



CHEMISTRY ONLINE
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BIOLOGY

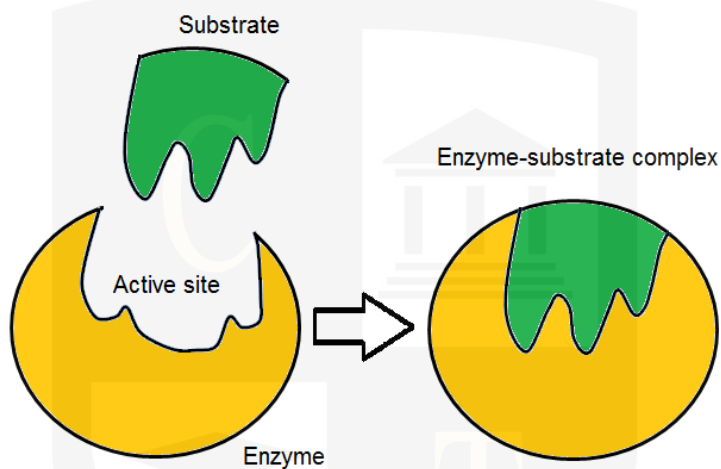
BIOLOGICAL MOLECULES

LEVEL & BOARD:	AQA (A - LEVEL)
TOPIC:	Enzymes
PAPER TYPE:	QUESTION PAPER 2
TOTAL QUESTIONS	03
TOTAL MARKS	25

Enzyme and protein 2

1.

(a) The rate of reaction is accelerated by the creation of an enzyme-substrate complex. Explain how? Diagram that is given below show enzyme-substrate complex. (2)



(b) The rate of amino acid removal from a polypeptide with and without an enzyme present was measured by a scientist. 578 amino acids were released every second while the enzyme was present. 3.0×10^{-9} amino acids were released every second in the absence of the enzyme.

Determine how many times the presence of the enzyme increases the pace of the reaction.

Give a formal response to the question.

Answer =times faster

Another researcher looked at the enzyme that triggers the subsequent reaction.



Two experiments, C and L, were set up by the scientists.

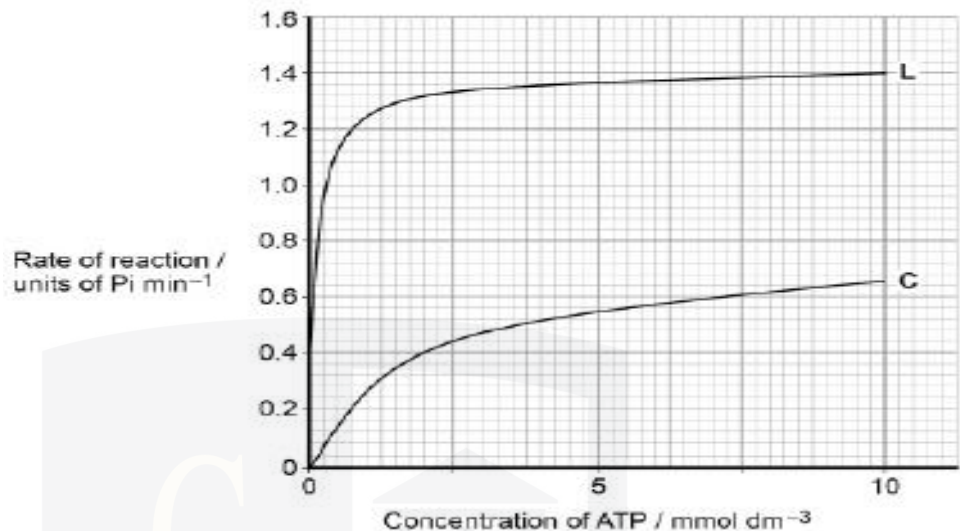
Experiment C was used

- the enzyme
- different concentrations of ATP.

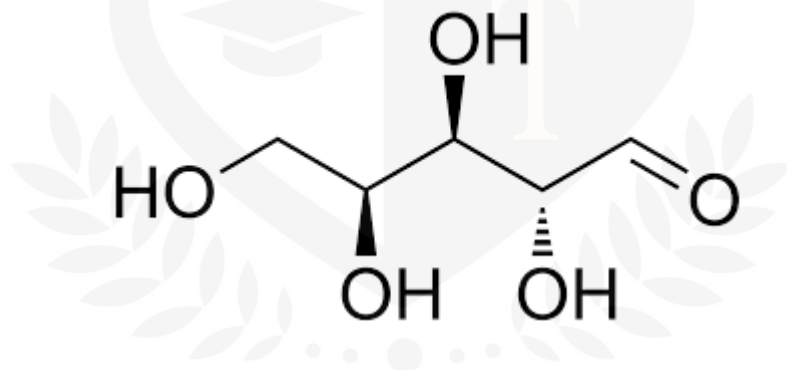
Experiment L was used

- the enzyme
- different concentrations of ATP
- a sugar called lyxose.

In each experiment, the scientists measured the pace of reaction. The graph displays their findings.



(c) Calculate the enzyme's reaction rate as a percentage of the maximum rate demonstrated with lyxose at 2.5 mmol dm⁻³ of ATP. Structure of lyxose is shown below. (2)



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Answer =%

(d) The enzyme binds to lyxose. (3)

Give an explanation for why the findings on the graph with and without lyxose differ.

2.

(a) Create a diagram showing an amino acid's general structure. (1)

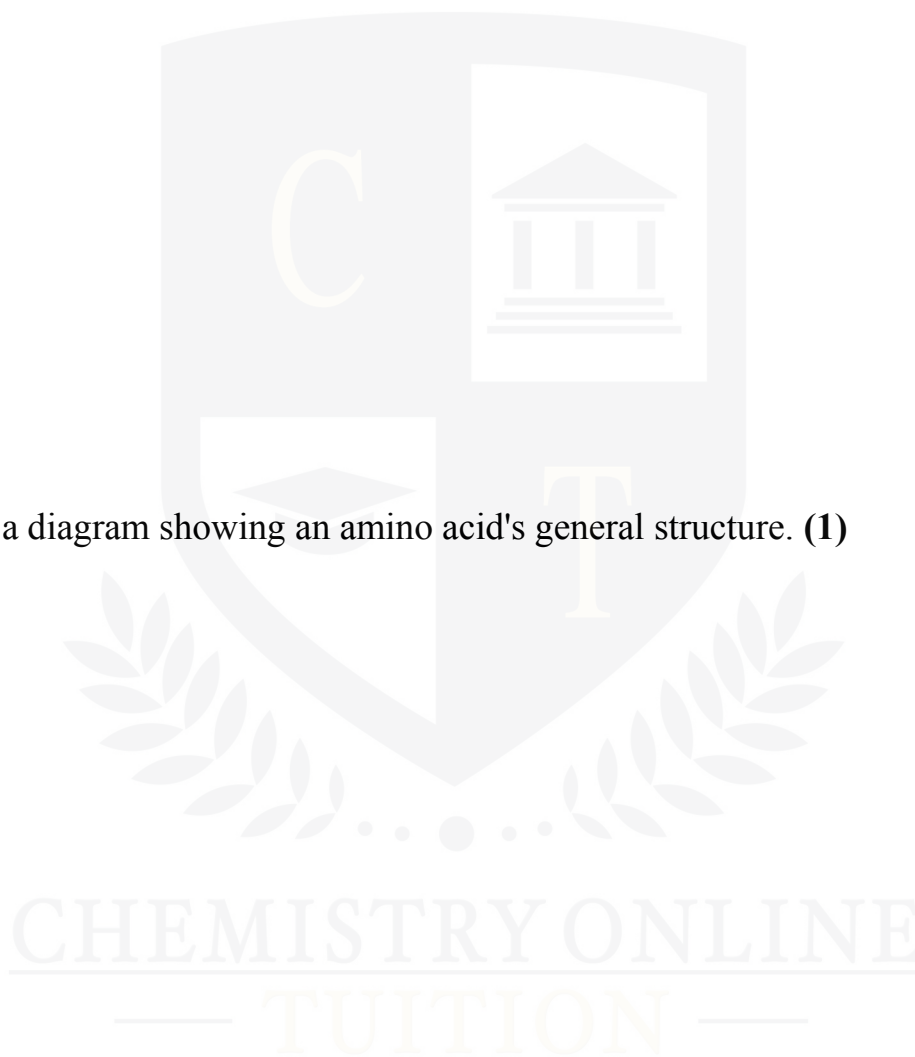


Table 1 lists the mRNA codons and the amino acids that each codon codes for. Additionally, it demonstrates a few traits of each amino acid's R group.

Table 1

1st base	2nd base				3rd base
	U	C	A	G	
U	Phe	Ser	Tyr	Cys	U
	Leu		Stop	Stop Trp	C A G
C	Leu	Pro	His	Arg	U
			Gln		C A G
A	Ile	Thr	Asn	Ser	U
	Met		Lys	Arg	C A G
G	Val	Ala	Asp	Gly	U
			Glu		C A G

Important characteristics of each amino acids R group

No overall charge

Positively charged

Negatively charged

(b) It is said that the genetic code is degenerate. **(2)**

What is meant by this? Use an example from Table 1 to demonstrate your answer.

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A researcher looked into how mutations affected the amino acid sequence of a human enzyme. Mutations caused by a single base substitution are the cause of all these amino acid alterations.

A polypeptide with 465 amino acids makes up this enzyme.

Three of the base substitutions' results are shown in **Table 2**.

Table 2

Amino number	Acid	Correct amino acid	Amino acid inserted as a result of mutation
203		Val	Ala
279		Glu	Lys
300		Glu	Lys

(c) How many bases must there be in the gene that codes for this polypeptide? **(1)**

Answer =

(d) Use the data in Table 1 to check () the box that represents a DNA mutation that would cause the amino acid number 203 to shift from Val to Ala due to a single base substitution. (1)

CAA → CGA

GUU → GCA

GUU → GUC

CAC → CGG

(e) The rate of reaction that the enzyme catalyzed was unaffected by the substitution of Lys for Glu at amino acid 300. The rate of reaction that the enzyme catalyzed was dramatically decreased by the same alteration at amino acid 279 in the chain.

Use all the data and your understanding of protein structure to propose explanations for the variations in the outcomes of these two alterations. **(3)**

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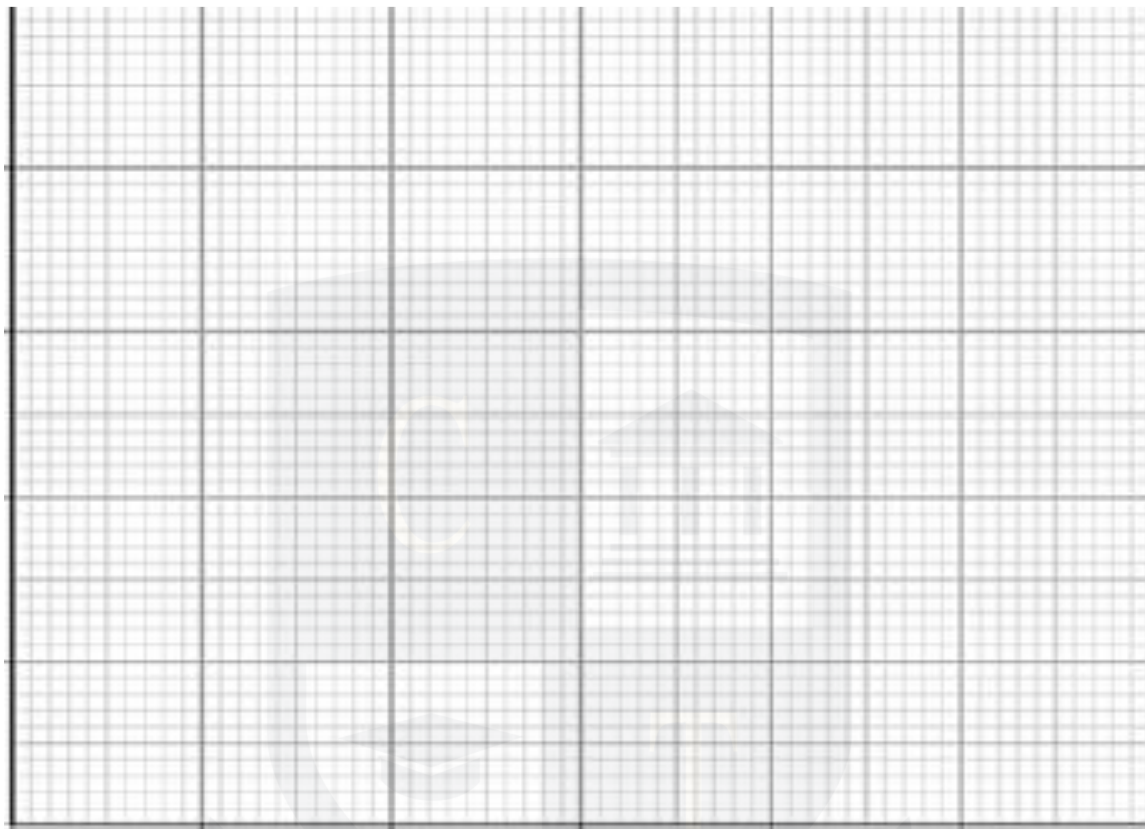
3. A protease was extracted from a bacterium by a scientist. He looked at how the temperature affected how quickly this protease hydrolyzed a protein. At each temperature, he measured the mass of protein hydrolyzed in 5 minutes.

The table below displays the outcomes.

Temperature / °C	Mass of protein hydrolysed / g	Rate of hydrolysis /
5	0.48	
10	1.11	
15	1.23	
20	1.05	
30	0.78	
45	0.12	

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(a) Analyze the information in the table. On the graph paper, plot the processed data. 4



(b) A student came to the conclusion that the bacterium can survive at 15 °C from a graph of the data in the table.

Does the information back up the student's interpretation? Explicitly justify your response. (4)

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(c) Propose two factors that the biochemist controlled when examining the impact of temperature on the protease's ability to break down proteins quickly.

- 1.
- 2.



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