

# Carbohydrates 2

Level: CIE A Level 9700

Subject: Biology

Exam Board: Suitable for all boards

Topic: Carbohydrates 2

Type: Mark Scheme

To be used by all students preparing for CIE Biology A Level 9700 foundation or higher tier but also suitable for students of other boards.



## Mark schemes

- 1** (a) Any two from:  
Loop of DNA; Non-cellulose cell wall;  
Plasmid; Capsule;  
Flagellum; Mesosome;  
*Accept small ribosomes*
- 2
- (b) (i) (Granules) turn blue-black / dark blue / black / purple with iodine;
- 1
- (ii) Cellulose / pectin;
- 1
- (c) Use principle:  
Feature of starch;  
Consequence in terms of storage;  
e.g.  
Insoluble;  
Therefore will not “wash” out of cell / affect water potential / affect osmosis;  
OR  
Molecule coiled / branched;  
Therefore large amount stored in small space / compact  
OR  
Does not affect water potential;  
So no effect on entry of water (into cell);
- 2
- [6]**
- 2** use of water;
- must be above arrowhead  
OH drawn correctly in place of glycosidic bond on  
each monosaccharide;*
- [2]**
- 3** (a) Digestion / hydrolysis / breakdown of a disaccharide into monosaccharides;  
OR  
(glucose and galactose form lactose) glucose is a monosaccharide;
- max 1
- (b) (i) Dipeptidase / disaccharidase / named disaccharidase;
- 1
- (ii) Enzymes not lost (with gut contents) / more effective absorption of products formed by these enzymes;
- 1
- (c) No ATP formed / no energy released by respiration;  
*[reject “making” energy]*
- Link ATP to active transport (of galactose) into cells;
- 2
- [5]**



<b>4</b>	(a) (i) fructose;	1	
	(ii) correctly drawn (OH group at bottom left);	1	
	(b) hydrolysis;	1	
	(c) (i) <u>heat</u> with Benedict's solution ( <i>disqualify if HCl added</i> ); orange / brown / brick red / green / yellow colour or precipitate;	2	
	(ii) biuret test / NaOH + CuSO <sub>4</sub> ; purple / violet / lilac / mauve;	2	[7]
<b>5</b>	(a) A – granum / thylakoid; chlorophyll molecules to trap light / light absorbing pigments / light dependent reaction / part of light dependent reaction;	2	
	B – stroma; (contains enzymes for) carbon dioxide fixation / light-independent reaction / part of light-independent reaction; (allow ribosome role of protein in photosynthesis)	2	
	(b) (i) C – starch;	1	
	(ii) from glucose in a condensation / polymerisation reaction / many glucose molecules joined together;	1	[6]
<b>6</b>	(a) (i) condensation;	1	
	(b) (i) <b>D</b> ;	1	
	(ii) <b>C</b> ;	1	
	(iii) <b>A</b> ;	1	
	(c) absence of a double bond; in the (hydrocarbon) chain; unable to accept more <u>hydrogen</u> / saturated with hydrogen;	2 max	[6]



- 7** (a) 1. **A:** phospholipid (layer);  
*1. Reject hydrophobic / hydrophilic phospholipid*
2. **B:** pore / channel / pump / carrier / transmembrane / intrinsic / transport protein;  
*2. Ignore unqualified reference to protein* 2
- (b) (i) Condensation (reaction); 1
- (ii) Organelle named; Function in protein production / secretion;  
*Function must be for organelle named*  
*Incorrect organelle = 0*
- eg
1. Golgi (apparatus);  
*1. Accept smooth endoplasmic reticulum*
2. Package / process proteins;
- OR**
3. Rough endoplasmic reticulum / ribosomes;  
*3. Accept alternative correct functions of rough endoplasmic reticulum. ER / RER is insufficient*  
*3. Accept folding polypeptide / protein*
4. Make polypeptide / protein / forming peptide bonds;
- OR**
5. Mitochondria;
6. Release of energy / make ATP;  
*6. Reject produce / make energy*  
*6. Accept produce energy in the form of ATP*
- OR**
7. Vesicles;
8. Secretion / transport of protein; 2

[5]

- 8** (a) (i) Glucose and fructose;  
*Ignore reference to alpha and beta*  
*Either way around* 1



- (ii) Glucose and galactose;  
*Ignore reference to alpha and beta*  
*Either way around*

1

- (b) 1. (Amylase) pancreas, produces maltose;  
*Place and product = 1 mark*  
*(mark horizontally)*
2. (Maltase) in / on epithelium (of small intestine), produces glucose;  
*Ignore references to salivary glands or saliva*  
*Accept wall / lining of small intestine*  
*Ignore reference to cells alone*  
*Ignore reference to ribosomes / rER*

2

[4]

9

(a)

Statement	Starch	Cellulose	Glycogen
Found in plant cells	✓	✓	
Contains glycosidic bonds	✓	✓	✓
Contains β-glucose		✓	

*One mark for each correct row*

3

- (b) Hydrolysis;  
*Accept: if phonetically correct*  
*Do not accept: 'hydration'*

1



- (c) 1. Coiled / helical / spiral;  
*Feature = one mark*  
*Explanation = one mark*  
*Note: these are independent marking points*  
*These must be related for both marks but can be in reverse order*
2. (So) compact / tightly packed / can fit (lots) into a small space;
3. Insoluble;
4. (So) no osmotic effect / does not leave cell / does not affect water potential;  
*Accept: prevents osmosis*
5. Large molecule / long chain;
6. (So) does not leave cell / contains large number of glucose units;  
*4. and 6. Accept: can't cross membranes*
7. Branched chains;
8. (So) easy to remove glucose;

2 max

- (d) Two marks for correct answer of 479 - 521;  
*Accept: measured and actual lengths in different but correct units for 1 mark*

One mark for incorrect answers in which candidate clearly divides measured length by actual length;

*The actual range is 23 - 25mm, If they just divide this by 48 they gain 1 mark*

*Just writing the formula is insufficient, numbers must be used*

2

[8]

10

- (a) (i)  $\beta$  / Beta glucose;  
*Accept b / B*  
*Reject any reference to alpha /  $\alpha$*
- (ii) Glycosidic;  
*Reject references to  $\alpha$ (1-4) glycosidic bond, but allow beta 1-4, or unspecified reference to 1-4 (1,4)*
- (iii) OH / hydroxyl / HO;  
*Reject hydroxide*  
*Reject OH / HO molecule*  
*Ignore alcohol*

1

1

1



(b) (i)

Starch	Cellulose
1. (1,4 and) 1,6 bonds / contains 1,6 bonds / branching	1. 1,4 bonds / no 1,6 bonds / unbranched / straight;
2. All glucoses / monomers same way up	2. Alternate glucoses / monomers upside down;
3. Helix / coiled / compact	3. Straight;
4. Alpha glucose	4. Beta glucose;
5. No (micro / macro) fibrils / fibres	5. Micro / macro fibrils / fibres;

*1 mark per pair of contrasts, both starch and cellulose required  
Accept other comparable differences eg hydrogen bonds **within** starch but **between** cellulose molecules*

2 max

- (ii) 1. H-bonds / micro / macro fibrils / fibres;  
*Reject strong hydrogen bonds*
2. Strength / rigidity / inelasticity;  
*'Strong hydrogen bonds' = 0 but 'Strong hydrogen bonds give strength (to the molecule)' = 1*

2

[7]

11

- (a) (i) (Human cells) don't have a cell wall;  
*Accept "they" refers to human cells.*

1

- (ii) (Affects) protein synthesis;  
*Allow description e.g. 'amino acids not joined together / translation.  
Reject: affects transcription.*

1



- (b) 1. Mutation present / occurs;  
*Ignore antibiotic causes mutation.*
2. Resistance gene / allele;  
*1. or 2.*  
*Reference to immunity disqualifies first credited marking point.*
3. Resistant bacteria (survive and) reproduce;  
*Reference to mitosis negates marking point 3.*

2

[4]

12

- (a) (i) Hydrolysis;  
*Accept phonetic spelling.*  
*Ignore reaction.*
- (ii) (Alpha) glucose;  
*Accept  $\alpha$  glucose.*  
*Reject  $\beta$  glucose / beta glucose*
- (b) (i) Add Benedict's (reagent) and heat / warm;  
  
Red / orange / yellow / green (colour);  
*Reject Add HCl*  
*Accept brown, reject other colours*
- (ii) 2 products / 2 sugars produced;  
*Look for idea of **two***  
*Accept named monosaccharides produced.*  
*"More" insufficient for mark*  
*Neutral if incorrect products named*  
*Neutral "lactose is a polysaccharide"*  
*Neutral "lactose is not a reducing sugar"*  
*Neutral: Reference to surface area.*

1

1

2

1





- (c) 1. Galactose is a similar shape / structure to lactose / both complementary;  
*Q Reject: Same shape / structure*
2. (Inhibitor / Galactose) fits into / enters / binds with active site (of enzyme);  
*Accept blocks active site*
3. Prevents / less substrate fitting into / binding with (active site) / fewer or no E-S complexes;  
*Look for principles:*  
1. *Shape*  
2. *Binding to active site*  
3. *Consequence*

2 max

[7]

13

- (a) Helical / spiral / coiled;  
Compact / description e.g. 'tightly packed';  
*Feature = one mark*  
*Explanation = one mark*

Insoluble;

Prevents osmosis / uptake of water / does not affect water potential / (starch) does not leave cell;

*These must be related for both marks but can be in reverse order.*

Large molecule / long chain;

Does not leave cell;

*Allow idea of compact / helical / spiral / coiled due to bonding for two marks.*

2 max

- (b) (i)  $\beta$  / beta Glucose;  
*Q Reject alpha glucose*

1

- (ii) Glycosidic;

1

- (c) Long / straight / unbranched chains (of glucose joined by) hydrogen bonds;  
*Q Ignore reference to alpha glucose*

Form (micro)fibrils / (macro)fibrils;

Provide rigidity / strength / support;

*Allow suitable descriptions for last point e.g. 'prevents bursting';*

3

[7]



14

(a)

✓	✓	✓	
			✓
		✓	✓

One mark for each correct column

Mark ticks only and ignore crosses

4

- (b) 1. Two marks for box round two hydrogens and one of the oxygens from OH groups on carbons 1 and 4;;
2. One mark from incorrect answer involving any two hydrogens and an oxygen from carbons 1 and 4;

*Do not award marks if all atoms concerned are on same carbon atom or are on carbon atoms other than 1 and 4 or where the answer does not have two hydrogen and one oxygen*

2

- (c) (i) 1. Holds chains / cellulose molecules together / forms cross links between chains / cellulose molecules / forms microfibrils, providing strength / rigidity (to cellulose / cell wall);
2. Hydrogen bonds strong in large numbers;x  
*Principles here are first mark for where hydrogen bonds are formed and second for a consequence of this.*  
*Accept microfibrils*

2

- (ii) Compact / occupies small space / tightly packed;  
*Answer indicates depth required. Answers such as "good for storage", "easily stored" or "small" are insufficient.*

1

[9]

15

So there is no / less food in digestive system;

Which could affect the absorption of glucose;

[2]

16

- (a) (i) (Lactose +) Water; → (Glucose +) Galactose;  
*Accept: H<sub>2</sub>O for water*

2

- (ii) Hydrolysis;  
*Accept: if phonetically correct*

1



- (b) (i) (Add Biuret reagent to both solutions) – no mark;  
*Neutral: positive / negative result*

Lactase / enzyme will give purple / lilac / mauve;  
*Neutral: incorrect reference to the method*

**OR**

Lactose / reducing sugar will not give purple / lilac / mauve / will remain blue;

1

- (ii) Lactase / enzyme is a protein;  
*Accept: lactase / enzyme contains peptide bonds*

1

[5]

17

- (a) (Group of) similar / identical cells / cells with a common origin;  
**Q** *Ignore references to function*

1

- (b) (i) Add iodine / stain specific for starch to the slide / cells / tissue / add iodine / stain specific for starch and examine under microscope;

Blue-black / blue / black / purple;  
*Reject sample*

2

- (ii) Need a single layer of cells / only a few cells thick / not too many layers / detail obscured by cells underneath;

Light must be able to pass through;

2

- (c) Both are polymers / made of monomers;

Joined by condensation / molecules can be broken down by hydrolysis;

Both have 1-4 links;

Contain C(arbon), H(ydrogen) and O(xygen) / both made up of glucose;

Both insoluble;

Both contain glycosidic bonds;

*Accept other valid answers.  
Ignore ref to unbranched.*

2 max

[7]



18

- (a) Enzyme / active site has a (specific) tertiary structure;

Only glucose has correct shape / is complementary / will bind / fit to active site;

(Forming) enzyme-substrate complex;

*Q Allow second mark if candidate refers to correct shape or complementary in terms of the enzyme. Do not allow 'same' shape*

*Q Do not allow third mark if active site is described as being on substrate.*

3

- (b) (Only detects glucose whereas) Benedict's detects (all) reducing sugars / named examples;

Provides a reading / is quantitative / Benedict's only provides a colour / doesn't measure concentration / is qualitative / semiquantitative;

Is more sensitive / detects low concentration;

Red colour / colour of blood masks result;

Can monitor blood glucose concentration continuously;

*Q Do not credit quicker / more accurate unless qualified.*

*Q Allow Benedict's detects monosaccharides for first mark point.*

2 max

- (c) (i) Broken down by enzymes / digested / denatured (by pH) too large to be absorbed;

1

- (ii) Study not carried out on humans / only carried out on rats;  
Long-term / side effects not known;  
Scientists have vested interest;  
Study should be repeated / further studies / sample size not known;

2 max

[8]

19

- (a) (i) Glucose;

Fructose;

*Any order.*

2



- (ii) Lactose has a different shape / structure;

Does not fit / bind to active site of enzyme / sucrase;

*Only allow a second mark if reference is made to the active site.*

*Max 1 mark if active site is described as being on the substrate.*

**OR**

Active site of enzyme / sucrase has a specific shape / structure; Does not fit / bind to lactose;

*Do not accept same shape.*

2

- (b) (i) Rose and fell;

Peak at 45 (minutes) / concentration of 6.6 (mmol dm<sup>-3</sup>);

2

- (ii) Glucose (produced by digestion) is absorbed / enters blood;

Decrease as used up / stored;

2

**[8]**