

# Biological Molecules

## Question Paper 1

<b>Level</b>	International A Level
<b>Subject</b>	Biology
<b>Exam Board</b>	CIE
<b>Topic</b>	Biological Molecules
<b>Sub Topic</b>	
<b>Booklet</b>	Multiple Choice
<b>Paper Type</b>	Question Paper 1

**Time Allowed :** 60 minutes

**Score :** / 50

**Percentage :** /100

**Grade Boundaries:**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 Which row shows the correct match between the descriptions of biological molecules and where they are found?

- 1 a linear polymer of 1,4 linked  $\beta$ -glucose molecules
- 2 a bipolar, phosphate containing molecule
- 3 a highly branched polymer of 1,4 and 1,6 linked  $\alpha$ -glucose molecules

	1	2	3
<b>A</b>	eukaryote and prokaryote cell walls	cell surface membranes of both eukaryotes and prokaryotes	forming storage granules in the cells of prokaryotes
<b>B</b>	eukaryote cell walls	cell surface membranes of both eukaryotes and prokaryotes	forming storage granules in the cells of some eukaryotes
<b>C</b>	eukaryote cell walls	cell surface membranes of both eukaryotes and prokaryotes	forming starch grains in the cells of all eukaryotes
<b>D</b>	forms storage granules in the cells of eukaryotes	prokaryote cell walls	eukaryote cell walls

2 Which is the correct description for the structure of amylose and cellulose?

	amylose	cellulose
<b>A</b>	$\alpha$ -glucose 180° rotation 1,4 and 1,6 linkages	$\beta$ -glucose no rotation 1,4 linkages
<b>B</b>	$\alpha$ -glucose no rotation 1,4 linkages	$\beta$ -glucose 180° rotation 1,4 linkages
<b>C</b>	$\alpha$ -glucose no rotation 1,4 linkages	$\alpha$ -glucose 180° rotation 1,4 and 1,6 linkages
<b>D</b>	$\beta$ -glucose no rotation 1,4 linkages	$\alpha$ -glucose 180° rotation 1,4 linkages

3 Which type of cell has a large number of glycoproteins on the cell surface membrane?

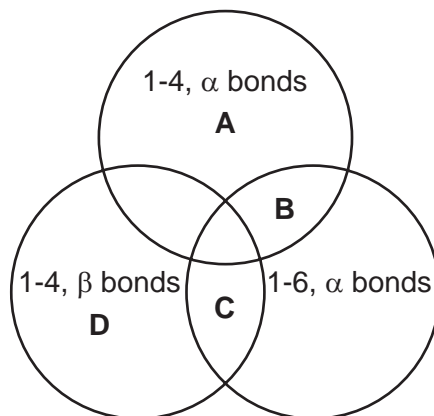
- A ciliated cell
- B goblet cell
- C lymphocyte
- D red blood cell

4 Which bonds hold together the structure of cellulose?

- 1 glycosidic
- 2 hydrogen
- 3 ionic

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

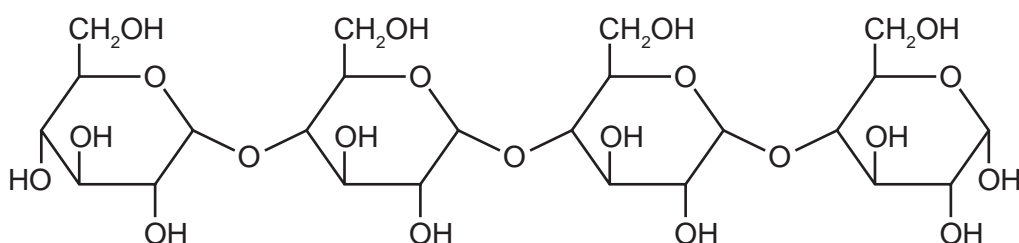
5 Which bonds are found in glycogen?





- 8 Which adaptation would increase active transport of carbohydrates from a plant cell?
- A areas where the cell wall is thin
  - B increased permeability of the cell wall
  - C large surface area of the cell surface membrane
  - D selective permeability of the vacuole membrane

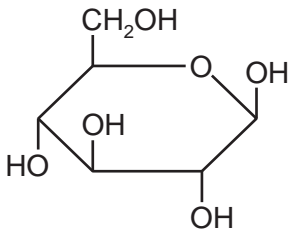
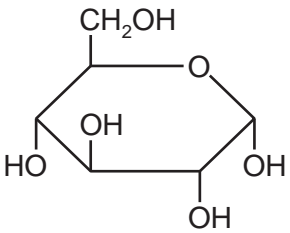
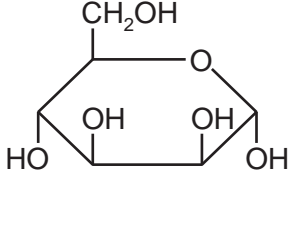
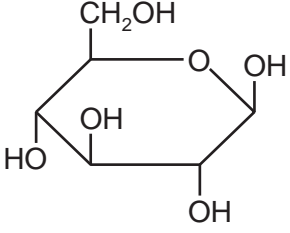
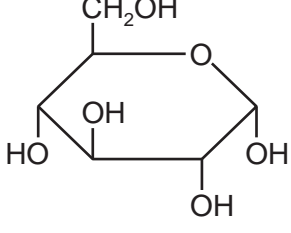
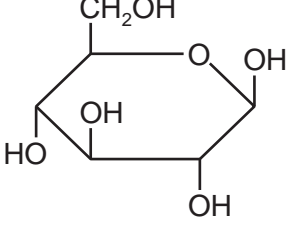
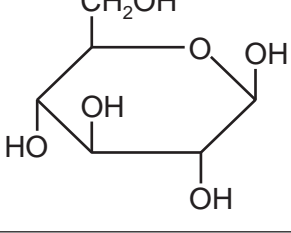
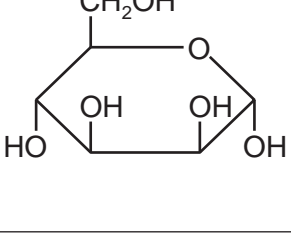
- 9 The molecule shown is a polymer of reducing sugars.



Which procedures could be carried out in order to test for the presence of the reducing sugars in this molecule?

- 1 Add hydrolytic enzyme and then heat with Benedict's reagent.
  - 2 Dissolve in water, neutralise and then heat with Benedict's reagent.
  - 3 Boil with hydrochloric acid, neutralise and then heat with Benedict's reagent.
- A 1, 2 and 3      B 1 and 2 only      C 1 and 3 only      D 2 and 3 only

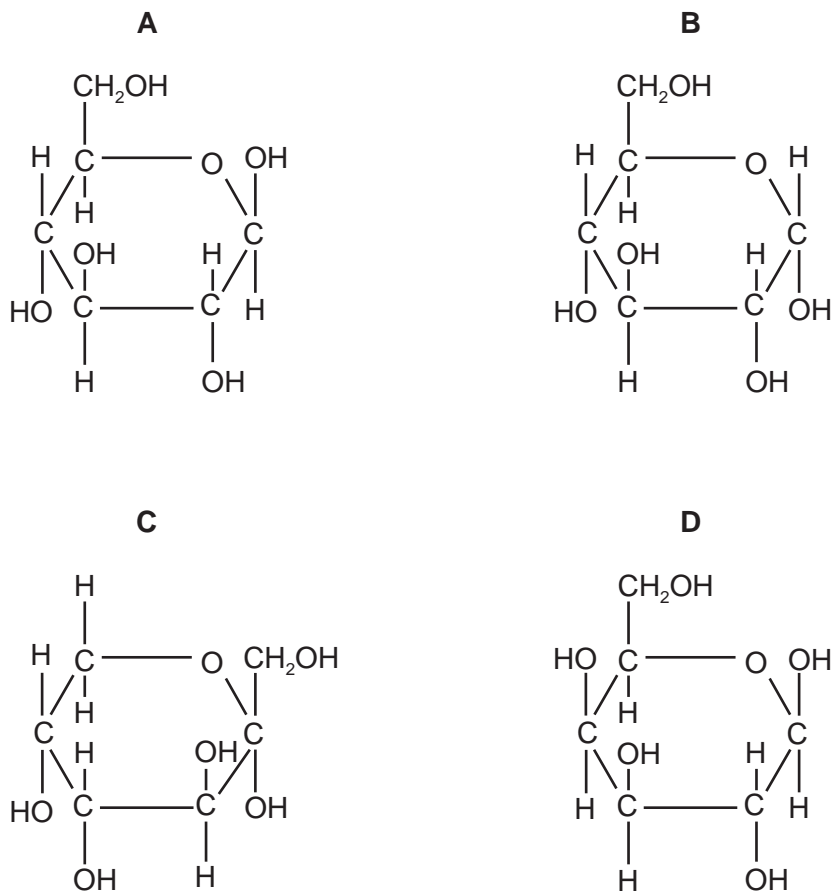
10 Which molecules show the structure of  $\alpha$ -glucose and of  $\beta$ -glucose?

	$\alpha$ -glucose	$\beta$ -glucose
<b>A</b>		
<b>B</b>		
<b>C</b>		
<b>D</b>		

11 In unsaturated lipid molecules, where are double bonds located?

- A** between fatty acids and glycerol
- B** within fatty acids and within glycerol
- C** within fatty acids only
- D** within glycerol only

12 Which shows the basic unit of glycogen?

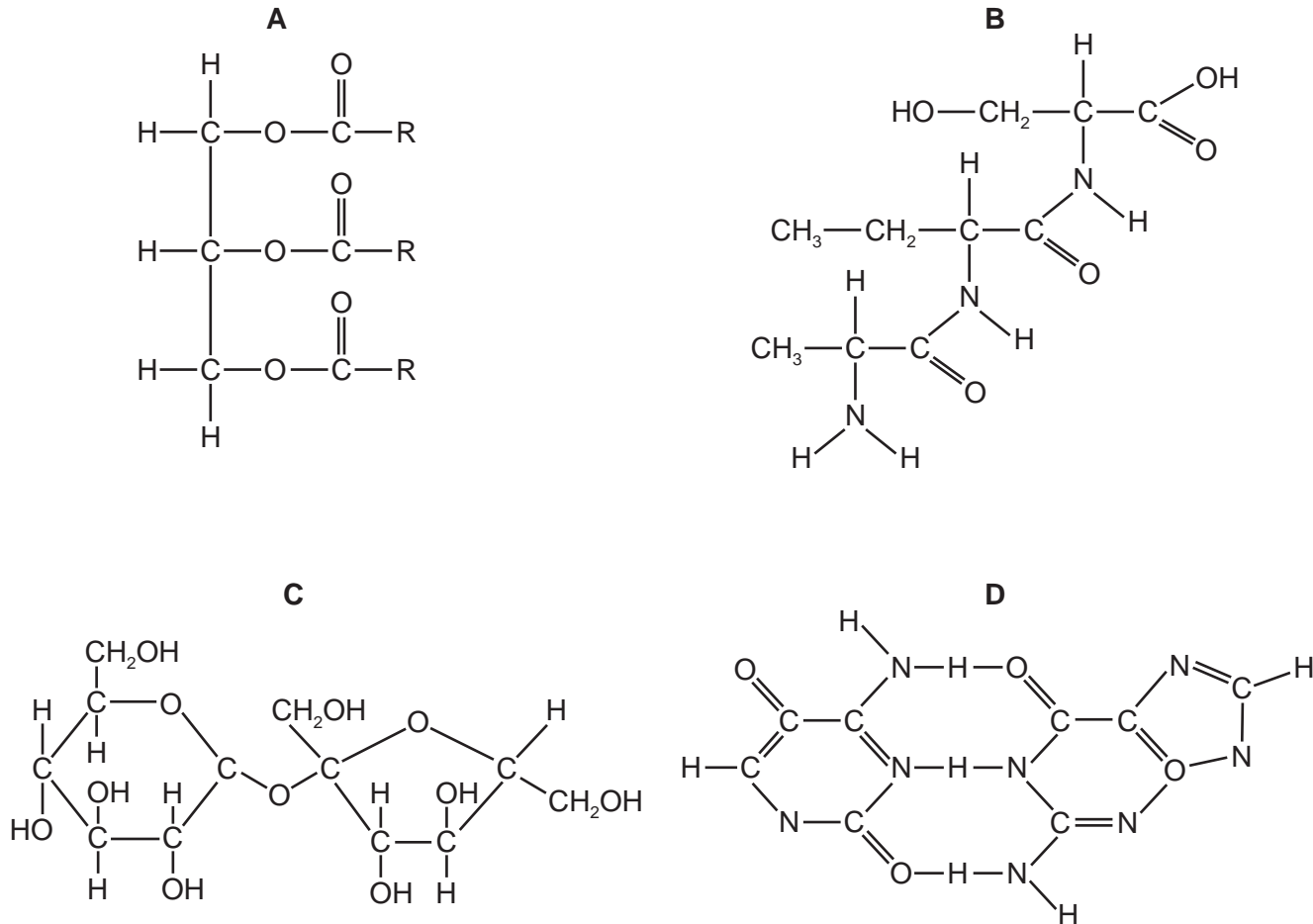


13 Which features adapt a cellulose molecule for its function?

- 1 Long chains of glucose molecules coil into a helix.
- 2 Many hydrogen bonds form between adjacent chains.
- 3 It is insoluble in water.

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

14 Which molecule contains a glycosidic bond?



15 Which bonds will be broken when a molecule of amylose is hydrolysed?

- 1  $\alpha$ 1,4
- 2  $\beta$ 1,4
- 3  $\alpha$ 1,6
- 4  $\beta$ 1,6

A 1 and 2

B 2 and 4

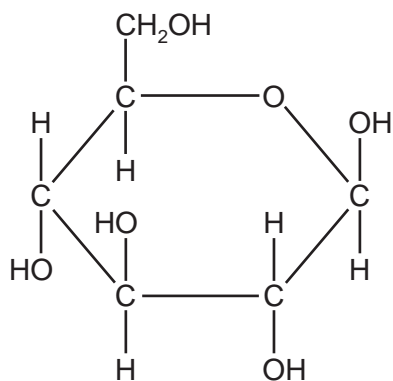
C 1 only

D 2 only

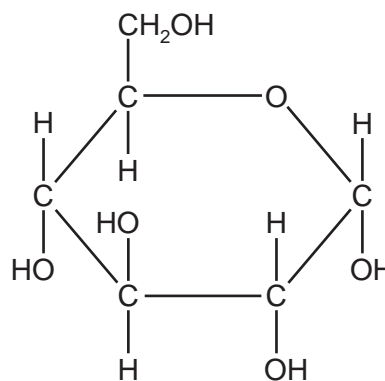


- 16 Which statement describes how the molecular structure of starch is suited to its function?
- A** Amylose has a branched structure and amylopectin is coiled to give a compact molecule for transport.
  - B** In the breakdown of amylose and amylopectin, many condensation reactions release stored energy.
  - C** In the formation of amylose and amylopectin, many hydrolysis reactions allow the release of stored energy.
  - D** The amylose-amylopectin complex is insoluble and does not affect the water potential of the cell.
- 17 Which comparative statements concerning biological molecules are correct?
- 1 A collagen molecule is a fibrous protein that contains many amino acids with hydrophobic R-groups whereas a haemoglobin molecule is a globular protein with no amino acids with hydrophobic R-groups.
  - 2 Sucrose hydrolysis results in glycosidic bond breakage and the production of equal proportions of fructose and  $\alpha$ -glucose molecules, whereas cellulose hydrolysis results in only  $\beta$ -glucose molecules.
  - 3 The glycosidic bonds of glycogen have been formed between two  $\alpha$ -glucose molecules, whereas with amylopectin, the bonds have been formed between an  $\alpha$ -glucose molecule and a  $\beta$ -glucose molecule.
- A** 1 and 2                      **B** 1 and 3                      **C** 2 only                      **D** 3 only
- 18 In triglyceride molecules, where are double bonds located?
- A** between fatty acids and glycerol
  - B** within fatty acids and within glycerol
  - C** within fatty acids only
  - D** within glycerol only

19 X and Y show the structures of two hexose sugars.



X

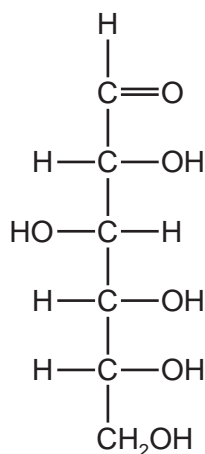


Y

Which statement is correct?

- A X is found in amylopectin.
- B X is found in amylose.
- C Y is found in cellulose.
- D Y is found in glycogen.

20 The structural formula of a carbohydrate molecule can be shown as:



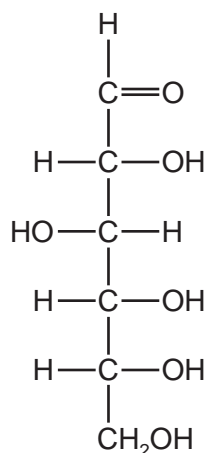
Which of the molecules could be represented by this formula?

- 1  $\alpha$  glucose
- 2 deoxyribose
- 3 ribose

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

- 21 What occurs when sucrose is broken down to monosaccharides?
- A** condensation of reducing sugars releasing water
  - B** condensation of reducing sugars using water
  - C** hydrolysis, releasing reducing sugars and releasing water
  - D** hydrolysis, releasing reducing sugars and using water
- 22 One naturally occurring polysaccharide is an unbranched chain of the molecule acetylglucosamine linked by  $\beta$ -1, 4 glycosidic bonds. There are  $-\text{CH}_2\text{OH}$  groups that alternate on each side of the polysaccharide chain.
- Many hydrogen bonds form between these unbranched chains.
- Which polysaccharide has a structure similar to that described?
- A** amylose
  - B** amylopectin
  - C** cellulose
  - D** glycogen
- 23 Which describes the emulsion test for the presence of lipids?
- A** Add ethanol and shake.
  - B** Add ethanol, pour into water and shake.
  - C** Add water and shake.
  - D** Add water, pour into ethanol and shake.

24 The structural formula of a carbohydrate molecule can be shown as:

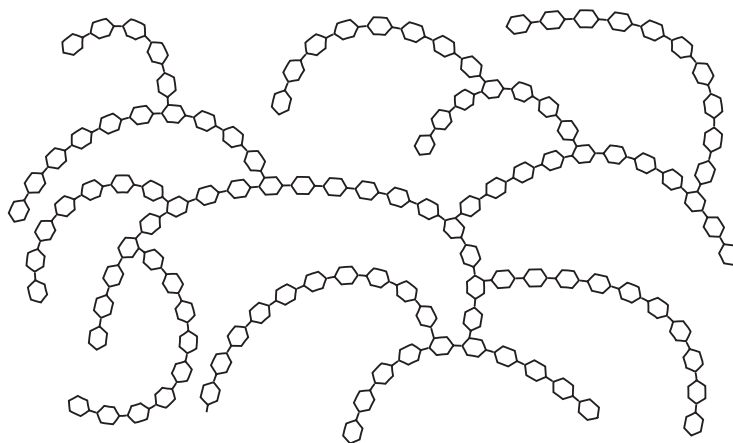


Which of the molecules could be represented by this formula?

- 1 ribose
- 2  $\beta$ -glucose
- 3 sucrose

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

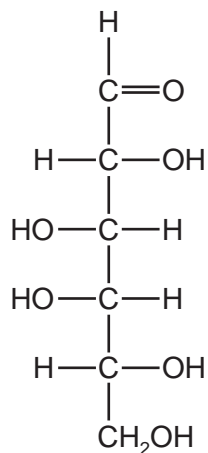
25 The diagram shows part of a molecule of glycogen.



How does the molecule differ from a molecule of amylose?

- A** Amylose has only  $\alpha$ -1,4 glycosidic bonds.
- B** Amylose has only  $\beta$ -1,4 glycosidic bonds.
- C** Amylose has  $\alpha$ -1,6 glycosidic bonds with 1,4 linkages forming branches.
- D** Amylose has  $\beta$ -1,4 glycosidic bonds with 1,6 linkages forming branches.

26 The structural formula of a carbohydrate molecule can be shown as:

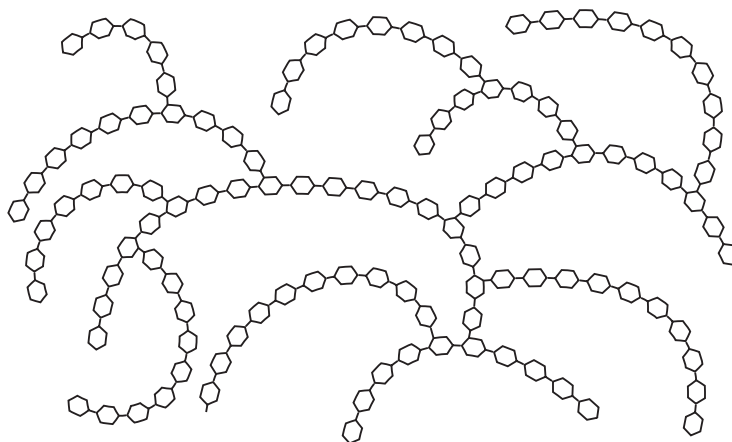


Which of the molecules could be represented by this formula?

- 1  $\beta$ -glucose
- 2 deoxyribose
- 3 ribose

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

27 The diagram shows part of a molecule of a carbohydrate formed by glucose.



What is the name of the molecule?

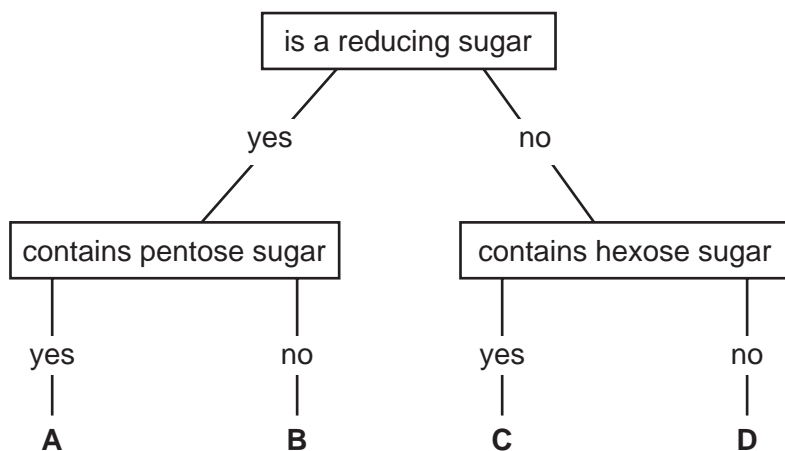
- A** amylose
- B** cellulose
- C** glycogen
- D** starch

28 Which of the statements about polysaccharides can be used to describe both amylopectin and cellulose?

- 1 adjacent glucose molecules are rotated by  $180^\circ$
- 2 contains 1,4 glycosidic bonds
- 3 polymer of  $\alpha$ -glucose

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

29 Which molecule in the key is sucrose?



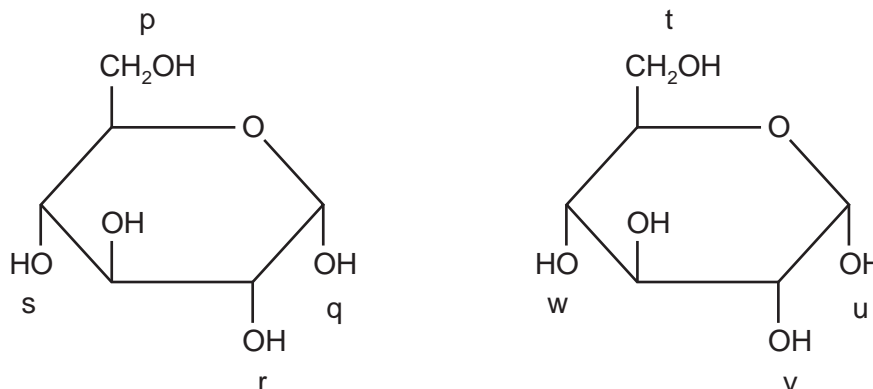
30 Which molecules have a structural formula that contains C=O bonds?

- 1 fatty acids
- 2 glucose
- 3 glycerol

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

- 31 Glycogen is a polymer of glucose.  
Which description summarises its structure?
- A  $\alpha$ -glucose joined by glycosidic bonds involving carbons 1 and 4
  - B  $\alpha$ -alpha glucose joined by glycosidic bonds involving carbons 1, 4 and 6
  - C  $\beta$ -beta glucose joined by glycosidic bonds involving carbons 1 and 4
  - D  $\beta$ -beta glucose joined by glycosidic bonds involving carbons 1, 4 and 6
- 32 Which molecules contain C=O bonds?
- 1 amino acids
  - 2 fatty acids
  - 3 proteins
- A 1 and 2 only
  - B 1 and 3 only
  - C 2 and 3 only
  - D 1, 2 and 3
- 33 Which of the statements about polysaccharides can be used to describe both amylose and amylopectin?
- 1 contains 1,4 glycosidic bonds
  - 2 contains 1,6 glycosidic bonds
  - 3 polymer of  $\alpha$ -glucose
- A 1 only
  - B 1 and 3 only
  - C 2 and 3 only
  - D 1, 2 and 3 only

- 34 The diagram shows two molecules of glucose. Four possible bonding positions are labelled p, q, r, and s, and t, u, v, w.



When these two molecules condense during the formation of a glycogen molecule, where could bonds form?

- A p – u or q – w
  - B q – w or p – v
  - C r – t or q – u
  - D s – w or r – v
- 35 Glucose in urine can be detected using a biochemical test. When the end of a test strip, which is impregnated with the enzyme glucose oxidase, is dipped into urine, the development of a blue colour indicates that glucose is present.

This is a reliable test that people with diabetes can carry out at home.

Which feature of the enzyme makes this test so reliable?

- A It is heat stable.
- B It is specific.
- C It lowers the activation energy of the reaction.
- D It only works at low pH range.



- 36 Which molecular bonds will be broken by hydrolysis when a molecule of glycogen is converted to glucose?

	bonds			
	1,2	1,4	1,6	
<b>A</b>	✓	x	x	key ✓ = broken x = unbroken
<b>B</b>	x	✓	✓	
<b>C</b>	✓	x	✓	
<b>D</b>	x	✓	x	

- 37 Some foods contain 'hydrogenated vegetable oils'. These are unsaturated fats that have been converted to saturated fats.

Which property of the fats will have changed?

- A** Their hydrocarbon chains will fit together more closely.  
**B** Their solubility in water will increase.  
**C** They will have more double bonds in their molecules.  
**D** They will remain liquid at room temperature.

- 38 Which rows show the chemical groups present in the biological molecules listed?

	biological molecule	presence of carboxyl (COOH) groups	presence of two or more hydroxyl (OH) groups
1	amino acid	yes	no
2	β-glucose	no	yes
3	glycerol	no	no
4	fatty acid	yes	no

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

39 Which correctly matches the functional and structural features of cellulose, collagen, glycogen or triglyceride?

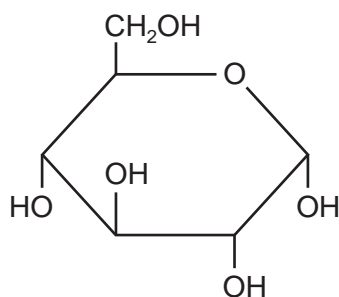
		function	structure		
			fibrous	molecule held together by hydrogen bonds	branched chains
<b>A</b>	cellulose triglyceride	support energy source	✓ ✗	✓ ✗	✗ ✗
<b>B</b>	collagen cellulose	strengthening support	✓ ✓	✓ ✗	✗ ✓
<b>C</b>	collagen glycogen	strengthening storage	✓ ✗	✓ ✗	✓ ✓
<b>D</b>	glycogen triglyceride	storage energy source	✗ ✗	✓ ✓	✓ ✗

key ✓ = true ✗ = false

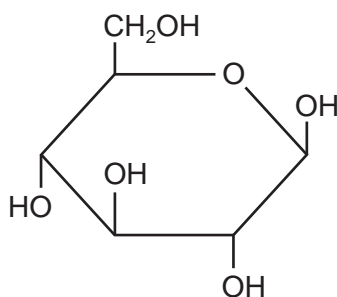
40 Which polysaccharides are branched and which are unbranched?

	branched	unbranched
<b>A</b>	amylose	cellulose
<b>B</b>	amylopectin	cellulose
<b>C</b>	cellulose	amylose
<b>D</b>	cellulose	amylopectin

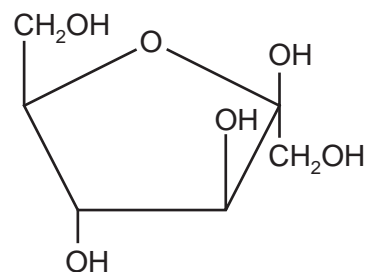
41 Three carbohydrate molecules are shown.



1



2



Which two molecules combine to form a molecule of sucrose?

- A** 1 and 2      **B** 1 and 3      **C** 2 and 3      **D** two of molecule 1

42 Which row describes a triglyceride?

	hydrophilic	insoluble in alcohol
<b>A</b>	✓	✓
<b>B</b>	✓	x
<b>C</b>	x	✓
<b>D</b>	x	x

key

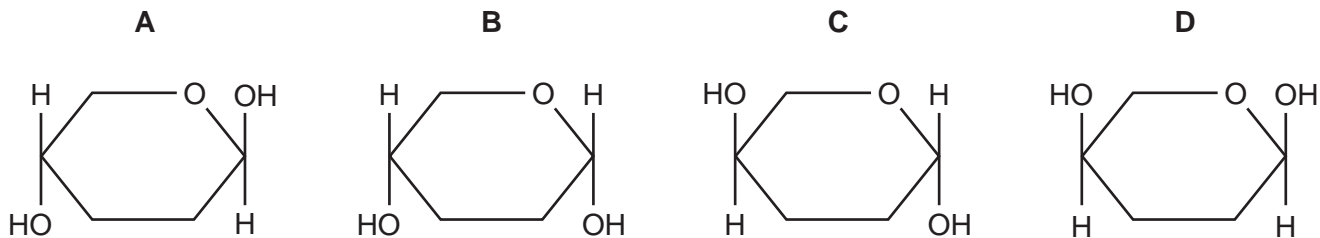
✓ = correct

x = incorrect

43 Which statement describes how the molecular structure of starch is suited to its function?

- A** Amylose has a branched structure and amylopectin is coiled to give a compact molecule for transport.
- B** In the breakdown of amylose and amylopectin, many hydrolysis reactions release stored energy.
- C** In the formation of amylose and amylopectin, many condensation reactions allow the release of stored energy.
- D** The final amylose / amylopectin complex is insoluble and does not affect the osmotic properties of the cell.

44 Which diagram represents part of the ring form of a molecule of  $\beta$ -glucose?



45 How many fatty acid residues are normally present in a phospholipid molecule?

- A** 1                      **B** 2                      **C** 3                      **D** 4

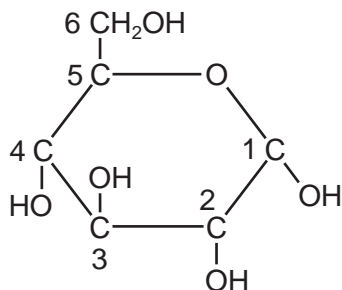
46 Which feature distinguishes starch from glycogen?

- A** Starch contains  $\alpha$ -glucose.  
**B** Starch contains 1,6 glycosidic bonds.  
**C** Starch has an unbranched component.  
**D** Starch is a polysaccharide.

47 What is the general formula for starch?

- A**  $(C_5H_{10}O_5)_n$     **B**  $(C_5H_{10}O_6)_n$     **C**  $(C_6H_{10}O_5)_n$     **D**  $(C_6H_{12}O_6)_n$

48 The hexose sugar molecule in the diagram has its six carbon atoms numbered.



Which carbon atoms join by glycosidic bonds to form amylose and amylopectin?

	amylose	amylopectin
<b>A</b>	1 to 4	1 to 4 and 1 to 6
<b>B</b>	1 to 6	1 to 4 and 1 to 6
<b>C</b>	1 to 4 and 1 to 6	1 to 4
<b>D</b>	1 to 4 and 1 to 6	1 to 6

49 Which statement about triglycerides is correct?

- A** They are made up of three fatty acids combined with glycogen.
- B** They are more saturated with hydrogen compared with phospholipids.
- C** They form a bilayer in the membranes of cells.
- D** They have a lower ratio of oxygen to carbon compared with carbohydrates.

50 Lactose is a disaccharide present in the milk of mammals.

How will a baby mammal benefit from having this sugar, instead of a monosaccharide, in the milk?

- A** Condensation of disaccharides enables rapid production of glycogen.
- B** Disaccharides can be transported across membranes for more rapid absorption.
- C** Disaccharides have a higher energy value than triglycerides.
- D** Hydrolysis of the glycosidic bond gives a gradual release of monosaccharide.