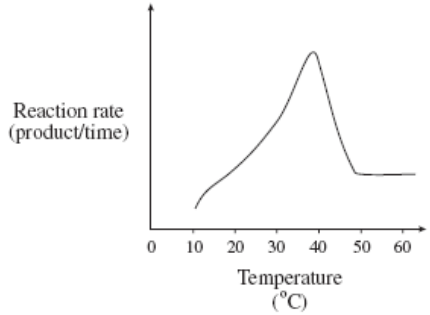
# CH.6 – ENZYMES & ENERGY

PRACTICE QUESTIONS

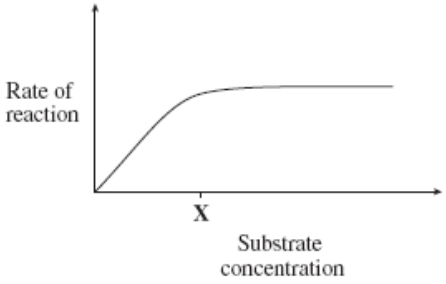
1. The following graph illustrates the effects of temperature on the reaction rate during the hydrolysis of protein.




At what temperature is the greatest amount of protein present?

A. 10°C
B. 37°C
C. 45°C
D. 50°C

2. Provide a possible explanation for what is happening in the reaction represented by the graph below:

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**3.** Explain how the addition of mercury affects the rate of an enzyme-catalyzed reaction. **(4 marks)**

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4. How do enzymes increase the rate of reaction?

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5. How are coenzymes involved in enzymatic reactions?

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6. What is the function of thyroxin?

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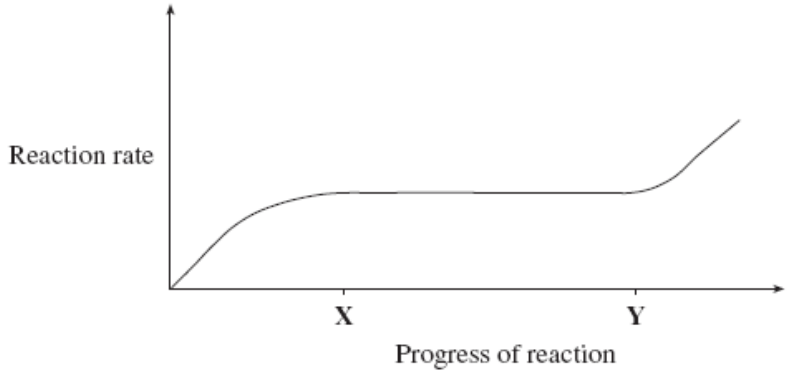
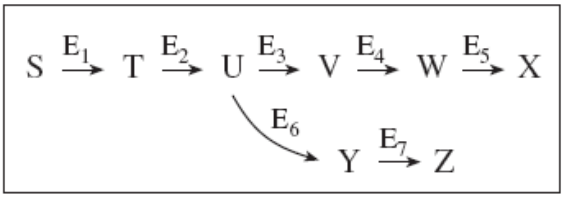
7. The graph shows changes in the reaction rate of an enzyme-catalyzed reaction. What accounts for the shape of the graph between **X** and **Y**?




A. There is not enough substrate.
B. All the active sites are occupied.
C. More coenzyme has been added.
D. Heavy metal ions have been added.




**$E_1$ to $E_7$ are enzymes**
**S to Z are substrates**

8. In an experiment, substrate **S** was added to a beaker containing equal amounts of enzymes **E1** to **E7**. The metabolic pathway in the diagram shows the reactions that occurred. After 15 minutes a competitive inhibitor for **E3** is added to the beaker and the reactions continue to completion. What would happen to the rate of production of X? What would happen to the rate of production of Z?

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9. The following procedure demonstrates the effect of pH on the activity of the enzyme trypsin.
    - 10 ml of a protein solution is added to each of five numbered test tubes, each of which is buffered at a different pH.
    - The pH of each of the test tubes is maintained.
    - An equal amount of a trypsin solution is added to each test tube.
    - The temperature is maintained at 37°C.
    - Each test tube is analyzed after three hours.

    The results are recorded in the table below:

| Test Tube | pH | Amount of product (g) |
|---|---|---|
| 1 | 2.0 | 0.3 |
| 2 | 3.5 | 0.8 |
| 3 | 7.0 | 1.7 |
| 4 | 8.5 | 3.5 |
| 5 | 10.0 | 2.1 |

a) Use the data from the table to produce a line graph which illustrates the "Amount of product vs. pH" (plot the pH on the *x*-axis). **(2 marks)**



b) Explain why less product is found in test tubes **1** and **2** than in the others.

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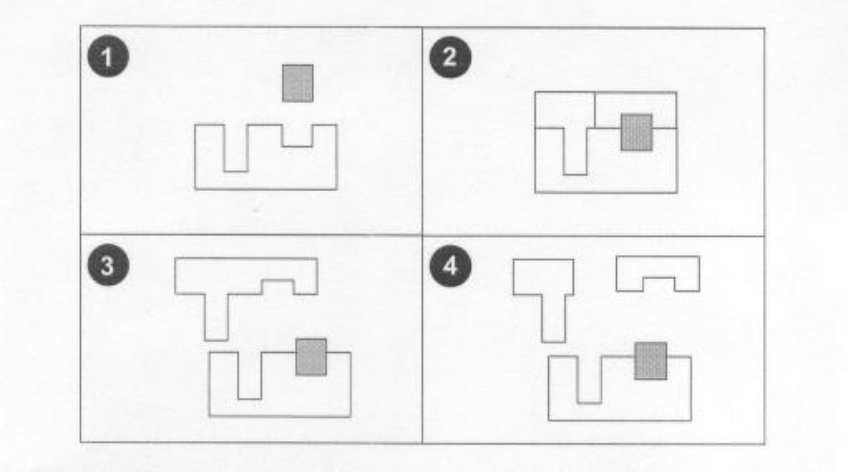


10. To represent the "lock and key" model of enzymatic action, in which order would the diagrams above have to be placed?

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11. The following experiment was conducted to observe the effect of temperature on the rate of enzyme activity:
    1 10 mL of a starch solution was added to each of five lettered test tubes.
    2 Each test tube was placed in a different water bath as shown in the table below.
    3 An equal amount of salivary amylase was added to test tubes W,X ,Y and Z.
    4 A sample was taken from each test tube every minute and tested with IKI, an indicator that turns from yellow to black when mixed with starch.

| Test Tube | Temperature of Water Bath (°C) | 1 min. | 2 min. | 3 min. | 4 min. | 5 min. |
|---|---|---|---|---|---|---|
| V | 20 | black | black | black | black | black |
| W | 0 | black | black | black | yellow | yellow |
| X | 20 | black | black | yellow | yellow | yellow |
| Y | 40 | black | yellow | yellow | yellow | yellow |
| Z | 60 | black | black | black | black | yellow |

a) What is the purpose of test tube V?

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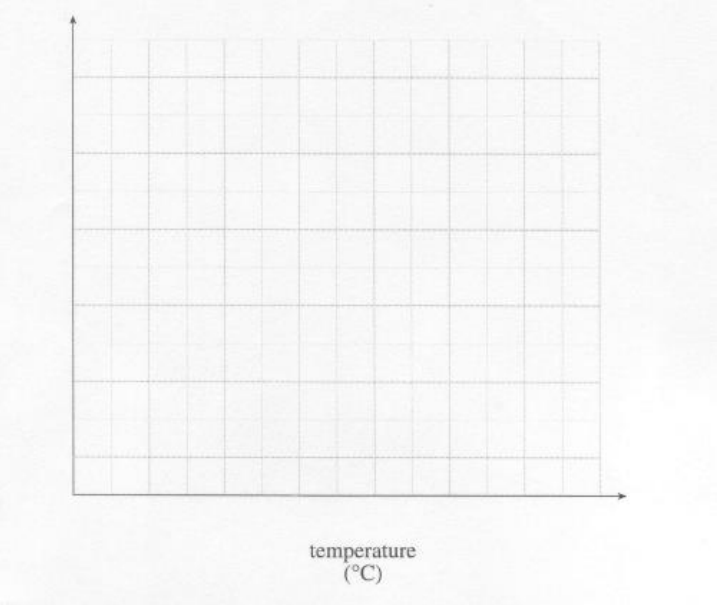
b) Using the grid provided, draw a graph that relates the time it takes for the indicator to turn yellow to the temperatures of test tubes W, X,Y and Z.




c) Explain the results of the experiment.

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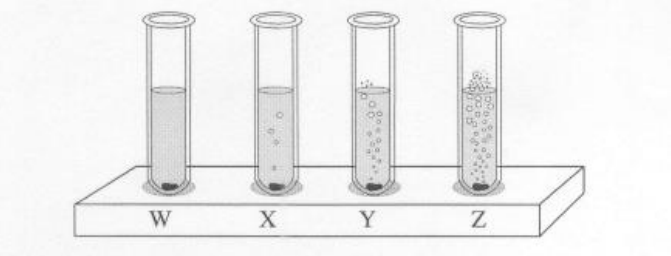
12. An experiment was setup to measure the effect of temperature on catalase an enzyme found in the liver that breaks down hydrogen peroxide into water and oxygen gas. Four labeled test tubes, each containing similar amounts of catalase and 2 mL of hydrogen peroxide were incubated at different temperatures.




a) Which of the following matches the test tube with its correct temperature?

| | W | X | Y | Z |
|---|---|---|---|---|
| A. | 70°C | 37°C | 20°C | 5°C |
| B. | 5°C | 20°C | 37°C | 70°C |
| C. | 70°C | 5°C | 20°C | 37°C |
| D. | 5°C | 70°C | 37°C | 20°C |

13. Describe **two** changes that could be made to an enzyme-catalyzed reaction which would result in a decrease in the rate of the reaction. Explain why these changes cause the reaction rate to decrease.

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