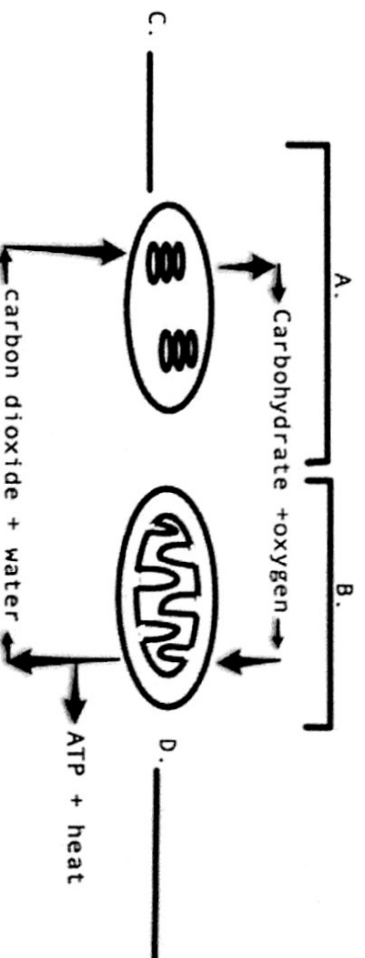


Review Questions:

1. Define metabolism. What are the advantages of having metabolic pathways in a cell?
2. What are enzymes? Why are enzymes important?
3. Are enzymes specific?
4. How are enzymes named?
5. Why are enzymes absolutely necessary to the continued existence of a cell?
6. HOW do enzymes increase the rate of a reaction?
7. Describe what happens when an enzyme reacts with a substrate.
8. Where does the substrate fit onto the enzyme?
9. What happens to the enzyme after the reaction?
10. Describe the difference between the lock and key theory and the induced-fit model.
11. What is the difference between enzymatic reactions that bring about synthesis and those that bring about degradation?
12. Why will an increase in the substrate concentration cause an increase in the enzyme's activity only up to a certain point?
13. What happens to an enzyme as the temperature continues to increase? If the pH continues to increase?
14. Define competitive inhibition. What is the difference between irreversible and reversible inhibition?
15. Define noncompetitive inhibition. What is the normal way by which metabolic pathways are regulated?
16. What are coenzymes? List 3 vitamins that are used in coenzymes.

Completion and Short Answer Questions

1. _____ is defined as the capacity to bring about change or do work.
2. When cells require energy for synthetic reactions, they "spend" _____.
3. In the diagram below, list the two cellular processes that allow for energy transformations on lines a and b. On lines c and d, list the organelles responsible for each cellular process.



4. Every ATP molecule is composed of the base (a) _____ the sugar, (b) _____ and three (c) _____ groups.
5. The equation $\text{ADP} + \text{P} \rightarrow \text{ATP}$ is energy _____ (requiring/releasing).

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6. $A \xrightarrow{E_1} B \xrightarrow{E_2} C \xrightarrow{E_3} D$

In this metabolic pathway, the letter B stands for the (a) _____ as a result of the action of Enzyme 1. However, as a result of the action of Enzyme 2, B represents a (b) _____. Each and every reaction a cell requires a specific (c) _____.

7. The generalized equation for enzymatic action is :

8. This equation show that the enzyme and the substrate form a temporary _____ complex.

9. In the list below, give the name of the enzyme for each specific substrate.

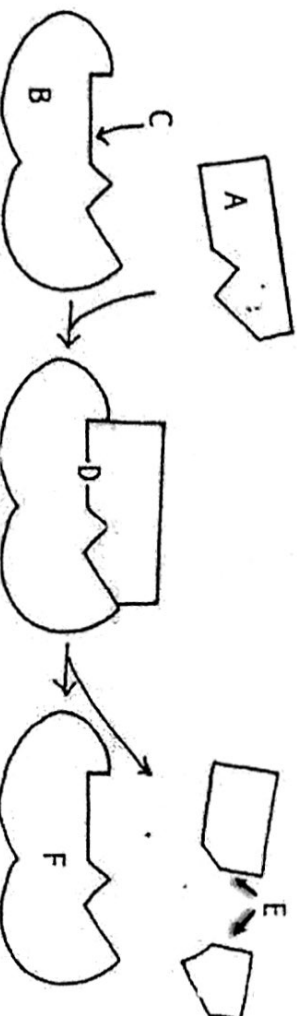
Substrate	Enzyme
Lipid	
Urea	
Maltose	
Ribonucleic acid	

10. Less heat is needed to bring about a chemical reaction within a cell because enzymes will _____ the energy of activation of a reaction.

11. The _____ site is the place where the substrate fits onto the enzyme for orientation so that the reaction takes place.

12. Use the following terms to label this diagram:

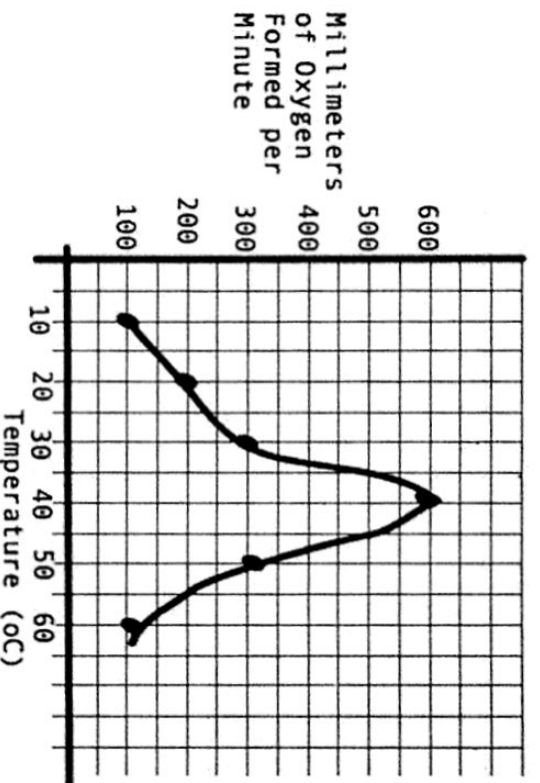
a. *substrate*, B. *enzyme*, c. *active site*, D. *enzyme-substrate complex* e. *product*,



13. When substrate binds to the enzyme, the enzyme undergoes a slight change in shape to achieve maximum fit. This concept is termed the _____ model.

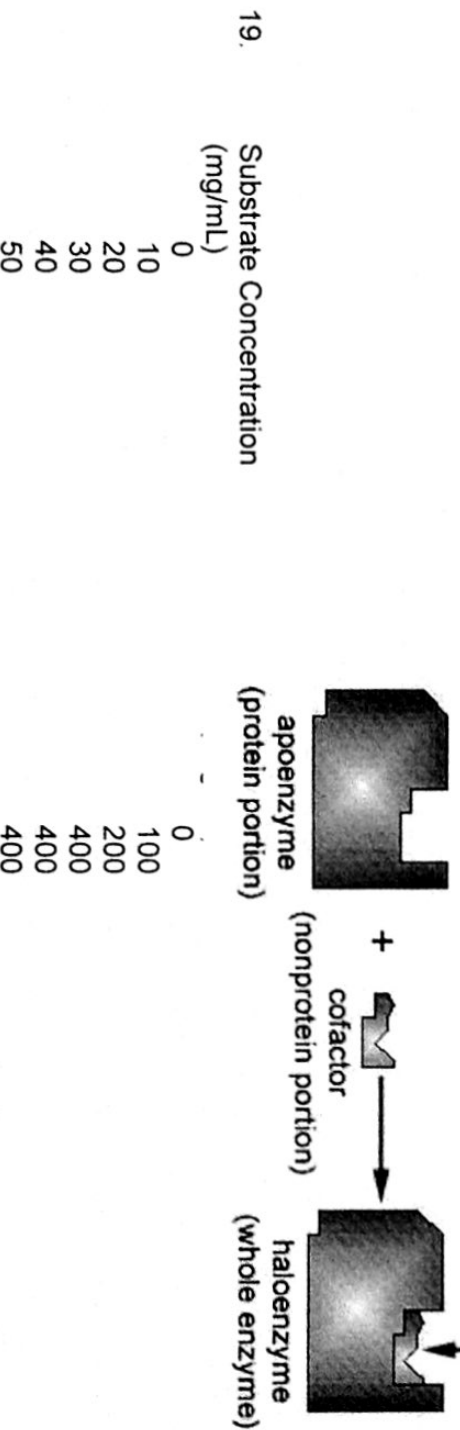
14. Suppose two amino acids join together to form a dipeptide. This type of reaction is considered a _____ reaction.

15. Catalase is an enzyme that breaks down hydrogen peroxide into water and oxygen. Plot the results of the data below in the accompanying graph.



16. On the basis of the above graph, at which temperature did the catalase exhibit the greatest activity? _____
17. Why did the activity of catalase decrease as the temperature continued to increase above 40°C? _____
18. Explain why hydrogen peroxide can be broken down by the enzyme catalase but another substrate, such as maltose, cannot be broken down catalase. _____

What is the cofactor show in the diagram to the right often made from?



Study the table given above.

- a. Which substrate concentration will initially yield the maximum amount of product formed? _____
- b. Explain why the amount of product formed does not increase as the substrate _____

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concentration goes beyond 30 mg/mL

20. On the basis of the two tables presented below, which table shows irreversible inhibition?

Table A

Substrate Concentration (mg/mL)	Inhibitor Concentration (mg/mL)	Amount of Product Formed (mg/mL)
20	0	200
20	10	100
20	20	50
20	40	0
100	40	400

Table B

Substrate Concentration (mg/mL)	Inhibitor Concentration (mg/mL)	Amount of Product Formed (mg/mL)
20	0	200
20	10	0
20	20	0
20	40	0
100	40	0

21. In _____ inhibition, an inhibitor binds to an enzyme at a site other than the active site.

22. Organic molecules that bind to enzymes and serve as carriers for electrons are called _____

23. Two environmental factors that can change the shape of an enzyme are _____ and _____.

24. Enzymes may have a non-protein helper called a(n) _____ or an organic molecule called a(n) _____.

Matching Questions: Use the following answers to match with the words below.

a. inhibitor b. ATP c. extreme temperature d. enzyme

denatured

substance that can compete with a substrate _____

energy currency of the cell _____

substance that can speed up one particular reaction _____

True or False: If you believe the statement to be false, then rewrite the statement as a true one.

1. Enzymes, being molecules that speed up chemical reactions, are required in photosynthesis and respiration.

2. The shape of an inhibitor molecule is very similar to the shape of the enzyme's substrate.

- _____ 3. High temperature and extreme pH can cause an enzyme to denature.
- _____ 4. All enzymes function at the same pH.
- _____ 5. The first law of thermodynamics states that one usable form of energy cannot be completely converted into another usable form.

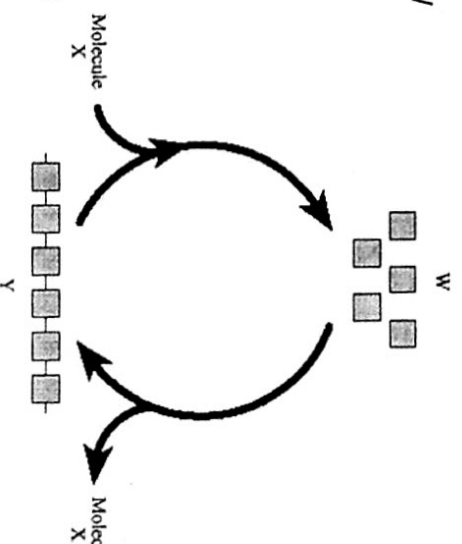
Fill in the Blanks:**B. Energy and Enzymes:**

1. A metabolic _____ begins with a particular reactant, terminates with an end product, and has many minute steps in between. A _____ is a substance that participates in a reaction. A _____ is a substance that is formed by the reaction. The reactants in an enzymatic reaction are called the _____ for that enzyme.
2. An _____ is a protein molecule that functions as an organic catalyst to speed up a chemical reaction.
3. The energy that must be added to cause molecules to react with one another is called the _____. Enzymes _____ the amount of energy for activation to occur.
4. When an enzyme forms a complex with its substrate, the small part of the enzyme that complexes with the substrate is called the _____. In the _____ model, the active site undergoes a slight change in shape in order to accommodate the substrate. Only a small amount of enzyme is actually needed in a cell because enzymes are not _____.
5. Enzymes are very _____ in their action and are named for their _____.
6. As the temperature rises, why is there an increase in enzyme activity? _____.
7. When an enzyme's shape changes due to high temperature or extreme pH, the enzyme is said to be _____.
8. In _____ inhibition, a product produced in high amounts by an enzymatic reaction can inhibit the enzyme's activity. The end product of an enzymatic pathway binds at an allosteric site on the _____ enzyme of the pathway.
9. In _____ inhibition, another molecule is so close in shape to the enzyme's substrate that it can compete with the true substrate for the enzyme's active site. In _____ inhibition, a molecule binds to an enzyme, but not at the active site. This other site is called the _____ site and causes a shift in the three-dimensional structure.
10. _____ are organic molecules that bind to enzymes and serve as _____ for chemical groups or electrons.
11. _____ are small organic molecules that are required in trace amounts in our diet for the synthesis of coenzymes.
12. When the substrate binds to the enzyme, the enzyme undergoes a slight alteration in shape to achieve optimum fit. This concept is termed the _____ model.
13. For each of the following characteristics of enzymes, put T for true or F for false.
- _____ Each reaction in a cell uses a specific enzyme
- _____ **(a better word would be REGULATES)** Slows down chemical reactions
- _____ Named for their substrates
- _____ Enzymes and products form a complex
- _____ Substrate binds to enzyme at active site
- _____ Increase in temperature causes decreased activity (unless well beyond optimal)
- _____ Each enzyme has an optimal temperature
- _____ All enzymes have the same optimal pH
14. The thyroid gland releases a hormone called _____ which acts on cells, causing them to _____.

15. If iodine is lacking in the diet, the thyroid gland enlarges, producing a _____
16. As a result, when there are low levels of thyroxin in the blood, called _____, no negative feedback occurs, and the anterior pituitary continues to produce _____, which stimulates the thyroid to hypertrophy.
17. Thyroxin increases the _____ rate in which glucose is broken down.
18. Describe the process that controls the release of thyroxin from the thyroid gland. (including the hypothalamus) ?What is this process called? _____

19. Examine the diagram to the right.

- a. What is the name of the type of reaction that changes substance "W" substance "Y"?
- b. What is the opposite reaction, from Y to W, called?
- c. What is Molecule X?
- d. Suggest a molecule that is properly represented by "W" and "Y".



20. What is the name of the biological molecule shown below? What is for?

