Questions

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.

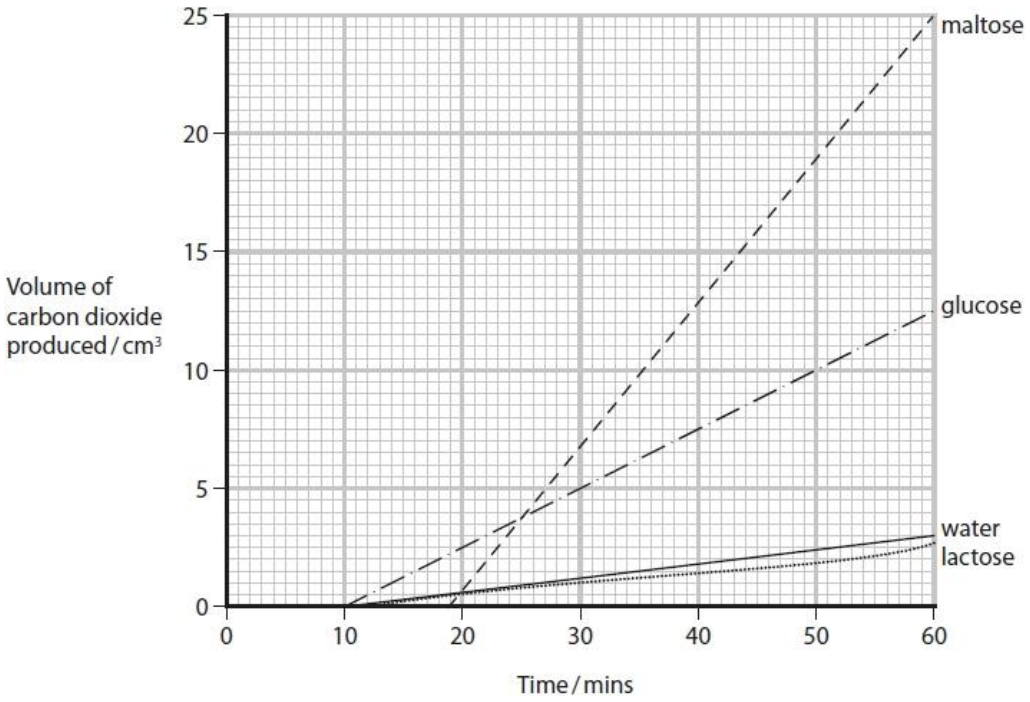
A suspension of yeast was used to produce three cultures, each one with a different sugar.

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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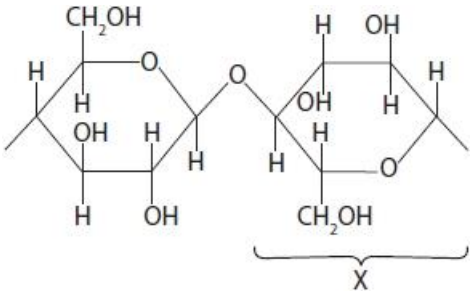
(Total for question = 3 marks)

Q4.

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)

Q5.

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)

Q6.

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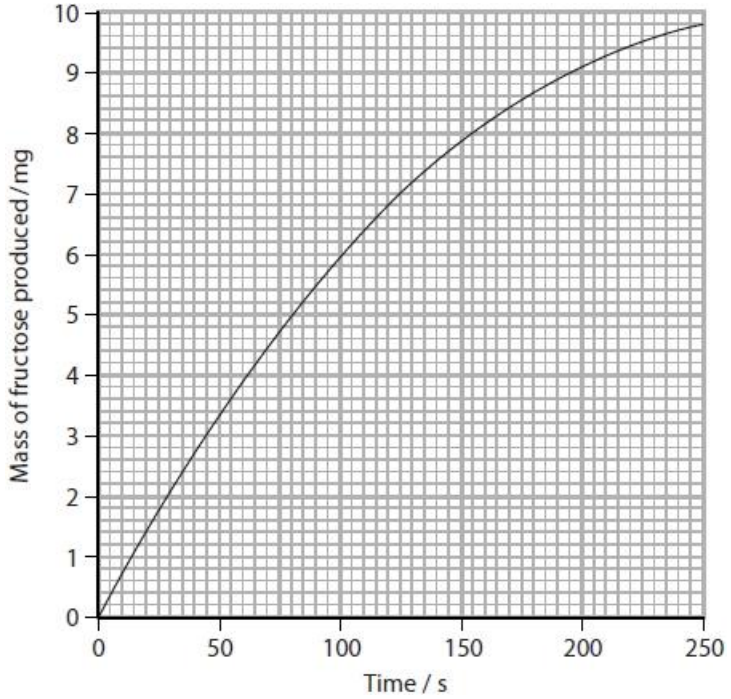
(ii) A student investigated the activity of glucose isomerase.

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)

Q7.

Give **two** differences between the structure of a ribose molecule and the structure of a glucose molecule.

(2)

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(Total for question = 2 marks)

Q8.

Fruits consist mainly of sugars, fibre (cellulose) and water.

The sweetness of a fruit depends on the proportion of the different types of sugars that it contains.

The table shows the relative sweetness of five sugars.

Sugar	Relative sweetness
Fructose	1.73
Glucose	0.74
Sucrose	1.00
Maltose	0.32
Galactose	0.32

(i) Which row of the table shows the sugars that are monosaccharides and the sugars that are disaccharides?

(1)

		Monosaccharides	Disaccharides
☒	**A**	fructose and glucose	galactose and maltose
☒	**B**	galactose and glucose	maltose and sucrose
☒	**C**	glucose and maltose	fructose and sucrose
☒	**D**	maltose and sucrose	galactose and glucose

(ii) How are two monosaccharides joined together to form a disaccharide?

(1)

☒ **A** by an ester bond formed during a condensation reaction

☒ **B** by an ester bond formed during a hydrolysis reaction

☒ **C** by a glycosidic bond formed during a condensation reaction

☒ **D** by a glycosidic bond formed during a hydrolysis reaction

(Total for question = 2 marks)

Q9.

Fruits consist mainly of sugars, fibre (cellulose) and water.

The sweetness of a fruit depends on the proportion of the different types of sugars that it contains.

The table shows the relative sweetness of five sugars.

Sugar	Relative sweetness
Fructose	1.73
Glucose	0.74
Sucrose	1.00
Maltose	0.32
Galactose	0.32

The relative sweetness of a sugar solution can be determined by a taste test.

Devise an investigation, that a student could do, to confirm the relative sweetness of the sugars listed in the table.

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(Total for question = 3 marks)

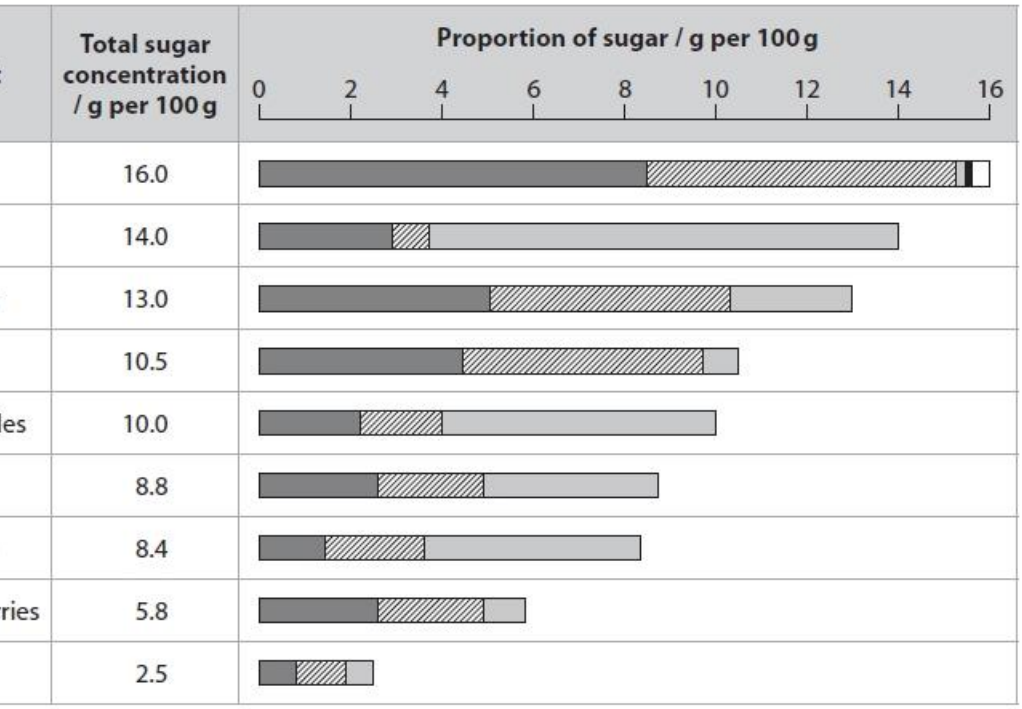
Q10.

Fruits consist mainly of sugars, fibre (cellulose) and water.

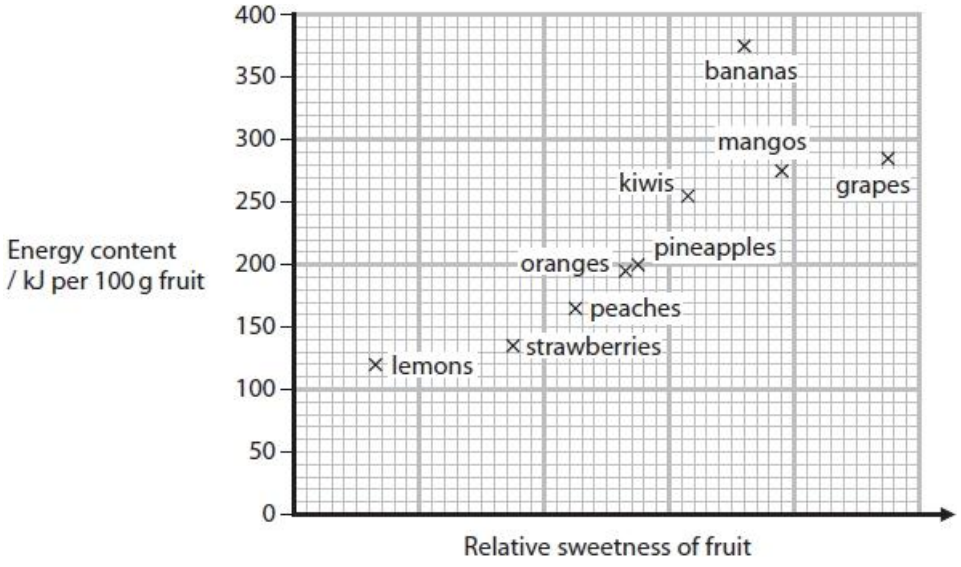
The sweetness of a fruit depends on the proportion of the different types of sugars that it contains.

The table shows the total sugar concentration of some fruits and the proportion of the sugars in each of these fruits.

Fruit	Total sugar concentration / g per 100 g	Proportion of sugar / g per 100 g
grapes	16.0	
mangos	14.0	
bananas	13.0	
kiwis	10.5	
pineapples	10.0	
oranges	8.8	
peaches	8.4	
strawberries	5.8	
lemons	2.5	



The graph shows the energy content of some fruits and the relative sweetness of each of these fruits.



(i) Determine the ratio of the proportion of sugars in mangos.

(1)

Answer .....

*(ii) Analyse the data to discuss the relationship between the sugar content, the relative sweetness and the energy content of these fruits.

(6)

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(Total for question = 7 marks)

Q11.

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?

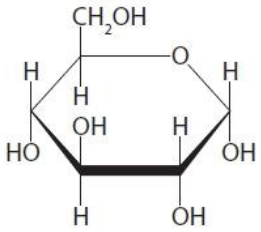
(1)

- ☐ **A** condensation reaction breaking glycosidic bonds
- ☐ **B** condensation reaction breaking phosphodiester bonds
- ☐ **C** hydrolysis reaction breaking glycosidic bonds
- ☐ **D** hydrolysis reaction breaking phosphodiester bonds

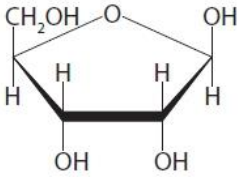
(ii) Which diagram shows the structure of the glucose produced?

(1)

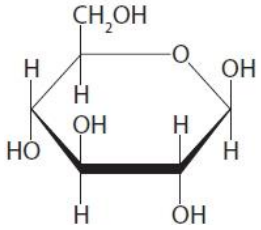
☐ **A**



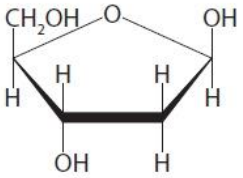
☐ **C**



☐ **B**



☐ **D**



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

(3)

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(Total for question = 5 marks)

Q12.

Most human cells use carbohydrate as a source of energy.

Explain why glycogen releases energy more slowly than glucose.

(2)

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(Total for question = 2 marks)

Q13.

Only monosaccharides and most disaccharides are reducing sugars.

Reducing sugars produce a red precipitate when heated with blue Benedict's reagent.

Identify the row that shows the correct results after heating three carbohydrates, maltose, amylose and fructose, with Benedict's reagent.

(1)

	maltose	amylose	fructose
☒ **A**	no precipitate	no precipitate	no precipitate
☒ **B**	red precipitate	no precipitate	red precipitate
☒ **C**	red precipitate	red precipitate	no precipitate
☒ **D**	red precipitate	red precipitate	red precipitate

(Total for question = 1 mark)

Q14.

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)

Q15.

Only monosaccharides and most disaccharides are reducing sugars.

Reducing sugars produce a red precipitate when heated with blue Benedict's reagent.

The Benedict's test can be made quantitative and used to determine the concentration of a glucose solution.

The red precipitate formed is removed by filtration. The precipitate is dried and the mass recorded.

The table shows the mass of precipitate formed from a range of glucose concentrations heated with 5 cm^3 of Benedict's reagent.

Glucose concentration / mg cm^{-3}	Mass of precipitate formed / g
0	0.00
2	0.28
4	0.57
6	0.92
8	1.33
10	1.63
12	1.92
14	1.98
16	2.00
18	2.00
20	2.00

(i) Analyse the data to explain the relationship between the glucose concentration and the mass of precipitate formed.

(4)

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(ii) When the investigation was repeated, the mean error for each measurement was calculated.

The mean error for each measurement was 0.05 g.
Calculate the percentage error for the mass of precipitate measured at the glucose concentration of 2 mg cm^{-3}.

(1)

Answer ..... %

(iii) Explain one way in which the mean error in measuring the mass of precipitate could be reduced.

(2)

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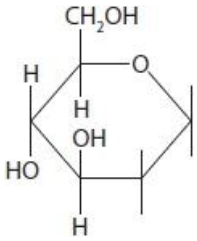
(Total for question = 7 marks)

Q16.

Glucose and fructose are monosaccharides.

Complete the diagram to show the structure of alpha glucose.

(1)



(Total for question = 1 mark)

Q17.

A laboratory technician made a 1 mol dm^{-3} glucose solution and a 1 mol dm^{-3} maltose solution.

In order to do this, the technician calculated the molecular mass of both sugars.

The table shows the molecular mass of the elements present in these sugars.

Element	Molecular mass
carbon	12
hydrogen	1
oxygen	16

(i) Explain why the molecular mass of one glucose molecule is 180.

(2)

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(ii) Calculate the molecular mass of maltose.

(2)

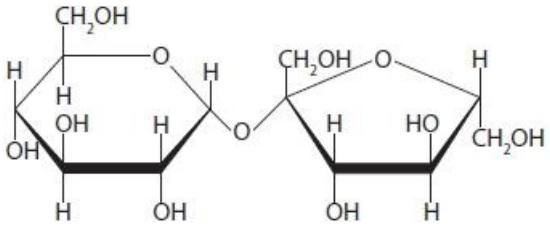
Answer .....

(Total for question = 4 marks)

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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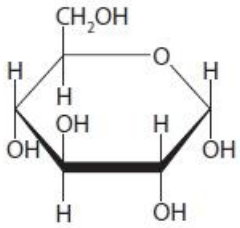
(iii) The diagram shows one of these monosaccharides.

Draw the structure of the other monosaccharide.

(1)



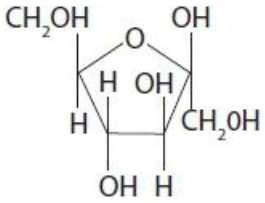
(Total for question = 3 marks)

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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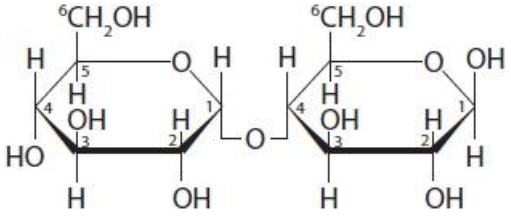
(Total for question = 6 marks)

Q20.

Enzymes are involved in a wide range of metabolic reactions.

The diagram represents the structure of a maltose molecule.



Draw a diagram to show the hydrolysis of maltose.

(3)

(Total for question = 3 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
(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

Q5.

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)

Q6.

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)**

Q7.

Question Number	Acceptable Answer	Additional Guidance	Mark
	An answer that makes reference to the following: • ribose is a {pentose / pentagon / 5 carbon sugar / 5 C } and glucose is a {hexose / hexagon / 6 carbon sugar / 6 C } (1) • formula for ribose is $C_5H_{10}O_5$ and the formula for glucose is $C_6H_{12}O_6$ (1)	Allow correct structures drawn out Allow ribose has 2 less H **and** 1 less O accept converse Allow molecular mass of ribose is 150 and molecular mass of glucose is 180	**(2)**

Q8.

Question Number	Answer	Additional Guidance	Mark
(i)	**The only correct answer is B** ***A*** *is incorrect because galactose is a monosaccharide* ***C*** *is incorrect because maltose is a disaccharide* ***D*** *is incorrect because the pairs of sugars are the wrong way round*		(1) COMP

Question Number	Answer	Additional Guidance	Mark
(ii)	**The only correct answer is C** ***A*** *is incorrect because glycosidic bonds join sugars not ester bonds* ***B*** *is incorrect because glycosidic bonds join sugars not ester bonds* ***D*** *is incorrect because bonds are formed by condensation reactions*		(1) COMP

Q9.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to three of the following: • same concentration of sugar used (1) • (solution of) each sugar should be tasted by same person (1) • sweetness compared with sucrose solution (1) • {water / dried biscuit} should be used between each tasting (1)	**IGNORE** amount / volume / mass **ACCEPT** several people doing the test provided it is clear that they are each tasting all the sugars **ACCEPT** rank sugars in the order of sweetness if no other marks awarded	(3) EXP

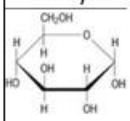
Q10.

Question Number	Answer	Additional Guidance	Mark
(i)	• {3.0 to 4.0} : 1 : {10 to 13.0} (1)		(1) GRAD

Question Number	Indicative content	
*(ii)	**Points made from table:** • statement about fruit and sugar concentration (S) e.g. grapes have the highest concentration lemons have the lowest concentration • comment about grapes being the only fruit to contain maltose and galactose (P) • comment about high sugar concentration and high proportion of fructose or glucose or sucrose (P) **Points made from graph:** • statement about fruit and energy content (S) e.g. bananas have the highest energy content • statement about fruit and relative sweetness (S) e.g. grapes have highest relative sweetness • comment linking energy content to relative sweetness (P) e.g. lemons have the lowest energy content and relative sweetness bananas have the highest energy content but not the highest relative sweetness • comment on the positive correlation between relative sweetness and energy content (P*) **Links made between different sources of information given:** • link between relative sweetness and total sugar concentration (L) e.g. grapes have the highest relative sweetness and total sugar concentration lemons have the lowest relative sweetness and total sugar concentration • positive correlation between relative sweetness and total sugar concentration (L) • positive correlation between energy content and total sugar concentration (L) • with bananas not fitting this pattern (L) • link between relative sweetness and sugar content (L) e.g. grapes have the highest relative sweetness and a high proportion of fructose and glucose mangoes have lower fructose and glucose but have a high relative sweetness because they contain a large proportion of sucrose • bananas must contain other high-energy substances as they have the highest energy content but not the highest sugar content (L)	**Level 1:** 1 mark = 1 point made 2 marks = 2 points made **Level 2:** 3 marks = 3 points made about table and graph that includes either one P or L 4 marks = 3 points made about table and graph that contains at least two P or L **Level 3:** 5 marks = 4 points made about table and graph that contains two Ls 6 marks = 4 points made about table and graph that contains at least three Ls and P* **NB by implication, an L is about graph and table**

Q11.

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

Q12.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • glycogen is a {polymer / polysaccharide} **(1)** • therefore glycosidic bonds need to be broken **(1)**	**DO NOT ACCEPT** glucose {is a polysaccharide/ has more glycosidic bonds} **ACCEPT** description of polysaccharide structure **ACCEPT** needs hydrolysis before it can be used in respiration	**(2)**

Q13.

Question Number	Answer	Additional Guidance	Mark
	B		**(1)**

Q14.

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	

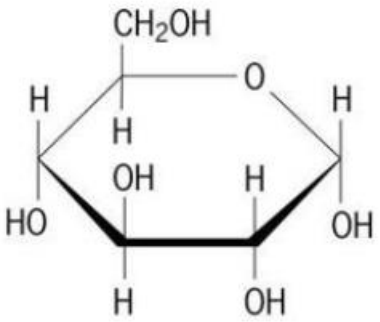
Q15.

Question Number	Answer	Additional Guidance	Mark
i	An explanation that makes reference to the following: • as glucose doubles mass of precipitate doubles between 0 and 12 mg cm^{-3} (1) • because all the glucose reacts with the Benedict's reagent (1) • the increase in the mass of precipitate is {non-linear above 12 mg cm^{-3} / stops increasing above 16 mg cm^{-3} } (1) • this is because { all Benedict's reagent used up after 16 mg cm^{-3} / there is an excess of glucose at 16 mg cm^{-3} } (1)	accept there is a linear increase between 0 and 12 mg cm^{-3} accept Benedict's becomes limiting after 12 mg cm^{-3}	**(4)**

Question Number	Answer	Additional Guidance	Mark
ii	• Percentage error calculated	0.05 ÷ 0.28 x 100 = 17.9% accept 17.86 / 18	**(1)**

Question Number	Answer	Additional Guidance	Mark
iii	An explanation that makes reference to one pair of the following: • repeat measurements more times (1) • to reduce standard deviation (1) • increase drying time (1) • to ensure all water removed (1) • check calibration of balance (1) • to increase accuracy of measurement of mass (1) • rinse all precipitate off filter paper (1) • to ensure all precipitate collected and measured (1)	ALLOW the precipitate should be repeatedly dried and weighed until a constant mass is achieved.	**(2)**

Q16.

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

Q17.

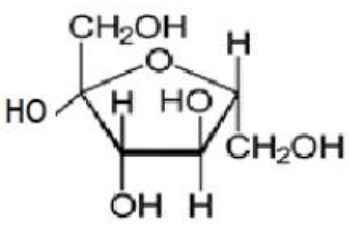
Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following: • because the formula for glucose is $C_6H_{12}O_6$ (1) • therefore 72 + 12 + 96 (=180) (1)	Allow description e.g. 6 carbons 12 hydrogen and 6 oxygens Allow both marks for 6x12 + 12x1 + 6x16 (=180)	(2)

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	• molecular mass for two glucoses added together (1) • molecular mass for water subtracted (1)	Example of calculation 180 + 180 = 360 360 - 18 = 342 Correct answer gains full marks with no working	(2)

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)

Q20.

Question Number	Answer	Additional Guidance	Mark
	A diagram showing the following: • two glucose molecules (1) • correct H and OH groups on each glucose (1) • water clear as substrate not product (1)		**(3)**