PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



EXAM QUESTION PACK

TOPIC 1: BIOLOGICAL MOLECULES

CARBOHYDRATES

SCORE	PERCENTAGE
/62	%

STEMUP

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Q1.

Enzymes are involved in the breakdown of carbohydrates.

The enzyme amylase breaks down the polysaccharide amylose into maltose.

How many of these statements are true for amylose?

(1)

- It contains 1,6 glycosidic bonds
- It contains 1,4 glycosidic bonds
- It has a helical structure
- It has a branched structure

☒ **A** 1

☒ **B** 2

☒ **C** 3

☒ **D** 4

(Total for question = 1 mark)

Q2.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Lipids and carbohydrates are used as respiratory substrates.

The respiration of lipids generates more ATP than the respiration of carbohydrates.

The table shows bonds that may be found in carbohydrates and lipids.

Which box in each row shows whether the bond may be found in these molecules?

(3)

Bond	Molecule that bond may be found in			
	carbohydrate only	lipid only	both carbohydrate and lipid	neither carbohydrate nor lipid
covalent	☐	☐	☐	☐
ester	☐	☐	☐	☐
hydrogen	☐	☐	☐	☐

(Total for question = 3 marks)

Q3.

An investigation was carried out to compare the aerobic respiration of different sugars by yeast.

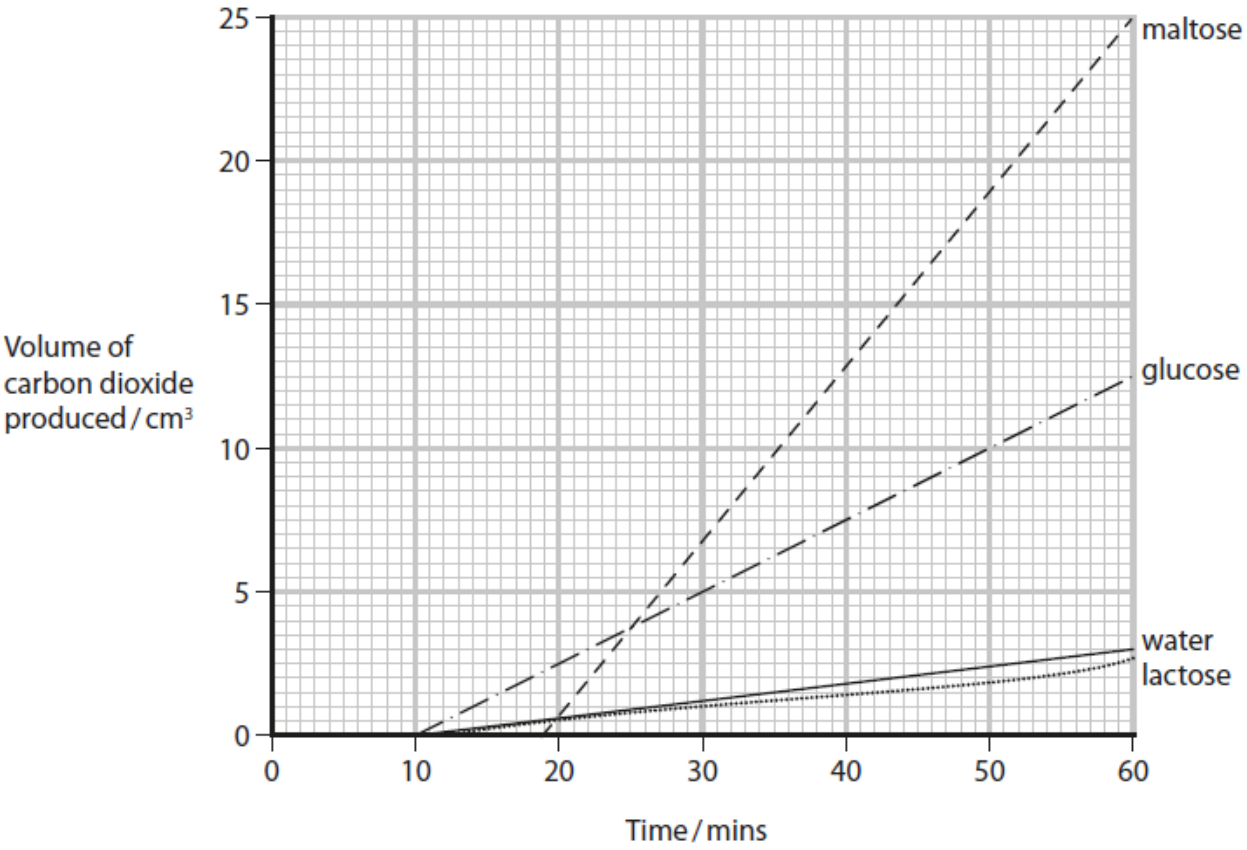
A suspension of yeast was used to produce three cultures, each one with a different sugar.

A control was set up that had a suspension of yeast cultured with water only.

The volume of carbon dioxide produced was measured.

The mass of yeast and the concentration of each sugar were controlled.

The graph shows the results of this investigation.



(i) Give one difference between the structure of glucose and the structure of maltose.

(1)

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(ii) Explain the results for the yeast cultured with glucose and the yeast cultured with maltose.

(2)

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(Total for question = 3 marks)

Q4.

An investigation was carried out to compare the aerobic respiration of different sugars by yeast.

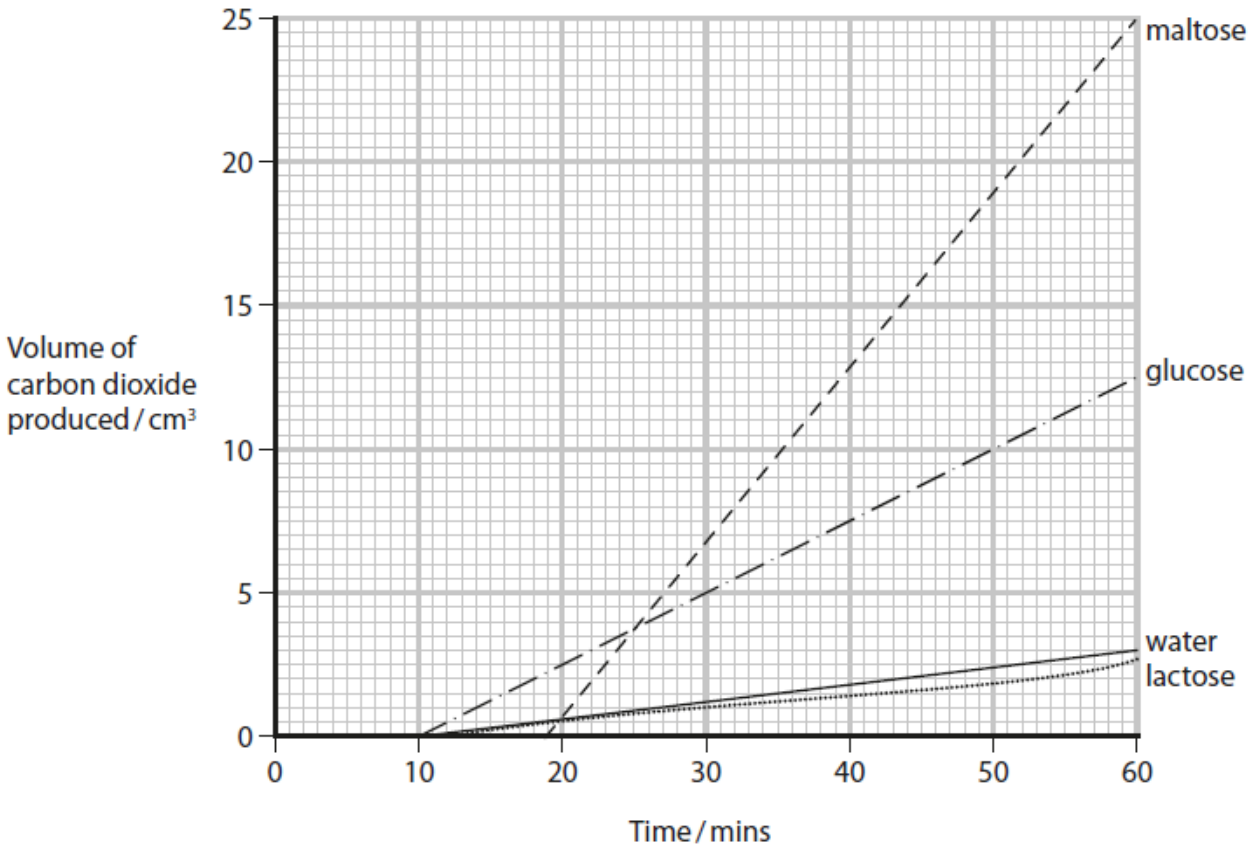
A suspension of yeast was used to produce three cultures, each one with a different sugar.

A control was set up that had a suspension of yeast cultured with water only.

The volume of carbon dioxide produced was measured.

The mass of yeast and the concentration of each sugar were controlled.

The graph shows the results of this investigation.



Explain the results for the yeast cultured with lactose.

(2)

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(Total for question = 2 marks)

Q5.

A student investigated the effect of the concentration of sodium chloride solution on blood.

The student set up six test tubes, each with a different concentration of sodium chloride solution.

Five drops of blood were added to each test tube.

The appearance of the solutions was then recorded.

Samples of each solution were observed using a light microscope.

The table shows the results of this investigation.

Concentration of sodium chloride (%)	Appearance of solution after blood was added	Observation with light microscope
3.0	very cloudy	cells seen with shrunken edges
1.0	very cloudy	cells seen
0.9	very cloudy	cells seen
0.7	slightly cloudy	cells seen
0.5	cloudy at first, then went clear	no cells seen
0.3	clear	no cells seen

The student then investigated the effect of using glucose solutions and sucrose solutions, instead of sodium chloride solutions.

The appearance of the solutions was recorded and samples were observed using a light microscope.

When the concentration of glucose solution was below 3%, the solution was clear and no blood cells could be seen. When the concentration of glucose solution was above 3%, the solution was cloudy and blood cells could be seen.

When the concentration of sucrose solution was below 6%, the solution was also clear and no blood cells could be seen. When the concentration of sucrose solution was above 6%, the solution was cloudy and blood cells could be seen.

Explain the differences in the effects of the solutions of glucose and sucrose.

(3)

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(Total for question = 3 marks)

Q6.

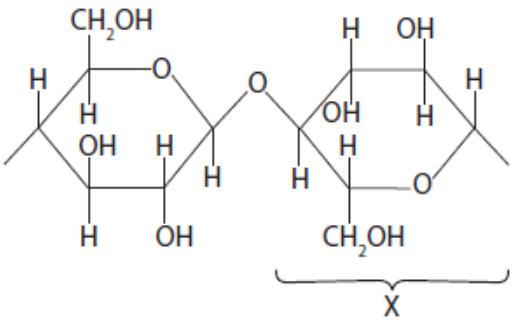
Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

In Kenya, an in-situ conservation project has been set up to make paper from elephant dung.

This project aims to help conserve elephant populations, conserve biodiversity and help local communities.

Paper is produced from cellulose molecules present in elephant dung.

The diagram shows part of a cellulose molecule.



(i) Which of the following is the name of the monomer labelled X on the diagram?

(1)

☒ **A** α glucose

☒ **B** β glucose

☒ **C** α ribose

☒ **D** β ribose

(ii) Draw one of the products of the hydrolysis of this part of the cellulose molecule.

(2)

(iii) Explain how the structure of cellulose is adapted for its function in plant cell walls.

(3)

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(Total for question = 6 marks)

Q7.

Chemical control in plants is brought about by plant growth substances such as auxins.

Auxins cause elongation of cells.

Auxins weaken the bonds between molecules found in cell walls. Molecules found in cell walls include cellulose and hemicellulose.

(i) Which of the following statements about cellulose molecules is correct?

(1)

☒ **A** they are branched polymers

☒ **B** they contain α-glucose

☒ **C** they are bonded to each other by hydrogen bonds

☒ **D** they contain 1,6 glycosidic bonds

(ii) The following statements relate to calcium pectate:

1. found in the middle lamella

2. cell walls together

3. prevents the movement of water

Which of the following is correct for calcium pectate?

(1)

☒ **A** statement 1 and statement 2

☒ **B** statement 1 and statement 3

☒ **C** statement 2 only

☒ **D** statement 3 only

(Total for question = 2 marks)

Q8.

Glucose and fructose are monosaccharides.

The makers of sweet tasting drinks use the enzyme glucose isomerase to convert glucose into fructose.

Fructose is a monosaccharide that tastes much sweeter than glucose.

(i) Explain a possible health benefit of converting glucose into fructose for use in sweet tasting drinks.

(2)

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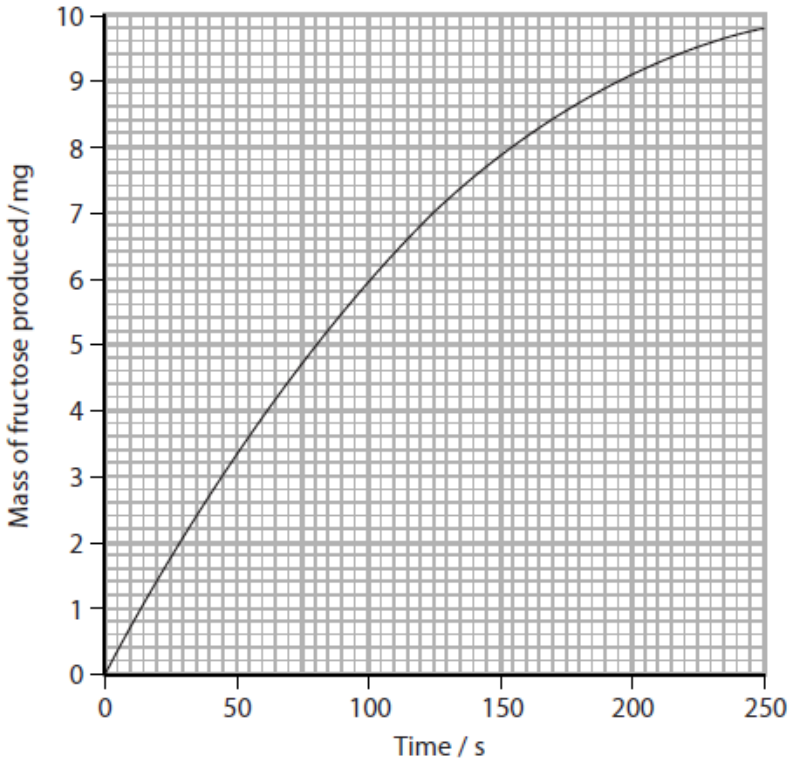
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(ii) A student investigated the activity of glucose isomerase.

The graph shows the results of this investigation.



Determine the initial rate of the reaction.

(1)

Answer .....

(iii) Cofactors are non-protein molecules that help enzymes to function.

Magnesium ions act as cofactors for some enzymes.

Devise an experiment to investigate the effect of magnesium ions on the initial rate of this reaction.

(5)

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(Total for question = 8 marks)

Q9.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Adrenaline is a hormone that stimulates the breakdown of glycogen into glucose.

(i) Which of the following describes this breakdown?

(1)

☒ **A** condensation reaction breaking glycosidic bonds

☒ **B** condensation reaction breaking phosphodiester bonds

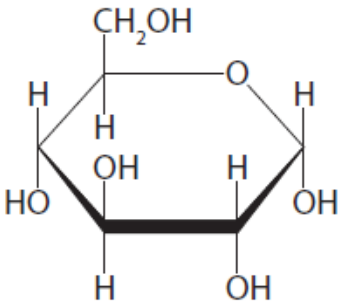
☒ **C** hydrolysis reaction breaking glycosidic bonds

☒ **D** hydrolysis reaction breaking phosphodiester bonds

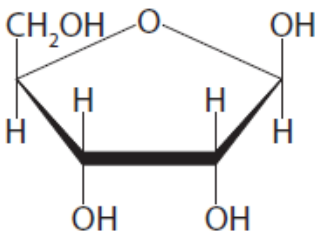
(ii) Which diagram shows the structure of the glucose produced?

(1)

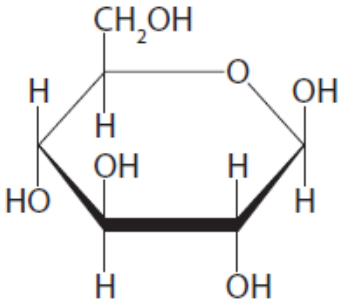
☒ **A**



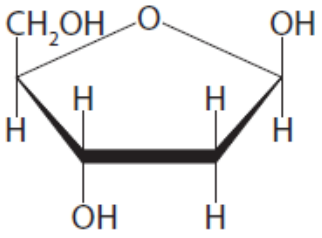
☒ **C**



☒ **B**



☒ **D**



(iii) Explain how the structure of glycogen is related to its function.

(3)

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(Total for question = 5 marks)

Q10.

Fungi break down dead plant and animal material in ecosystems.

Some types of fungi produce cellulase enzymes. These enzymes break down cellulose.

The breakdown of cellulose can be detected using Benedict's solution.
This solution turns red if monomers from the breakdown of cellulose are present.

(a) State the type of reaction catalysed by cellulase to break down cellulose.

(1)

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(b) Describe the structure of the monomer produced when cellulose is broken down.

(2)

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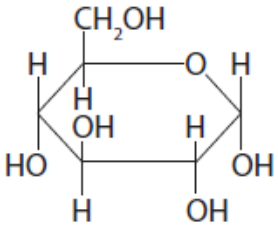
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Q11.

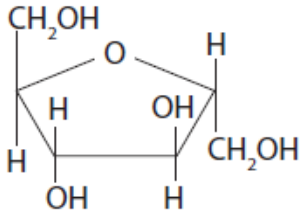
Glucose is broken down by respiration and produces ATP as a source of energy for metabolic reactions in cells.

The diagram shows the structure of four carbohydrates.

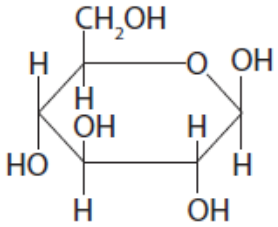
A



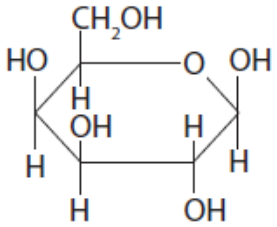
B



C



D



Which of the structures is beta glucose?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

Q12.

Many of the chemicals found in living organisms are polymers.

Which of the following molecules are all polymers?

(1)

- ☒ **A** polypeptides, nucleotides, starch
- ☒ **B** polypeptides, starch, lipids
- ☒ **C** proteins, carbohydrates, lipids
- ☒ **D** proteins, nucleic acids, starch

Q13.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Bacteria were cultured in two different types of medium.

One medium contained glucose as the energy source and the other contained sucrose.

The same molar concentrations of glucose and sucrose were used.

Which row of the table identifies these sugars?

(1)

	Glucose	Sucrose
☒ **A**	monosaccharide	monosaccharide
☒ **B**	monosaccharide	disaccharide
☒ **C**	disaccharide	disaccharide
☒ **D**	disaccharide	monosaccharide

(Total for question = 1 mark)

Q14.

Mitochondria and chloroplasts in eukaryotic cells are thought to have originated millions of years ago by a process called endosymbiosis.

In endosymbiosis, free-living prokaryotic organisms were engulfed by their new host cells.

The table shows the lipid composition of the membranes of these two organelles.

Type of lipid	Percentage of total lipid composition of membranes (%)	
	In mitochondria	In chloroplasts
phosphatidyl A	43	0
phosphatidyl B	35	0
phosphatidyl C	6	1
phosphatidyl D	3	7
phosphatidyl E	13	0
monogalactosyldiacylglycerol F	0	55
digalactosyldiacylglycerol G	0	24
sulfolipid H	0	8

(i) Analyse the data and use your knowledge to explain why these two organelles are thought to have originated from different prokaryotic organisms.

(3)

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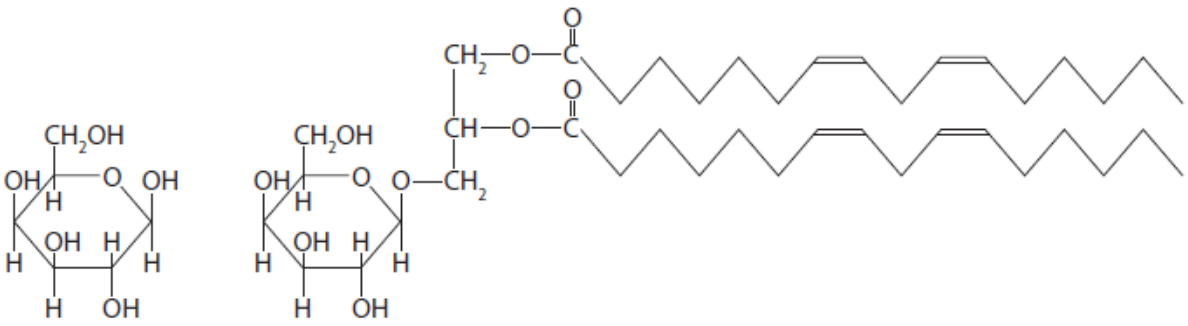
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(ii) Digalactosyldiacylglycerol (DGDG) is synthesised from galactose and monogalactosyldiacylglycerol (MGDG).

The galactose forms a 1,6 glycosidic bond with the MGDG.

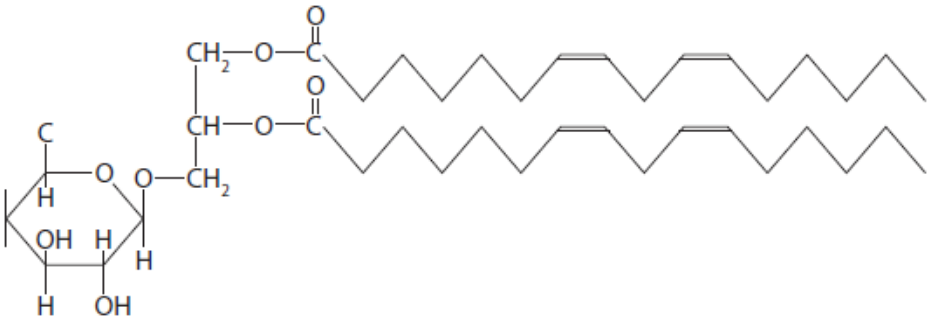
The diagram shows the structure of galactose and MGDG.



galactose MGDG

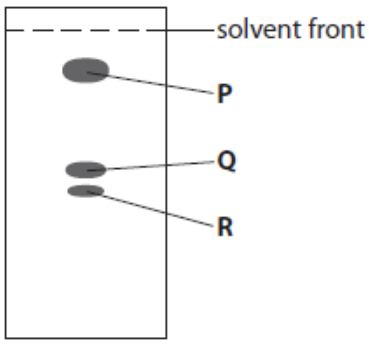
Complete the diagram below to show the structures of the products formed when DGDG is synthesised from galactose and MGDG.

(3)



(iii) Chromatography can be used to separate MGDG, DGDG and sulfolipid extracted from chloroplasts.

The diagram shows the position of these three lipids, **P**, **Q** and **R**, on a chromatogram.



Which row in the table identifies the position of these three lipids in this chromatogram ?

(1)

	Lipid in position P	Lipid in position Q	Lipid in position R
☒ **A**	DGDG	sulfolipid	MGDG
☒ **B**	MGDG	DGDG	sulfolipid
☒ **C**	sulfolipid	DGDG	MGDG
☒ **D**	sulfolipid	MGDG	DGDG

(Total for question = 7 marks)

Q15.

Many of the chemicals found in living organisms are polymers.

Which of the following molecules is made of different monosaccharides?

(1)

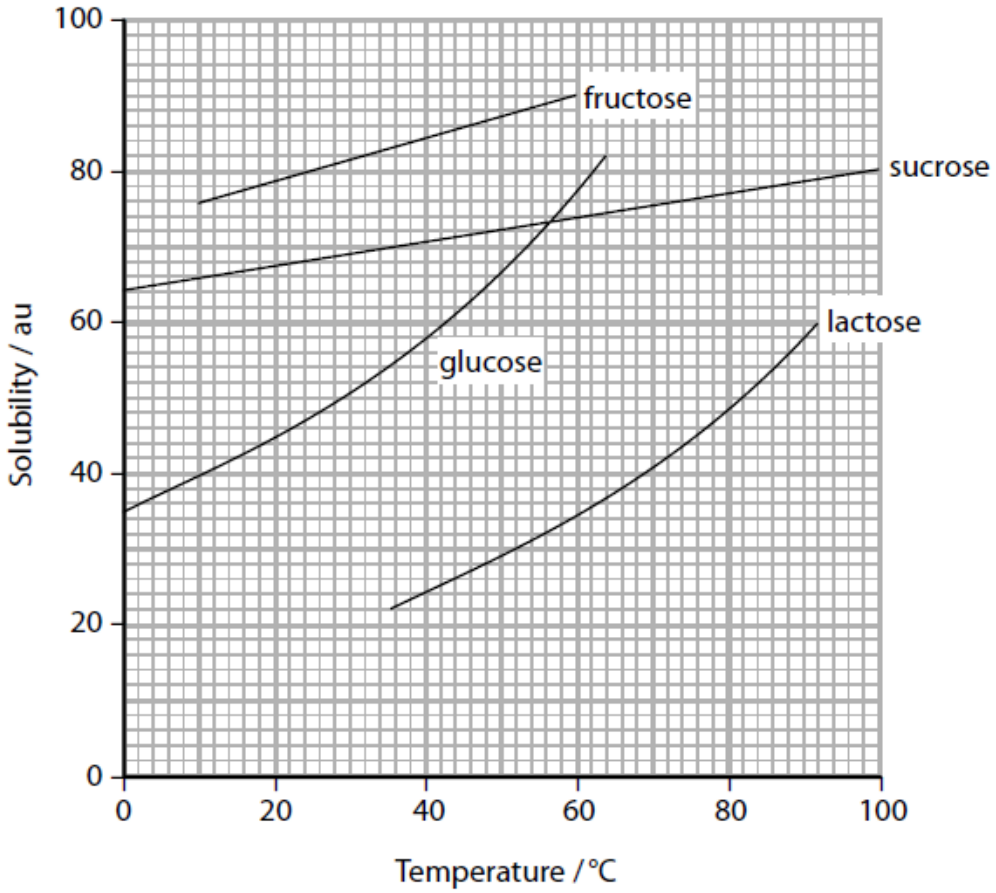
- ☒ **A** amylose
- ☒ **B** glycogen
- ☒ **C** lactose
- ☒ **D** maltose

Q16.

An investigation into the effect of temperature on the solubility of some monosaccharides and some disaccharides was carried out.

Each monosaccharide and disaccharide was dissolved in water at different temperatures.

The graph below shows the solubility of some monosaccharides and some disaccharides in water at different temperatures.



(a) The graph shows that as water temperature increases, the solubility of

(1)

☒ **A** monosaccharides increases more than that of disaccharides

☒ **B** monosaccharides increases less than that of disaccharides

☒ **C** monosaccharides is always more than that of disaccharides

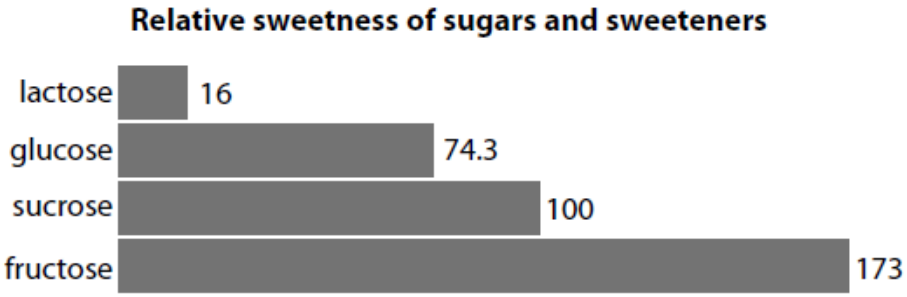
☒ **D** monosaccharides is always less than that of disaccharides

(b) Which row of the table below is correct for carbohydrates?

(1)

	Contains only six carbon atoms	Can be split by hydrolysis
☒ **A**	glucose	glucose
☒ **B**	glucose	lactose
☒ **C**	lactose	glucose
☒ **D**	lactose	lactose

(c) The graph below shows the relative sweetness of the monosaccharides and disaccharides.



People who are obese are at an increased risk of developing health problems.

Explain why the food industry uses the enzyme glucose isomerase to convert glucose into fructose when manufacturing its slimming products.

(3)

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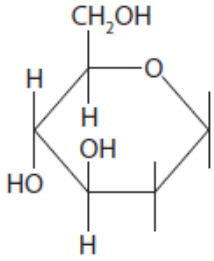
(Total for question = 5 marks)

Q17.

Glucose and fructose are monosaccharides.

Complete the diagram to show the structure of alpha glucose.

(1)

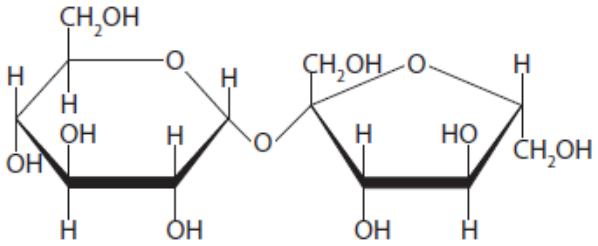


(Total for question = 1 mark)

Q18.

Enzymes are involved in the breakdown of carbohydrates.

The diagram shows the structure of sucrose.



The enzyme sucrase breaks down sucrose into two monosaccharides.

(i) Which type of reaction does sucrase catalyse?

(1)

☒ **A** condensation

☒ **B** hydrolysis

☒ **C** phosphorylation

☒ **D** translocation

(ii) Name the monosaccharides produced from the breakdown of sucrose.

(1)

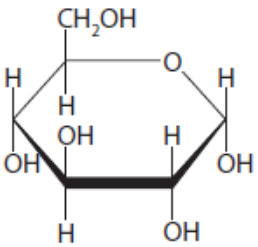
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(iii) The diagram shows one of these monosaccharides.

Draw the structure of the other monosaccharide.

(1)



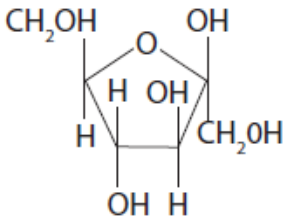
(Total for question = 3 marks)

Q19.

Sperm cells are released into the female genital tract in seminal fluid.

Seminal fluid contains fructose instead of glucose.

The diagram shows the structure of fructose.



(i) Compare and contrast the structure of fructose with the structure of glucose.

(3)

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(ii) Explain the advantages of the presence of fructose in seminal fluid.

(3)

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(Total for question = 6 marks)

Mark Scheme

Q1.

Question Number	Answer	Mark
	The only correct answer is B ***A*** *is not correct because amylose has a helical and contains 1,4 glycosidic bonds* ***C*** *is not correct because amylose is not branched and does not contain 1,6 glycosidic bonds* ***D*** *is not correct because* amylose is not branched and does not contain 1,6 glycosidic bonds	**(1)**

Q2.

Question Number	Answer	Mark
		(3)

Bond	Molecule that bond may be found in			
	carbohydrate only	lipid only	both carbohydrate and lipid	neither carbohydrate nor lipid
covalent	☐	☐	X	☐
ester	☐	X	☐	☐
hydrogen	X	☐	☐	☐

Q3.

Question Number	Answer	Additional Guidance	Mark
(i)	• glucose is a monosaccharide and maltose is {a disaccharide /made of two glucoses / made of two monosaccharides} (1)	**ACCEPT** maltose has a glycosidic bond and glucosedoes not glucose has 6 carbons and maltose has 12 glucose has the formula $C_6H_{12}O_6$ and maltose $C_{12}H_{22}O_{11}$ **ACCEPT** a labelled diagram	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to two of the following: • neither sugars respired immediately because the yeast need to {acclimatise / adjust to the conditions} (1) • delay is longer for maltose as {enzymes need to be synthesised / maltose needs to be broken down into glucose} (1) • respiration of maltose is faster (than glucose) as maltose has {twice the number of sugar units / more glucoses / more hydrogens} (1)	**ACCEPT** glycosidic bonds have to be broken **ACCEPT** because maltose contains more energy / maltose is a disaccharide and glucose is a monosaccharide	(2)

Q4.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • lactose is not {respired / used} as the yeast do not produce {theappropriate enzymes / lactase} (1) • sugars in the cytoplasm are {used / respired} (1)	**ACCEPT** yeast cannot break lactose down **NB** at least one reference to respiration for bothmarks to be awarded	(2)

Q5.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • the osmotic potential of the red blood cells is equivalentto 3% glucose or 6% sucrose (1) • because the molecular mass of sucrose is twice that ofglucose (1) • because it is the number of molecules that determine theosmotic potential, not % concentration (1)	Allow twice the concentration of sucrose is needed to have the same effect Accept sucrose as a disaccharide whereas glucose is a monosaccharide	**(3)**

Q6.

Question Number	Answer	Additional Guidance	Mark
(i)	The only correct answer is **B** β glucose *A is incorrect because cellulose does not contain a glucose* *C is incorrect because cellulose does not contain ribose* *D is incorrect because cellulose does not contain ribose*		**1 comp**

Question Number	Answer	Additional Guidance	Mark
(ii)	A drawing showing the following: • Correct structure drawn (1) *Hexagonal ring with oxygen in correct place in ring. CH_2OH in correct place. All OHs apart from Carbon 1 in right places. Allow Hydrogens to be just stalks.* • OH groups shown correctly on carbon 1 (1) *pointing in same direction as CH_2OH*	**Do not accept** if water molecule also released / drawn	**2 grad**

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to three from the following points: • (cellulose molecules are) straight / not helical (1) • (many) hydrogen bonds hold molecules / chains / layers together (1) • (strong) to prevent cell lysis / cells bursting / maintain turgidity / resist (turgor) pressure (1) • (polar nature of glucose) allows water /minerals to diffuse through (1)	**Accept** not coiled **Accept** hydrogen bonds between microfibrils **Accept** other correct functions of strong cell wall	3 exp

Q7.

Question Number	Answer	Additional Guidance	Mark
(i)	The only correct answer is **C** (they are bonded to each other by hydrogen bonds) **A** is not correct because cellulose molecules are not branched polymers **B** is not correct because cellulose molecules do not contain α - glucose, they contain β - glucose **D** is not correct because cellulose molecules do not contain 1,6 glycosidic bonds, they contain 1,4 glycosidic bonds		**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	The only correct answer is **A** (statement 1 and statement 2) **B** is not correct because calcium pectate does not prevent the movement of water **C** is not correct because calcium pectate is also found in the middle lamella **D** is not correct because calcium pectate does not prevent the movement of water		**(1)**

Q8.

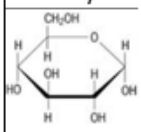
Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to two of the following: • less needed for same sweet effect (1) • therefore less {energy / calorie} intake (1) • therefore less risk of appropriate named health benefit (1)	**e.g.** reduced obesity / (type 2) diabetes / tooth decay / heart disease / atherosclerosis / high blood pressure / CVD / CHD	**(2)**

Question Number	Answer	Additional Guidance	Mark
	• 0.066 to 0.074	**DO NOT ACCEPT** 0.06°	**(1)**

Question Number	Answer	Additional Guidance	Mark
(iii)	An answer that makes reference to the following: • with and without magnesium ions (1) • use same {volume / stated cm^3 / concentration} of isomerase enzyme (1) • use excess {glucose / substrate} (1) • control {temperature / pH} (1) • repeat to {calculate mean / calculate average / standard deviation / standard error / recognise anomalies} (1)	**ACCEPT** same mass **DO NOT ACCEPT** if in list	**(5)**

Q9.

Question Number	Answer	Mark
(i)	The only correct answer is C hydrolysis reaction breaking glycosidic bonds *A is not correct because condensation reactions forms glycogen* *B is not correct because the bonds are not phosphodiester bonds* *D is not correct because the bonds are not phosphodiester bonds*	1

Question Number	Answer	Mark
(ii)	The only correct answer is A  *B is not correct because it is -glucose* *C is nor correct because it is ribose* *D is not correct because it is deoxyribose*	1

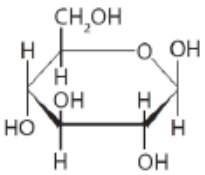
Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that make reference to three of the following: • glucose molecules joined {1,4 glycosidic} bonds (1) • compact for (energy) storage (1) • {1,6 glycosidic bonds / branched} for rapid / easy {breakdown / hydrolysis} (1) • {large / insoluble} molecule which does not {affect osmosis / leave cells / solute potential / water potential} (1)	**DO NOT ACCEPT** beta glucose once	3

Q10.

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)	hydrolysis		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)	A description that makes reference to the following: • a ring of one oxygen and 5 carbon atoms, with a 6th carbon projecting from the ring (1) • OH groups on carbon atoms 1 and 4 projecting to opposite sides of the molecule (1)	Allow marks if in drawing	**(2)**

Q11.

Question Number	Acceptable Answer	Additional guidance	Mark
	C ()		**(1)**

Q12.

Question Number	Acceptable Answer	Additional Guidance	Mark
	D (proteins, nucleic acids, starch)		**(1)**

Q13.

Question Number	Answer	Additional Guidance	Mark
	B monosaccharide disaccharide	A is incorrect because sucrose is a disaccharide C is incorrect because glucose is a monosaccharide D is incorrect because glucose is a monosaccharide and sucrose is a disaccharide	

Q14.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following: • because different types of lipid are found in the mitochondria and chloroplasts **(1)** • because mitochondria are associated with { respiration / oxidative phosphorylation} whereas chloroplasts are associated with {photosynthesis / light-dependent reactions / photophosphorylation} **(1)** • because mitochondria contain {electron transport proteins / cytochromes / cristae / stalked particles} whereas chloroplasts contain {grana / chlorophyll / photosystems / carotenoids} **(1)**	**Accept** a description of the differences e.g. a lipid high in mitochondria is low in chloroplast, only two of the lipids are found in both organelles **Do not accept** a list of values from the table without some sort of comparison **Accept** any other membrane difference	**(3)**

Question Number	Answer	Additional Guidance	Mark
(ii)	A diagram that shows the following: • a glycosidic bond between C 1 on galactose and C 6 on MGDG **(1)** • rest of molecules complete **(1)** • water molecule **(1)**	ecf if glycosidic bond drawn between C1 and C 4 **Accept** H_20 / water	**(3)**

Question Number	Answer	Mark
(iii)	**The only correct answer is B** ***A*** *is not correct because DGDG is larger than MGDG so will not travel as far and sulfolipid is the smallest quantity so will be the smallest spot* ***C*** *is not correct because DGDG is larger than MGDG so will not travel as far and sulfolipid is the smallest quantity so will be the smallest spot* ***D*** *is not correct because sulfolipid is the smallest quantity so will be the smallest spot*	**(1)**

Q15.

Question Number	Acceptable Answer	Additional Guidance	Mark
	C (lactose)		**(1)**

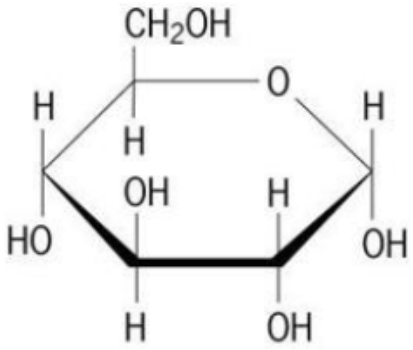
Q16.

Question Number	Correct Answer	Additional guidance	Mark
(a)	A		**(1)**

Question Number	Correct Answer	Additional guidance	Mark
(b)	B		**(1)**

Question Number	Correct Answer	Additional guidance	Mark
(c)	An explanation that makes reference to three of the following: • same energy in glucose molecule as in fructose molecule (1) • fructose is sweeter than glucose so less needs to be used (1) • produce products that reduce the risk of developing obesity (1) • cost savings for food industry (1)		**(3)**

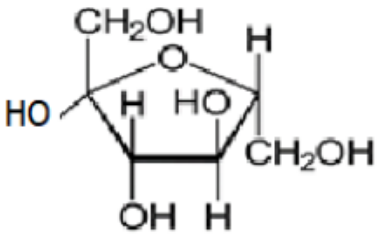
Q17.

Question Number	Answer	Additional Guidance	Mark
	• correct structure of alpha glucose		(1)

Q18.

Question Number	Answer	Mark
(i)	**The only correct answer is B** ***A*** *is not correct because condensation joins monomers* ***C*** *is not correct because phosphorylation adds phosphate* ***D*** *is not correct because translocation does not break down sucrose*	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	• glucose and fructose	Reject beta glucose	(1)

Question Number	Answer	Additional Guidance	Mark
(iii)		**ACCEPT** HO or OH **ACCEPT** correct variations of fructose **ACCEPT** C's in ring **ACCEPT** line with nothing as H	(1)

Q19.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to three of the following: Similarities • both {are hexoses / have formula of $C_6H_{12}O_6$} (1) • both contain covalent bonds (1) Differences • glucose is a hexagon and fructose is a pentagon (1) • glucose has one CH_2OH and fructose has two (1)	**ACCEPT** have 6 carbons	(3)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • as a {respiratory substrate / energy source} for the sperm (1) • because movement (through female genital tract) requires ATP (1) • in order to reduce competition for carbohydrates with the {skin / genital tract} {bacteria / cells} (1)	**ACCEPT** provides energy **NB** ATP must be mentioned at least once for both mps to be awarded **ACCEPT** fructose may not be used by skin cells	(3)