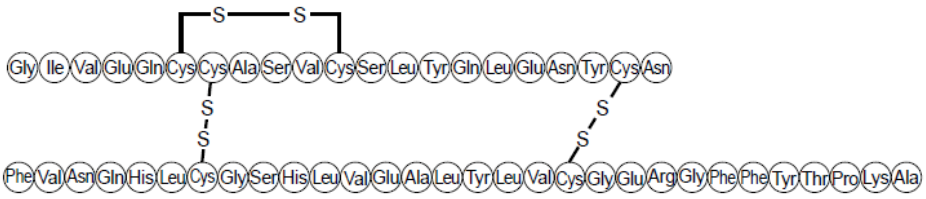
B1.2 Proteins [33 marks]

1. [Maximum mark: 1]

The diagram shows the structure of insulin.



From the diagram, what can be concluded about the structure of insulin?

A. It is composed of two polypeptide chains stabilized by disulfide bonds.

B. It is a simple protein composed of one continuous polypeptide chain.

C. It is a fibrous protein.

D. Its molecules do not display quaternary structure. [1]

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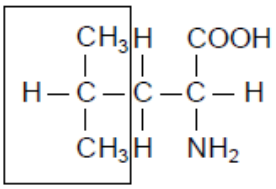
2. [Maximum mark: 1]

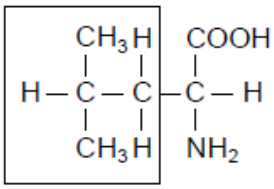
The diagrams show the structure of leucine, an essential amino acid.

Which diagram highlights the part of leucine that distinguishes it from other amino acids?

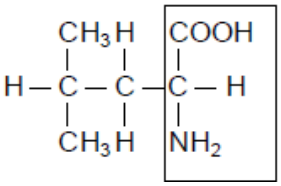
A.



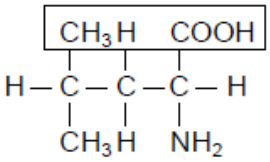
B.



C.



D.



[1]

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3. [Maximum mark: 1]

Which row correctly matches the level of structure of a protein molecule with the bonds that stabilize it?

	Level of structure	Bonds
A.	primary	peptide and hydrogen bonds between amine and carboxyl groups
B.	secondary	hydrogen bonds between R-groups of amino acids
C.	tertiary	disulfide, hydrogen and ionic bonds between R-groups of amino acids
D.	quaternary	covalent bonds between hydrophobic and hydrophilic regions on the polypeptide subunits

[1]

4. [Maximum mark: 1]

Myoglobin is a globular protein in which nearly all the non-polar R-groups point towards the inside of the molecule. The outside surface contains all the polar R-groups. What can be deduced from this?

A. Disulfide bonds occur on the inside.

B. Hydrogen bonds form with water on the outside.

C. Ionic bonds form with water on the outside.

D. Covalent bonds occur on the inside. [1]

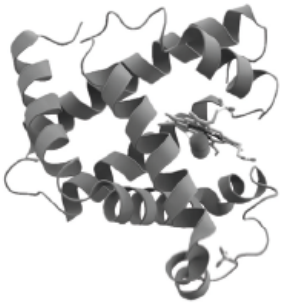
5. [Maximum mark: 1]

Diagrams of three different proteins, X, Y and Z, are shown.

X

Y

Z



Which row describes the structure of each protein shown?

	X	Y	Z
A.	quaternary	globular	secondary
B.	conjugated	fibrous	globular
C.	tertiary	quaternary	primary
D.	globular	secondary	fibrous

[Source: X: Keertana, A., n.d. [*Protein X*]. [online] Available at: https://simplemed.co.uk [Accessed 18 April 2024]. Reference redacted. Source adapted.

Y: Nevit Dilmen. https://commons.wikimedia.org/wiki/File:1K6F_Crystal_Structure_Of_The_Collagen_Triple_Helix_Model_Pro-_Pro-Gly103_04.png. Helix_Model_Pro-_Pro-Gly103_04.png. CC BY-SA 3.0. http://creativecommons.org/licenses/by-sa/3.0/. Source adapted.

Z: AzaToth. https://commons.wikimedia.org/wiki/File:Myoglobin.png. Public domain.] [1]

6. [Maximum mark: 1]

What must vegans ensure when they plan their diet?

A. Higher protein consumption than meat-eaters

B. Sufficient quantities of all essential amino acids are consumed

C. Only proteins with all 20 amino acids are consumed

D. Higher fat consumption than meat-eaters [1]

7. [Maximum mark: 7]

(a) State the products of a condensation reaction between two amino acids.

amino acid + amino acid → ..... + ... [1]

(b) Describe how the diversity of amino acids gives proteins a broad range of forms. [2]

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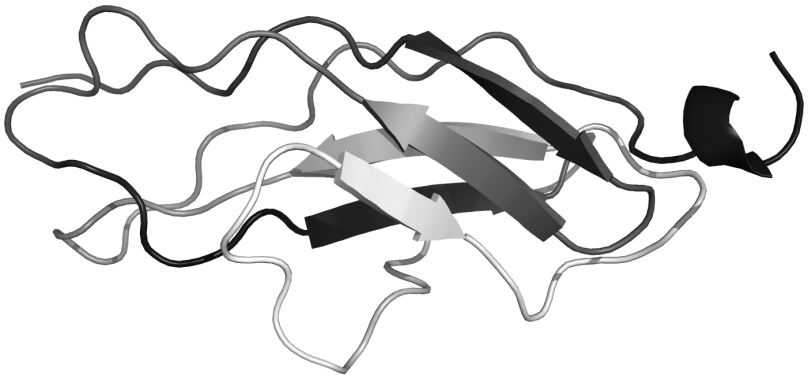
Titin is the longest protein in the human body, consisting of a single strand of over 34 000 amino acids.



[Source: Boghog2, 2008. *1BPV*. [image online] Available at: https://commons.wikimedia.org/wiki/File:1BPV.png [Accessed 25 June 2024]. Source adapted. Public domain.]

(c.i) Describe the secondary structures represented by the arrows in the diagram. [2]

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(c.ii) Explain the role of titin in sarcomeres. [2]

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8. [Maximum mark: 1]

Insulin is a protein. In human insulin, there are a total of 51 amino acids, in two polypeptides. How many peptide bonds are there in a molecule of human insulin?

A. 48

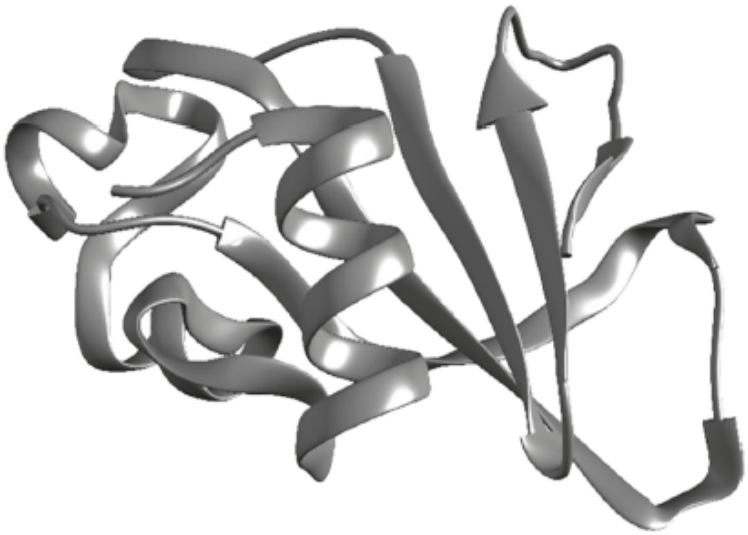
B. 49

C. 50

D. 51 [1]

9. [Maximum mark: 1]

The nuclease enzyme shown in the diagram is from the bacterium *Bacillus amyloliquefaciens*. It consists of 110 amino acids.



Which levels of protein structure does this nuclease enzyme have?

A. Primary, secondary and tertiary only

B. Primary, secondary and quaternary only

C. Primary, tertiary and quaternary only

D. Primary, secondary, tertiary and quaternary [1]

10. [Maximum mark: 1]

Polypeptides are made of twenty different types of amino acids. What makes amino acids different from each other?

A. The number of unsaturated carbons

B. The position of the carboxyl group

C. The composition of the side chains

D. The position of the amino group [1]

11. [Maximum mark: 1]
What describes the structure of proteins?

I. Proteins are made from amino acids linked together by peptide bonds.

II. The sequence of amino acids in all proteins is the same.

III. A protein may consist of more than one polypeptide.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III [1]

12. [Maximum mark: 15]
Genetic information controls the production of all proteins needed by the body to carry out its functions, including proteins acting as enzymes and hormones as well as proteins for structures and transport.

(a) Outline protein structure. [4]

(b) Describe the role of **two named** hormones in the regulation of blood sugar levels. [4]

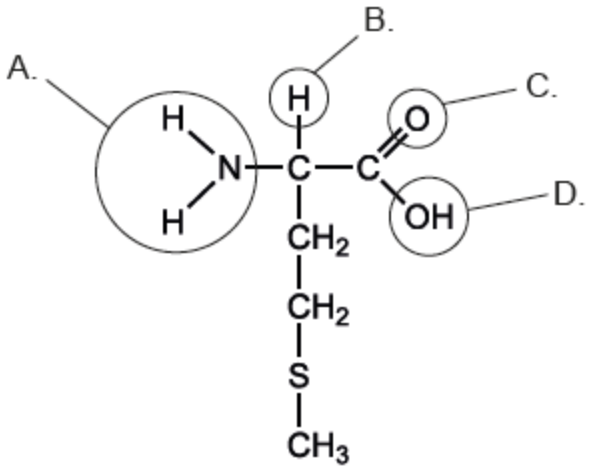
(c) Explain the stages and processes of meiosis leading to genetic variation.

[7]

13. [Maximum mark: 1]

The diagram shows the structure of the amino acid methionine with some atoms labelled.

Which atom(s) would be removed when two molecules of methionine join to form a dipeptide?



[1]