**ENZYME REVIEW**

1. An enzyme is a biological *carbohydrate-based* catalyst. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. A protein whose three-dimensional shape has been permanently changed is said to be *denatured. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*
3. Enzymes often work in a closely-regulated sequence, in which an enzyme later in the sequence may stop the activity of an earlier enzyme by a process known as *precursor activation. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

4. Of the following characteristics, which one is **not** true about enzymes?

A. They function best at specific temperatures but break down at high temperatures.

B. They are essential to the metabolism of cells for the conversion of energy.

C. They undergo major chemical change after reacting with their specific substrate

D. Some enzymes need activators or cofactors.

5. At which temperature would you expect any enzyme extracted from a human tissue to have its optimal performance?

A. 5C

B. 25C

C. 37C

D. 95C

6. The activity of an enzyme can be controlled by changing the pH of its surroundings slightly. This change in pH works by

A. altering its three dimensional shape

B. breaking its peptide bonds

C. causing the enzyme to precipitate

D. increasing the activation energy of the reaction

7. Enzymes work as catalysts by doing which of the following?

A. increasing the free energy of the reactants

B. decreasing the free energy of the reactants

C. increasing the activation energy of the reactants

D. decreasing the activation energy of the reactants

8. Biochemical catalysts are known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Each has a specific \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ where the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ attaches.

9. Examine the following data related to a variety of enzymes that have been tested at a number of temperatures and pH levels to measure their activities.

Enzyme Activity (mmol/ug of enzyme protein/min) for **Enzyme 'A'**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **T  4C** | **T  20C** | **T  37C** | **T  45C** | **T  80C** |
| **pH = 1** | 0 | 0 | 0 | 0 | 0 |
| **pH = 4** | 0 | 2 | 10 | 2 | 0 |
| **pH = 7** | 0 | 5 | 50 | 5 | 0 |
| **pH = 10** | 0 | 2 | 10 | 2 | 0 |
| **pH = 13** | 0 | 0 | 0 | 0 | 0 |

Enzyme Activity (mmol/ug of enzyme protein/min) for **Enzyme 'B'**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **T  4C** | **T  20C** | **T  37C** | **T  45C** | **T  80C** |
| **pH = 1** | 0 | 2 | 10 | 2 | 0 |
| **pH = 4** | 0 | 2 | 10 | 2 | 0 |
| **pH = 7** | 0 | 2 | 10 | 2 | 0 |
| **pH = 10** | 0 | 2 | 10 | 2 | 0 |
| **pH = 13** | 0 | 2 | 10 | 2 | 0 |

Enzyme Activity (mmol/ug of enzyme protein/min) for **Enzyme 'C'**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **T  4C** | **T  20C** | **T  37C** | **T  45C** | **T  80C** |
| **pH = 1** | 0 | 0 | 0 | 0 | 0 |
| **pH = 4** | 2 | 2 | 2 | 2 | 2 |
| **pH = 7** | 10 | 10 | 10 | 10 | 10 |
| **pH = 10** | 2 | 2 | 2 | 2 | 2 |
| **pH = 13** | 0 | 0 | 0 | 0 | 0 |

Complete the following table based on these results.

|  |  |  |
| --- | --- | --- |
| **Enzyme** | **Optimal temperature** | **Optimal pH** |
| **A** |  |  |
| **B** |  |  |
| **C** |  |  |

10. Explain the term *denaturation* and explain the biological importance of this process with a specific example.

11. When making bread, temperature is critical. If the dough is kept too hot or too cold, the dough will not rise. Explain these observations.

12. Enzymes are not used up in a chemical reaction, but are reused. Why must amylase be added to the digesting food by both the salivary glands and the pancreas?

13. Describe the induced-fit model of enzyme activity.

14. Why are enzymes used in the cleaning industry?

15. “Feed a cold and starve a fever” is a common saying among an older generation. Using your knowledge of the relationship between temperature and the rate of enzyme activity, state whether this statement has a basis in fact or not and explain why.