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VCE Biology ¾
Proteins, Protein Export & Enzymes [1.4]
Homework

Homework Outline:

Compulsory Questions	Pg 2 – Pg 14

Section A: Compulsory Questions (32 Marks)

Sub-Section [1.4.1]: Define and Compare Primary, Secondary, Tertiary and Quaternary Structures of Proteins

Question 1

Definitions:

a. Primary structure.

_____

_____

b. Secondary structure.

_ _____

_____

c. Tertiary structure.

_____

_____

d. Quaternary structure.

_____

_____

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Question 2 (1 mark)

A proteome is defined as:

A. The sum of all of the functional proteins that an individual organism produces.

B. Primitive, simple form of protein.

C. The kinds of proteins produced by prokaryotic organisms.

D. The kinds of proteins produced by eukaryotic organisms.

Question 3 (1 mark)

The bonds linking amino acids together are called:

A. Peptide bonds.

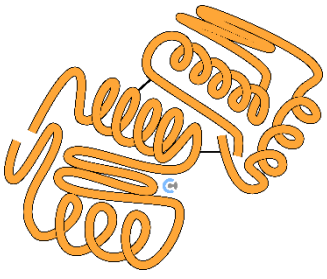
B. Hydrogen bonds.

C. Intermolecular bonds.

D. Covalent bonds.

Question 4 (1 mark)

The following diagram is of a functional protein.



The highest level of hierarchical structure for the functional protein is:

A. Primary.

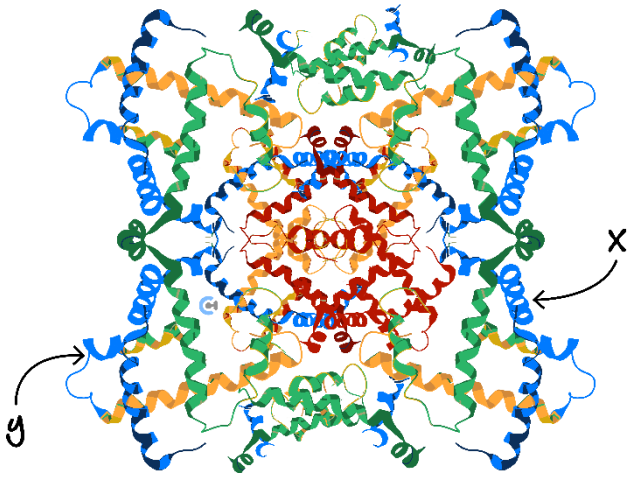
B. Secondary.

C. Tertiary.

D. Quaternary.

Question 5 (5 marks)

The diagram below shows a transmembrane protein, found in the cell membranes of mice.
There are two secondary structures labelled as ***X*** and ***Y***.



a. Give one function of a transmembrane protein. (1 mark)

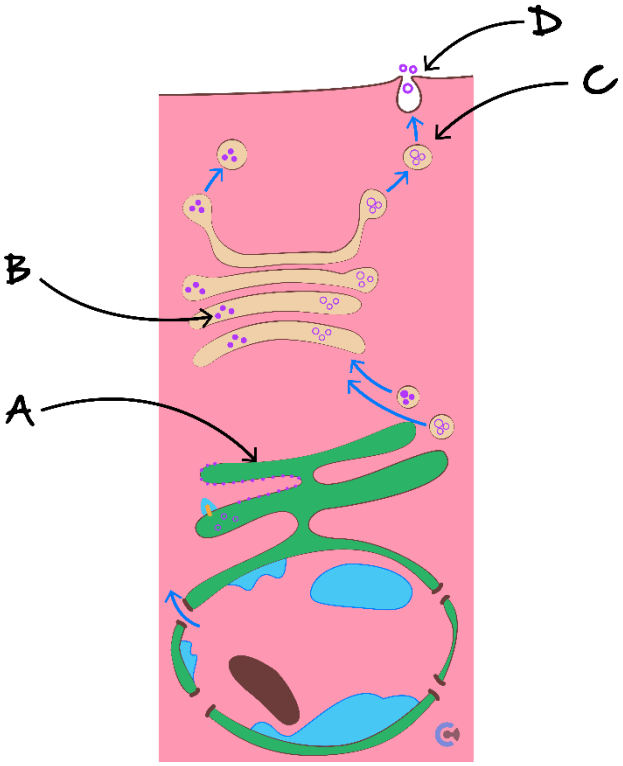
b. Name the structures labelled ***X*** and ***Y***. (2 marks)

c. The protein also displays a tertiary structure. Explain how the tertiary structure would be related to the function of the protein. (2 marks)

Sub-Section [1.4.2]: Identify and Describe the Roles of Ribosomes, Rough Endoplasmic Reticulum and Golgi Apparatus in the Transport and Export of Proteins from a Cell

Question 6 (6 marks)

The diagram below shows the production and export of a protein from a cell.



a. Name the final **cellular process** shown at point *D* in the diagram. (1 mark)

_____

_____

b. Identify the organelles labelled *A*, *B*, and *C* in the diagram. (2 marks)

_____

_____

_____

_____

c. Describe the process shown in the diagram for exporting a protein from a cell. (3 marks)

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Sub-Section [1.4.3]: Explain the Lock-And-Key Model, the Induced Fit Model and why Enzymes are Specific and only Catalyse One Reaction.

Question 7

Definitions:

a. Lock and key.

_____

_____

b. Induced fit.

_____

_____

c. Catalyst.

_____

_____

d. Substrate.

_____

_____

e. Active site.

_____

_____

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Question 8 (1 mark)

Enzymes catalyse biochemical reactions by:

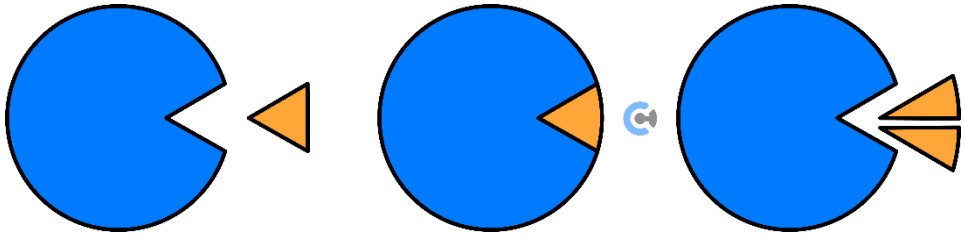
A. Providing energy to speed up the rate of reaction.

B. Lowering the energy of activation for a reaction.

C. Changing the direction of equilibrium.

D. Changing endergonic into exergonic reactions.

Question 9 (1 mark)



The diagram above best depicts the:

A. Interaction between an enzyme and a substrate.

B. Interaction between an antigen and an antibody.

C. Interaction between a receptor and a signalling molecule.

D. Action on a non-competitive drug to slow down metabolism.

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Question 10 (3 marks)

The equation below describes a reaction that occurs in the liver cells of humans. The enzyme catalase breaks down the toxin hydrogen peroxide into water and oxygen.

$$\underset{\text{hydrogen peroxide}}{2H_2O_2} \xrightarrow{\text{catalase}} \underset{\text{water}}{2H_2O} + \underset{\text{oxygen}}{O_2}$$

a. What is the substrate in the reaction? (1 mark)

_____

_____

b. Can the enzyme catalase catalyse other reactions in the liver cells?
Explain your answer. (2 marks)

_____

_____

_____

_____

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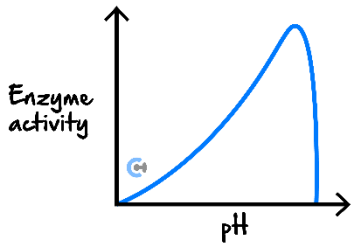
Sub-Section [1.4.4]: Explain how Enzymes Change/Denature in Different pH and at Different Temperatures

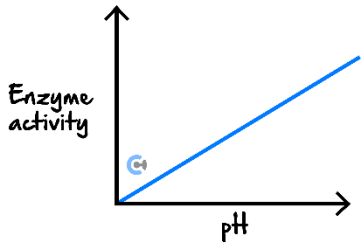
Question 11 (1 mark)

Which of the graphs below shows how enzyme activity changes with pH?

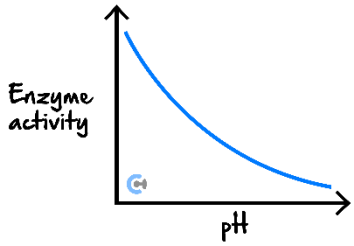
A.



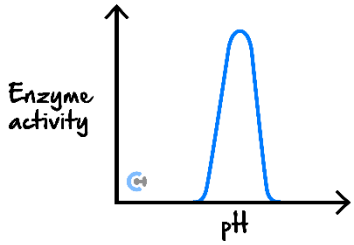
B.



C.



D.



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Question 12 (1 mark)

Laundry powder is sometimes advertised as containing powerful enzymes that break down dirt. These enzymes are called extremozymes. They come from some species of bacteria and archaea. The following table gives the optimal functioning of enzymes from some of these species.

Species	Enzyme	Optimal Temperature (°C)	Optimal pH
Psychrobacter sp.	*J*	10-30	7.0-9.0
Pseudomonas sp.	*K*	40	10.0
Methanococcus sp.	*L*	120	5.0-8.0
Cystofilobasidium sp.	*M*	40-42	5.0

Given this information and your knowledge of enzyme function, the best enzyme to add to the laundry powder would be:

A. Enzyme *J*.

B. Enzyme *K*.

C. Enzyme *L*.

D. Enzyme *M*.

Using the information given below, answer the following questions.

The enzyme lactase digests lactose.

$$\text{lactose} \xrightarrow{\text{lactase}} \text{glucose} + \text{galactose}$$

Two test tubes were set up using 5 *mL* of lactose syrup and 0.5 *mL* of lactase. Test tube **one** was incubated at 37°C, while test tube **two** was incubated at 15°C. Both tubes were incubated for 10 minutes.

Question 13 (1 mark)

At the end of 10 minutes, the amount of glucose produced in test tube **two** when compared to test tube **one** would be:

A. Lower as the enzyme's active site would have denatured at this temperature.

B. Equal as lowering the temperature does not affect the digestion of lactose.

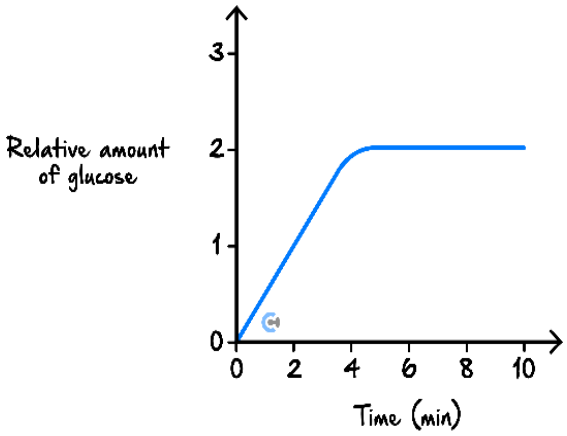
C. Lower as there would be fewer collisions between the substrate and the enzyme.

D. Equal as the two test tubes contained the same amount of lactose and lactase enzyme.

Question 14 (1 mark)

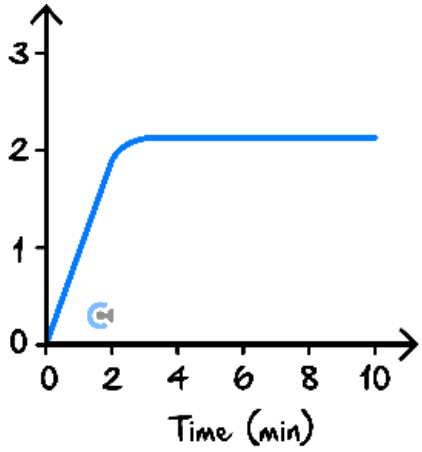
In another experiment, test tube **three** was compared with test tube **four**. Each tube contained 5 mL of lactose syrup. Tube **three** contained 0.5 mL of lactase and tube **four** contained 0.25 mL of lactase. The two tubes were incubated at 15°C and monitored for 10 minutes.

The result for test tube **three** is shown below.

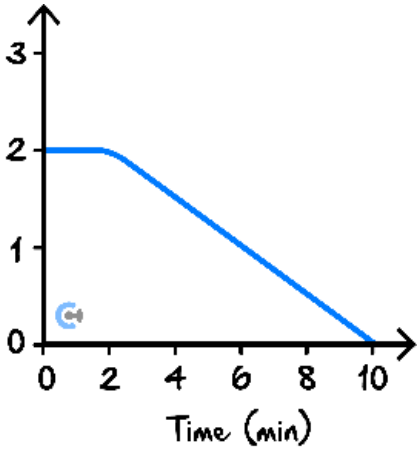


The graph of results for tube **four** would resemble:

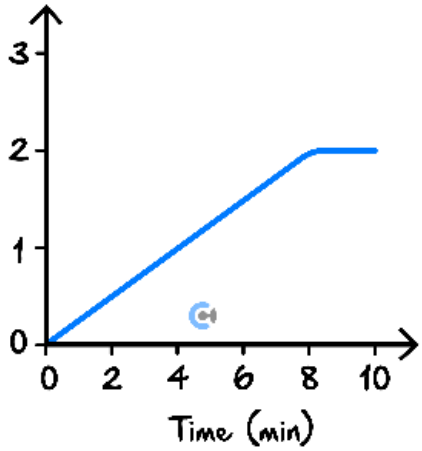
A.



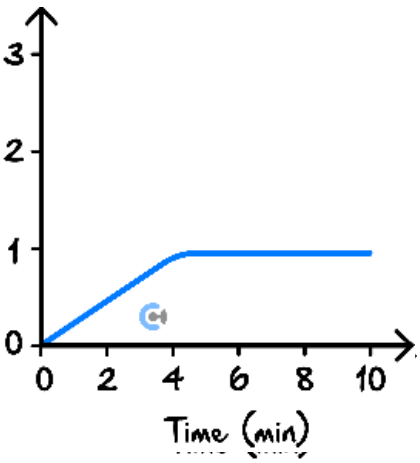
B.



C.



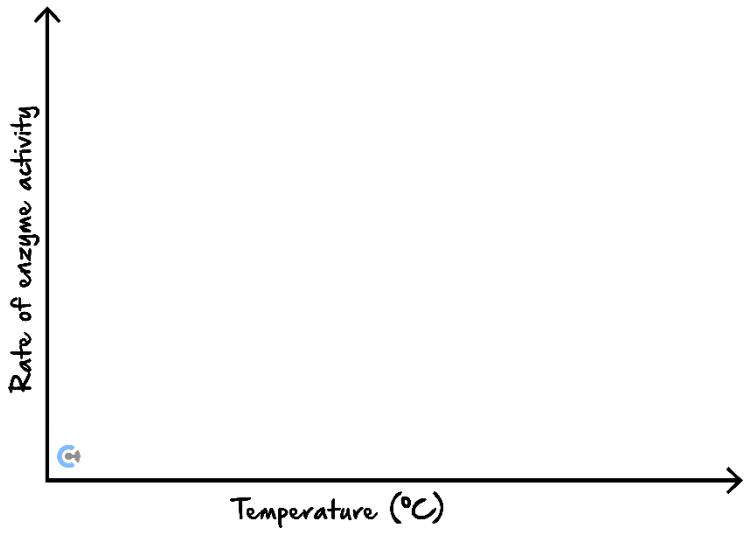
D.



Question 15 (6 marks)

a. The average human body temperature is 37°C, which is the optimum temperature for catalase.

Complete the graph below to show the rate of catalase-controlled reactions at temperatures above and below 37°C. (2 marks)



b. Explain what happens to the enzyme if the body temperature is over 40°C for an extended period. (2 marks)

c. State the likely optimal pH for this enzyme, and describe how pH can impact enzyme function. (2 marks)

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Sub-Section [1.4.5]: Explain function of Competitive and Non-Competitive Enzyme Inhibitors and how they affect Rate of Reaction, and how they may/may not be Overcome

Question 16

Definitions:

a. Competitive Inhibitor.

_____

_____

b. Non-competitive inhibitor.

_____

_____

Question 17 (3 marks)

Catalase activity in humans can be affected by toxins that act as non-competitive inhibitors.

In the space below, draw labelled diagrams to show the action of non-competitive inhibitors on catalase.

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