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**.

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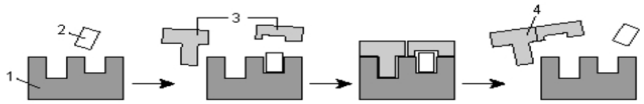
|---|---|---|
| i. | metabolism | all the chemical reactions that take place in living systems to maintain homeostasis |
| ii. | substrate | the substances that enter a specific reaction |
| iii. | enzyme | proteins that serve as catalysts (they speed up reactions) |
| iv. | active site | the place on an enzyme where substrate(s) bind |
| v. | apoenzyme | the protein part of an enzyme, gives the enzyme its specificity |
| vi. | coenzyme | non-protein organic molecules (e.g. NAD+) that help enzymes to catalyze reactions or carry electrons, hydrogen, or functional groups stripped from substrates. Often complete the active site. |
| vii. | metabolic pathway | a stepwise sequence of reactions in cells, with specific enzymes catalyzing each step. |
| viii. | activation energy | the minimum amount of energy that colliding reactants must have in order for a chemical reaction to occur. |

**Part B: Short Answers**

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

3. If an enzymatic reaction is heated *gently*, it will **speed up**.
4. Enzymes **LOWER** 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 **reduced**, while the substrate is **oxidized**.
6. In the equation S + E $\rightarrow$ SE $\rightarrow$ P + E, what do the letters stand for?
   S: **substrate** P: **product**
   SE: **substrate-enzyme complex** E: **enzyme**
7. Name two environmental factors that can change the shape of an enzyme.
   i. **temperature** ii. **pH**
8. Name two factors that can speed up enzymatic reactions
   i. **increase temp** ii. **increase [] of substrate or enzyme**
9. Enzymes have helpers called **coenzymes**. A common example of the latter is NAD. What is the function of NAD in cells? **Carries H atoms in oxidation reduction reactions**.
10. Give the overall equation for aerobic cellular respiration. Indicate energy on the correct side.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $C_6H_{12}O_6$ | + | $6O_2$ | --------> | $6CO_2$ | + | $6H_2O$ | + | 38 ATP |
| Food (Glucose) | + | oxygen | | carbon dioxide | + | Water | + | Energy |

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 **correct answer = a**
12. Label the parts on the diagram to the right.

| | |
|---|---|
| 1 | **ENZYME** |
| 2 | **COENZYME** |
| 3 | **SUBSTRATE** |
| 4 | **PRODUCT** |