** rate, trial 1 or trial 3? WHY?

5. If we were to **completely** denature an enzyme, explain the effects on the enzymes activity in a cell.

6. What effect do inhibitors (trial 4) have on the speed of an enzyme?
(How would you PROVE this mathematically?)

7. The inhibitors we talked about were COMPETITIVE. What were the substrates and the inhibitors competing for?

8. Why does an enzyme not work as well when its active site is changed in shape?

9. Define the term SUBSTRATE.

10. Enzymes are very much affected by the amount of substrate available to them in a given time. As you played to role of the enzyme, how did the amount of substrate available effect you? EXPLAIN!!!!!!

11. Graph the class data as directed by your teacher. You will graph some on paper and some on the calculator!