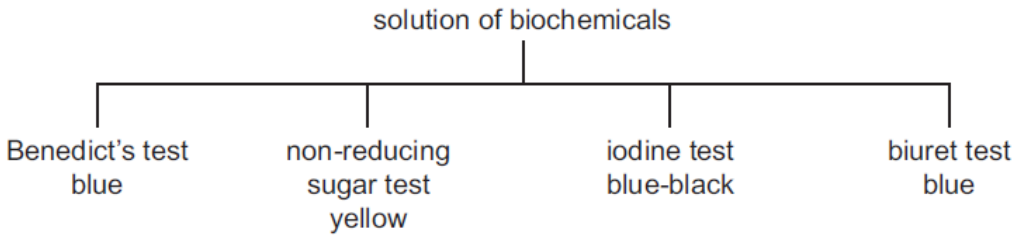
Biological Molecules – AS 9700 Biology Nov 2022

1. Nov/2022/Paper_11/No.6

The diagram shows the results of a number of tests on a solution of biochemicals.



Which substances are present in the solution?

A non-reducing sugar and starch only

B protein, non-reducing sugar and starch

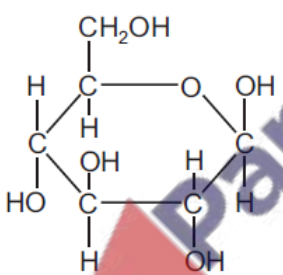
C starch and reducing sugar

D starch only

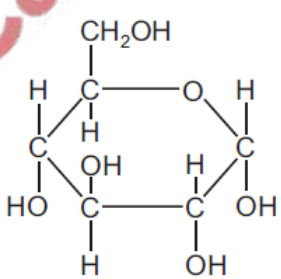
2. Nov/2022/Paper_11/No.7

Which diagram shows the ring form of β-glucose?

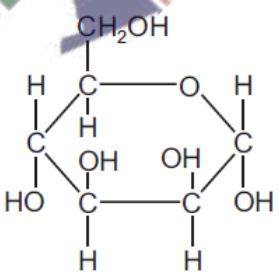
A



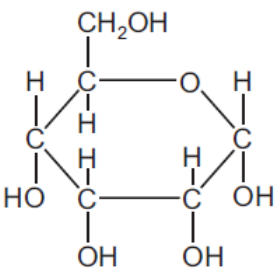
B



C



D



3. Nov/2022/Paper_11/No.8

Which row correctly matches the example with the type of molecule?

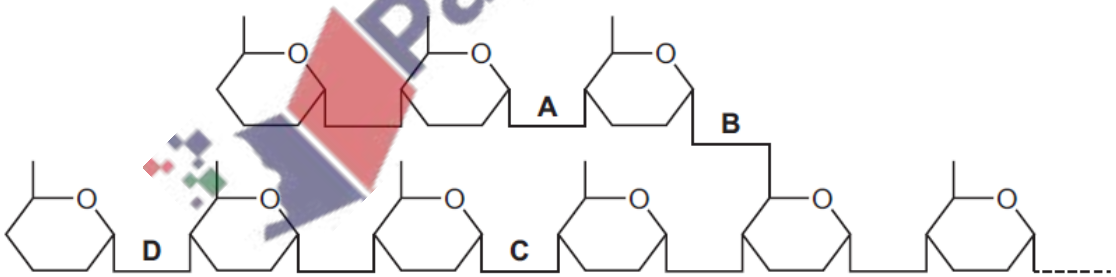
	disaccharide	macromolecule	monomer	polymer
A	fructose	glycogen	glucose	starch
B	starch	haemoglobin	ribose	glycogen
C	maltose	ribonucleic acid	sucrose	cellulose
D	sucrose	cellulose	fructose	collagen

4. Nov/2022/Paper_11/No.9

The enzyme α-amylase hydrolyses amylopectin but it is not able to hydrolyse some of its glycosidic bonds.

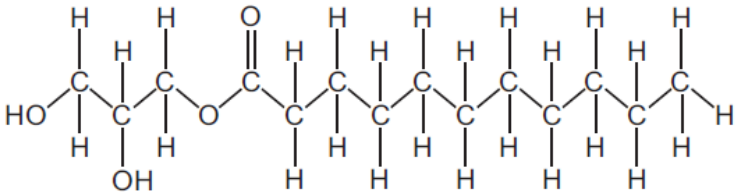
- It only hydrolyses 1,4 glycosidic bonds.
- It is not able to hydrolyse the last bond of a chain.
- It is not able to hydrolyse the bonds in a chain of three units attached by a 1,6 glycosidic bond to another chain.

Which glycosidic bond can be hydrolysed by α-amylase?



5. Nov/2022/Paper_11/No.10

Molecule X is a lipid.



molecule X

Which row is correct for molecule X and a triglyceride?

	molecule X contains	triglyceride contains
A	one unsaturated fatty acid	saturated fatty acids
B	no ester bonds	three ester bonds
C	one fatty acid	three fatty acids
D	two fatty acids	three fatty acids

6. Nov/2022/Paper_11/No.11

Bread contains a mixture of polypeptides known as gluten.

Two of the polypeptides found in gluten are glutenin and gliadin.

Which statement describes the tertiary structure of a protein?

A Disulfide bonds form between glutenin and gliadin.

B A large proportion of the amino acids in gliadin are glutamine.

C α-helical sections are found in glutenin and gliadin.

D Amino acids with hydrophobic R groups are found on the inside of glutenin.

7. Nov/2022/Paper_12/No.6

The table shows the observations recorded from tests for biological molecules on four samples, **A**, **B**, **C** and **D**.

Which conclusion is correct?

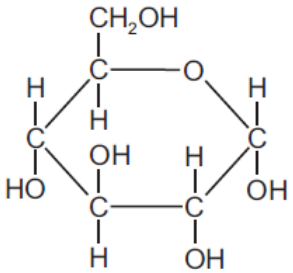
	Benedict's solution	biuret reagent	iodine solution	conclusion
A	blue	blue	blue-black	contains starch only
B	blue	purple	orange	contains reducing sugar only
C	green	blue	orange	contains reducing sugar and protein
D	red	blue	blue-black	contains starch and protein

8. Nov/2022/Paper_12/No.7

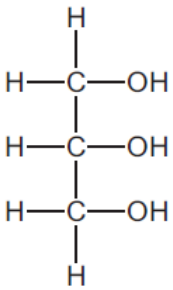
The diagrams show some biological molecules.

Which biological molecule forms a polymer with a structural role in plants?

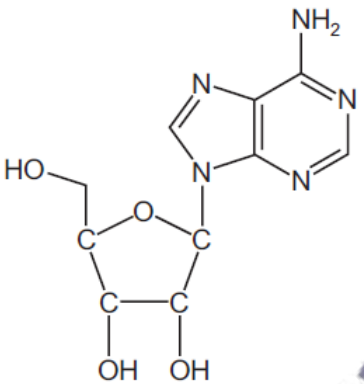
A



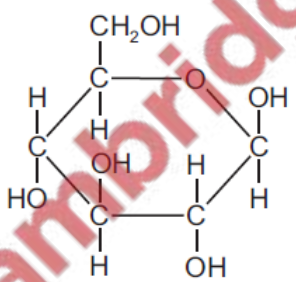
B



C



D



9. Nov/2022/Paper_12/No.8

Which molecule is a disaccharide **and** a reducing sugar?

A fructose

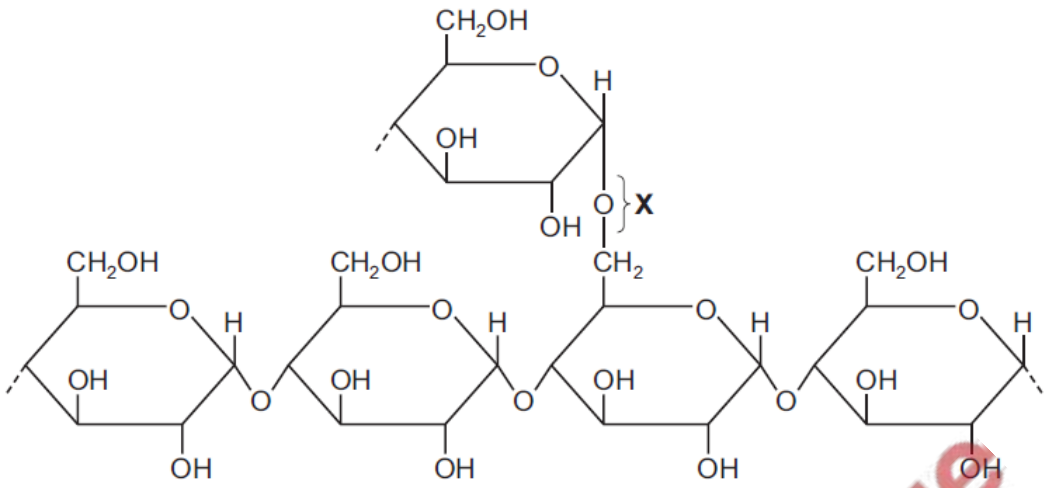
B glucose

C maltose

D sucrose

10. Nov/2022/Paper_12/No.9

The diagram shows bonding in part of a polysaccharide.



Which type of glycosidic bond is shown at position **X**?

A α-1,4 **B** α-1,6 **C** β-1,4 **D** β-1,6

11. Nov/2022/Paper_12/No.11

Silk moth caterpillars have been genetically modified to produce a mixture of their own silk and the much stronger spider silk of the golden orb web spider.

The spider silk polypeptide chain has many repeated sequences of two amino acids, glycine and alanine, arranged in a crystalline structure.

What correctly describes the structure of spider silk?

A primary protein structure with regions of α-helices

B secondary protein structure with regions of β-pleated sheets

C tertiary protein structure with regions of α-helices

D quaternary protein structure with regions of β-pleated sheets

12. Nov/2022/Paper_12/No.12

Which property of the tertiary structure of a globular protein enables it to catalyse a metabolic reaction?

A It has hydrophobic amino acid R groups on the outside.

B It will be denatured by high temperatures.

C The R groups of some amino acids form bonds with a substrate.

D The three-dimensional shape depends on hydrogen bonding.

13. Nov/2022/Paper_13/No.6

The Benedict's test and ethanol emulsion test were carried out on a sample of biological molecules. The solution became brick-red during the Benedict's test and cloudy during the ethanol emulsion test.

Which molecules did the sample contain?

A reducing sugars and lipids

B proteins and reducing sugars only

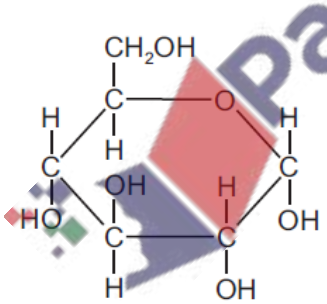
C starch, proteins and reducing sugars

D non-reducing sugars and lipids

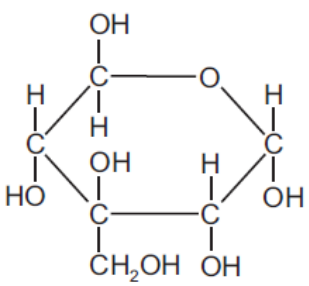
14. Nov/2022/Paper_13/No.7

Which diagram is correct for α-glucose?

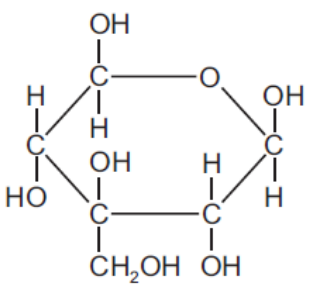
A



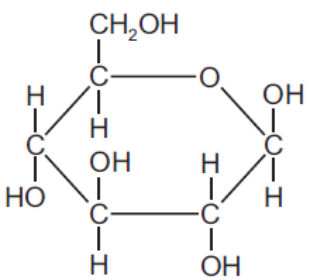
B



C



D



15. Nov/2022/Paper_13/No.8

Which reaction correctly represents one way sucrose can form?

A (α-glucose – OH^-) + (fructose – H^+) → sucrose + H_2O

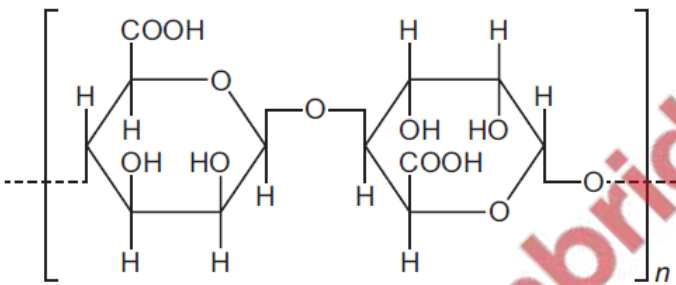
B (α-glucose + OH^-) + (α-glucose + H^+) → sucrose – H_2O

C (α-glucose – OH^-) + (β-glucose – H^+) → sucrose + H_2O

D (α-glucose + OH^-) + (fructose + H^+) → sucrose – H_2O

16. Nov/2022/Paper_13/No.9

The diagram represents part of an alginic acid molecule. Alginic acid is a polymer found in the cell walls of brown seaweeds.



Which statement about alginic acid is correct?

A Alginic acid is a linear polysaccharide containing 1,6 glycosidic bonds between each hexose sugar.

B Alginic acid is formed from two monomers joined by 1,4 glycosidic bonds.

C Alternate monosaccharides are arranged in opposite directions; this is also seen in glycogen molecules.

D Hexose sugars and water molecules are joined by condensation reactions to make alginic acid.

17. Nov/2022/Paper_13/No.10

Which features are correct for triglycerides **and** phospholipids?

1 They have ester bonds between glycerol and fatty acids.

2 Fatty acid chains may have single or double bonds between carbon atoms in the chains.

3 The fatty acid chains are non-polar and hydrophobic.

4 Saturated fatty acid chains allow closer packing of the molecules than unsaturated fatty acid chains.

A 1, 2, 3 and 4

B 1 and 3 only

C 2, 3 and 4 only

D 2 and 4 only

18. Nov/2022/Paper_13/No.11

A scientist studying the structure of a protein reported that it consists of two polypeptide chains joined by disulfide bonds.

Which feature of protein structure does this describe?

A primary structure

B secondary structure

C tertiary structure

D quaternary structure

19. Nov/2022/Paper_13/No.12

Some molecules fluoresce when illuminated with ultraviolet light. Changes in the structure or shape of such molecules can change the intensity of the fluorescence.

The enzyme tryptophan synthase fluoresces bluish-green because of a phosphate group associated with the active site. The enzyme catalyses the reaction shown.

$$\text{serine} + \text{indole} \rightarrow \text{tryptophan}$$

Adding serine to the enzyme increases the intensity of the fluorescence, but when indole is also added the bluish-green fluorescence decreases in intensity.

What may be concluded from these observations?

1 Serine and indole attach to the active site of the enzyme.

2 An enzyme–serine complex is formed.

3 An enzyme–serine–indole complex is formed.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

20. Nov/2022/Paper_13/No.27

The statements describe some of the properties of water.

1 requires a lot of heat energy to evaporate

2 retains a lot of heat energy

3 is able to form hydrogen bonds with other water molecules

4 is able to form hydrogen bonds with other polar and non-polar molecules

Which properties are **also** important for transport in xylem?

A 1, 2 and 3 **B** 1, 2 and 4 **C** 1 and 3 only **D** 3 and 4

21. Nov/2022/Paper_22/No.5(a)

Fibroblasts are one of the cell types of connective tissue. The cells synthesise and secrete collagen, which forms part of the supporting external cellular environment, known as the extracellular matrix.

(a) Fig. 5.1 shows the primary structure of a section of a polypeptide chain of collagen.

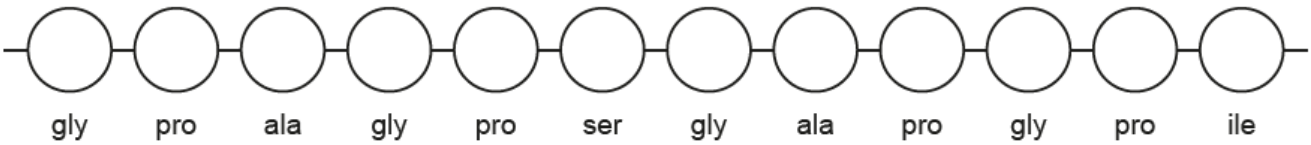


Fig. 5.1

Explain how the primary structure shown in Fig. 5.1 indicates that the structure of the polypeptide is suited to be a component of a collagen molecule.

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..... [3]

(b) After final processing in the Golgi body, collagen is released to the outer surface of the cell by exocytosis.

Complete the passage to describe the process of exocytosis.

After final processing in the Golgi body,

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..... [3]

(c) Hydrolytic enzymes, known as collagenases, are secreted by cells in an inactive form.

Cells also secrete inhibitors of collagenases. The activity of the enzymes and inhibitors is regulated so that the development and maintenance of the extracellular matrix is controlled.

(i) State **and** explain what the outcome will be for the composition of the extracellular matrix if collagenase inhibitor activity is needed.

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..... [2]

(ii) Synthetic inhibitors have been trialled as potential treatment for diseases caused by a lack of regulation of collagenase activity.

Research involves investigating the mechanism of action of an inhibitor.

State the effect that a **non-competitive** inhibitor will have on the maximum rate of reaction, V_{max}, and the Michaelis–Menten constant, K_m, of collagenase.

V_{max} .....

K_m .....

[2]

[Total: 10]

(a) During translation, a polypeptide is synthesised when amino acids are added to a growing chain of amino acids.

Fig. 1.1 shows part of a growing chain of amino acids and the amino acid cysteine.

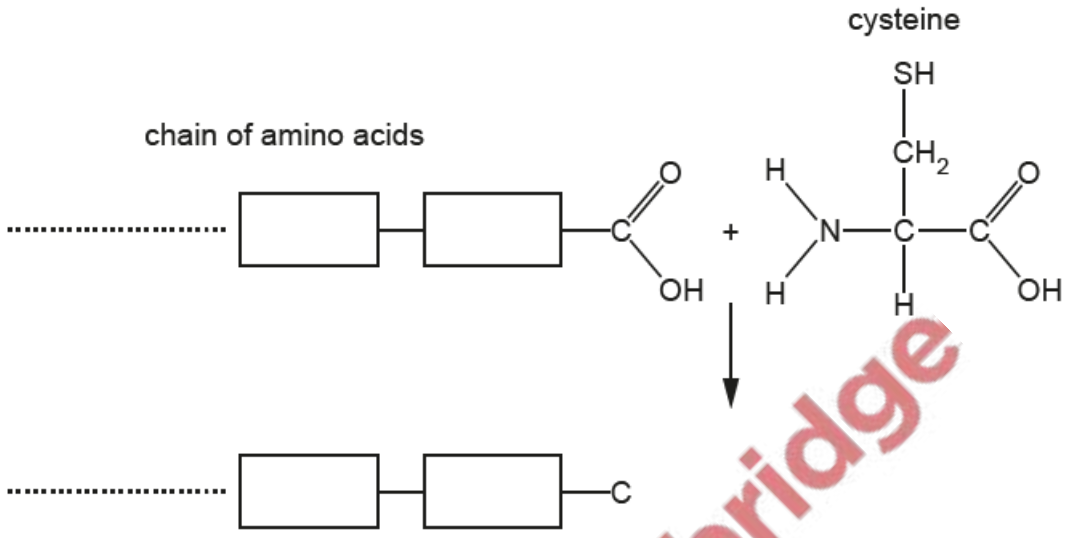

Fig. 1.1

(i) Complete Fig. 1.1 by showing the formation of the bond between cysteine and the growing chain of amino acids in the process of translation. [3]

(ii) State the name of the covalent bond that forms when cysteine is added to the growing chain of amino acids.

..... [1]

(iii) State the organelle where the reaction shown in Fig. 1.1 takes place.

..... [1]

(b) Fig. 1.2 is a ribbon diagram showing the three-dimensional structure of a protein from the bacterium *Streptococcus*.

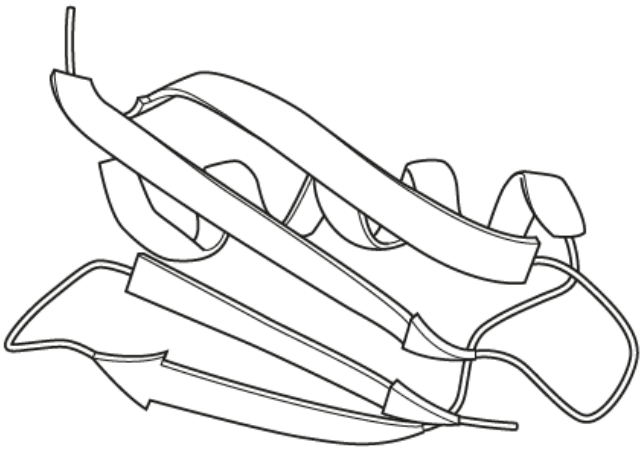

Fig. 1.2

(i) Describe the secondary structure of the protein shown in Fig. 1.2.

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..... [2]

(ii) Explain why the protein shown in Fig. 1.2 has tertiary structure, but not quaternary structure.

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..... [2]

(iii) An analysis of the amino acid composition of the protein in Fig. 1.2 showed that it does **not** contain any cysteine residues.

Explain how the three-dimensional structure of the protein shown in Fig. 1.2 is held in place.

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..... [3]

[Total: 12]