Name: _____ Block: _____ Date: _____

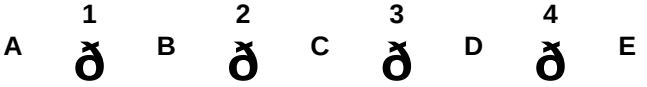
BIOLOGY 12 - ENZYMES & METABOLISM

- **Part A: Definitions**: Define the following terms, **IN YOUR OWN WORDS, IN AS FEW WORDS AS CLARITY AND COMPLETENESS ALLOW**.

i.	metabolism	
ii.	substrate	
iii.	enzyme	
iv.	active site	
v.	apoenzyme	
vi.	coenzyme	
vii.	metabolic pathway	
viii.	activation energy	

Part B: Short Answers

1. The equation ADP + $P_i \rightarrow$ ATP is energy (*requiring or releasing*) _____.
2. In the pathway below, the letters stand for _____and the numbers stand for _____. Each and every reaction in a cell requires a specific _____.



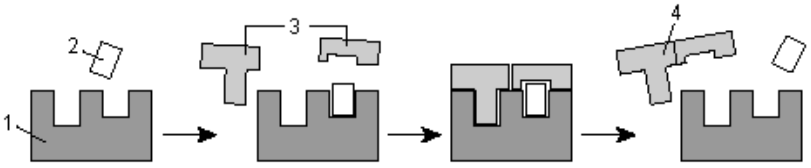
3. If an enzymatic reaction is heated *gently*, it will _____.
4. Enzymes _____the amount of activation energy necessary for a reaction to take place by putting its substrates on a precise "collision course."
5. When NAD accepts hydrogens from a substrate, it is _____, while the substrate is _____.
6. In the equation S + E $\rightarrow$ SE $\rightarrow$ P + E, what do the letters stand for?
   S: _____ P: _____
   SE: _____ E: _____
7. Name two environmental factors that can change the shape of an enzyme.
   i. _____ ii. _____
8. Name two factors that can speed up enzymatic reactions
   i. _____ ii. _____
9. Enzymes have helpers called _____. A common example of the latter is NAD. What is the function of NAD in cells? _____.
10. Give the overall equation for aerobic cellular respiration. Indicate energy on the correct side.

	+	$6O_2$	-------->		+	$6H_2O$	+	38 ATP
Food (Glucose)	+			carbon dioxide	+		+	

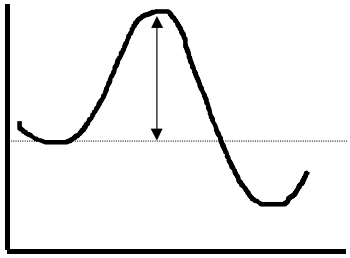
11. In a metabolic pathway, a) the product of one reaction becomes the substrate of the next reaction b) the same enzyme is used for all reactions c) the end product is always pyruvic acid d) ATP is used up all the time e) all of these

12. Label the parts on this diagram.

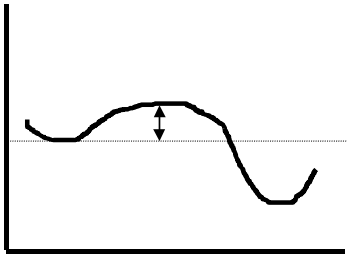
1	
2	
3	
4	



13. Label all missing parts on the graphs to the right. **Highlight the energy of activation** on both graphs.

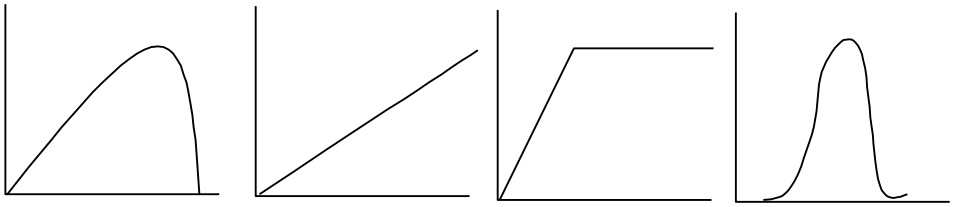


Progress of Reaction



Progress of Reaction

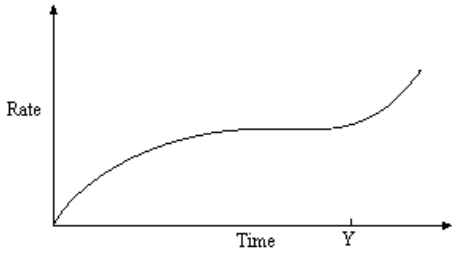
14. Which graph below best represents a graph of the Enzyme activity vs pH?



A B C D

Part C: Thinking Questions - Answer on separate sheets of paper, in your <u>OWN</u> <u>WORDS</u>.

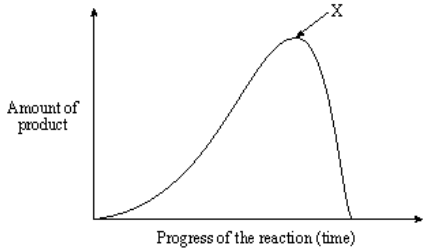
1. What **advantages** can you see in having **complex metabolic pathways** within body cells to produce various substances, such as amino acids and ATP?
2. What gland produces the hormone thyroxin? What is the function of thyroxin in metabolism?
3. Explain, using a good example, how a metabolic pathway can be **self-regulating** (that is, how it can shut itself on and off).
4. How does the "**Lock and Key**" theory of enzyme action differ from the "Induced Fit" theory? Use diagrams to help your explanation.
5. Why do you think each enzyme has its own preferred pH at which it operates?
6. What is the effect of lowering the temperature on enzyme activity. How about raising the temperature? Draw a graph to show these relationships.
7. Describe three factors that can lead to the **denaturing of enzymes**. How would denaturing an enzyme affect its activity?
8. What happens to the **rate of product formation** if you continue to add to an enzyme-catalyzed reaction the following: a) **substrate** b) **enzyme** c) **an inhibitor** d) **Lead**, **mercury**, or **cadmium** e) **H^+ ions** f) **$OH^=$ ions**
9. Explain, using diagrams, how **competitive inhibitors** differ from **non-competitive** inhibitors in the way they act on enzymes.
10. Discuss, using examples, the effects of **reversible** and **non-reversible** inhibitors on enzyme activity.
11. Explain the role of vitamins in metabolic reactions. List at least 2 examples.
12. Explain why a genetic defect that affects only one enzyme in a metabolic pathway can have serious consequences.



The graph above shows the rate of an enzyme-catalyzed reaction in the stomach. What was done at time **Y**?

A. Lead ions were added.
B. More enzyme was added.
C. Temperature was increased by 50°C.
D. Substrate concentration was decreased.

The graph below shows the rate of product formation in an enzyme-catalyzed reaction.



The change observed at **X** could result from the addition of

A. lead.
B. a coenzyme.
C. more enzyme.
D. more substrate.