EXAM PAPERS PRACTICE

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Level: HL IB in Biology
Subject: Biology
Topic: IB HL Biology
Type: Topic Question

All International Baccalaureate IB Topic Questions HL Biology

BIOLOGY

HL - IB

Key skills

Question 1

The formation of the 3D shape of a globular protein relies on hydrophobic and hydrophilic interactions.

Which of the statements below correctly describes this process?

A. When peptide bonds form, the condensation reaction releases water, which forms hydrogen bonds with the hydrophilic R groups of the amino acids.

B. Certain hydrophilic amino acid R groups are able to form hydrogen bonds with other hydrophilic amino acids R groups on different proteins.

C. Hydrophobic R groups of amino acids are repelled by the water surrounding the protein, forcing them into the center of the protein away from the water, and hydrophilic R groups get pulled to the outside.

D. Hydrophilic R groups are repelled by water and pushed away to the center of the 3D structure, causing the shape to be distorted.

[1 mark]

Question 2

Human insulin is a peptide hormone consisting of 51 amino acids.

Which of the following would represent the minimum number of bases that the gene coding for insulin would consist of?

A. 26

B. 51

C. 102

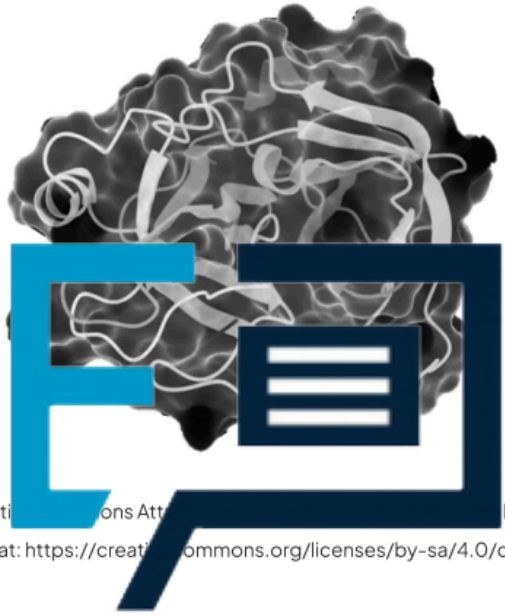
D. 153

[1 mark]

Question 3

Trypsin is a digestive enzyme found in pancreatic juices that breaks down proteins into polypeptides in the small intestine.

The image below represents the three dimensional structure of trypsin.



Which of the following would be the most accurate description of the conformation of trypsin?

A. It is a functional protein folded into a specific shape, held in position by bonds between the R-groups of neighboring amino acids, with hydrophilic R-groups facing towards the outside of the molecule.

B. It is a functional protein folded into a specific shape, held in position by bonds between the R-groups of neighboring amino acids, with hydrophobic R-groups facing towards the outside of the molecule.

C. It is a structural protein folded into a specific shape, held in position by bonds between the R-groups of repeating amino acids.

D. It is a functional protein folded into a specific shape, held in position by bonds between the R-groups of neighboring amino acids, with hydrophilic R-groups facing towards the inside of the molecule.

[1 mark]

Question 4

Rituximab is a therapeutic protein used to treat certain types of cancers and autoimmune diseases. It is very sensitive to temperature and pH changes and is typically injected into the bloodstream.

Which of the following statements explains why therapeutic proteins, such as rituximab, cannot be taken orally?

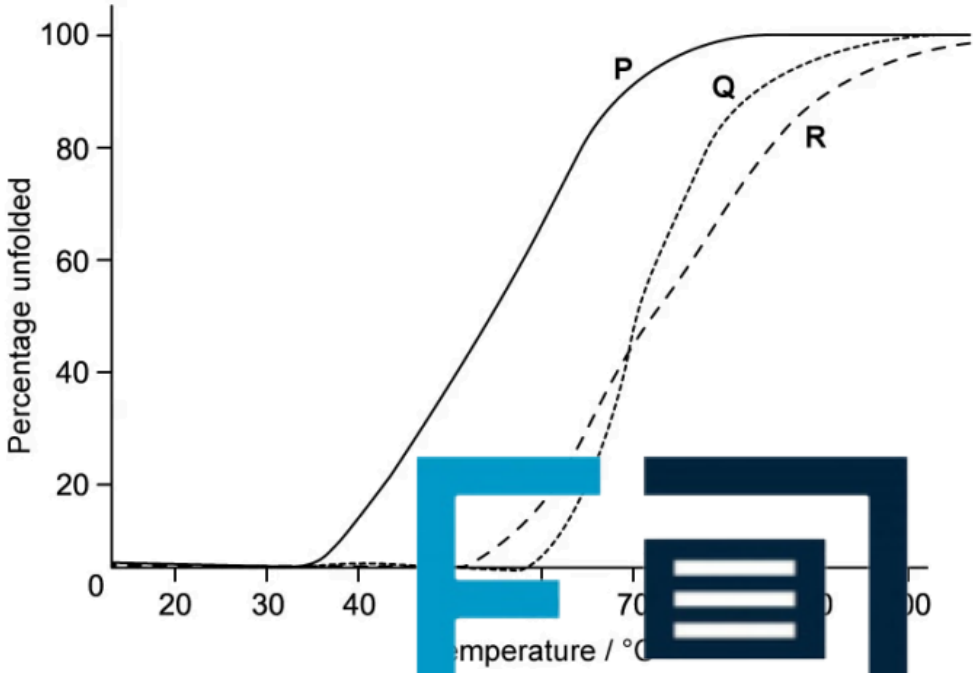
I. The molecule would vibrate so fast in the stomach that the intermolecular bonds would break.
II. The conformation of the protein will change in the stomach, potentially becoming non-functional.
III. The protein may become insoluble in the stomach and form a precipitate due to the breakage of ionic bonds.
IV. Conditions in the stomach will expose the hydrophobic regions of the protein to the outside of the molecule.

A. I and IV
B. I, II, and III
C. II and III
D. II, III, and IV

[1 mark]

Question 5

The denaturation of three different proteins (P, Q, and R) at different temperatures was investigated. The more denatured a protein is, the less stable it becomes. The following graph shows the results of this investigation.



Which of the following would be the [illegible] valid [illegible] ults?

A. Protein R would be less stable and had a lower rate of denaturation above 70°C compared to protein Q, while protein P was fully denatured by 80°C.

B. Protein R would be more stable and had a lower rate of denaturation above 70°C compared to protein Q, while protein P was the least heat-tolerant of all the proteins.

C. Protein Q would be more stable and had a lower rate of denaturation below 70°C compared to protein R, while protein P was fully denatured by 80°C.

D. Protein Q would be less stable and had a higher rate of denaturation below 70°C compared to protein R, while protein P was the least heat-tolerant of all the proteins.

[1 mark]

Question 6

Which of the following statements applies to both the proteome and genome of an organism?

I. Every cell in an organism relies on this for its survival.
II. It reflects the actual events inside the cells of an organism.
III. There are slight variations between individual organisms.
IV. It can vary over time depending on the activities of the cell.

A. I and II
B. I and III
C. I, II, and IV
D. II, III, and IV

[1 mark]

Question 7

Ustilago maydis is a fungal pathogen affecting maize. It secretes toxins, such as the KP6 toxin, which consists of two small polypeptides not linked by covalent bonds. The diagram below shows the ribbon structure of one of the polypeptides of the KP6 toxin.

Which of the following is the most accurate description of the structure of this polypeptide?

A. This polypeptide represents the tertiary structure of a protein due to the hydrogen bonds between the carboxyl group of one R-group and the amino group of another amino acid.

B. This polypeptide represents the secondary structure of a protein due to the presence of hydrogen bonds that form triple-helices and β-pleated sheets.

C. This polypeptide represents the quaternary structure of a protein due to the existence of more than one chain that can fit together to form the toxin.

D. This polypeptide represents the secondary structure of a protein due to the presence of hydrogen bonds that form α-helices and β-pleated sheets.

[1 mark]