



Physics. *You work it out.*

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Monosaccharides

A Level



Part A Hexose formula

What is the chemical formula for a hexose monosaccharide?

Part B Pentose vs hexose

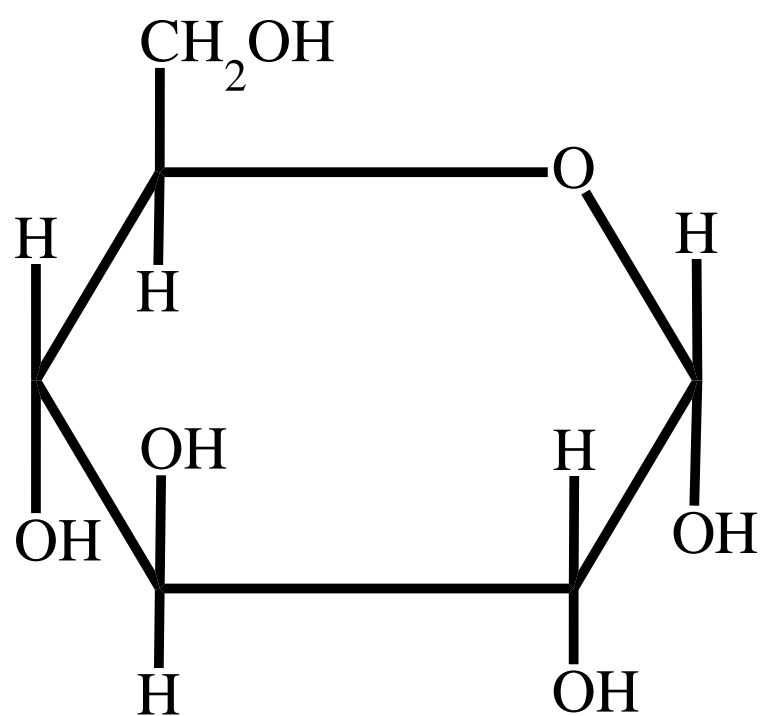
Which of the following are pentose monosaccharides?

- ☐ glucose
 - ☐ fructose
 - ☐ ribose
 - ☐ deoxyribose
 - ☐ galactose
 - ☐ maltose
-

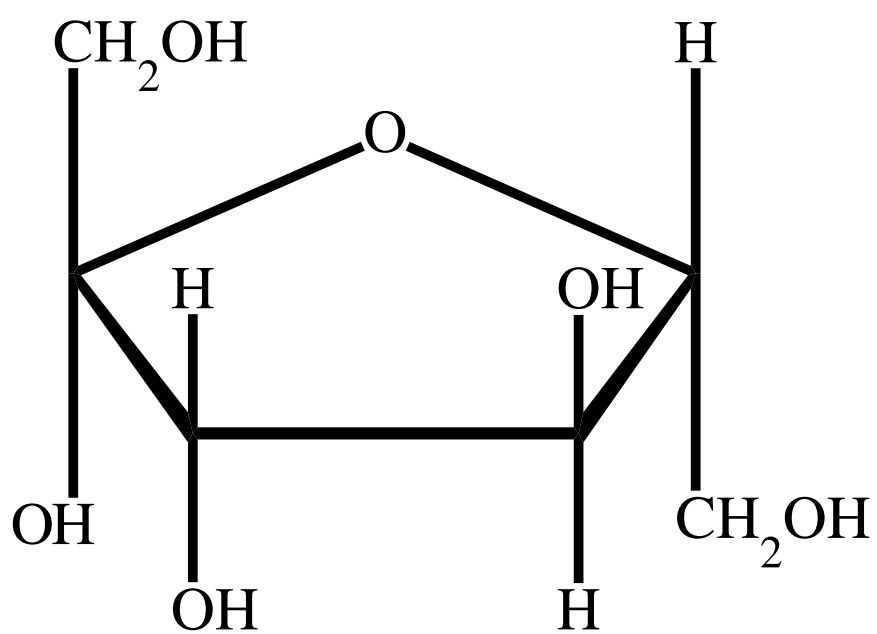
Which of the following are hexose monosaccharides?

- ☐ glucose
 - ☐ fructose
 - ☐ ribose
 - ☐ deoxyribose
 - ☐ galactose
 - ☐ maltose
-

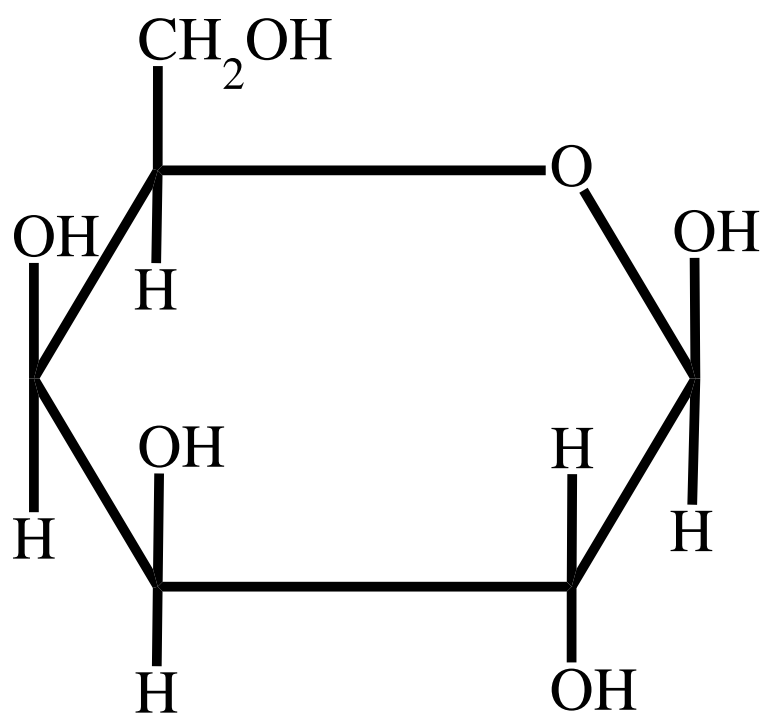
Part C Match the monosaccharide



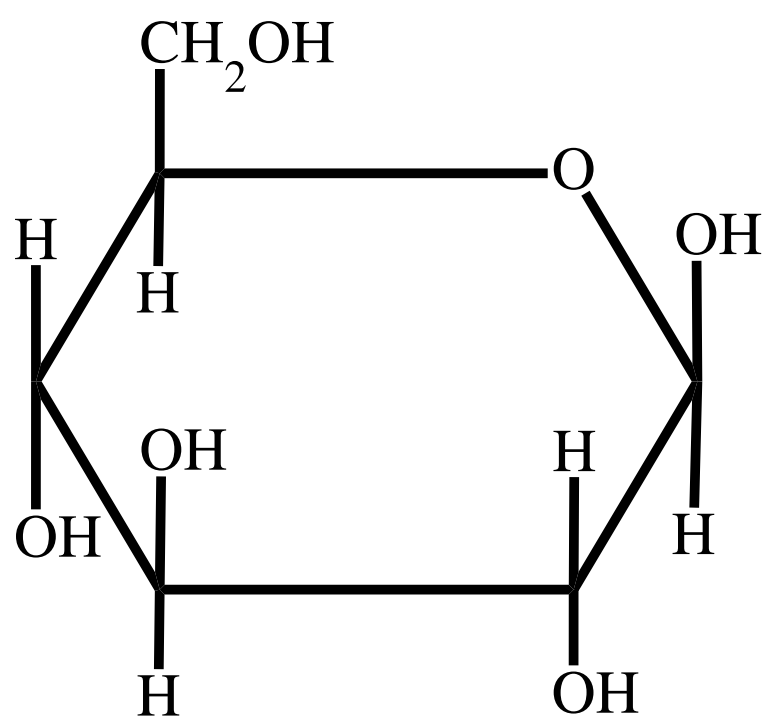
A



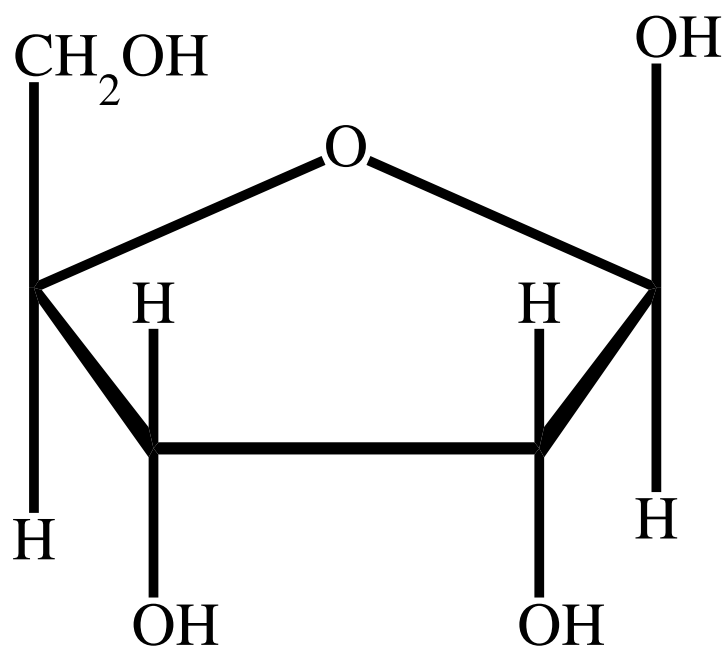
B



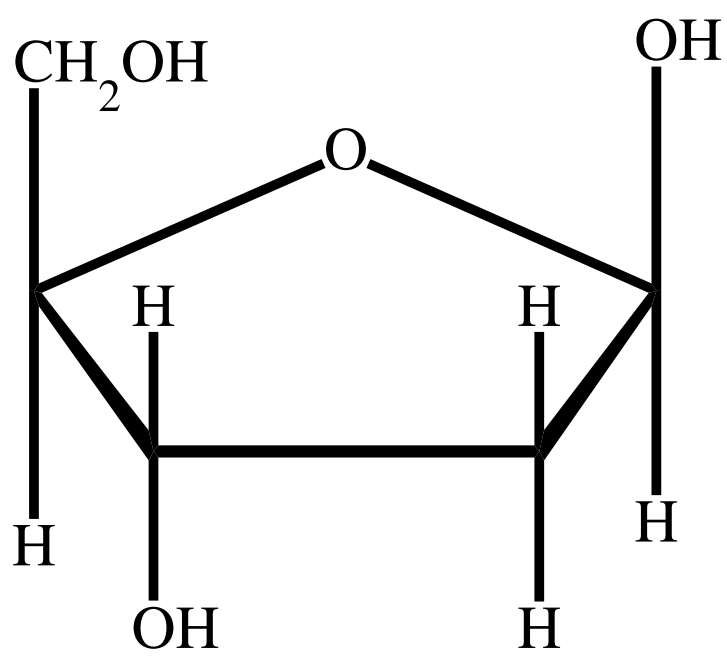
C



D



E



F

Match the monosaccharide to the image above.

Image	Monosaccharide
A	<div></div>
B	<div></div>
C	<div></div>
D	<div></div>
E	<div></div>
F	<div></div>

Items:

- β -glucose

galactose (β -galactose)

fructose (β -fructose)

α -glucose

ribose

deoxyribose



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Disaccharides

A Level



Part A Name the disaccharide

Which disaccharide is formed by the condensation of two glucose molecules?

Which disaccharide is formed by the condensation of one glucose molecule and one fructose molecule?

Which disaccharide is formed by the condensation of one glucose molecule and one galactose molecule?

Part B α and β glycosidic bonds

is formed from two glucose molecules bonded by , which means that the C1 of one α -glucose connects (via oxygen) to the C4 of the next glucose (which may be α - or β -glucose).

is formed from one galactose and one glucose molecule bonded by , which means that the C1 of the β -galactose connects (via oxygen) to the C4 of the glucose (which may be α - or β -glucose).

is formed from one glucose and one fructose molecule bonded by , which means that the C1 of the α -glucose connects (via oxygen) to the C2 of the β -fructose.

Items:

an $\alpha - 1, \beta - 2$ bond

Sucrose

a $\beta - 1, 4$ bond

an $\alpha - 1, 4$ bond

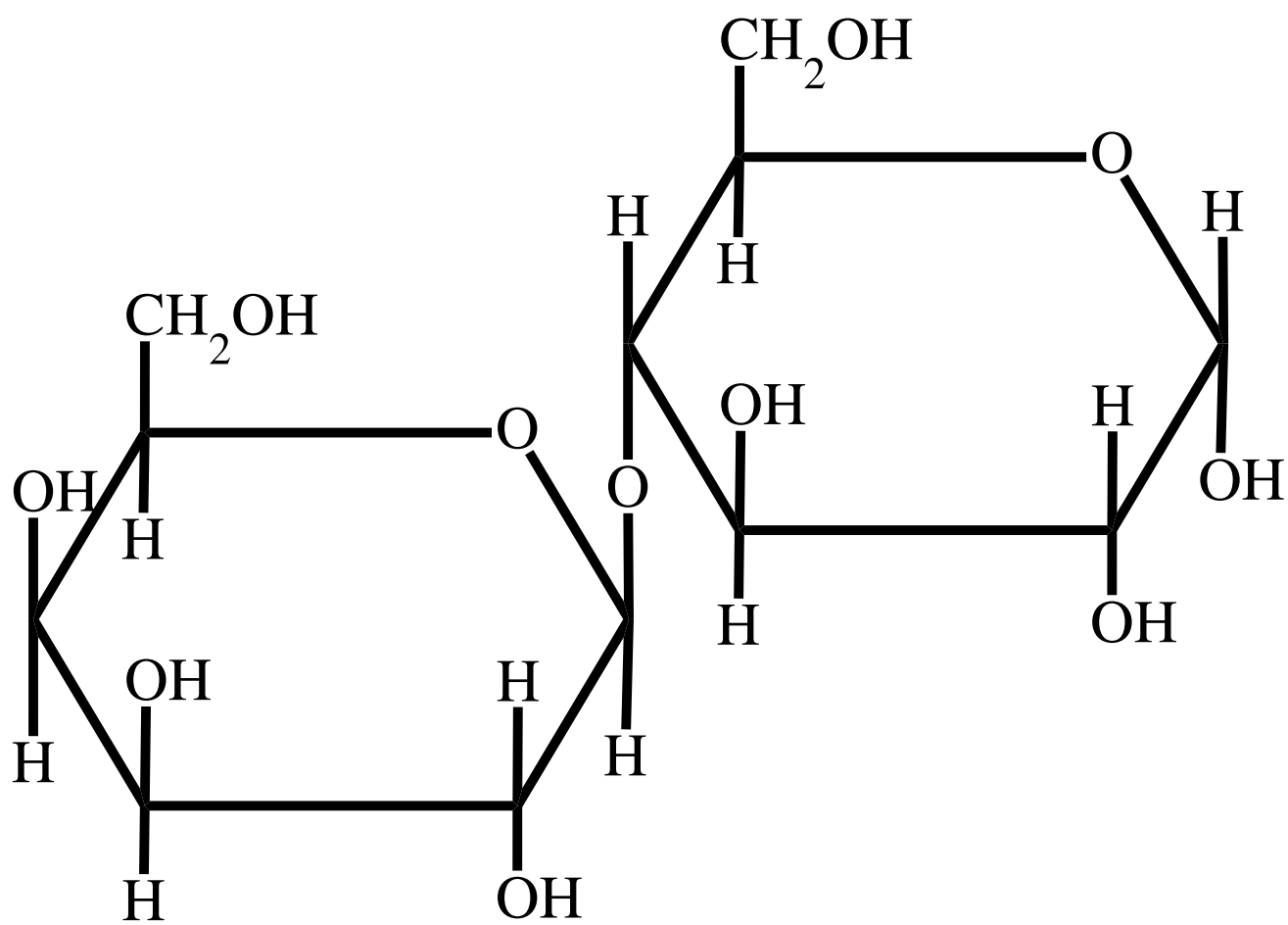
Maltose

Lactose

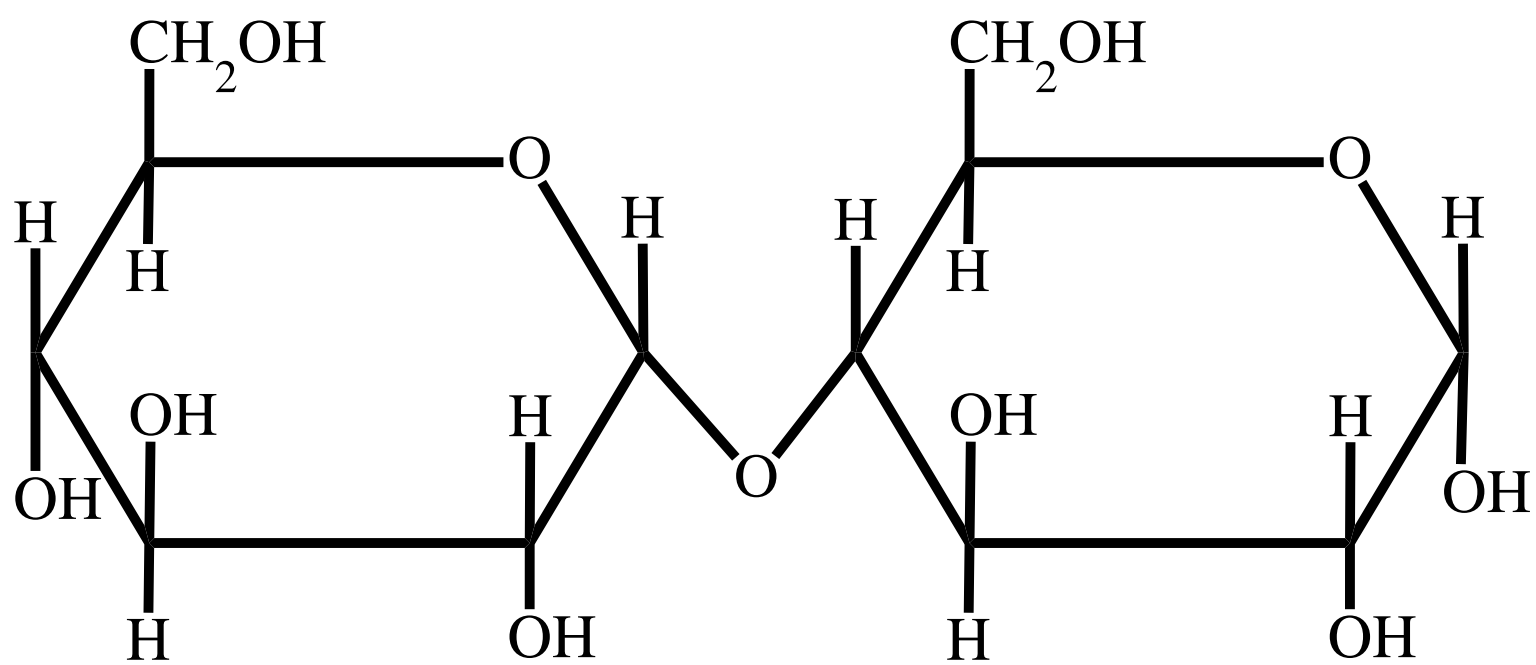
Part C Disaccharide formula

A disaccharide is produced by a condensation reaction between two hexose monosaccharides. What is the chemical formula for a disaccharide?

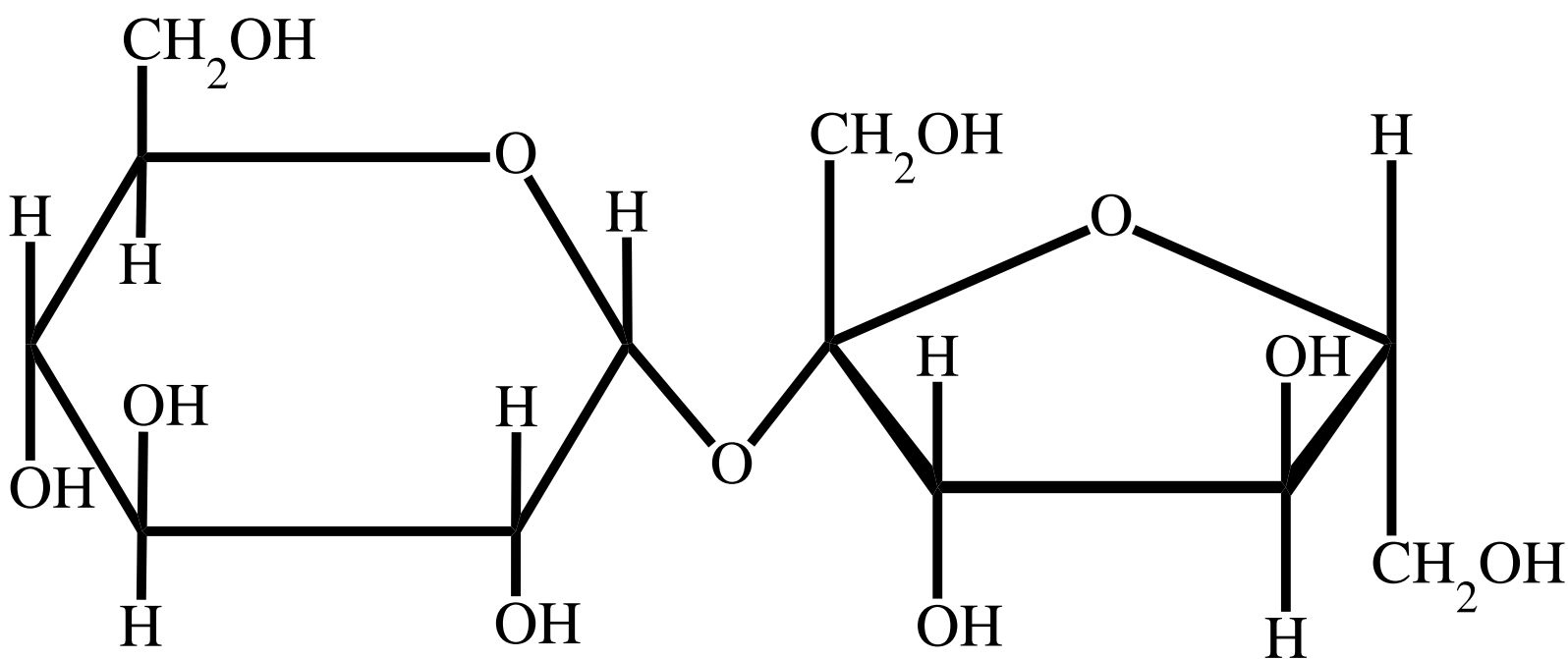
Part D Identify the disaccharide



A



B



C

Match the disaccharide to the image above.

Image	Disaccharide
A	<input type="text"/>
B	<input type="text"/>
C	<input type="text"/>

Items:

sucrose

maltose

lactose

Created for isaacphysics.org by Lewis Thomson

Gameboard:

STEM SMART Biology Week 4

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Polysaccharides

A Level



Part A Starch

Starch is the main energy storage carbohydrate of plants. It is a mixture of two types of polysaccharides: amylose and amylopectin.

is an unbranched, coiled chain of hundreds to thousands of glucose molecules bonded by bonds.

is a branched molecule. Shorter chains of glucose molecules bonded by bonds connect at branching points via bonds.

Items:

$\beta - 1,6$

$\beta - 1,4$

Amylopectin

$\alpha - 1,6$

$\alpha - 1,4$

Amylose

Part B Glycogen

Glycogen is the main energy storage carbohydrate of animals. In humans it is mostly found in the liver and in skeletal muscles. It is similar in structure to , but is more highly branched (i.e. branching points occur more frequently). It consists of short chains of glucose molecules (bonded by bonds) connected to each other at branching points via bonds.

Items:

amylopectin

$\beta - 1,6$

amylose

$\beta - 1,4$

$\alpha - 1,4$

$\alpha - 1,6$

Part C Cellulose

Cellulose is the main structural carbohydrate of plants, and forms the basis of their . It is an unbranched, straight chain of hundreds to thousands of glucose molecules bonded by bonds. The glucose molecules alternate in direction (top-bottom), which allows long, straight chains to form. These long chains are bonded by hydrogen bonds to form , which associate to form , which associate to form cellulose fibres.

Items:

- microfibrils
- cell membranes
- $\alpha - 1,6$
- cell walls
- $\alpha - 1,4$
- macrofibrils
- $\beta - 1,4$
- $\beta - 1,6$

Part D Identify the polysaccharide

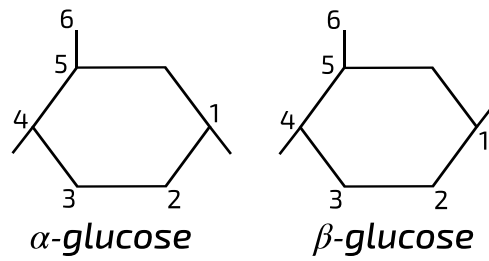
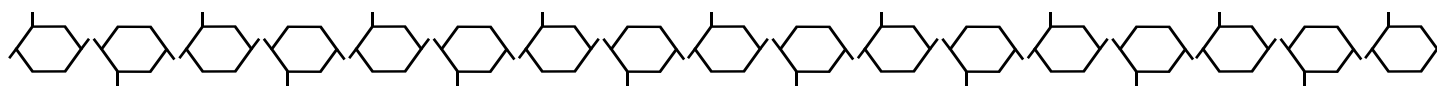
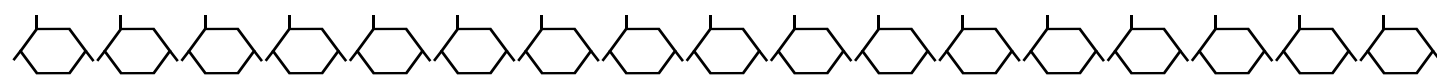


Figure 1: Simplified structures of α - and β - glucose. The numbers of the 6 carbons in each glucose molecule are shown. Projections from carbons 1 and 4 represent hydroxyl groups. The hydroxyl groups attached to carbons 2 and 3 are not shown.

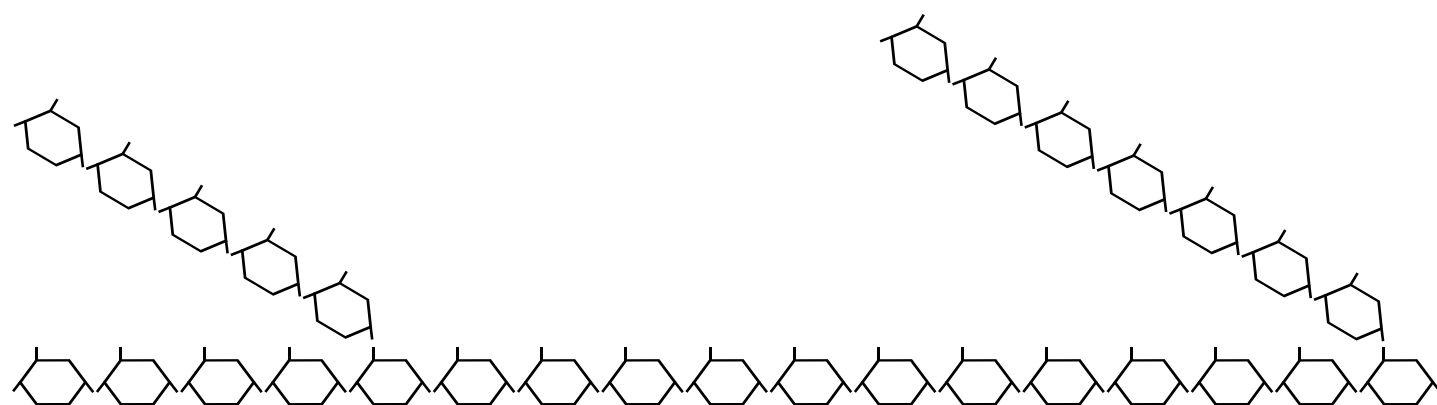
Each image below represents a part of a different polysaccharide, using the simplified structures of α - and β - glucose shown in Figure 1.



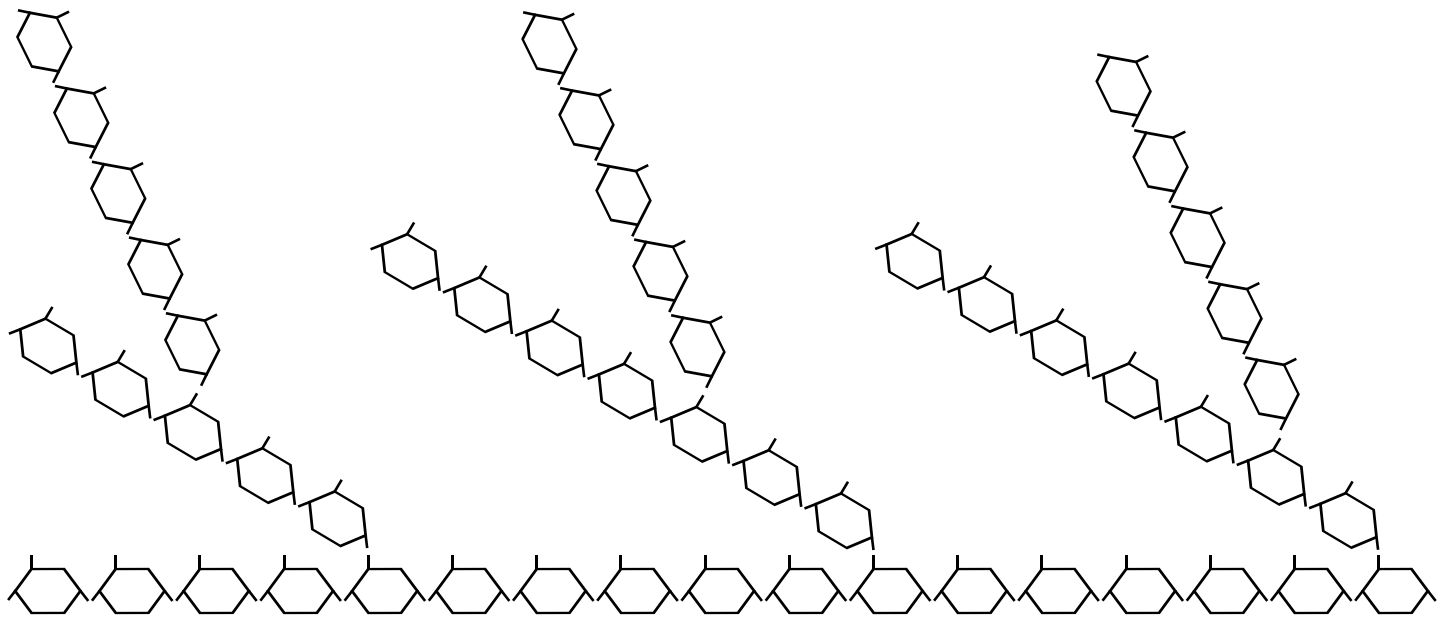
A



B



C



D

Match the polysaccharide to the image above.

Image	Disaccharide
A	<input type="text"/>
B	<input type="text"/>
C	<input type="text"/>
D	<input type="text"/>

Items:

- glycogen
- maltose
- galactose
- amylopectin
- amylose
- cellulose



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Carbohydrate Condensation

A Level
P P P

Part A Carbohydrate bonding

What kind of bond is formed between saccharides during condensation reactions?

Part B How much water?

How many molecules of water would be released in a condensation reaction of 1 000 α -glucose molecules to form one amylose molecule?

Part C Bond types

Carbohydrate	Monomers	Bonds
Glycogen	<div></div>	<div></div>
Amylose	<div></div>	<div></div>
Amylopectin	<div></div>	<div></div>
Cellulose	<div></div>	<div></div>

Items:

α –glucose

β –glucose

$\alpha - 1,4$ only

$\beta - 1,4$ only

$\alpha - 1,4$ and $\alpha - 1,6$



Carbohydrate Hydrolysis

A Level

P

P

P

Part A

Enzymes & products

Carbohydrate	Hydrolysis catalysed by	Product(s) of hydrolysis
Maltose	<div></div>	<div></div>
Lactose	<div></div>	<div></div>
Starch	<div></div>	<div></div>
Cellulose	<div></div>	<div></div>

Items:

maltase

amylase

glucose & galactose

cellulase

glucose

lactase

maltose

starchase

Part B

Hydrolysis in humans

Which enzyme(s) do humans **not** have a gene for?

- ☐ cellulase
- ☐ amylase
- ☐ lactase
- ☐ maltase



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Carbohydrate Practicals



Part A Testing for reducing sugars

What is the name of the test used to determine if reducing sugars are present in a solution?

Fill in the blanks to explain how this test works.

The carbohydrate solution is added to : an alkaline solution containing copper(II) sulfate solution. The mixture is then heated. If reducing sugars are present, the solution will change colour from to (low concentration of reducing sugars), (medium concentration of reducing sugars), or (high concentration of reducing sugars). The colour change is due to copper(II) ions being reduced to copper(I) oxide.

Items:

Part B Reducing sugar or not?

Which of the following are reducing sugars? Select all that apply.

- ☐ maltose
 - ☐ cellulose
 - ☐ lactose
 - ☐ starch
 - ☐ sucrose
 - ☐ galactose
 - ☐ glucose
-

Part C Testing for starch

To test for the presence of starch, a solution of and potassium iodide is added to the sample. If starch is present, the solution will change colour from to . This colour change is due to a reaction between iodide ions and the molecules in starch.

Items:

amylose

yellow/brown

blue/black

Benedict's reagent

amylopectin

iodine
