

Carbohydrates 2

Level: Edexcel A Level 9BN0

Subject: Biology

Exam Board: Suitable for all boards

Topic: Carbohydrates 2

Type: Mark Scheme

To be used by all students preparing for Edexcel Biology A Level 9BN0 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]**



4	(a) (i) fructose;	1	[7]
	(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 ₄ ; purple / violet / lilac / mauve;	2	
5	(a) A – granum / thylakoid; chlorophyll molecules to trap light / light absorbing pigments / light dependent reaction / part of light dependent reaction;	2	[6]
	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	
	(a) (i) condensation;	1	
6	(b) (i) D ;	1	[6]
	(ii) C ;	1	
	(iii) A ;	1	
	(c) absence of a double bond; in the (hydrocarbon) chain; unable to accept more <u>hydrogen</u> / saturated with hydrogen;	2 max	



- 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) β / Beta glucose;
Accept b / B
Reject any reference to alpha / α
- (ii) Glycosidic;
Reject references to α (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]

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- (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 α glucose.
Reject β 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) β / 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: H₂O 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]

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- (a) (i) Glucose;

Fructose;

Any order.

2



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

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

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 / sucrose 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⁻³);

2

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

Decrease as used up / stored;

2

[8]