Name	Date started	Target end date

GCE AS / A LEVEL — BIOLOGY UNIT 1 QUESTION PACK

1071-01 (Legacy BY1) · New spec Unit 1 Topic 1 · AS unit, first sat 2016, 80 marks, 1h 30min paper

REVISE
.wales

BIOLOGY — UNIT 1 · WATER & CARBOHYDRATES

BY1.1 Biological compounds — water properties and carbohydrate structure

Polarity and hydrogen bonding in water, plus the structure and roles of mono-, di- and polysaccharides (glucose isomers, starch, glycogen, cellulose, chitin).

LEGACY 2008 SPECIFICATION

Estimated time for entire question pack: ~1 h 1 min

Derived from the legacy BY1 paper's pace of ~1.1 min/mark, padded for long-prose answers (38 marks over 4 questions).

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **comprehensive practice question pack**, not a single mock paper. It contains every question from the legacy WJEC BY1 papers (2008 modular spec, 2011–2017) that maps onto new-spec AS Unit 1 Topic 1 (1.1).

Questions are ordered by source paper date.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working — quality of written communication will affect marks. A calculator is allowed. Diagrams included in answers must be fully annotated.

For Examiner's use only

Q	Source	Max	Mark
1	Jun 12 Q2	6	
2	Jan 12 Q3	8	

Q	Source	Max	Mark
3	Jun 16 Q3	8	
4	Jan 13 Q6	16	
Total		**38**	

Water & Carbohydrates — what the new spec asks

WJEC GCE AS / A Level Biology (from 2015) · Unit 1: Basic Biochemistry & Cell Organisation · Topic 1.1.

Water properties

- Polar molecule — H-bonding between molecules.
- Cohesion, surface tension; high specific heat capacity.
- Universal solvent for polar / ionic substances.
- Ice less dense than water (insulates aquatic life).
- Acts as a metabolite in hydrolysis & condensation.

Monosaccharides

- Triose (3C), pentose (ribose, deoxyribose), hexose (glucose).
- α- vs β-glucose — structural isomers.
- Reducing-sugar test (Benedict's) gives brick-red precipitate.

Disaccharides

- Maltose (α-glucose + α-glucose).
- Sucrose (α-glucose + fructose); lactose (β-galactose + glucose).
- Formed by condensation — glycosidic bond; hydrolysed by water.

Polysaccharides

- Storage: starch (amylose & amylopectin) in plants; glycogen in animals.
- Structural: cellulose (β-1,4 in plant walls); chitin in insect cuticle & fungal cell walls.
- Branching & H-bonds explain compactness vs tensile strength.

Crib sheet »

Water & Carbohydrates in one page

Quick-reference notes — revisit before each question.

Water — the metabolite

Polar molecule; H-bonds between molecules.

Cohesion ⇒ surface tension; high specific heat ⇒ thermal stability.

Solvent for ions, sugars, amino acids; metabolite for hydrolysis / photosynthesis.

Glucose — α vs β

Both are $C_6H_{12}O_6$ hexoses but differ in OH position on C1.

α-glucose → starch / glycogen (storage).

β-glucose → cellulose (structural; alternating monomers).

Disaccharides

Maltose: α-glucose + α-glucose.

Sucrose: α-glucose + fructose (non-reducing).

Lactose: galactose + glucose (reducing).

Starch

Plant storage; in chloroplasts & storage organs.

Amylose: unbranched α-1,4 helix.

Amylopectin: branched α-1,4 + α-1,6 every ~25 residues.

Glycogen & cellulose

Glycogen: animal storage; more branched than amylopectin; in liver/muscle.

Cellulose: β-1,4 glucose; H-bonded into microfibrils; high tensile strength.

Chitin: like cellulose but with N-acetylglucosamine.

Benedict's test

Reducing sugar + Benedict's + heat → brick-red precipitate.

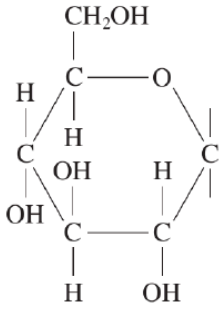
Non-reducing sugar: hydrolyse with HCl first, neutralise, then test.

Quantitative: filter precipitate or use a colorimeter.

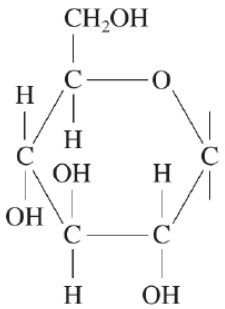
Examiner only

2. Carbohydrate molecules contain the chemical elements carbon, hydrogen and oxygen only.

(a) The diagrams below show structural formulae of two isomers of glucose. Complete the drawings to distinguish between the α and β isomers. [1]



α glucose



β glucose

(b) (i) Starch and cellulose are both polymers of glucose, but they are formed from different isomers. State the isomer which is found in: [1]

Cellulose ..... Starch .....

(ii) Explain how the structures of starch and cellulose are related to their functions as storage and structural molecules respectively. [4]

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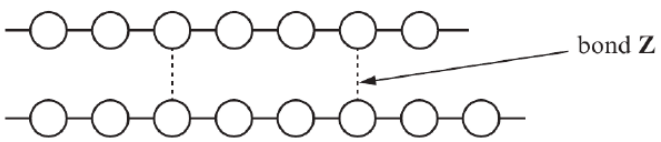
(Total 6 marks)

3. The diagram represents part of a cellulose molecule.



(a) (i) Name bond **Z** as shown on the diagram. [1]

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(ii) Explain the importance of bond **Z** in the role of cellulose in plant cell walls. [2]

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(b) (i) Name the chemical reaction by which monomers join together to form cellulose. [1]

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(ii) Chitin has many chemical and structural similarities to cellulose.
In chitin what additional compound replaces one of the –OH groups in each of its monosaccharides? [1]

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(iii) State the structural role of chitin in insects and describe its properties that make it suitable for this role. [1]

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Examiner only

3. *(a)* Explain the formation of hydrogen bonds between water molecules.
You may use annotated diagrams in your answer. [3]

Examiner only

(b) The following table shows some properties of water and their significance to life. [5]

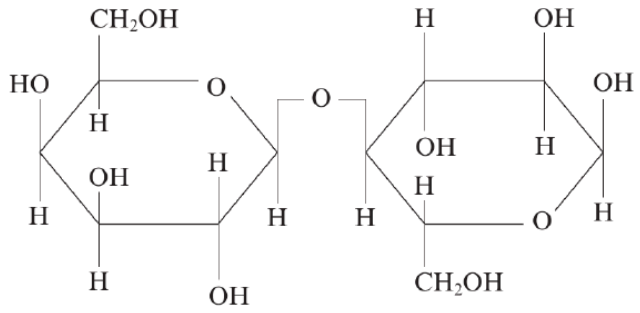
Complete the table below.

Property	Biological Significance
ice less dense than water	
	has a role in cooling the body through sweating
cohesion between water molecules	
	minimises temperature fluctuation in aquatic habitats
dissolves ionic substances	

8

Examiner only

6. Lactose is a disaccharide found in milk. The diagram below shows the structure of lactose.



(a) Lactose can be broken down into its constituent monosaccharides.

(i) Complete the diagram above to show how lactose is broken down. [2]

(ii) State the type of reaction involved in the breakdown of lactose. [1]

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(iii) Name the bond that is broken during this reaction. [1]

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(iv) Name the molecules produced when lactose is broken down. [1]

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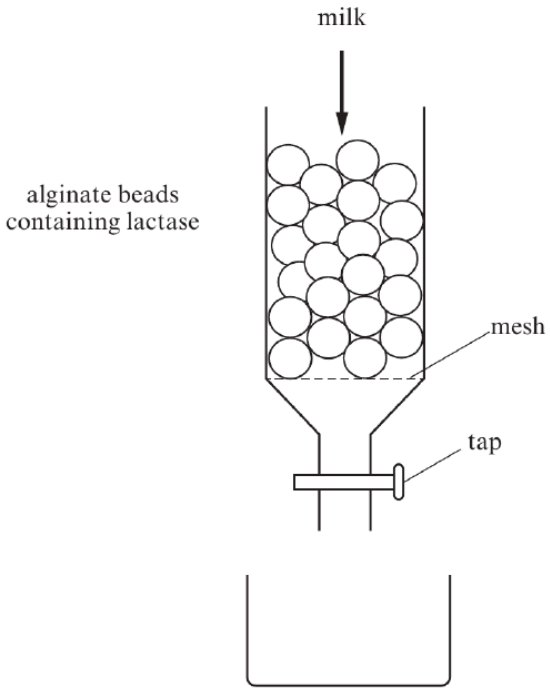
Examiner only

(b) The enzyme lactase can be used to break down lactose. In an experiment lactase was immobilised inside alginate beads and placed in a column, as shown in the diagram below. Fresh milk was then poured into the column and left for one minute before being allowed to drain into the beaker below. As the milk passes through the column the lactose in the milk is broken down.



(i) What is meant by the term immobilised enzyme? [1]

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(ii) Describe **two** advantages of using immobilised enzymes in this way. [2]

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Examiner only

(c) (i) The products produced from the breakdown of lactose are reducing sugars. Describe how you could test for the presence of a reducing sugar. [2]

(ii) The products produced could also be detected by a biosensor. What is meant by the term biosensor? [1]

(iii) What would be the main advantage of using the biosensor to detect the products? [1]

(d) Some bacteria which are found in milk can convert sugars within the milk to lactic acid. Over time the number of these bacteria increase and this eventually causes milk to go sour. The experiment above was repeated with milk that had been left for seven days. State and explain the effect this would have on the concentration of reducing sugars detected. [4]

(Total 16 marks)

END OF QUESTION PACK

4 questions · 38 marks · ~1 h 1 min
Source: WJEC BY1 (2008 modular spec, 2011–2017)
Curated for WJEC Biology 2015 spec AS Unit 1 — Topic 1 (1.1)