Chapter 11 Review Problems

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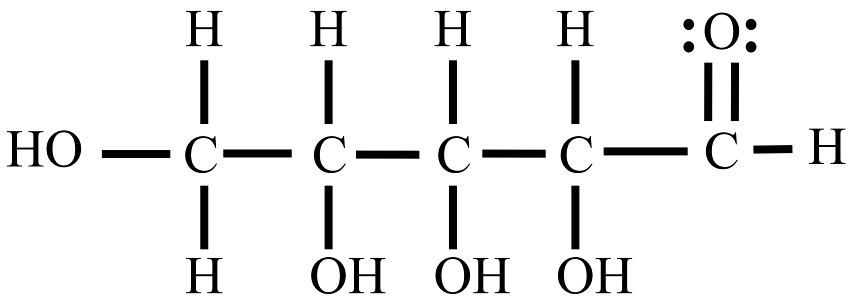
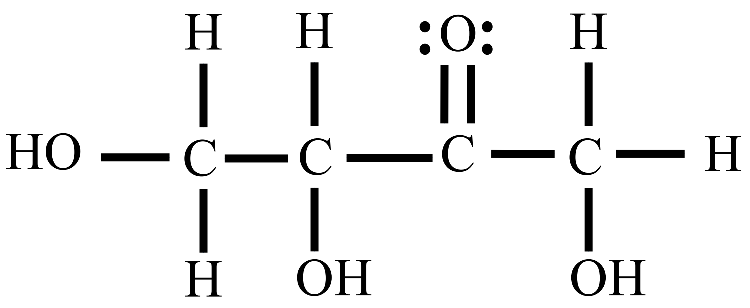
11.1) Classify each of the following monosaccharides as either an ***aldose*** or a ***ketose***.

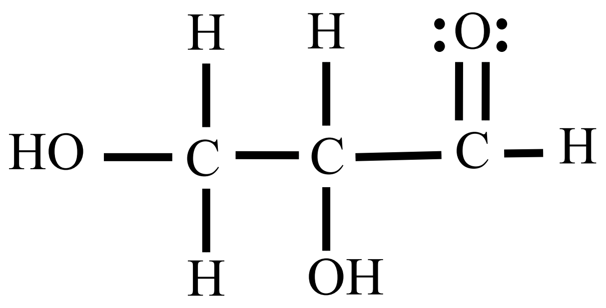
a)



b)



c)



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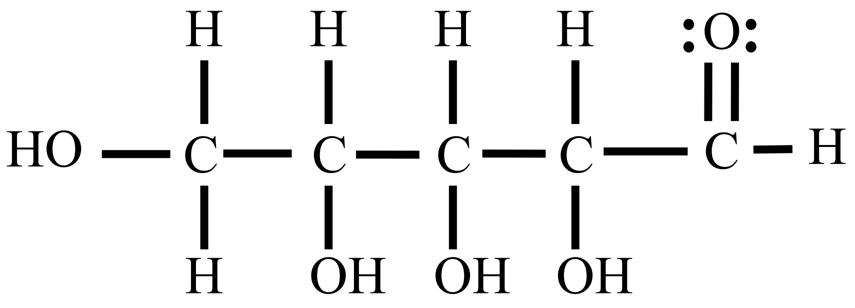

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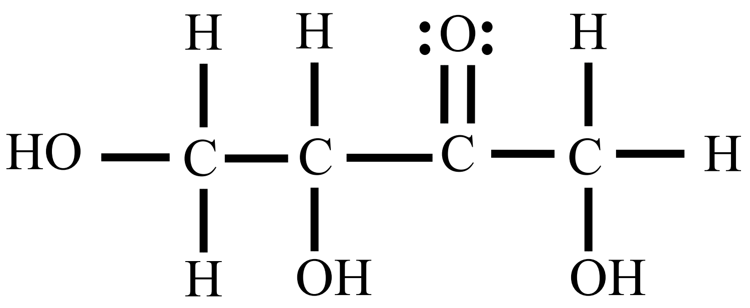

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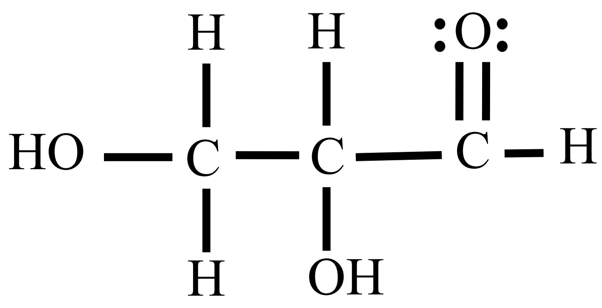

HINT:

Monosaccharides contain either an aldehyde group or a ketone bonding pattern.

- A monosaccharide that contains an ***aldehyde group*** is called an **aldose**.
- A monosaccharide that contains the ***ketone bonding pattern*** is called a **ketose**.

For more help: See chapter 11 part 1 video or chapter 11 section 2 in the textbook.

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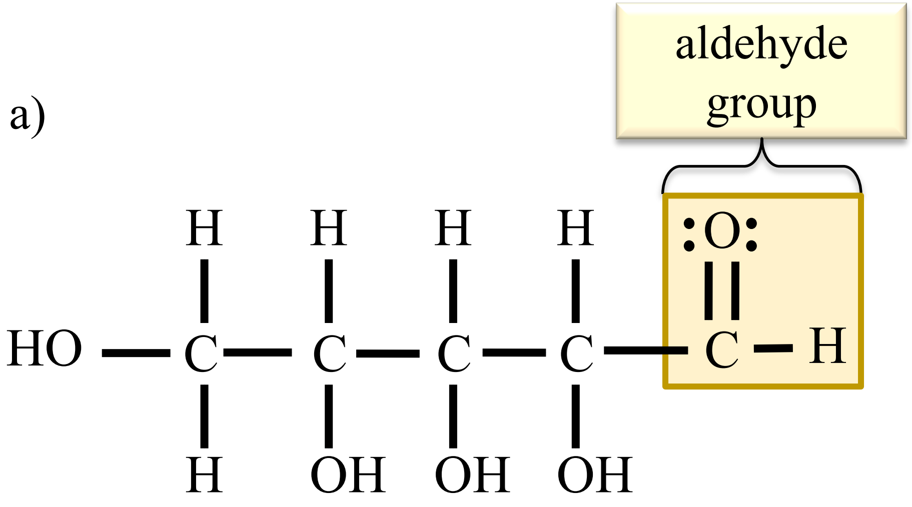
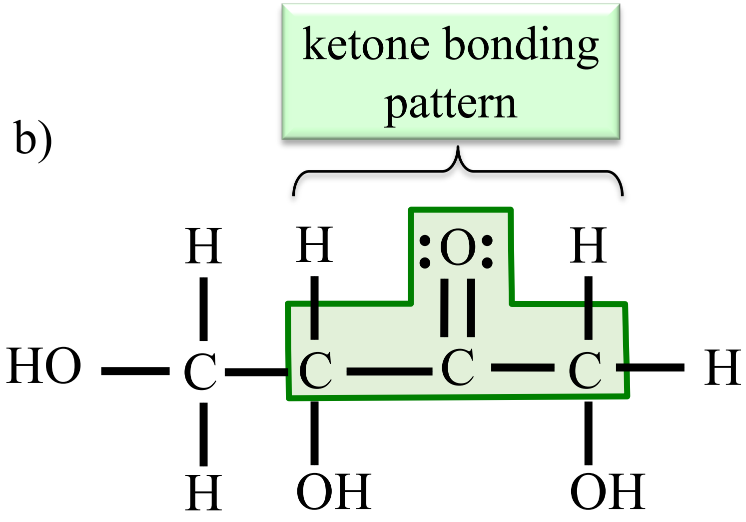


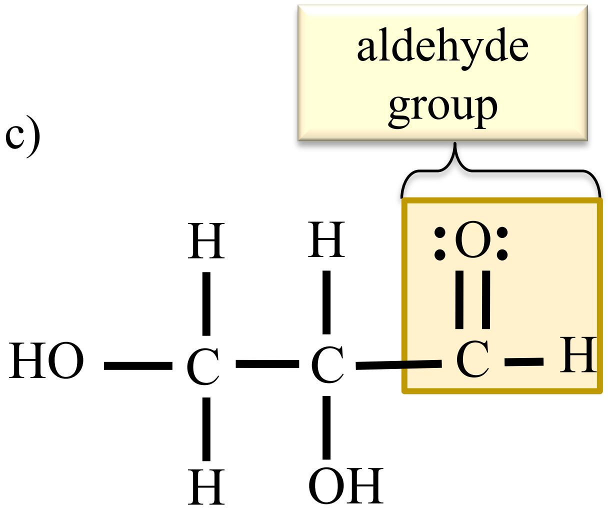
aldose

b)



ketose

c)



aldose

EXPLANATION:

Monosaccharides contain either an aldehyde group or a ketone bonding pattern.

- A monosaccharide that contains an ***aldehyde group*** is called an **aldose**.
- A monosaccharide that contains the ***ketone bonding pattern*** is called a **ketose**.

For more details: See chapter 11 part 1 video or chapter 11 section 2 in the textbook.

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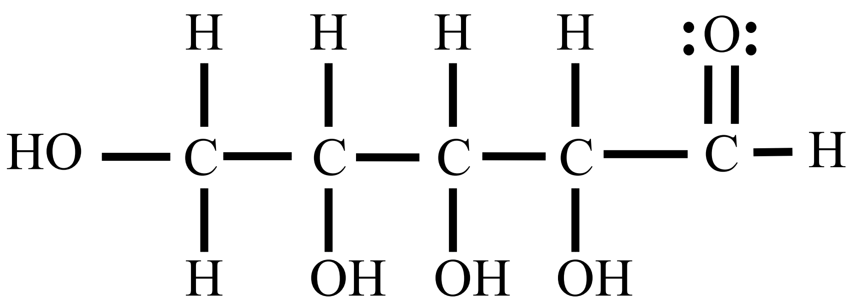
11.2) Classify each of the following monosaccharides using the prefix "aldo" for aldoses, or "keto" for ketose, in front of " triose," "tetrose," "pentose," "hexose," or "heptose."

a)



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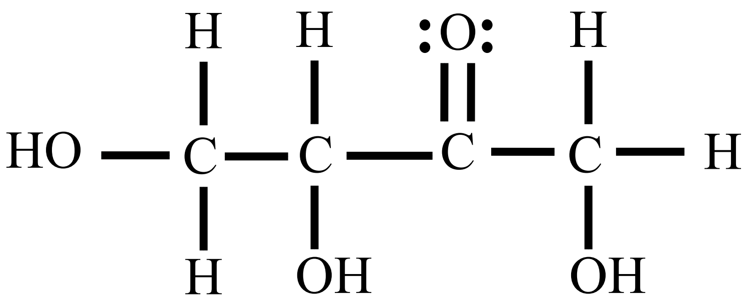

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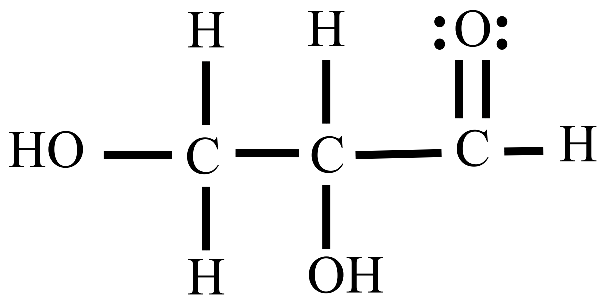

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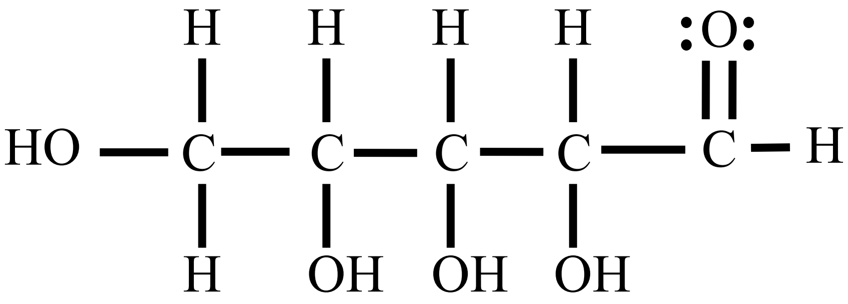

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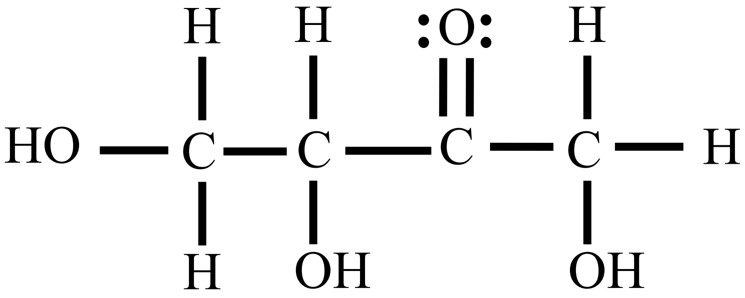

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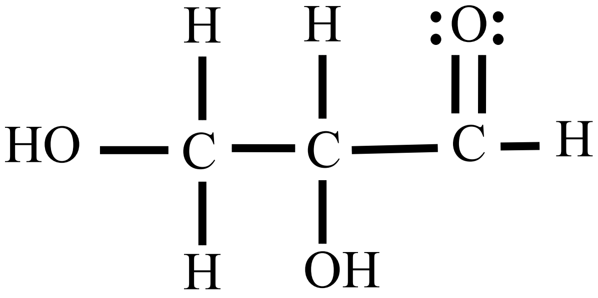

HINT: Monosaccharide may be classified by both the ***number of carbons*** and whether it is an aldose or a ketose.

- The table on the left is used to classify monosaccharides by the number of carbons they contain.
- A monosaccharide that contains an ***aldehyde group*** is called an **aldose**.
- A monosaccharide that contains the ***ketone bonding pattern*** is called a **ketose**.

Number of Carbons	Classification
3	triose
4	tetrose
5	pentose
6	hexose
7	heptose

For more help: See chapter 11 part 1 video or chapter 11 section 2 in the textbook.

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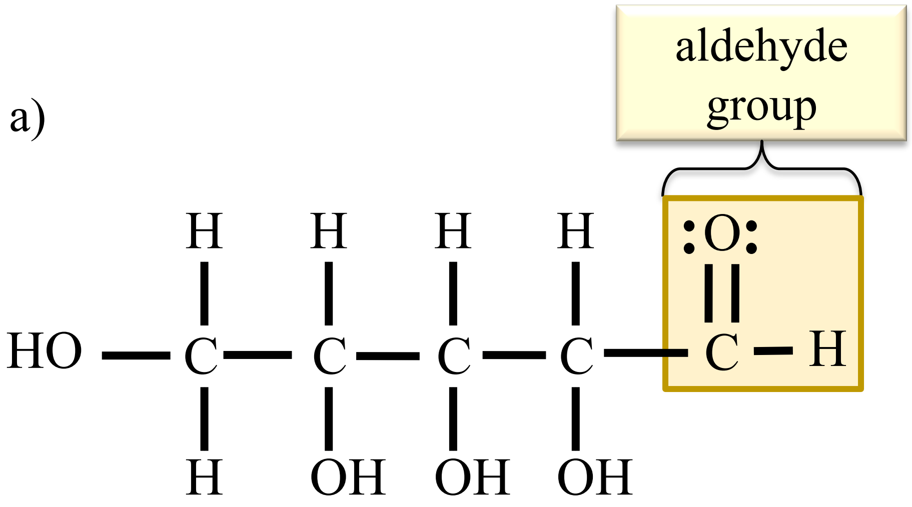
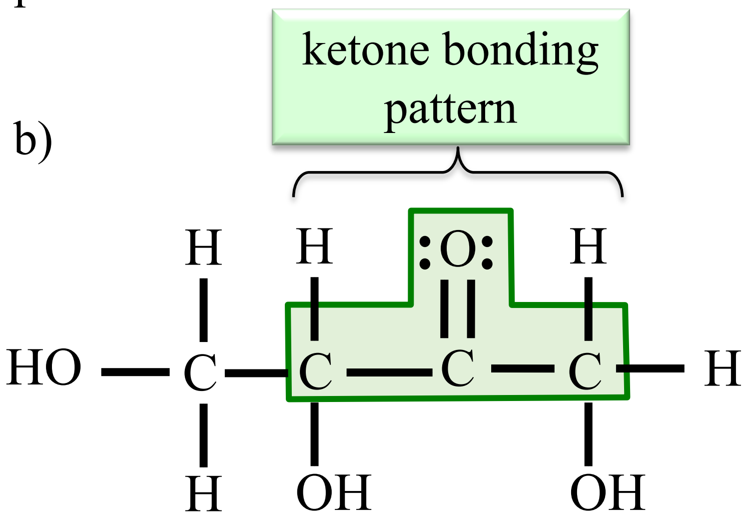


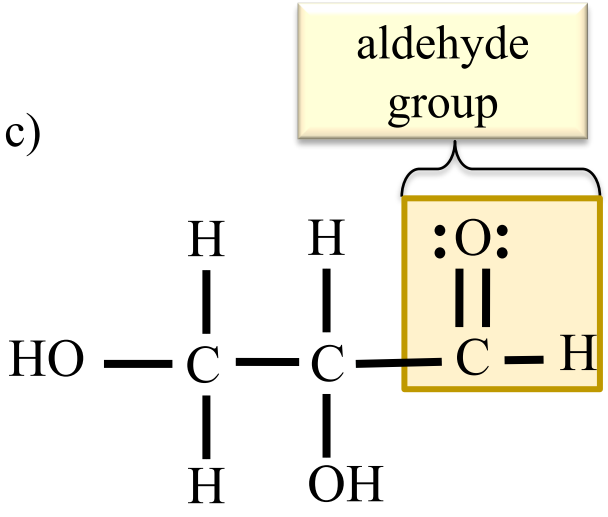
aldopentose

b)



ketotetrose

c)



aldotriose

EXPLANATION: Monosaccharide may be classified by both the ***number of carbons*** and whether it is an aldose or a ketose.

- The table on the left is used to classify monosaccharides by the number of carbons they contain.
- A monosaccharide that contains an ***aldehyde group*** is called an **aldose**.
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Number of Carbons	Classification
3	triose
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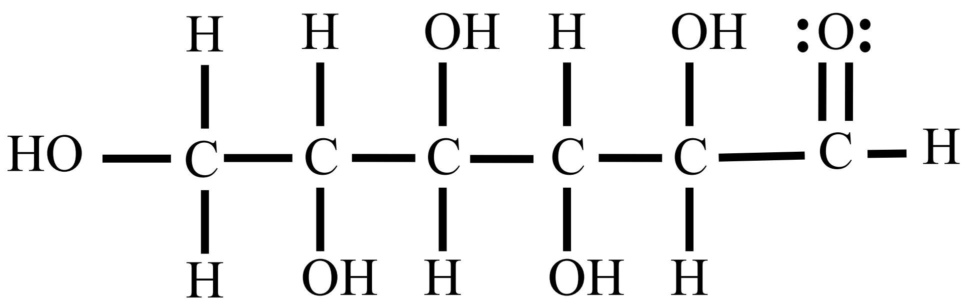
11.3) Most monosaccharides contain at least one ***chiral*** carbon. You learned that a chiral carbon is a carbon that is surrounded by *four different groups*. Molecules with just one chiral carbon have a pair of geometric isomers called ***enantiomers***. Enantiomers have the same atomic connections, but a different three-dimensional arrangement of atoms, and are nonsuperimposable mirror images of each other. If a molecule has more than one chiral carbon, then it will have more than one pair of enantiomers. The number of stereoisomers that a molecule has can be calculated from the number of chiral carbons. If a monosaccharide has "**n**" chiral carbons, then it will have 2^n stereoisomers.

QUESTION: How many stereoisomers are possible for each of the monosaccharides shown below?

a)



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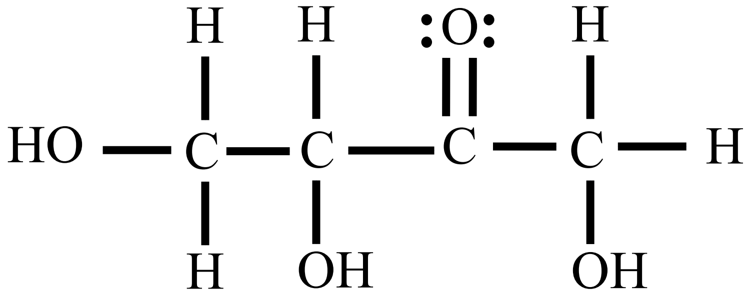

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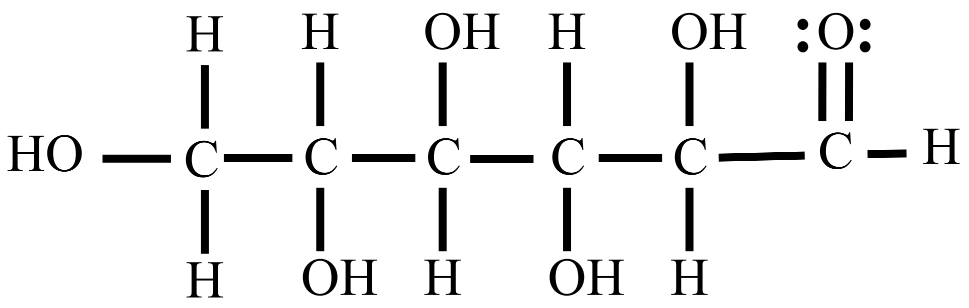
QUESTION: How many stereoisomers are possible for each of the monosaccharides shown below?

HINT: Identify the number of chiral carbons, and then calculate the number of stereoisomers. A carbon is chiral if it is surrounded by four different groups; you must consider whether *each of the entire groups bonded to the carbon* are different from each other.

a)



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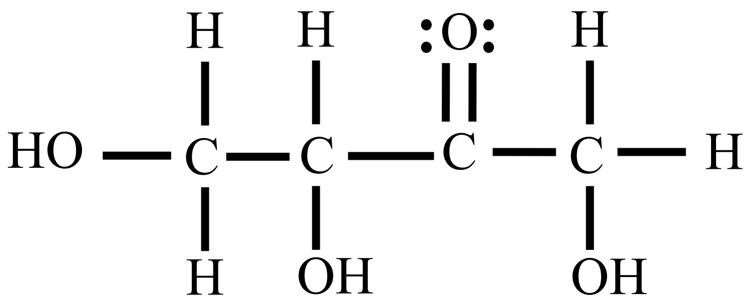

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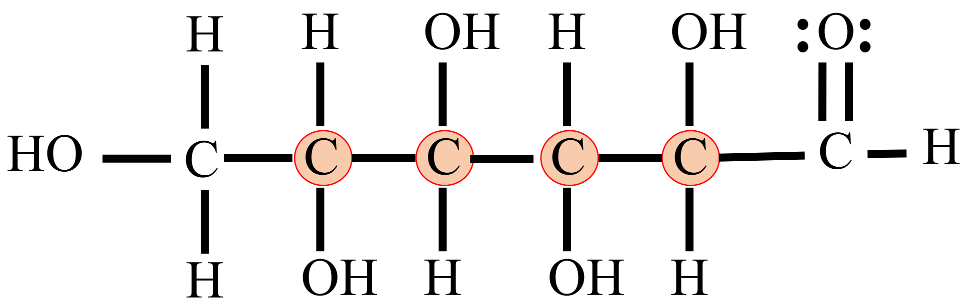
QUESTION: How many stereoisomers are possible for each of the monosaccharides shown below?

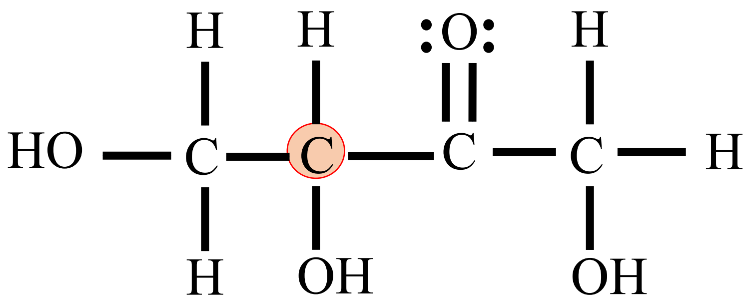
EXPLANATION: Identify the number of chiral carbons, and then calculate the number of stereoisomers. A carbon is chiral if it is surrounded by four different groups; you must consider whether each of the entire groups bonded to the carbon are different from each other. The chiral carbons are highlighted red in the structures below.

a)



Because this monosaccharide structure has four chiral carbons, there are $2^4 = (2 \times 2 \times 2 \times 2) = 16$ **possible stereoisomers** (eight pairs of enantiomers).

b)



Because this monosaccharide structure has one chiral carbon, there are $2^1 = 2$ **possible stereoisomers** (one pair of enantiomers).

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For more details: See chapter 11 part 2 video or chapter 11 section 3 in the textbook.

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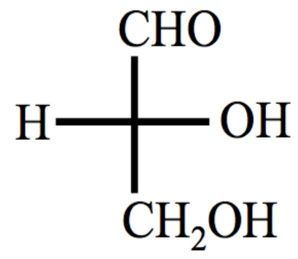
11.4) In previous chapters, we used the wedge and dash system to retain the three dimensional information on a flat surface. For monosaccharides, ***Fischer projections*** are used for this purpose. The Fischer projection for the one of the two enantiomers of glyceraldehyde is shown on the right. Using *two wedges* **and** *two dashes* emanating from the chiral carbon, draw the ***wedge and dash representation*** of this molecule.



Fischer projection

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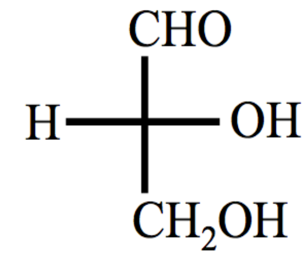
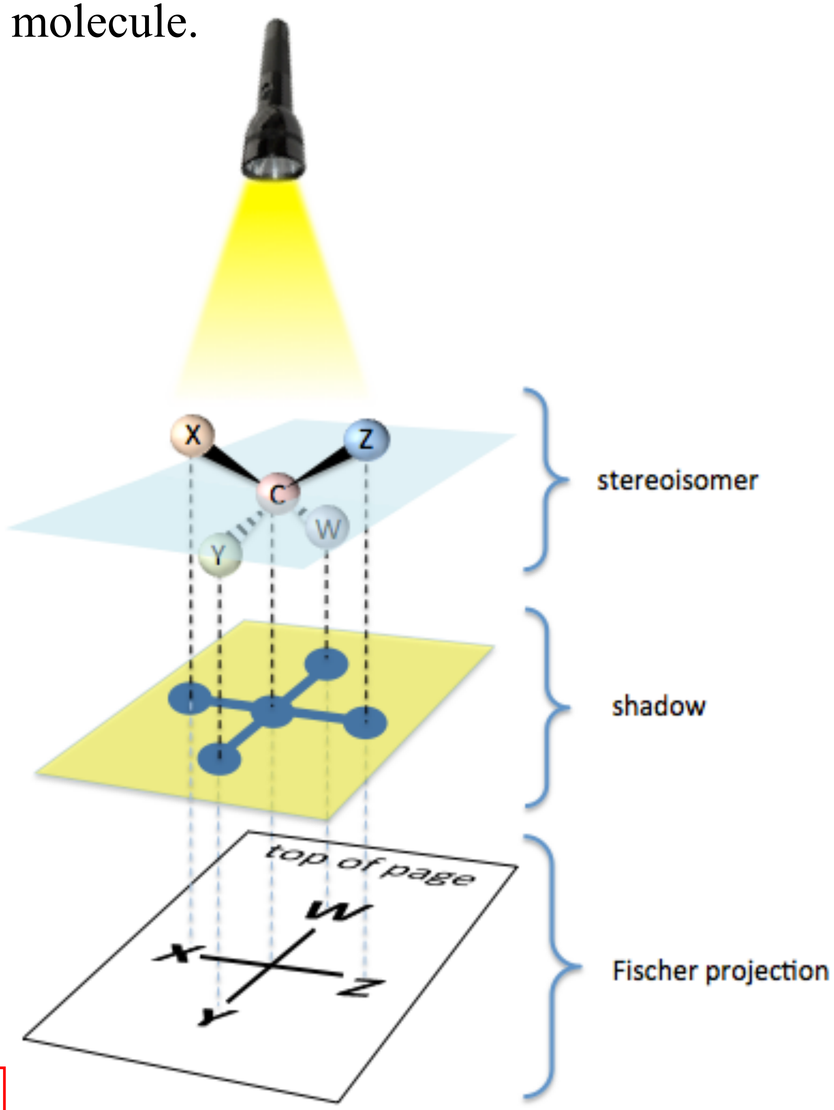


Fischer projection



HINT: Drawing and Interpreting Fischer Projections

1) The bonds from the chiral carbon to the other carbon atoms point at a downward angle (see the bonds from the chiral carbon (**C**) to **W** and **Y** in the figure on the left), and their shadows form vertical lines on the drawing surface/Fischer projection.
2) The bonds from the chiral carbon to the noncarbon groups (which will be an H and an OH) point at a upward angle (see the bonds from the chiral carbon (**C**) to **X** and **Z** in the figure), and their shadows form horizontal lines on the drawing surface/Fischer projection.
3) For aldoses, the aldehyde group is positioned at the end of the molecule that is closest to the top of the page (position **W** in the figure). For ketoses, the carbonyl carbon is positioned as close as possible to the end molecule that is nearest the top of the page.

For more help: See chapter 11 part 2 video or chapter 11 section 3 in the textbook.

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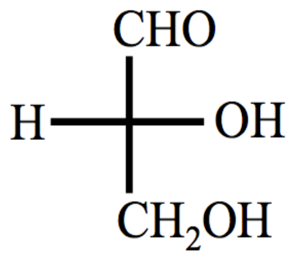
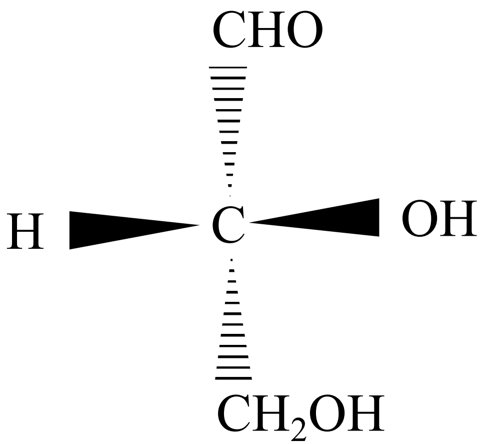
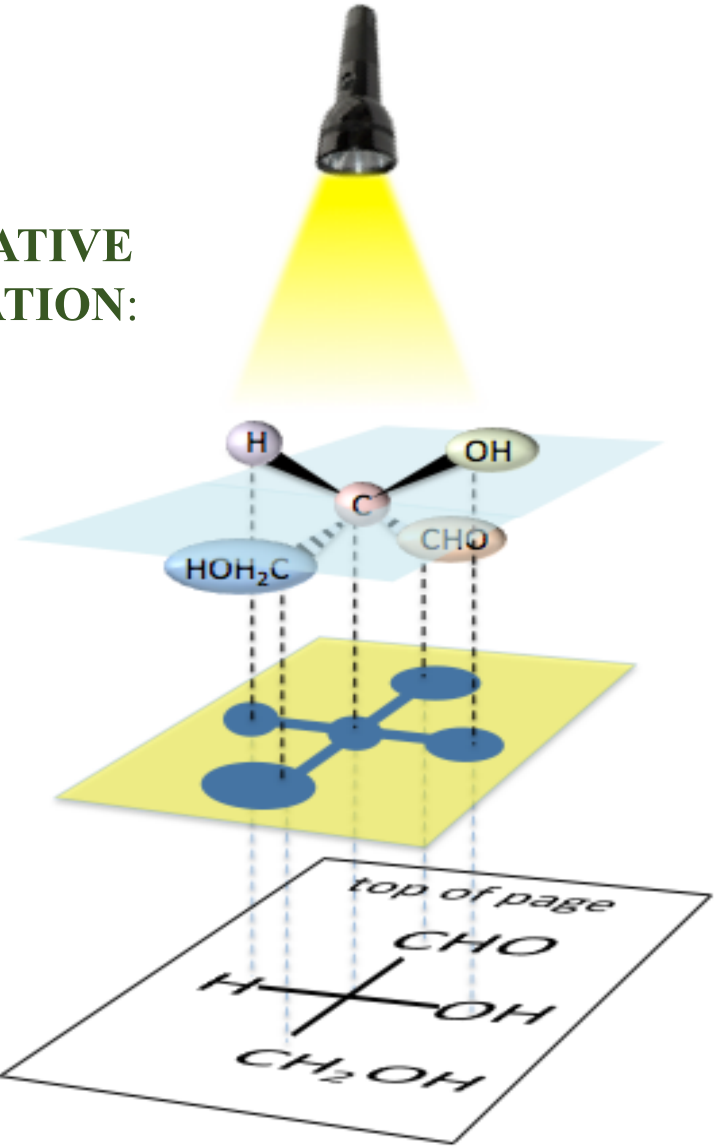


Fischer projection



wedge and dash representation

ILLUSTRATIVE EXPLANATION:



For more details: See chapter 11 part 2 video or chapter 11 section 3 in the textbook.

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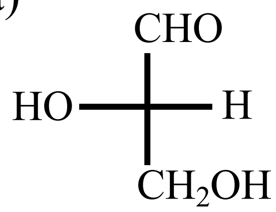
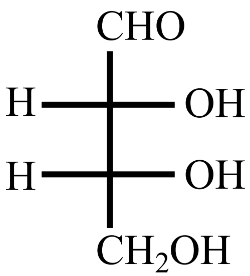
11.5) Draw the enantiomer (mirror image) for each of the monosaccharides shown below.

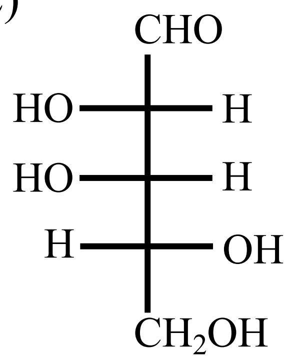
a)



b)



c)



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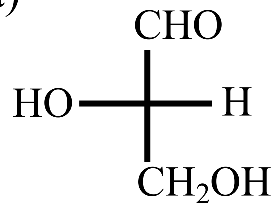
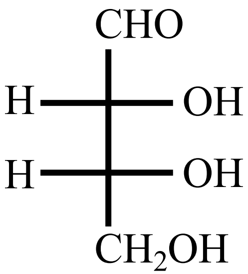
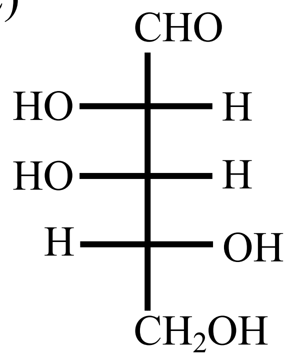


b)



c)



HINT:

A chiral carbon is located wherever lines cross (intersect) in Fischer projections.

The hydrogen (H) and the hydroxyl group (OH) positions are reversed on chiral carbons for each particular enantiomer pair. This is the case for all monosaccharide enantiomer pairs.

For more help: See chapter 11 part 2 video or chapter 11 section 3 in the textbook.

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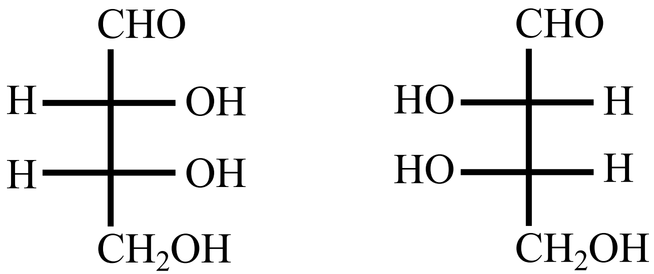
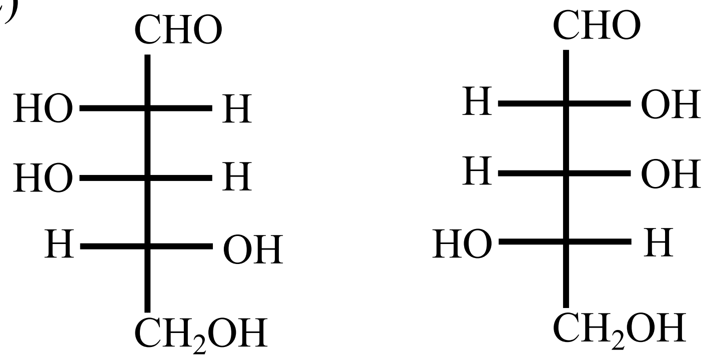
11.5) Draw the enantiomer (mirror image) for each of the monosaccharides shown below.

a)

b)



c)



EXPLANATION:

A chiral carbon is located wherever lines cross (intersect) in Fischer projections.

The hydrogen (H) and the hydroxyl group (OH) positions are reversed on chiral carbons for each particular enantiomer pair. This is the case for all monosaccharide enantiomer pairs.

For more details: See chapter 11 part 2 video or chapter 11 section 3 in the textbook.

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11.6) An *aldotetrose* contains two chiral carbons, and therefore there are 2^2 = **4** aldotetrose stereoisomers. Draw Fischer projections of the four stereoisomers.

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11.6) An *aldotetrose* contains two chiral carbons, and therefore there are 2^2 = **4** aldotetrose stereoisomers. Draw Fischer projections of the four stereoisomers.

HINT:

First draw the Fisher projection's aldehyde group, two chiral carbons, and non chiral carbon (as shown below) for all four of the stereoisomers. On your first Fischer projection, draw all of the hydroxyl groups on the right side of the chiral carbons and all hydrogens on the left side. Next, draw its mirror image (enantiomer) that has all hydroxyl groups on the left side of the chiral carbons and all hydrogens on the right side. That will give you two of the four stereoisomers. Construct your third Fischer projection by exchanging the positions of a hydroxyl group and a hydrogen that are bonded to the same chiral carbon in order to obtain a structure that differs from your previous ones. Then, draw its mirror image to get your fourth projection.

For more help: See chapter 11 part 2 video or chapter 11 section 3 in the textbook.

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11.6) An *aldotetrose* contains two chiral carbons, and therefore there are 2^2 = **4** aldotetrose stereoisomers. Draw Fischer projections of the four stereoisomers.

EXPLANATION: First draw the Fisher projection's aldehyde group, two chiral carbons, and non chiral carbon (as shown below) for all four of the stereoisomers. On the first Fischer projection, all of the hydroxyl groups were (arbitrarily) drawn on the right side of the chiral carbons and all hydrogens on the left side. Next, the mirror image (enantiomer) that has all hydroxyl groups on the left side of the chiral carbons and all hydrogens on the right side. This gives two of the four stereoisomers. The third Fischer projection is constructed by exchanging the positions of a hydroxyl group and a hydrogen that are bonded to the same chiral carbon in order to obtain a structure that differs from the previous ones. Finally, the mirror image of the third projection is drawn to get the fourth projection.

For more details: See chapter 11 part 2 video or chapter 11 section 3 in the textbook.

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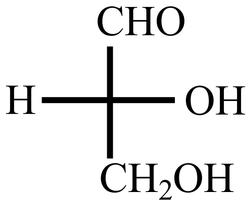
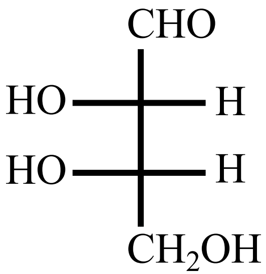
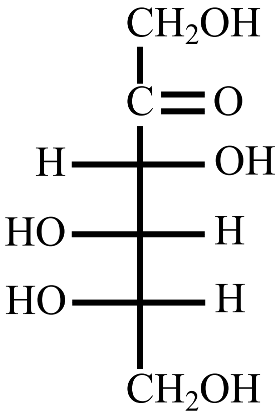
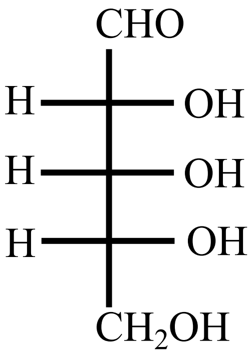
11.7) In order to differentiate the two individual monosaccharides of an enantiomer pair, 'D-' or 'L-' designations are used with the common name. Monosaccharides with the **L-** designation are sometimes referred to as "**L-sugars**," and those with the **D-** designation are sometimes referred to as "**D-sugars**."

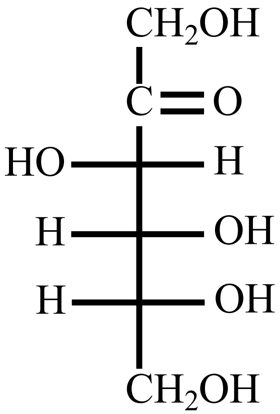
Classify each of the eight stereoisomers shown below as either the **D-sugar** or **L-sugar**.

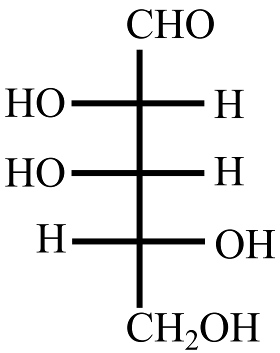


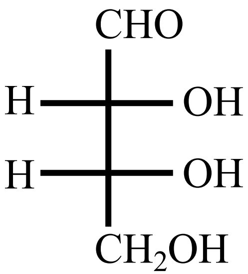


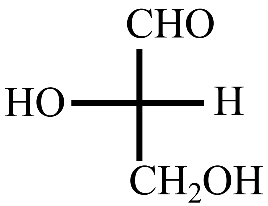












Go back

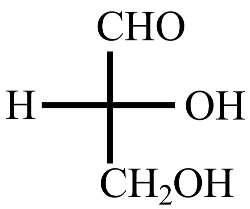
Click here for a **hint**

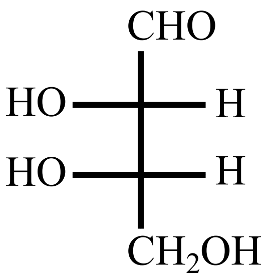
Click here to **check your answer**

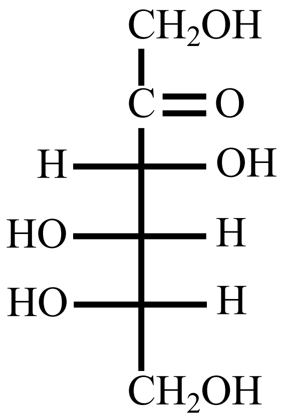
Go to next question

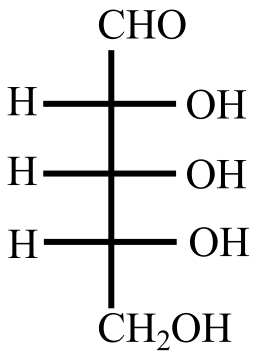
11.7) In order to differentiate the two individual monosaccharides of an enantiomer pair, 'D-' or 'L-' designations are used with the common name. Monosaccharides with the **L-** designation are sometimes referred to as "**L-sugars**," and those with the **D-** designation are sometimes referred to as "**D-sugars**."

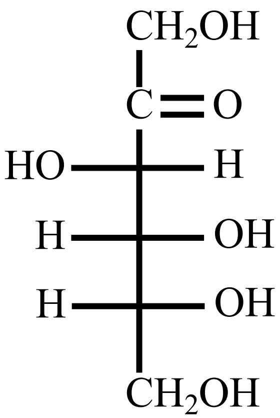
Classify each of the eight stereoisomers shown below as either the **D-sugar** or **L-sugar**.

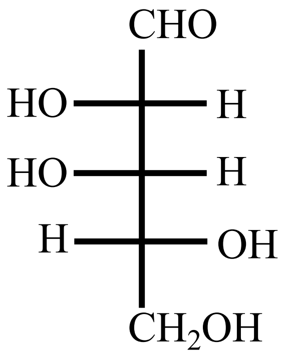


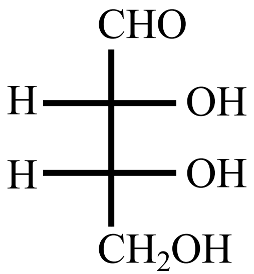


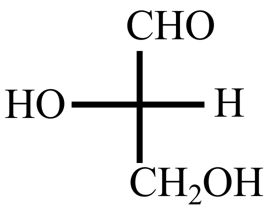












HINT:

In **L-sugars**, the chiral carbon that is furthest from the top of the Fischer projection has its hydroxyl group on the left.

In **D-sugars**, the chiral carbon that is furthest from the top of the Fischer projection has its hydroxyl group on the right.

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For more help: See chapter 11 part 2 video or chapter 11 section 3 in the textbook.

Click here to check your answer

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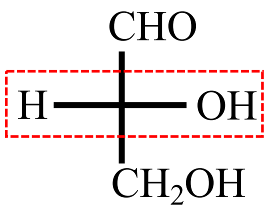
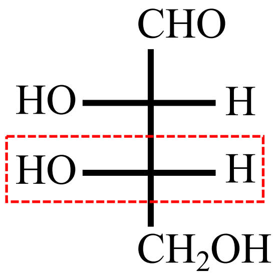
11.7) In order to differentiate the two individual monosaccharides of an enantiomer pair, 'D-' or 'L-' designations are used with the common name. Monosaccharides with the **L-** designation are sometimes referred to as "**L-sugars**," and those with the **D-** designation are sometimes referred to as "**D-sugars**."

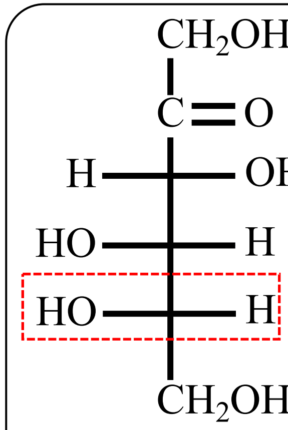
Classify each of the eight stereoisomers shown below as either the **D-sugar** or **L-sugar**.



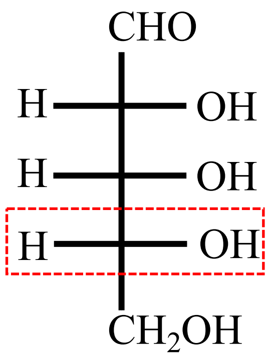
D-sugar



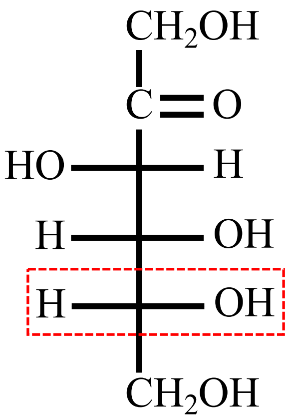
L-sugar



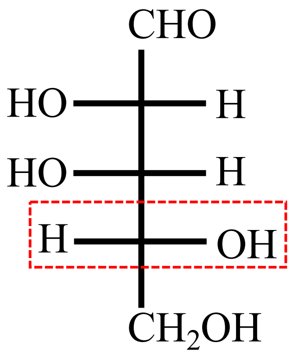
L-sugar



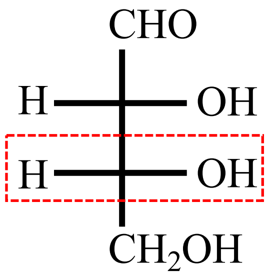
D-sugar



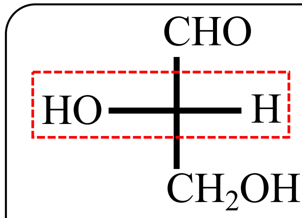
D-sugar



D-sugar



D-sugar



L-sugar

- In **L-sugars**, the chiral carbon that is furthest from the top of the Fischer projection has its hydroxyl group on the left.
- In **D-sugars**, the chiral carbon that is furthest from the top of the Fischer projection has its hydroxyl group on the right.

For more details:
See chapter 11 part 2 video or chapter 11 section 3 in the textbook.

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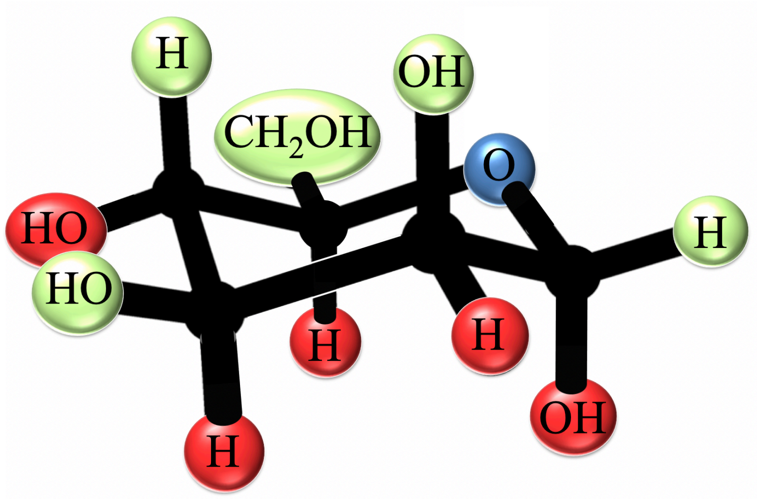
11.8) Draw a Haworth projection for ball and stick representation shown below.



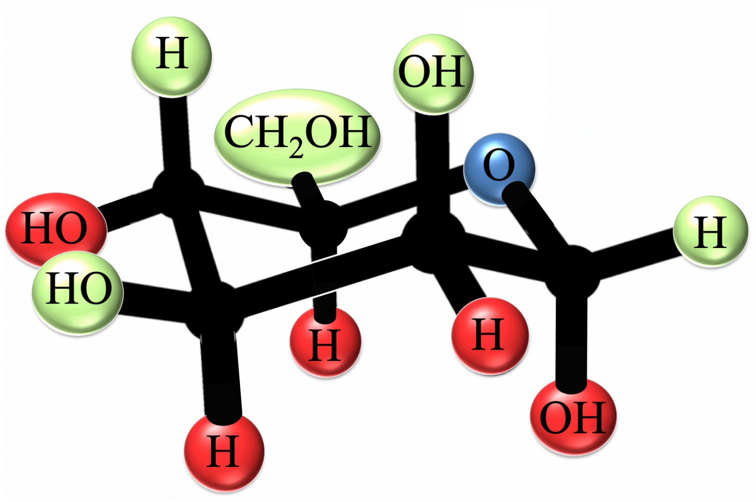
Go back

Click here for a **hint**

Click here to **check your answer**

Go to next question

11.8) Draw a Haworth projection for ball and stick representation shown below.



EXPLANATION:

The side view structures of cyclic monosaccharides are called Haworth projections or Haworth structures. In Haworth projections, the carbon atoms that form the ring are not drawn explicitly, but are implied to occur where lines/bonds meet. Each ring-carbon is bonded to two other ring atoms and two other groups. In the ball and stick representation, the ring carbons are shaded **black**, groups that are oriented upward relative to the ring-carbons are shaded **green**. Groups oriented downward from ring-carbons are shaded **red**.

For more help: See chapter 11 part 3 video or chapter 11 section 3 in the textbook.

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Click here to **check your answer**

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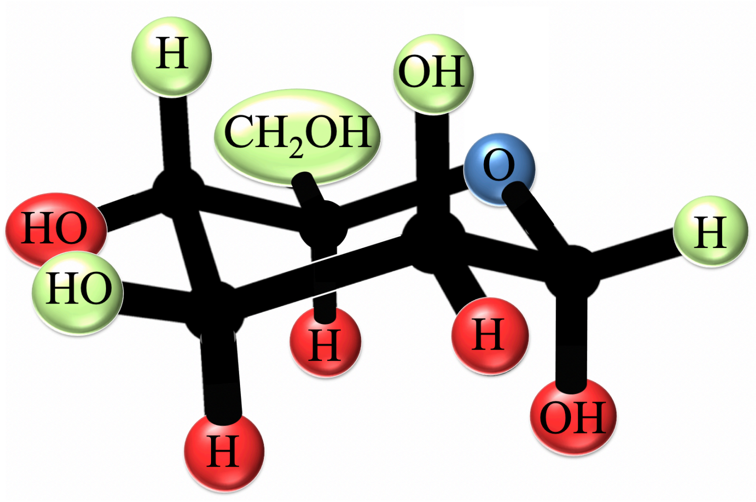
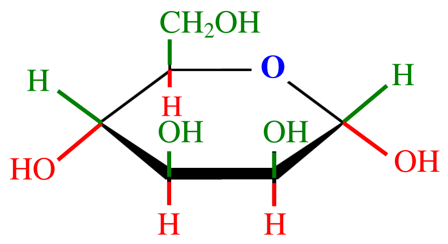
11.8) Draw a Haworth projection for ball and stick representation shown below.





Haworth Projection

EXPLANATION:

The side view structures of cyclic monosaccharides are called Haworth projections or Haworth structures. The carbon atoms that form the ring are not drawn explicitly, but are implied to occur where lines/bonds meet. Each ring-carbon is bonded to two other ring atoms and two other groups. To help you understand the three-dimensional implications of Haworth projections and give clarity to the solution to this particular problem, groups that are oriented upward relative to the ring-carbons are shaded **green**. Groups oriented downward from ring-carbons are shaded **red**.

For more details: See chapter 11 part 3 video or chapter 11 section 3 in the textbook.

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Go to next question

11.9) Using complete sentences, explain why glucose and many other monosaccharides can be represented by both a cyclic form (as seen in Haworth projections) **and** a non-cyclic form (as seen in Fischer projections).

NOTE: I am ***not asking*** you to explain what Haworth and Fischer projections are; I am asking **why** these monosaccharides can be represented using a cyclic form and a non-cyclic form.

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Click here for a **hint**

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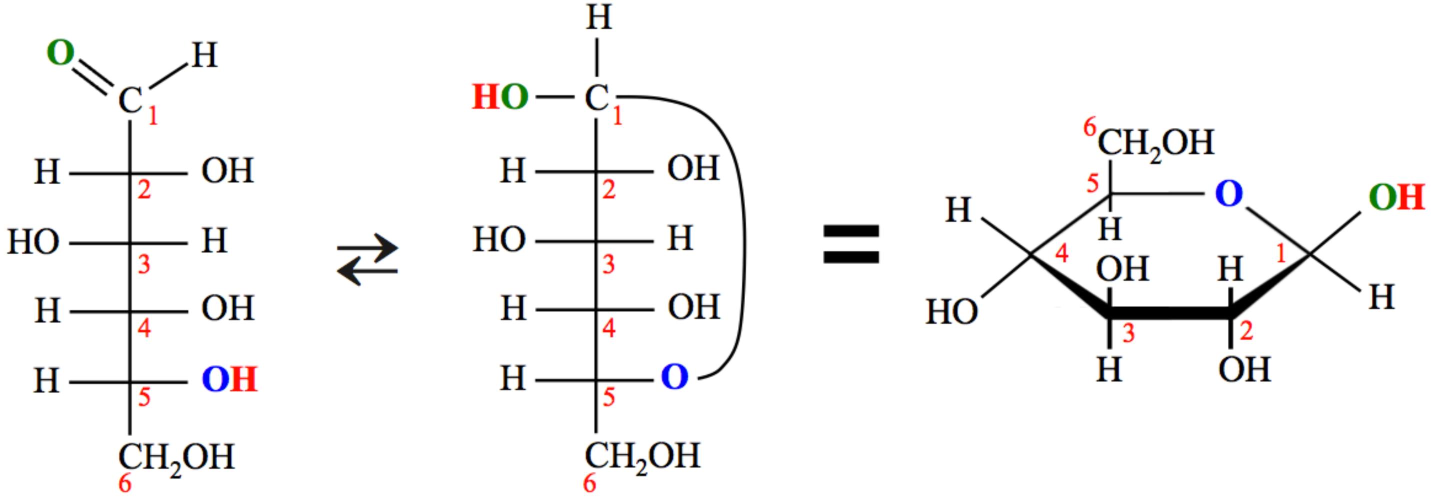
Go to next question

11.9) Using complete sentences, explain why glucose and many other monosaccharides can be represented by both a cyclic form (as seen in Haworth projections) **and** a non-cyclic form (as seen in Fischer projections).

NOTE: I am ***not asking*** you to explain what Haworth and Fischer projections are; I am asking **why** these monosaccharides can be represented using a cyclic form and a non-cyclic form.

HINT:

What is occurring in this image?



D-glucose Fischer projection (open-chain form)

D-glucose Haworth projection (cyclic form)

For more help: See chapter 11 part 3 video or chapter 11 section 3 in the textbook.

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Click here to **check your answer**

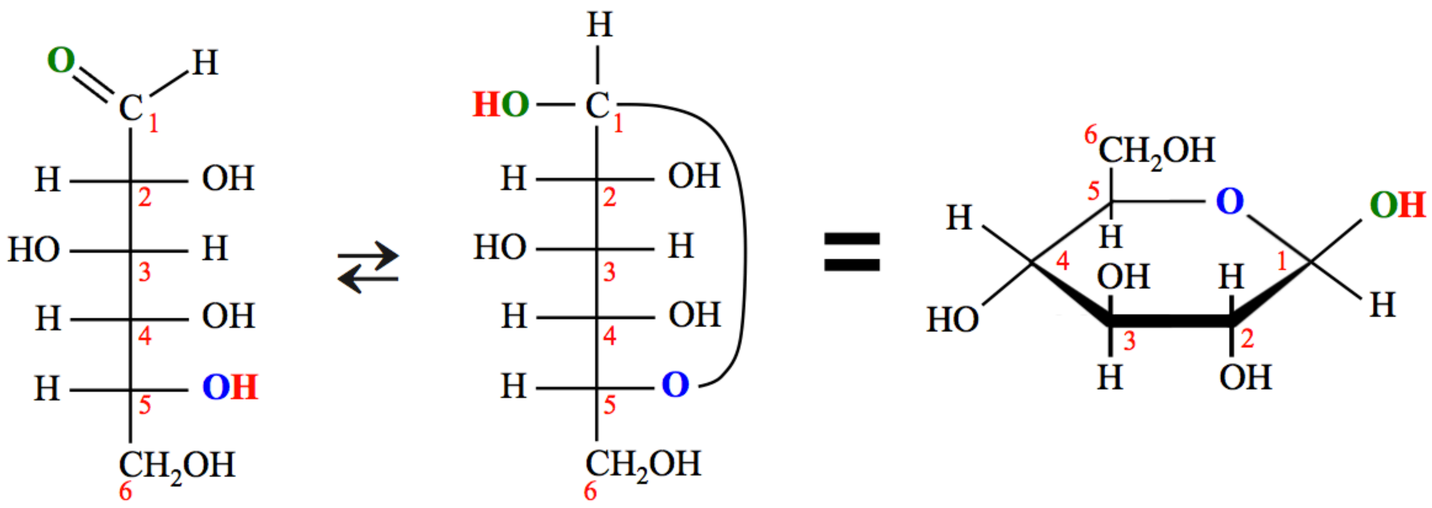
Go to next question

11.9) Using complete sentences, explain why glucose and many other monosaccharides can be represented by both a cyclic form (as seen in Haworth projections) **and** a non-cyclic form (as seen in Fischer projections).

NOTE: I am ***not asking*** you to explain what Haworth and Fischer projections are; I am asking **why** these monosaccharides can be represented using a cyclic form and a non-cyclic form.

ANSWER: When monosaccharides that contain five to seven carbons are in aqueous solutions, they can undergo a reversible reaction in which they rearrange their ***non-cyclic structure*** to form ***cyclic structures***.

EXPLANATION: The open-chain form of an aldose monosaccharide contains both an aldehyde group and at least two hydroxyl groups. The open-chain form of a ketose monosaccharide contains both the ketone bonding pattern and at least two hydroxyl groups. A hemiacetal is formed when a monosaccharide's hydroxyl group reacts with its carbonyl group. The monosaccharide is "reacting with itself." The *cyclization* rearrangement reaction is shown on the right for a **D-glucose** molecule.



D-glucose
Fischer projection
(open-chain form)

D-glucose
Haworth projection
(cyclic form)

For more details: See chapter 11 part 3 video or chapter 11 section 3 in the textbook.

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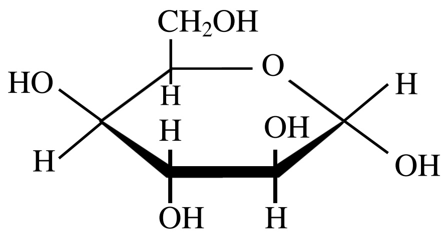
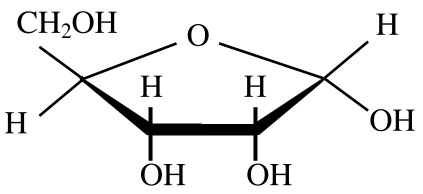
11.10) Classify each of the molecules shown below as either a **pyranose** or a **furanose**.

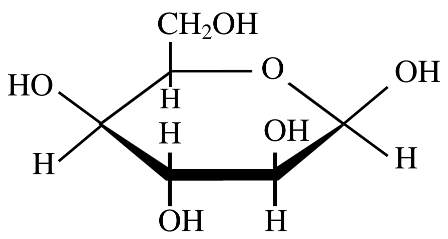
a)



b)



c)



Go back

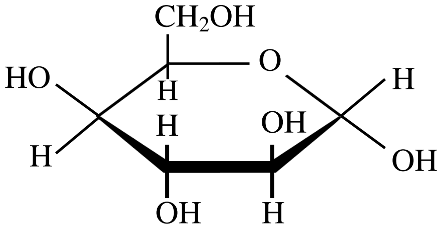
Click here for a **hint**

Click here to **check your answer**

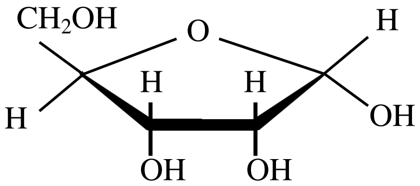
Go to next question

11.10) Classify each of the molecules shown below as either a **pyranose** or a **furanose**.

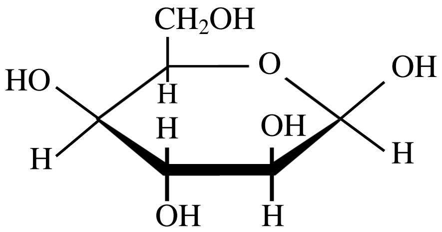
a)



b)



c)



HINT:

Cyclic monosaccharides with **five-member rings** (five atoms in the ring structure) are called **furanoses**.

Cyclic monosaccharides with **six-member rings** (six atoms in the ring structure) are called **pyranoses**.

For more help: See chapter 11 part 3 video or chapter 11 section 3 in the textbook.

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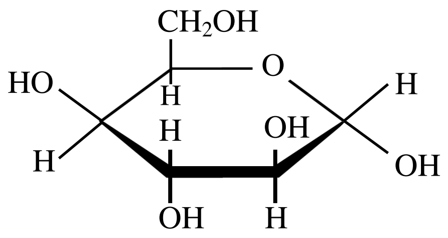
Click here to **check your answer**

Go to next question

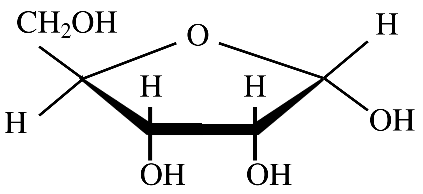
11.10) Classify each of the molecules shown below as either a **pyranose** or a **furanose**.

a)



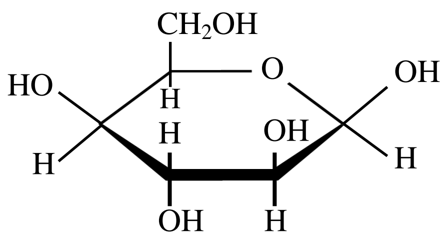
pyranose

b)



furanose

c)



pyranose

EXPLANATION:

Cyclic monosaccharides with **five-member rings** (five atoms in the ring structure) are called **furanoses**.

Cyclic monosaccharides with **six-member rings** (six atoms in the ring structure) are called **pyranoses**.

For more details: See chapter 11 part 3 video or chapter 11 section 3 in the textbook.

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11.11)

i) The two enantiomers that can be formed during the cyclization of monosaccharides are called ______________.

a) conformations
b) cis or trans
c) sugar twins
d) anomers

ii) It is easy to identify the *anomeric carbon* in a Haworth projection of a D-sugar; it is the ring-carbon to the ______________ side of the ring-oxygen.

a) right-hand
b) left-hand

iii) An **α**-anomer has the **OH** on the anomeric carbon oriented ________________ from the ring.

a) downward
b) upward
c) in a random direction

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Click here for a **hint**

Click here to **check your answer**

Go to next question

11.11)

i) The two enantiomers that can be formed during the cyclization of monosaccharides are called ______________.

HINT:
a) conformations
~~b) cis or trans~~
~~c) sugar twins~~
d) anomers

ii) It is easy to identify the *anomeric carbon* in a Haworth projection of a D-sugar; it is the ring-carbon to the ______________ side of the ring-oxygen.

a) right-hand
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HINT:
a) downward
b) upward
~~c) in a random direction~~

For more help: See chapter 11 part 3 video or chapter 11 section 3 in the textbook.

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Click here to **check your answer**

Go to next question

11.11)

i) The two enantiomers that can be formed during the cyclization of monosaccharides are called ______________.

a) conformations
b) cis or trans
c) sugar twins
d) anomers

ii) It is easy to identify the *anomeric carbon* in a Haworth projection of a D-sugar; it is the ring-carbon to the ______________ side of the ring-oxygen.

a) right-hand
b) left-hand

The sugar produced in photosynthesis, and almost all of the other monosaccharides found in plants and animals, are D-sugars. At some point in the history of Earth, nature chose D-sugars. In later chapters of this course, you will only see D-sugars.

iii) An **α**-anomer has the **OH** on the anomeric carbon oriented ________________ from the ring.

a) downward
b) upward
c) in a random direction

The **β**-anomer has the **OH** on the anomeric carbon oriented *upward* from the ring.

For more details: See chapter 11 part 3 video or chapter 11 section 3 in the textbook.

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Go to next question

11.12) Write the definition of the term “mutarotation.”

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Click here for a **hint**

Click here to **check your answer**

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11.12) Write the definition of the term "mutarotation."

HINT:

Mutarotation is the conversion from_____________, to the _________________ form, then to the ____________ (and vice versa).

For more help: See chapter 11 part 3 video or chapter 11 section 3 in the textbook.

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Click here to **check your answer**

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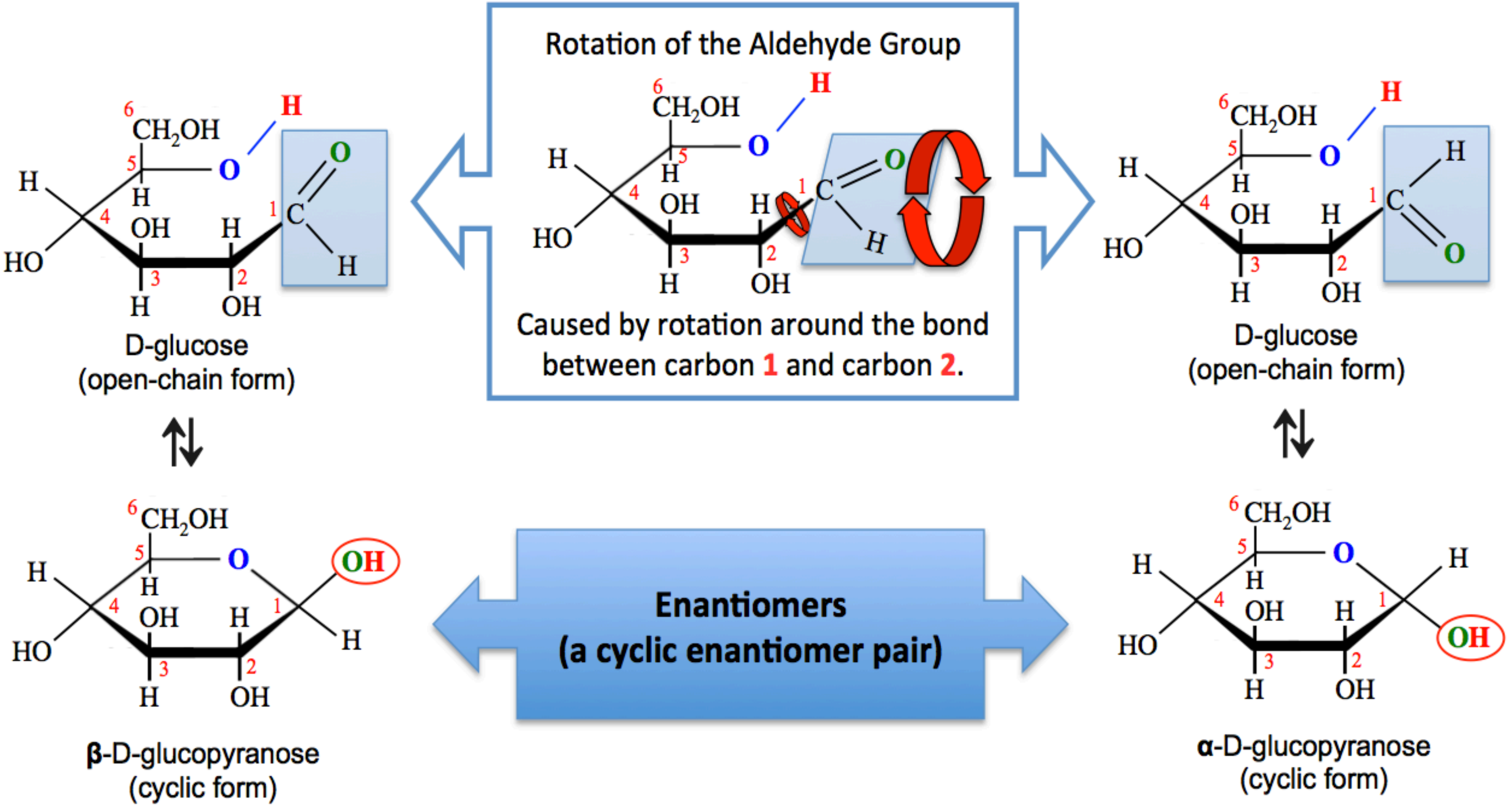
11.12) Write the definition of the term “mutarotation.”

ANSWER: *Mutarotation* is the conversion from α-anomer, to the open-chain form, then to the β-anomer (and vice versa).

The mutarotation process is illustrated below for an aldose (D-glucose).



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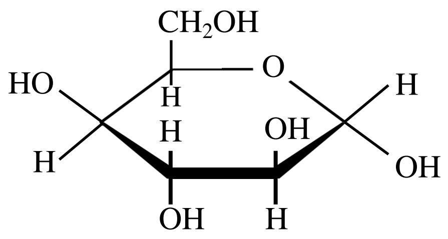
For more details: See chapter 11 part 3 video or chapter 11 section 3 in the textbook.

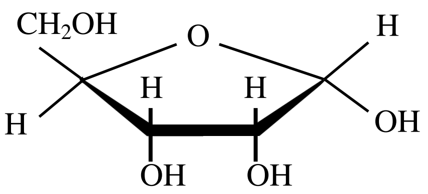
Go to next question

11.13) Classify each of the molecules shown below as either a **β-anomer** *or* an **α-anomer**.

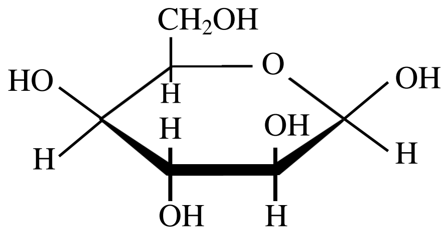
a)



b)



c)



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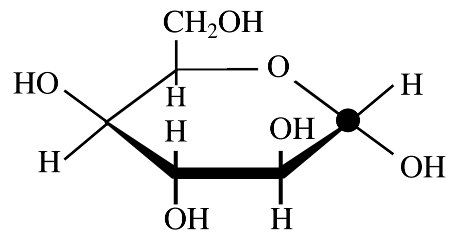
Click here for a **hint**

Click here to **check your answer**

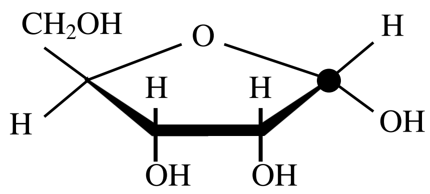
Go to next question

11.13) Classify each of the molecules shown below as either a **β-anomer** *or* an **α-anomer**.

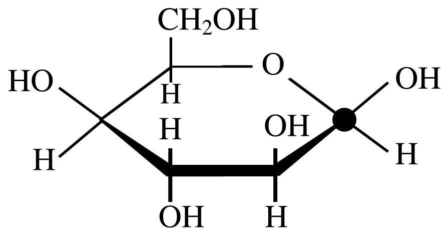
a)



b)



c)



HINT:

Although all of the ring-carbons in cyclic monosaccharides are chiral, the only possible change in stereochemistry that may occur in cyclization is that of the *anomeric carbon*. The two enantiomers that can be formed during the cyclization process are called anomers. They are classified, based on the orientation of the hydroxyl group (**OH**) on the *anomeric carbon*, as the α-anomer or the β-anomer.

I have included black spheres (●) in order to indicate the position of the *anomeric carbons*.

For more help: See chapter 11 part 3 video or chapter 11 section 3 in the textbook.

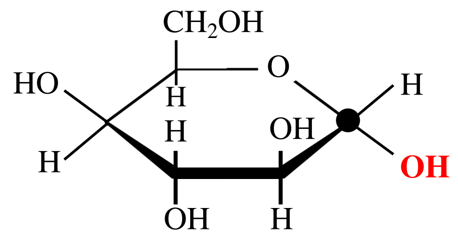
Go back

Click here to check **your answer**

Go to next question

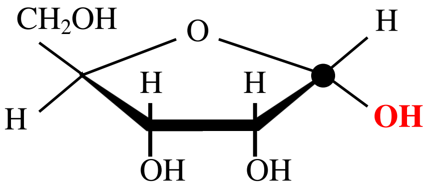
11.13) Classify each of the molecules shown below as either a **β-anomer** *or* an **α-anomer**.

a)



α-anomer: the **OH** on the *anomeric carbon* is oriented ***downward*** from the ring.

b)



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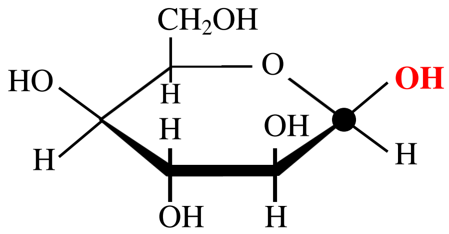


β-anomer: the **OH** on the *anomeric carbon* is oriented ***upward*** from the ring.

I have included black spheres (●) in order to indicate the position of the *anomeric carbons*.

EXPLANATION:

Although all of the ring-carbons in cyclic monosaccharides are chiral, the only possible change in stereochemistry that may occur in cyclization is that of the *anomeric carbon*. The two enantiomers that can be formed during the cyclization process are called anomers. They are classified, based on the orientation of the hydroxyl group (**OH**) on the *anomeric carbon*, as the α-anomer or the β-anomer.

- The **α-anomer** has the **OH** on the anomeric carbon oriented downward from the ring.
- The **β-anomer** has the **OH** on the anomeric carbon oriented upward from the ring.

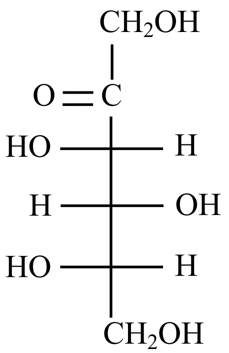
For more details: See chapter 11 part 3 video or chapter 11 section 3 in the textbook.

Go back

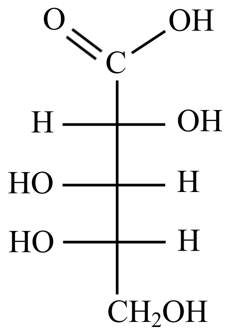
Go to next question

11.14) Identify each of the molecules shown below as either a monosaccharide, amino sugar, carboxylic acid sugar, alcohol sugar, or a deoxy sugar.

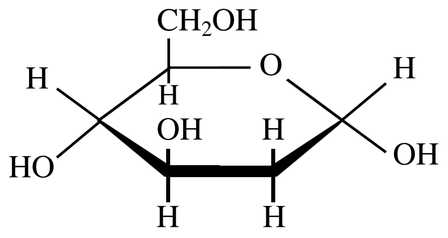
a)



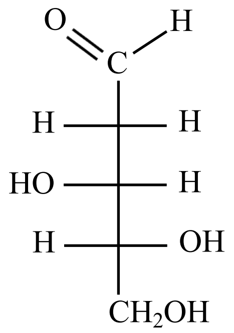
b)



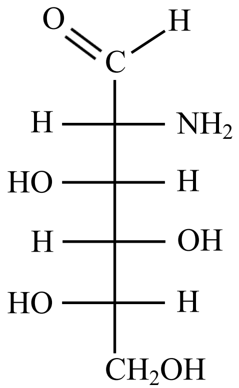
c)



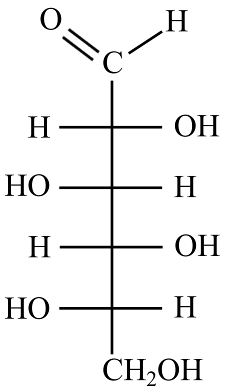
d)



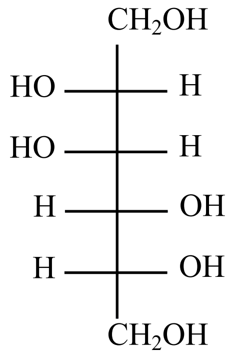
e)



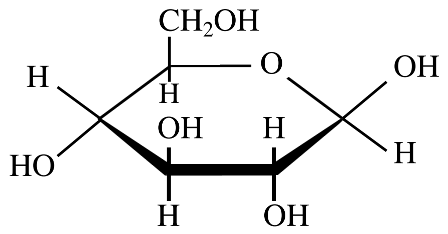
f)



g)



h)



Go back

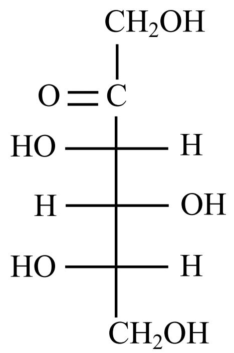
Click here for a **hint**

Click here to **check your answer**

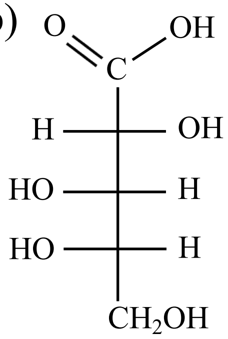
Go to next question

11.14) Identify each of the molecules shown below as either a monosaccharide, amino sugar, carboxylic acid sugar, alcohol sugar, or a deoxy sugar.

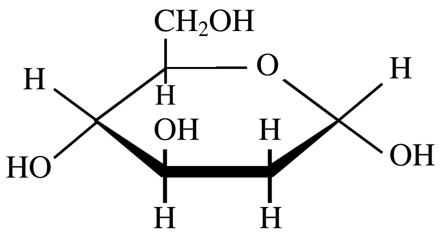
a)



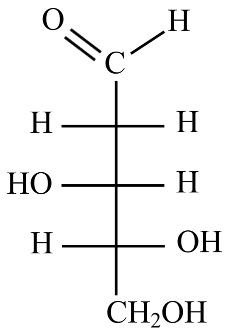
b)



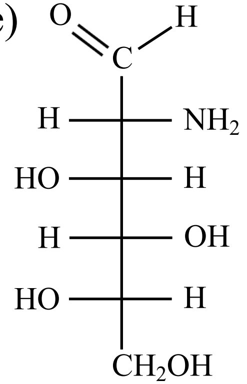
c)



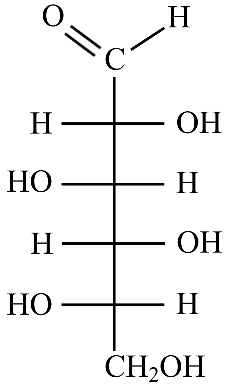
d)



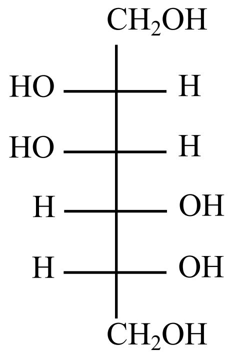
e)



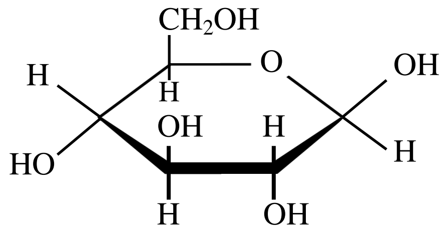
f)



g)



h)



HINT:

Monosaccharide Derivative	Defining Structural Trait
Amino Sugar	A hydroxyl group (OH) of a monosaccharide is replaced by an amino group (NH_2)
Carboxylic Acid Sugar	The aldehyde group (CHO) of an aldose is oxidized to a carboxyl group (COOH).
Alcohol Sugar	The carbonyl group (C=O) of a monosaccharide is reduced to a hydroxyl (OH) group
Deoxy Sugar	A hydroxyl group (OH) of a monosaccharide is replaced by a hydrogen.

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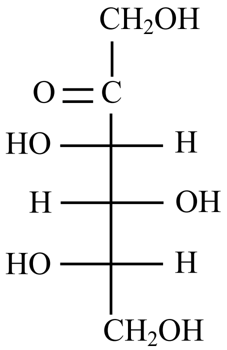
For more help: See chapter 11 part 4 video or chapter 11 section 4 in the textbook.

Click here to check your answer

Go to next question

11.14) Identify each of the molecules shown below as either a monosaccharide, amino sugar, carboxylic acid sugar, alcohol sugar, or a deoxy sugar.

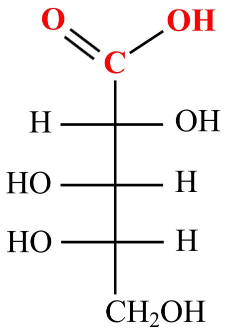
a)



monosaccharide

(a polyhydroxyl *ketone*)

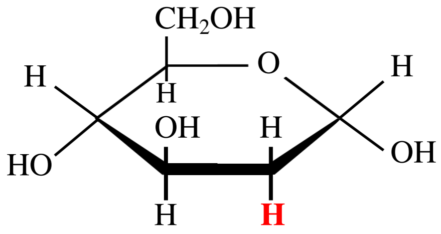
b)



carboxylic acid sugar

(the carbonyl group (C=O) of a aldose is oxidized to a *carboxyl group*)

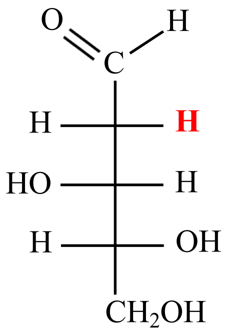
c)



deoxy sugar

(the cyclic form, a hydroxyl group (**-OH**) in a monosaccharide is replaced by a *hydrogen*)

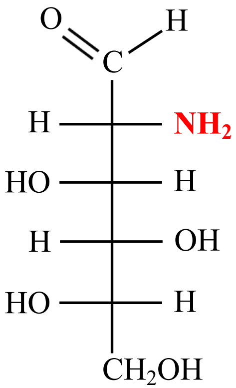
d)



deoxy sugar

(a hydroxyl group (**-OH**) in a monosaccharide is replaced by a *hydrogen*)

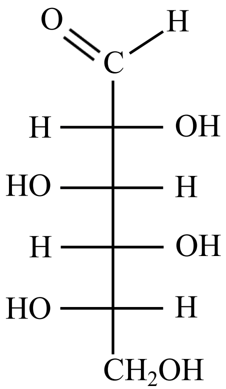
e)



amino sugar

(a hydroxyl group (**-OH**) in a monosaccharide is replaced by an *amino group*)

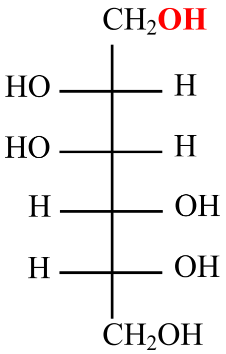
f)



monosaccharide

(a polyhydroxyl *aldehyde*)

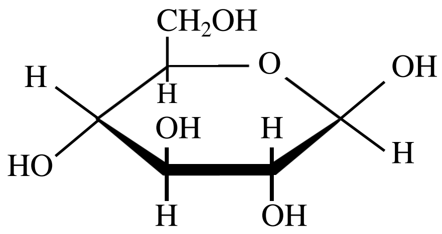
g)



alcohol sugar

(the carbonyl group (C=O) of a monosaccharide is *reduced* to an *alcohol*)

h)



monosaccharide

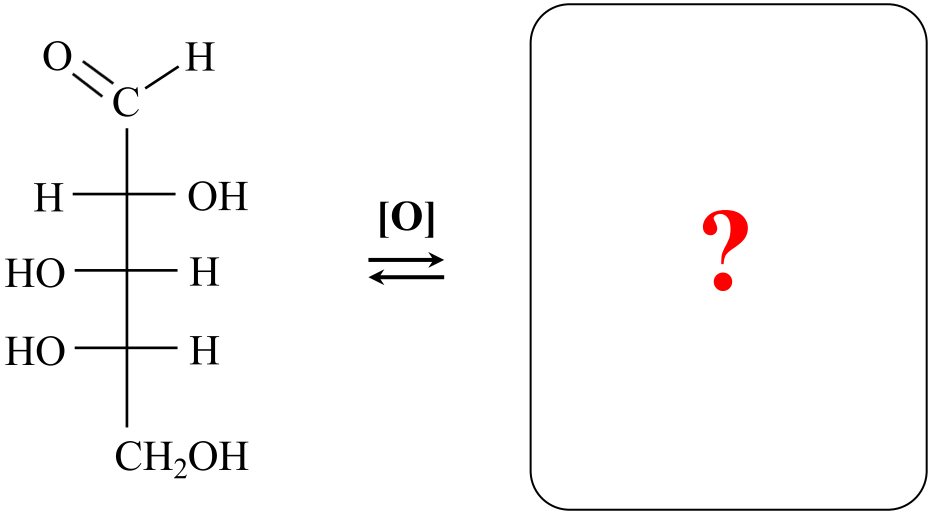
(the cyclic form)

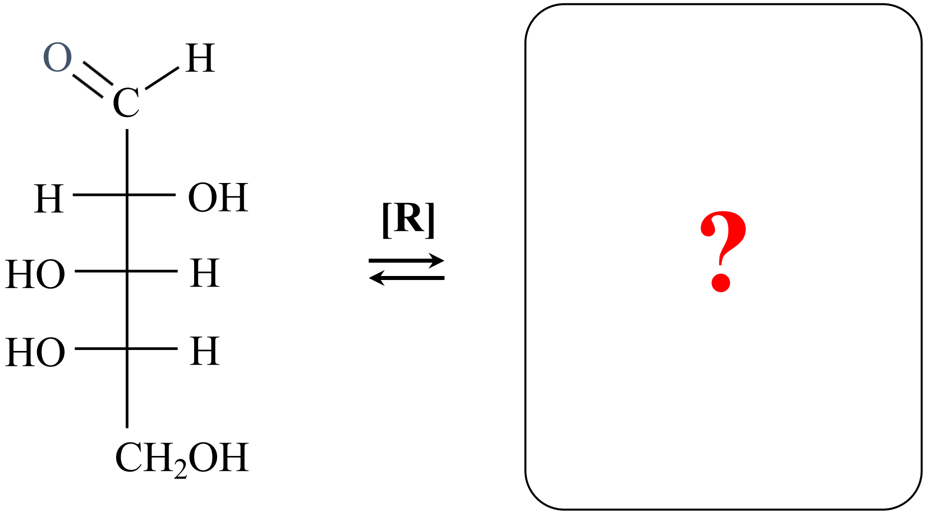
Go back

For more details: See chapter 11 part 4 video or chapter 11 section 4 in the textbook.

Go to next question

11.15) Draw the Fischer projection of the *monosaccharide derivative* that is formed for each of the reactions shown below.





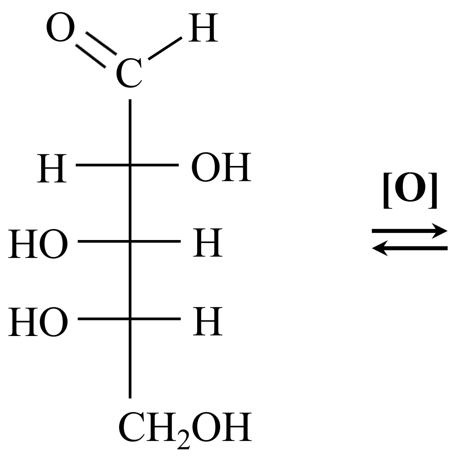
Go back

Click here for a **hint**

Click here to **check your answer**

Go to next question

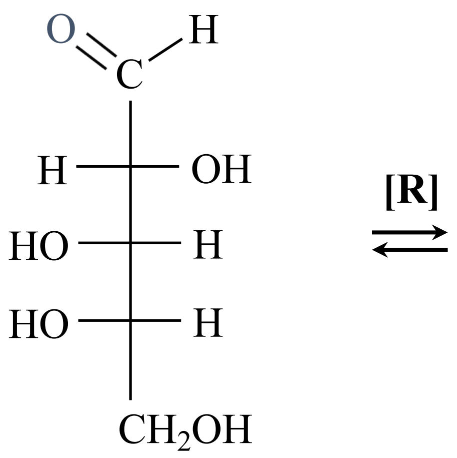
11.15) Draw the Fischer projection of the *monosaccharide derivative* that is formed for each of the reactions shown below.



HINT:

In a *carboxylic acid sugars* are derived when the aldehyde group (CHO) of a monosaccharide is **oxidized** to form a carboxyl group (COOH).

- You first learned about the oxidation of aldehydes to carboxylic acids in chapter 10.



HINT:

Alcohol sugars, sometimes called "sugar alcohols," are derived when the carbonyl group (C=O) of a monosaccharide is **reduced** to a hydroxyl group.

- In chapter 10, you learned how to predict the structure of the alcohol formed in this reaction by adding H_2 "across" the carbonyl group's double bond.

For more help: See chapter 11 part 4 video or chapter 11 section 4 in the textbook.

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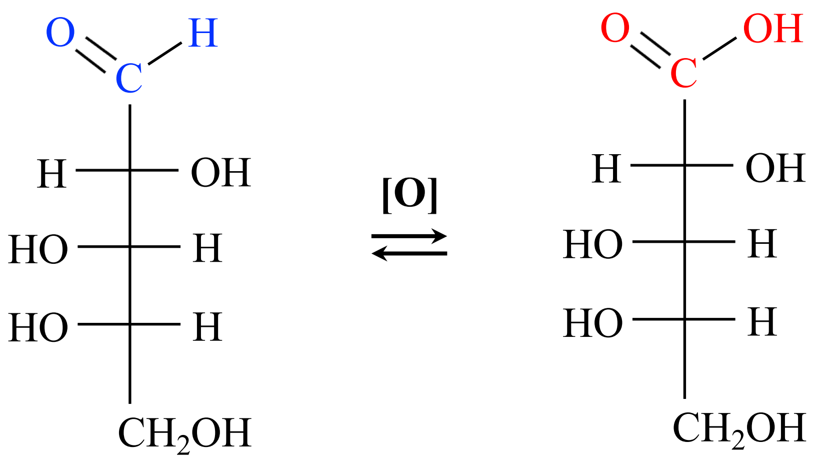
Click here to **check your answer**

Go to next question

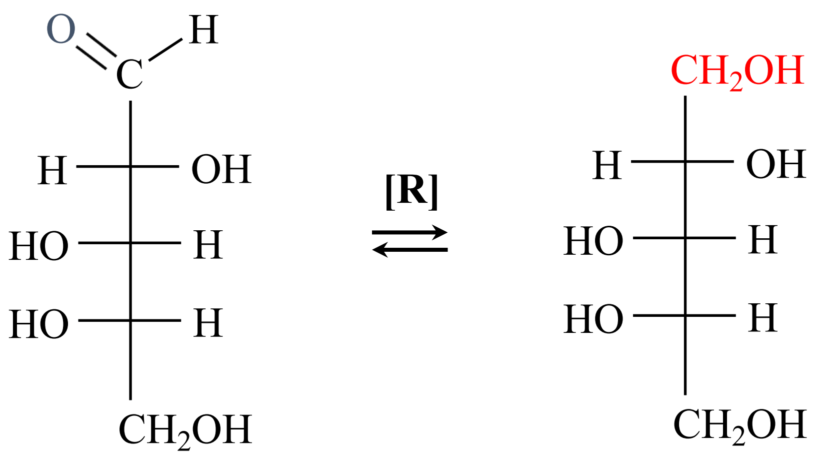
11.15) Draw the Fischer projection of the *monosaccharide derivative* that is formed for each of the reactions shown below.



EXPLANATION:

In a *carboxylic acid sugars* are derived when the aldehyde group (CHO) of a monosaccharide is **oxidized** to form a carboxyl group (COOH).

- You first learned about the oxidation of aldehydes to carboxylic acids in chapter 10.



EXPLANATION:

Alcohol sugars, sometimes called "sugar alcohols," are derived when the carbonyl group (C=O) of a monosaccharide is **reduced** to a hydroxyl group.

- In chapter 10, you learned how to predict the structure of the alcohol formed in this reaction by adding H_2 "across" the carbonyl group's double bond.

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For more details: See chapter 11 part 4 video or chapter 11 section 4 in the textbook.

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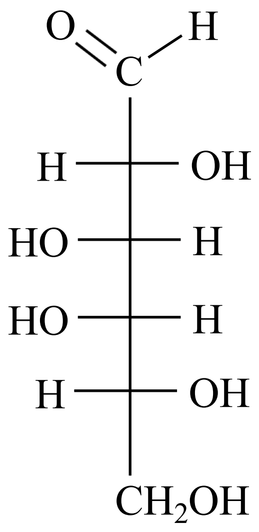
11.16) Draw a Fischer projection of the **2-deoxy sugar** that is derived from the monosaccharide shown below.



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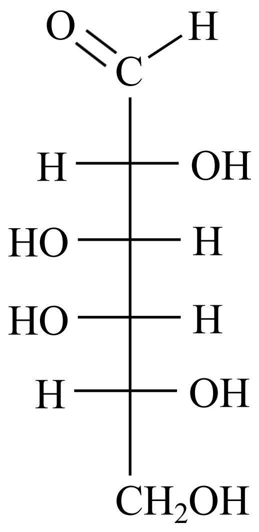
Click here for a **hint**

Click here to **check your answer**

Go to next question

11.16) Draw a Fischer projection of the **2-deoxy sugar** that is derived from the monosaccharide shown below.



HINT:

A deoxy sugar is derived when a hydroxyl group (**OH**) in a monosaccharide is replaced by a **hydrogen** atom.

- The "**2**" in **2-deoxy sugar** indicates the carbon position where a hydrogen (**H**) replaces a hydroxyl group (**OH**) of the monosaccharide.

For more help: See chapter 11 part 4 video or chapter 11 section 4 in the textbook.

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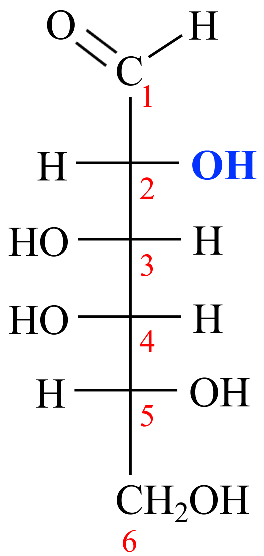
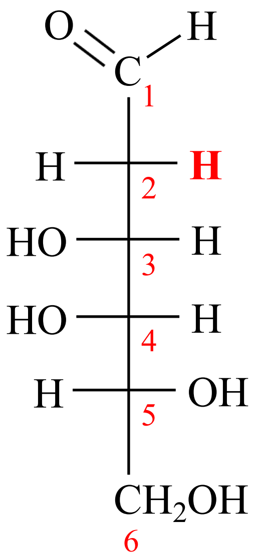
Click here to **check your answer**

Go to next question

11.16) Draw a Fischer projection of the **2-deoxysugar** that is derived from the monosaccharide shown below.



ANSWER:



EXPLANATION:

A deoxy sugar is derived when a hydroxyl group (**OH**) in a monosaccharide is replaced by a **hydrogen** atom.

- The "**2**" in **2-deoxy sugar** indicates the carbon position where a hydrogen (**H**) replaces a hydroxyl group (**OH**) of the monosaccharide.

For more details: See chapter 11 part 4 video or chapter 11 section 4 in the textbook.

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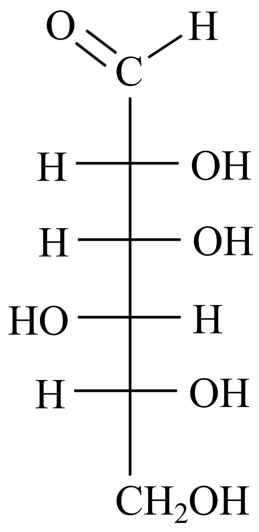
11.17) Draw a Fischer projection of the **3-amino sugar** that is derived from the monosaccharide shown below.



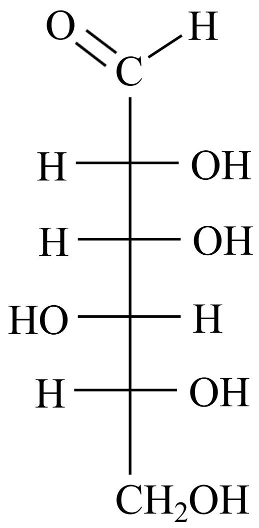
Go back

Click here for a **hint**

Click here to **check your answer**

Go to next question

11.17) Draw a Fischer projection of the **3-amino sugar** that is derived from the monosaccharide shown below.



HINT:

An amino sugar is derived when a hydroxyl group (**OH**) in a monosaccharide is replaced by an **amino group** (**NH_2**).

- The "**3**" in **3-amino sugar** indicates the carbon position where an **amino group** (**NH_2**) replaces a hydroxyl group (**OH**) of the monosaccharide.

For more help: See chapter 11 part 4 video or chapter 11 section 4 in the textbook.

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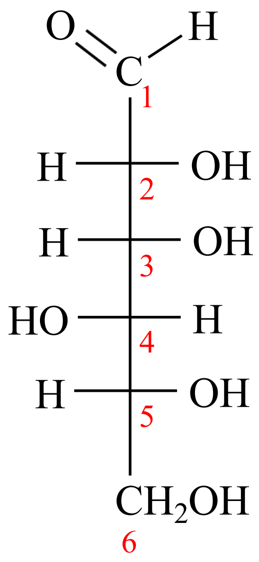
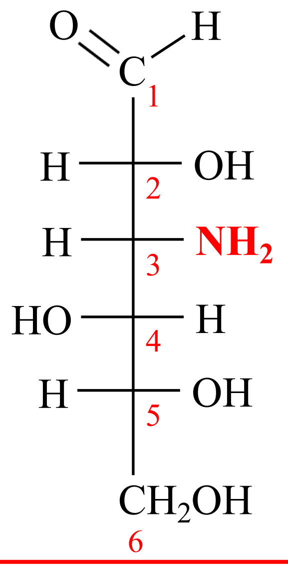
Click here to **check your answer**

Go to next question

11.17) Draw a Fischer projection of the **3-amino sugar** that is derived from the monosaccharide shown below.



ANSWER:



EXPLANATION:

An amino sugar is derived when a hydroxyl group (**OH**) in a monosaccharide is replaced by an **amino group** (**NH_2**).

- The "**3**" in **3-amino sugar** indicates the carbon position where an **amino group** (**NH_2**) replaces a hydroxyl group (**OH**) of the monosaccharide.

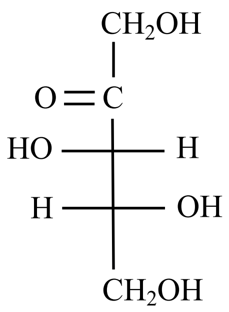
For more details: See chapter 11 part 4 video or chapter 11 section 4 in the textbook.

Go back

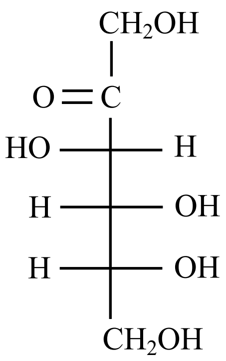
Go to next question

11.18) Predict whether each of the monosaccharides shown below would give a **positive** or **negative** Benedict's test.

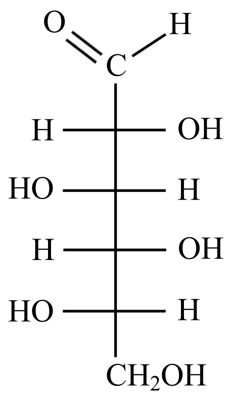
a)



b) **fructose**



c)



Go back

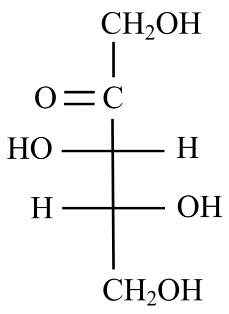
Click here for a **hint**

Click here to **check your answer**

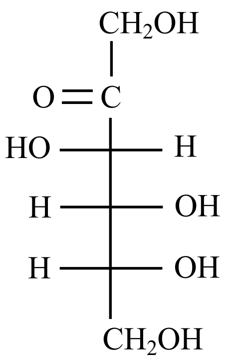
Go to next question

11.18) Predict whether each of the monosaccharides shown below would give a **positive** or **negative** Benedict's test.

a)

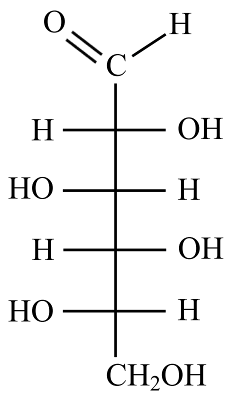


b) **fructose**



HINT: Only one ketose gives a positive Benedict's test.

c)



HINT:

This is an **aldose**. Do aldoses give positive or negative Benedict's tests?

For more help: See chapter 11 part 4 video or chapter 11 section 4 in the textbook.

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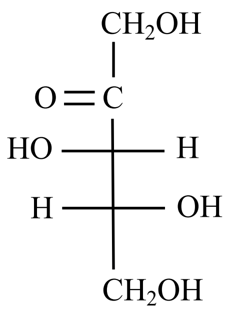
Click here to **check your answer**

Go to next question

11.18) Predict whether each of the monosaccharides shown below would give a **positive** or **negative** Benedict's test.

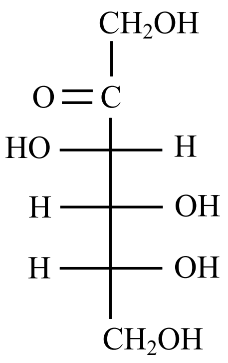
a)



negative

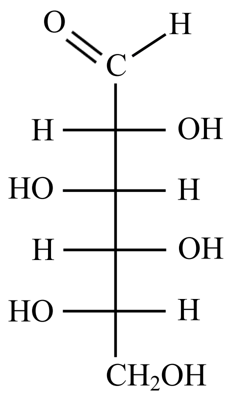
Except for fructose, ketoses give negative Benedict's tests.

b) **fructose**



Although *fructose* is a **ketose** (not an aldose), it gives a **positive** Benedict's test result. The reason for this is that when fructose is in a hot basic solution, it will undergo either of two rearrangement reactions (shown in your lecture notes), in which it is converted to *glucose* or *mannose*. It is actually the *glucose* and *mannose* **aldoses**, not fructose, that are subsequently oxidized to produce a color change in Benedict's test.

c)



positive

Aldoses give positive Benedict's tests

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For more details: See chapter 11 part 4 video or chapter 11 section 4 in the textbook.

Go to next question

11.19)

i) Oligosaccharides are molecules that are made when two to __________ *monosaccharides* chemically bond to each other.

a) three
b) ten
c) twenty

ii) Molecules from particular organic families (such as monosaccharides) are referred to as "____________" when they bond together to form a large molecule.

a) polymers
b) residues
c) sugar twins
d) anomers

iii) An oligosaccharide that is composed of ***two*** monosaccharide *residues* is called a _____________________.

a) doublet
b) disaccharide
c) residue pair

iv) The alpha (α) designation indicates that the bond from the anomeric carbon to the oxygen (O) in the glycosidic bond is oriented __________________ from the ring.

a) downward
b) upward
c) in a random direction

Go back

Click here for a **hint**

Click here to **check your answer**

Go to next question

11.19)

i) Oligosaccharides are molecules that are made when two to __________ *monosaccharides* chemically bond to each other.

HINT:
a) three
b) ten
~~c) twenty~~

ii) Molecules from particular organic families (such as monosaccharides) are referred to as "____________" when they bond together to form a large molecule.

HINT:
a) polymers
b) residues
~~c) sugar twins~~
~~d) anomers~~

iii) An oligosaccharide that is composed of ***two*** monosaccharide *residues* is called a _____________________.

HINT:
a) doublet
b) disaccharide
~~c) residue pair~~

iv) The alpha (α) designation indicates that the bond from the anomeric carbon to the oxygen (O) in the glycosidic bond is oriented __________________ from the ring.

HINT:
a) downward
b) upward
~~c) in a random direction~~

Go back

For more help: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

Click here to check your answer

Go to next question

11.19)

i) Oligosaccharides are molecules that are made when two to __________ *monosaccharides* chemically bond to each other.

a) three
b) ten
c) twenty

Note that sugars with **more than ten** *monosaccharides* chemically bonded to each other are referred to as polysaccharides.

ii) Molecules from particular organic families (such as monosaccharides) are referred to as "____________" when they bond together to form a large molecule.

a) polymers
b) residues
c) sugar twins
d) anomers

iii) An oligosaccharide that is composed of ***two*** monosaccharide *residues* is called a _____________________.

a) doublet
b) disaccharide
c) residue pair

Likewise, an oligosaccharide that is composed of ***three*** monosaccharide *residues* is called a trisaccharide.

iv) The alpha (α) designation indicates that the bond from the anomeric carbon to the oxygen (O) in the glycosidic bond is oriented __________________ from the ring.

a) downward
b) upward
c) in a random direction

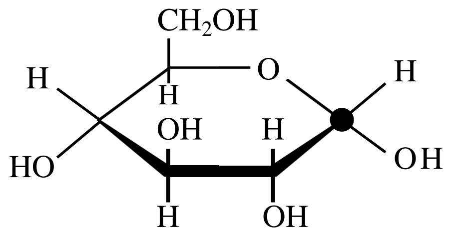
Glycosidic bonds are described using alpha (α) or beta (β) designations based on the orientation (stereochemistry) of the **glycosidic bond** relative to the *anomeric carbon*. This is done in a manner similar to the α and β designations for cyclic monosaccharides, which was based on the orientation of the hydroxyl group relative to the anomeric carbon.

Go back

For more details: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

Go to next question

11.20) Draw the structure of the ***disaccharide*** that is formed when **two** of the monosaccharide shown below are connected by an **α-(1→4)** glycosidic bond.



Go back

Click here for a **hint**

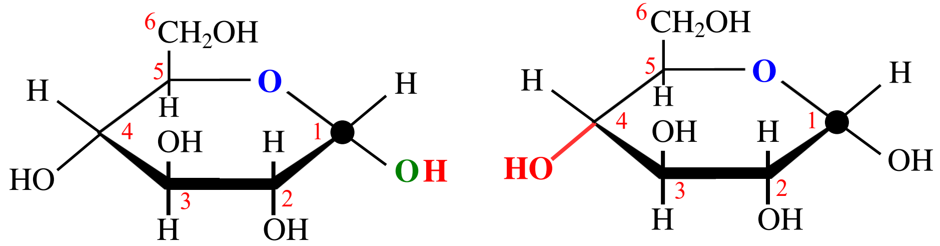
Click here to **check your answer**

Go to next question

11.20) Draw the structure of the ***disaccharide*** that is formed when **two** of the monosaccharide shown below are connected by an **α-(1→4)** glycosidic bond.

HINT:

In order to get a disaccharide with an **α** glycosidic bond, begin with the two monosaccharides in the **α** orientation.



For more help: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

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Click here to **check your answer**

Go to next question

11.20) Draw the structure of the ***disaccharide*** that is formed when **two** of the monosaccharide shown below are connected by an **α-(1→4)** glycosidic bond.

EXPLANATION:

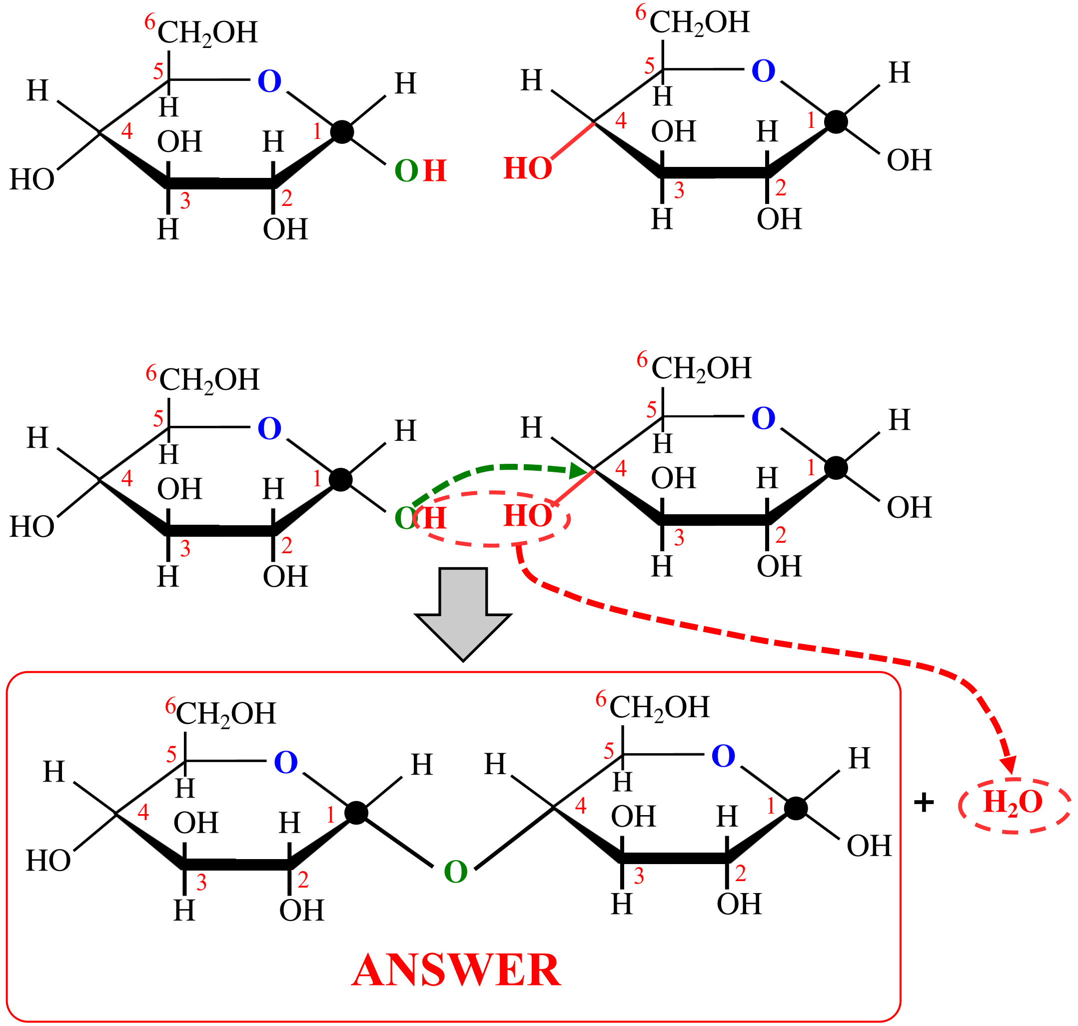
In order to get a disaccharide with an **α** glycosidic bond, begin with the two monosaccharides in the **α** orientation.

Step 1: An **H** atom is removed from the hydroxyl group (**OH**) ***that is bonded to the anomeric carbon*** of the left-most residue, and an **OH** is removed from ***carbon number*** **4** in the right-most residue.

- The **H** and **OH** that were removed form a water molecule.

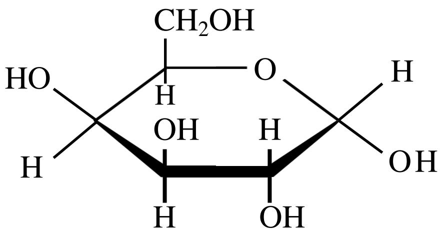
Step 2: Draw a ***new bond*** **from** the oxygen (**O**) that remains on the *anomeric carbon* in the left-most residue **to** the carbon from which the **OH** was removed in the right-most residue.

- This ***new bond*** is oriented in the same direction as *was* the bond to **OH** that was removed.



11.21) Draw the structure of the ***disaccharide*** that is formed when **two** of the monosaccharide shown below are connected by an **α-(1→4)** glycosidic bond.

NOTE: This is a different monosaccharide than the one used in the previous problem.



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Click here for a **hint**

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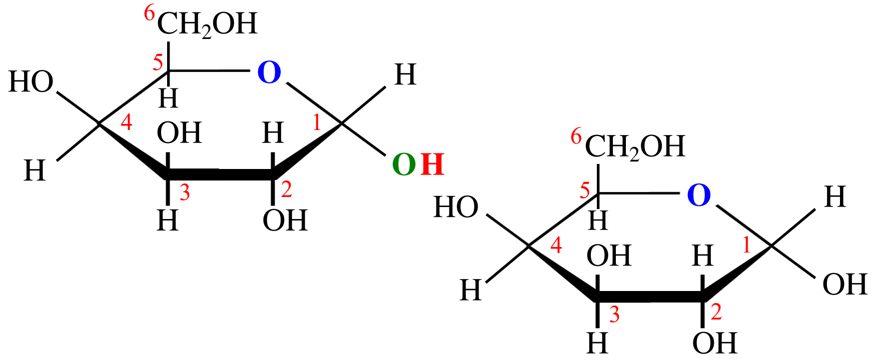
Go to next question

11.21) Draw the structure of the ***disaccharide*** that is formed when **two** of the monosaccharide shown below are connected by an **α-(1→4)** glycosidic bond.

HINT:

In order to get a disaccharide with an **α** glycosidic bond, begin with the two monosaccharides in the **α** orientation.



For more help: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

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Click here to **check your answer**

Go to next question

11.21) Draw the structure of the ***disaccharide*** that is formed when **two** of the monosaccharide shown below are connected by an **α-(1→4)** glycosidic bond.

EXPLANATION:

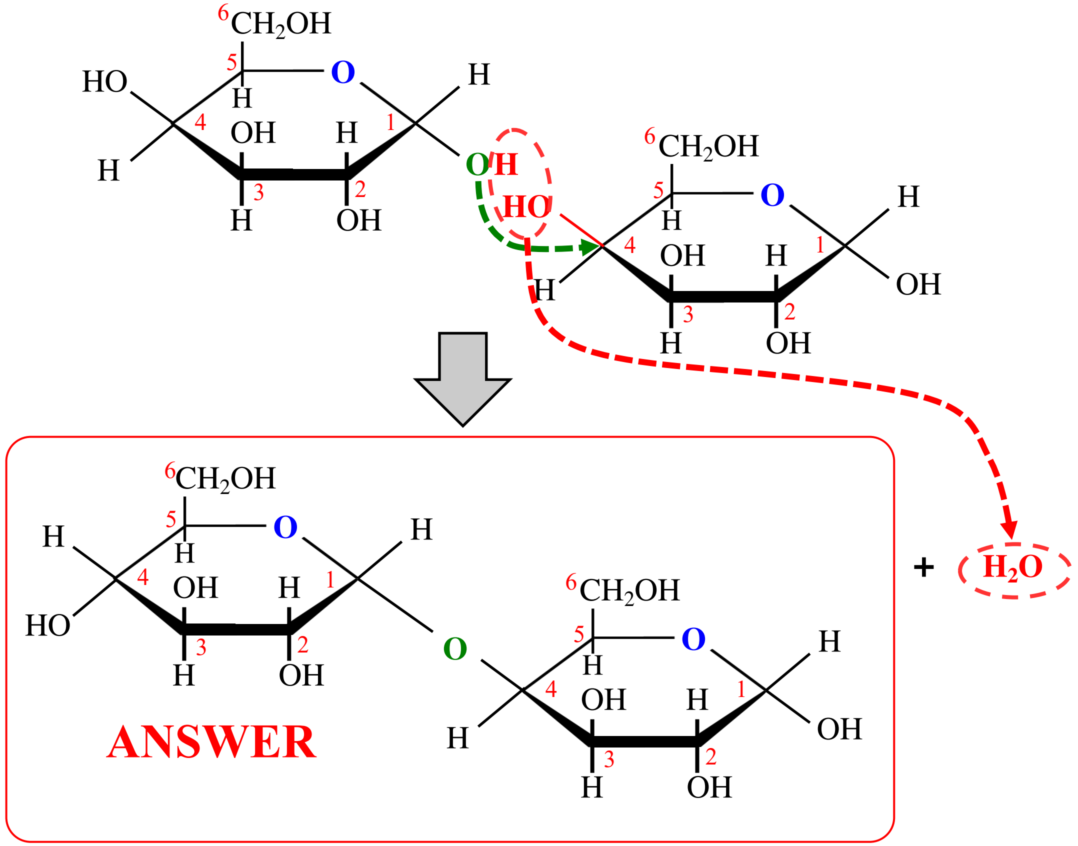
In order to get a disaccharide with an **α** glycosidic bond, begin with the two monosaccharides in the **α** orientation.

Step 1: An **H** atom is removed from the hydroxyl group (**OH**) ***that is bonded to the anomeric carbon*** of the left-most residue, and an **OH** is removed from ***carbon number*** **4** in the right-most residue.

- The **H** and **OH** that were removed form a water molecule.

Step 2: Draw a ***new bond*** **from** the oxygen (**O**) that remains on the *anomeric carbon* in the left-most residue **to** the carbon from which the **OH** was removed in the right-most residue.

- This ***new bond*** is oriented in the same direction as *was* the bond to **OH** that was removed.



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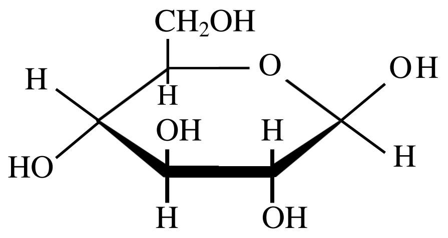
For more details: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

Go to next question

11.22) Draw the structure of the ***disaccharide*** that is formed when **two** of the monosaccharide shown below are connected by a **β-(1→4)** glycosidic bond.



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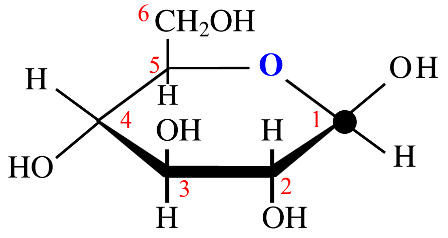
Click here to **check your answer**

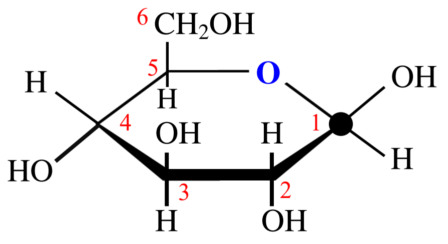
Go to next question

11.22) Draw the structure of the ***disaccharide*** that is formed when **two** of the monosaccharide shown below are connected by a **β-(1→4)** glycosidic bond.

HINT:

In order to get a disaccharide with a **β** glycosidic bond, begin with the two monosaccharides in the **β** orientation.





For more help: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

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Click here to **check your answer**

Go to next question

11.22) Draw the structure of the ***disaccharide*** that is formed when **two** of the monosaccharide shown below are connected by a **β-(1→4)** glycosidic bond.

EXPLANATION:

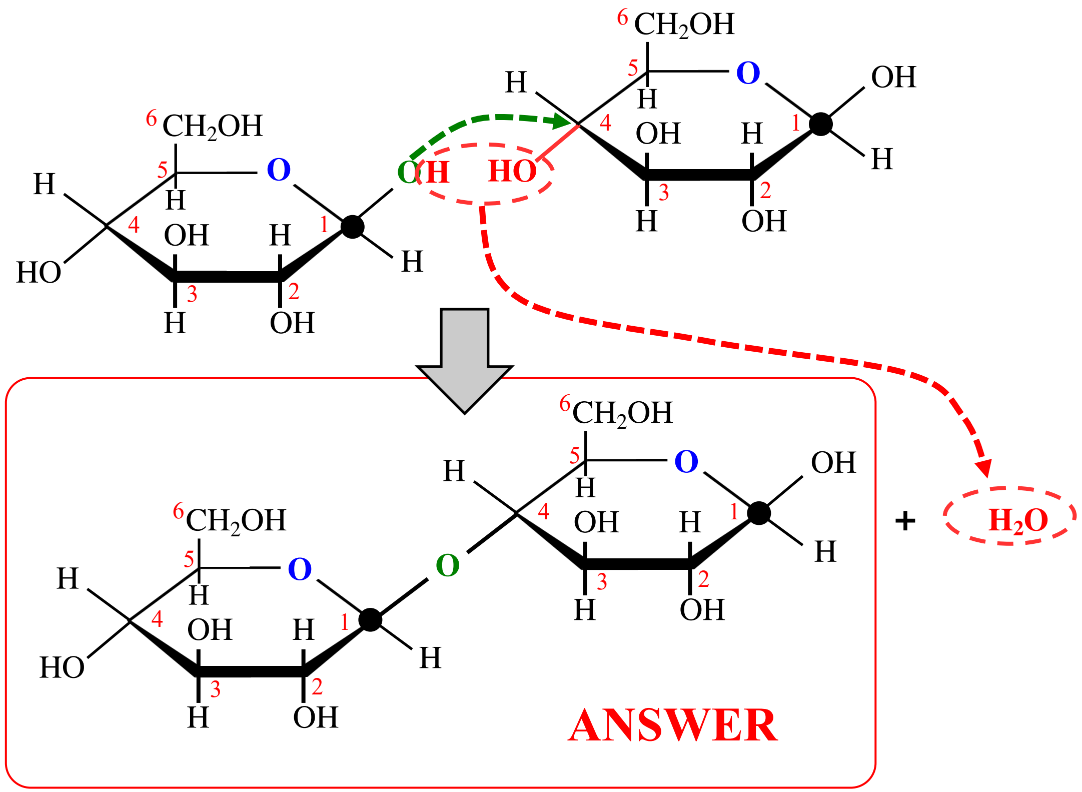
In order to get a disaccharide with a **β** glycosidic bond, begin with the two monosaccharides in the **β** orientation.

Step 1: An **H** atom is removed from the hydroxyl group (**OH**) ***that is bonded to the anomeric carbon*** of the left-most residue, and an **OH** is removed from ***carbon number*** **4** in the right-most residue.

- The **H** and **OH** that were removed form a water molecule.

Step 2: Draw a ***new bond*** **from** the oxygen (**O**) that remains on the *anomeric carbon* in the left-most residue **to** the carbon from which the **OH** was removed in the right-most residue.

- This ***new bond*** is oriented in the same direction as *was* the bond to **OH** that was removed.

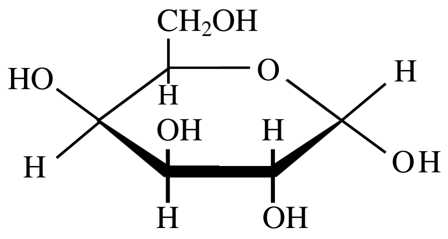


Go back

For more details: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

Go to next question

11.23) Draw the structure of the ***disaccharide*** that is formed when **two** of the monosaccharide shown below are connected by an **α-(1→6)** glycosidic bond.



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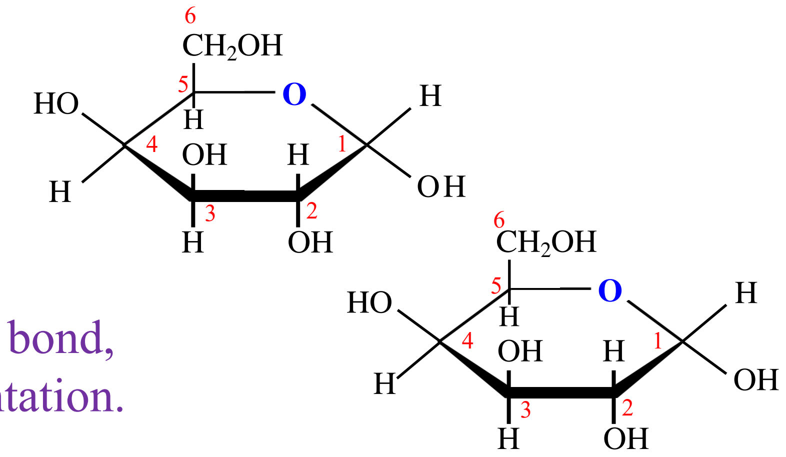
Go to next question

11.23) Draw the structure of the ***disaccharide*** that is formed when **two** of the monosaccharide shown below are connected by an **α-(1→6)** glycosidic bond.

HINT:

In order to get a disaccharide with an **α** glycosidic bond, begin with the two monosaccharides in the **α** orientation.



For more help: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

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Click here to **check your answer**

Go to next question

11.23) Draw the structure of the ***disaccharide*** that is formed when **two** of the monosaccharide shown below are connected by an **α-(1→6)** glycosidic bond.

EXPLANATION:

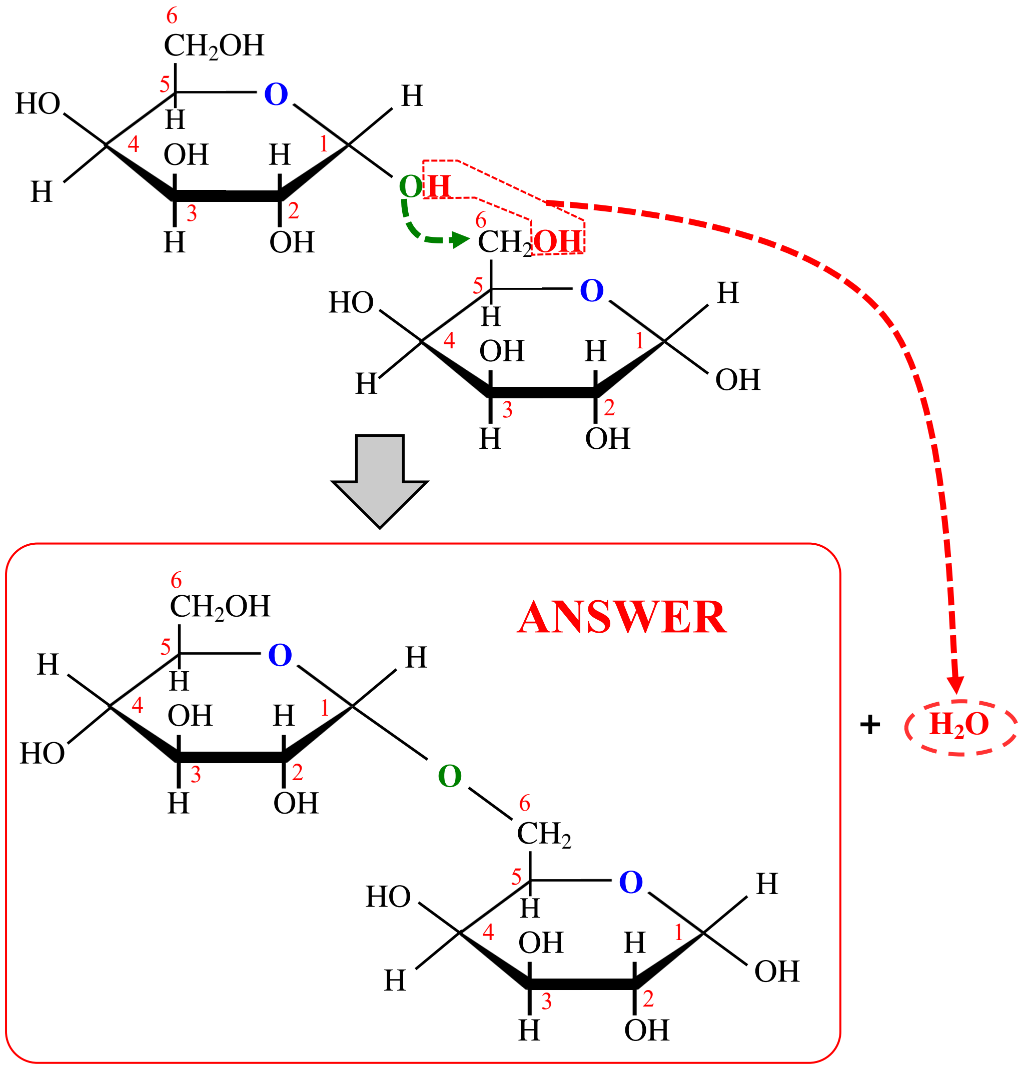
In order to get a disaccharide with an **α** glycosidic bond, begin with the two monosaccharides in the **α** orientation.

Step 1: An **H** atom is removed from the hydroxyl group (**OH**) ***that is bonded to the anomeric carbon*** of the left-most residue, and an **OH** is removed from ***carbon number* 6** in the right-most residue.

- The **H** and **OH** that were removed form a water molecule.

Step 2: Draw a ***new bond*** **from** the oxygen (**O**) that remains on the *anomeric carbon* in the left-most residue **to** the carbon from which the **OH** was removed in the right-most residue.

- This ***new bond*** is oriented in the same direction as *was* the bond to **OH** that was removed.



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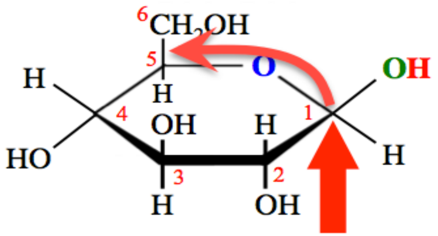
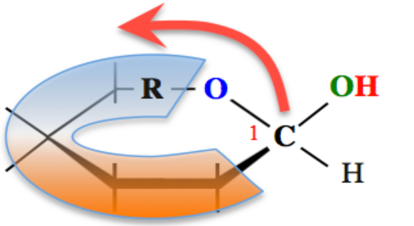
For more details: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

Go to next question

11.24) The cyclic form of D-glucose (shown on right) is a **cyclic hemiacetal**. Recall that a *hemiacetal* is a molecule that contains both an **OR** group and an **OH** group that are bonded to the same carbon. Carbons that are bonded to both an **OR** group and an **OH** group are called **hemiacetal carbons**. Carbon number **1** in the cyclic form of D-glucose meets this criterium. The **OH** that is bonded to carbon number **1** is obvious, but the **OR** may not be immediately obvious to you. However, note that, beginning at carbon number **1** and moving counter-clockwise, as indicated by the red arrow in the structures shown on the right, the **OR** bonding pattern is seen.

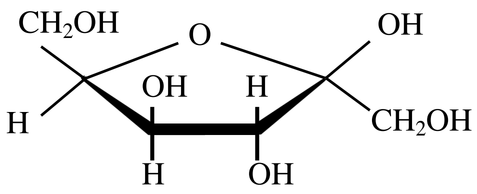


D-glucose
(cyclic form)

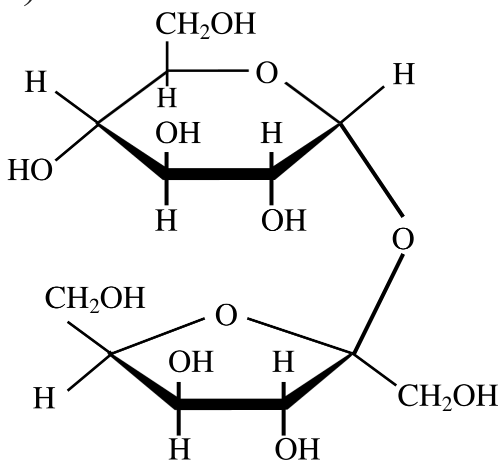


QUESTION: Which of the molecules shown below contain a **hemiacetal carbon**?

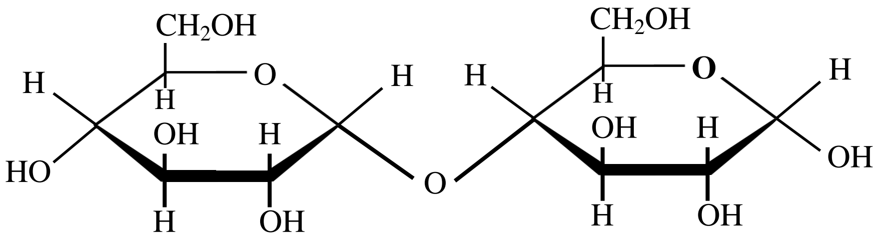
a)



b)



c)



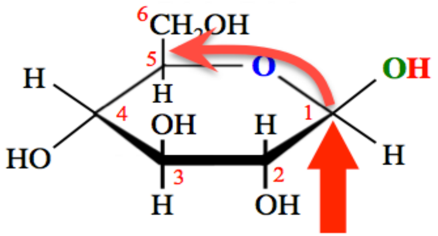
Go back

Click here for a **hint**

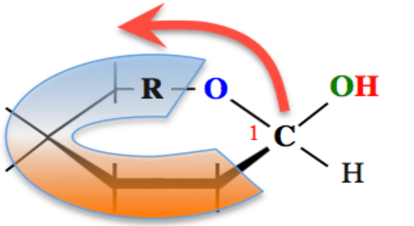
Click here to **check your answer**

Go to next question

11.24) The cyclic form of D-glucose (shown on right) is a **cyclic hemiacetal**. Recall that a *hemiacetal* is a molecule that contains both an **OR** group and an **OH** group that are bonded to the same carbon. Carbons that are bonded to both an **OR** group and an **OH** group are called **hemiacetal carbons**. Carbon number **1** in the cyclic form of D-glucose meets this criterium. The **OH** that is bonded to carbon number **1** is obvious, but the **OR** may not be immediately obvious to you. However, note that, beginning at carbon number **1** and moving counter-clockwise, as indicated by the red arrow in the structures shown on the right, the **OR** bonding pattern is seen.



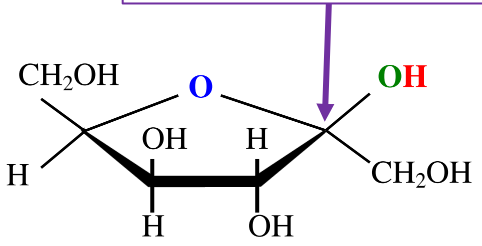
D-glucose
(cyclic form)



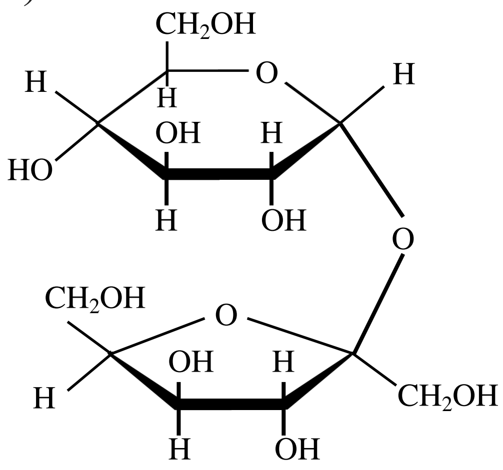
QUESTION: Which of the molecules shown below contain a **hemiacetal carbon**?

a)

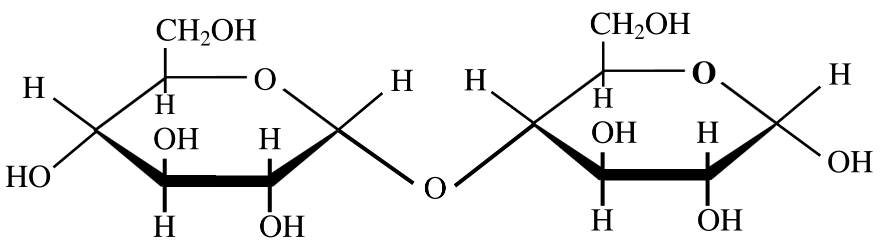
HINT: Is this a hemiacetal carbon?



b)



c)



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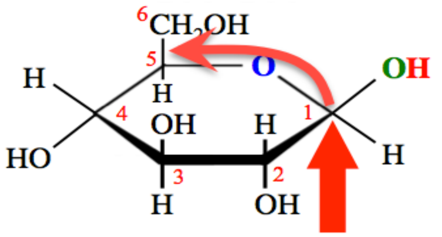
For more help: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

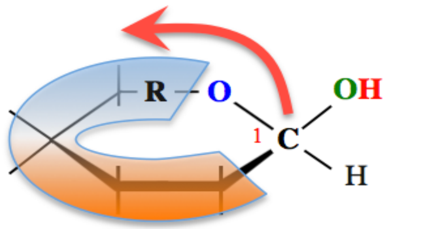
Click here to check your answer

Go to next question

11.24) The cyclic form of D-glucose (shown on right) is a **cyclic hemiacetal**. Recall that a *hemiacetal* is a molecule that contains both an **OR** group and an **OH** group that are bonded to the same carbon. Carbons that are bonded to both an **OR** group and an **OH** group are called **hemiacetal carbons**. Carbon number **1** in the cyclic form of D-glucose meets this criterium. The **OH** that is bonded to carbon number **1** is obvious, but the **OR** may not be immediately obvious to you. However, note that, beginning at carbon number **1** and moving counter-clockwise, as indicated by the red arrow in the structures shown on the right, the **OR** bonding pattern is seen.

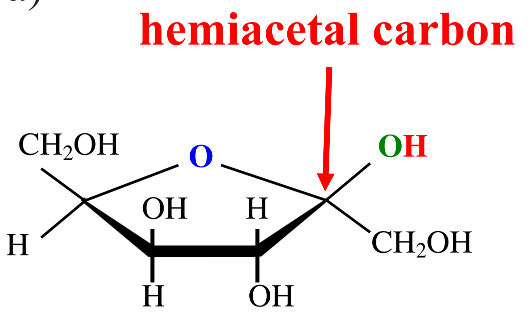


D-glucose
(cyclic form)

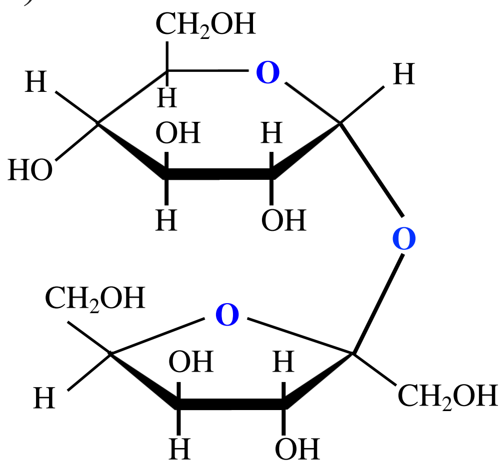


QUESTION: Which of the molecules shown below contain a **hemiacetal carbon**?

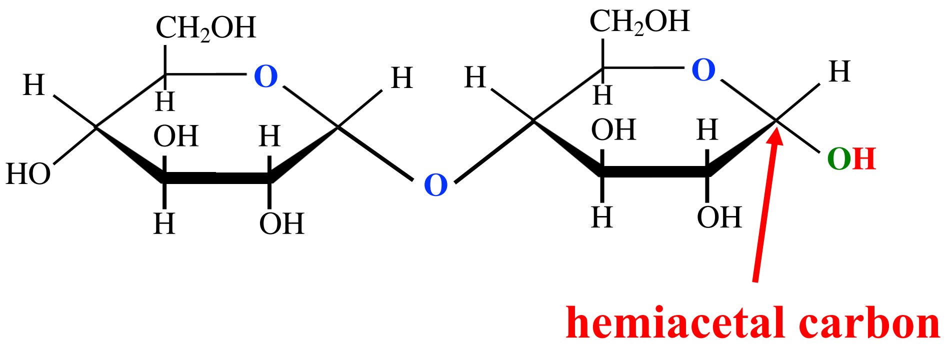
a)



b)



c)



ANSWER: Molecules (**a**) and (**c**) contain **hemiacetal carbons**.

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For more details: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

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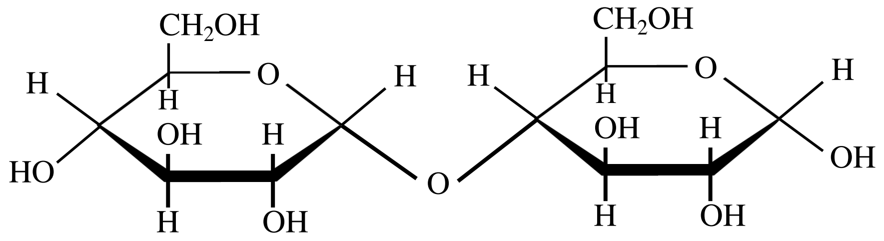
11.25) Can either of the residues in this disaccharide undergo *mutarotation*?



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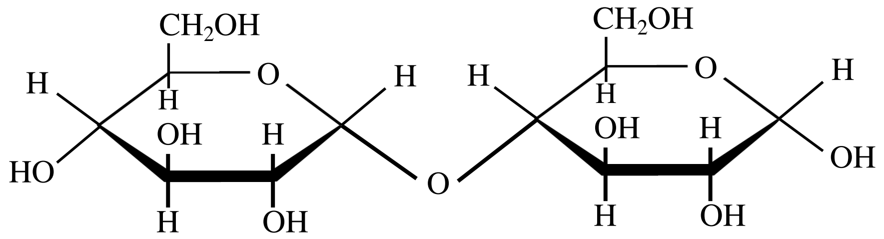
Click here for a **hint**

Click here to **check your answer**

Go to next question

11.25) Can either of the residues in this disaccharide undergo *mutarotation*?



HINT:

Oligosaccharides *with a residue that contains a hemiacetal anomeric carbon* will interconvert (*mutarotate*) between closed anomers and an open-form.

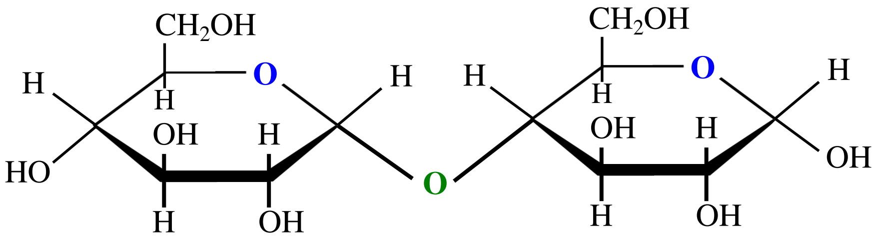
For more help: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

Go back

Click here to **check your answer**

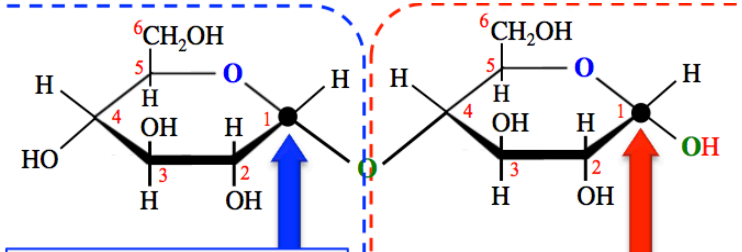
Go to next question

11.25) Can either of the residues in this disaccharide undergo *mutarotation*?



This residue can no longer interconvert between open-chain and cyclic forms.

- It is "locked" in the cyclic form.



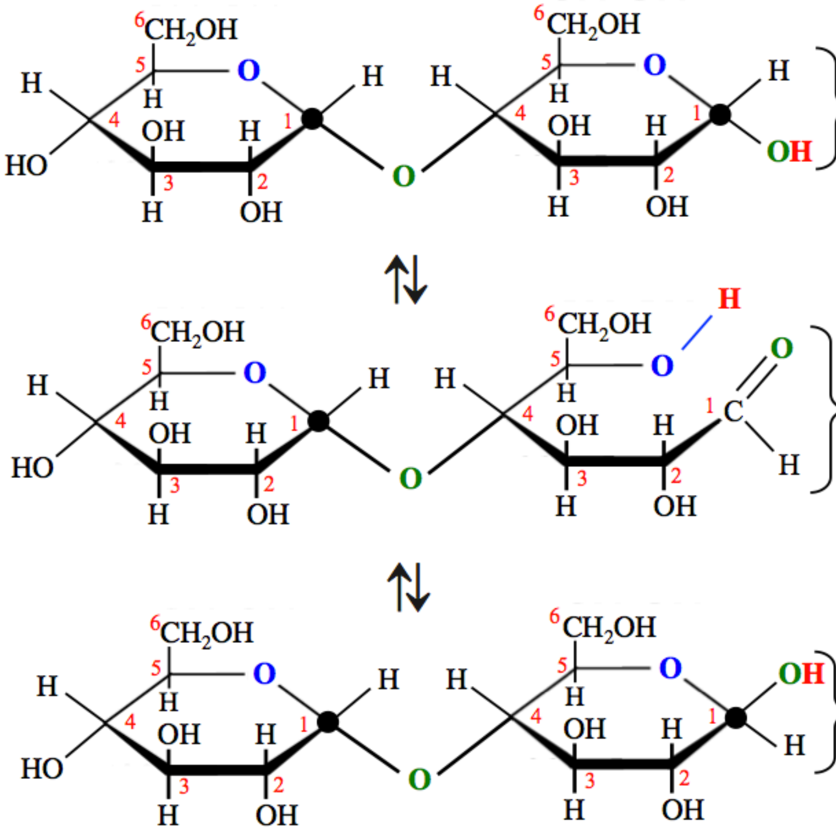
This residue can undergo **mutarotation**

acetal
carbon bonded to two OR groups.

hemiacetal
carbon bonded to to an OR and an OH group

Oligosaccharides *with a residue that contains a hemiacetal anomeric carbon* will interconvert (*mutarotate*) between closed anomers and an open-form.

Note that the mutarotation **does not** change the **α/β** designation ***of a glycosidic bond***.



OH in the α orientation

The right-most residue is in its *open-form*.

OH in the β orientation

For more details: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

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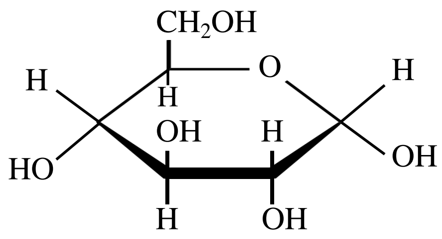
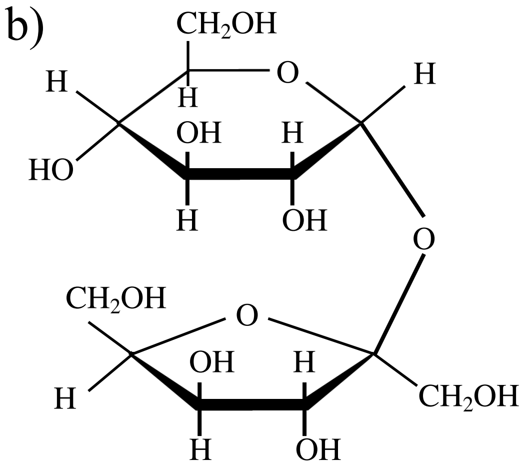
Go to next question

11.26) Determine whether each of the molecules shown below will give **positive** or **negative** benedicts tests.

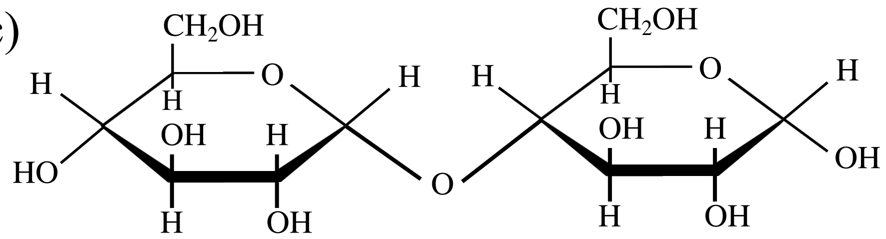
a)



b)



c)



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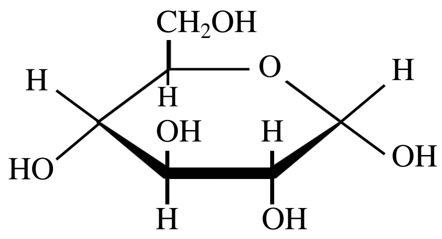
Click here for a **hint**

Click here to **check your answer**

Go to next question

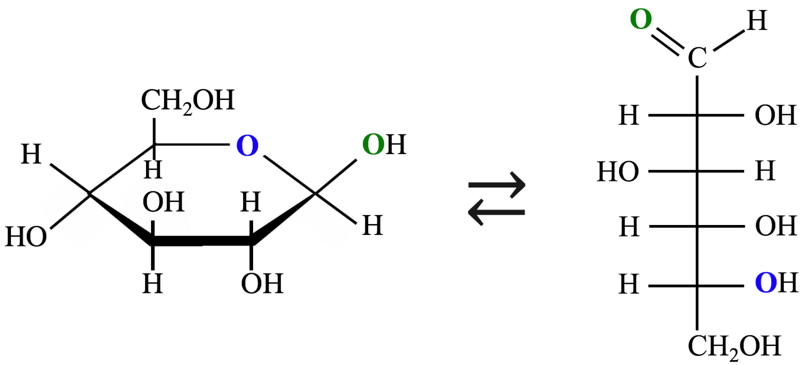
11.26) Determine whether each of the molecules shown below will give **positive** or **negative** benedicts tests.

a)

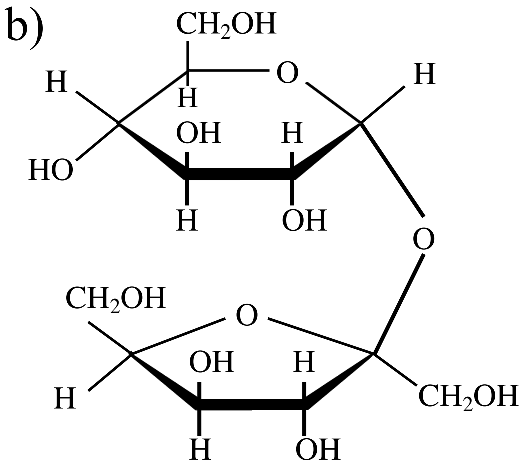


HINT:

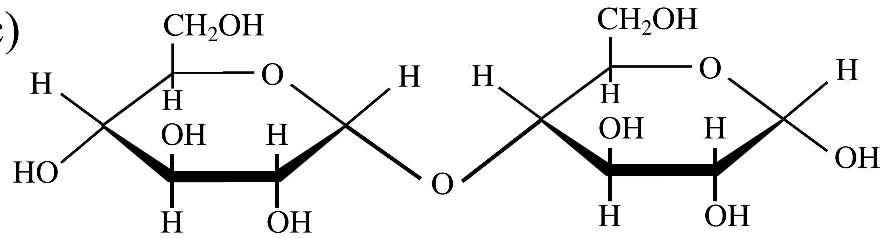
Although the cyclic form of this monosaccharide does not have an aldehyde group, its anomeric carbon is a *hemiacetal* which can interconvert to the **aldose** *open-chain* form as shown below.



b)



c)



HINT:

Do these disaccharides contain a *hemiacetal carbon* or are their residues are "locked" in their ***cyclic forms***. If the **open-chain form** of an oligosaccharide contains an ***aldehyde group***, it will give a positive Benedict's test

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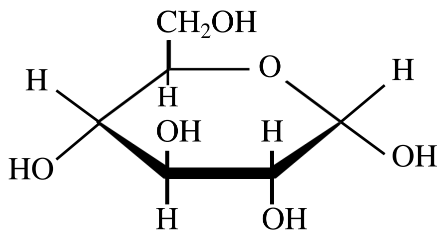
For more help: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

Click here to **check your answer**

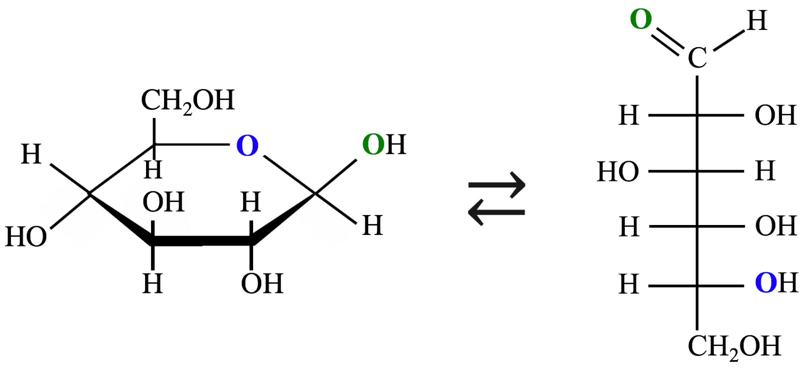
Go to next question

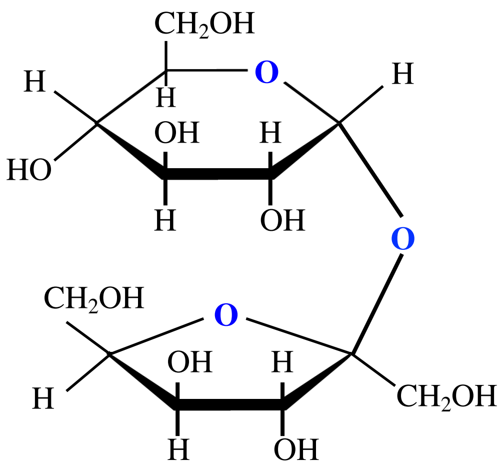
11.26) Determine whether each of the molecules shown below will give **positive** or **negative** benedicts tests.



positive

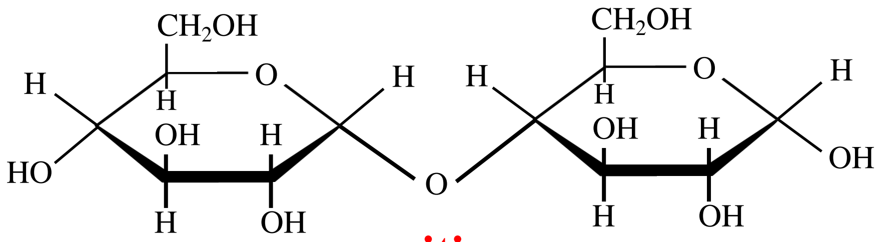
Although the cyclic form of this monosaccharide does not have an aldehyde group, its anomeric carbon is a *hemiacetal* which can interconvert to the **aldose** *open-chain* form as shown below. The **aldose** open-chain form is responsible for the positive Benedict's test.





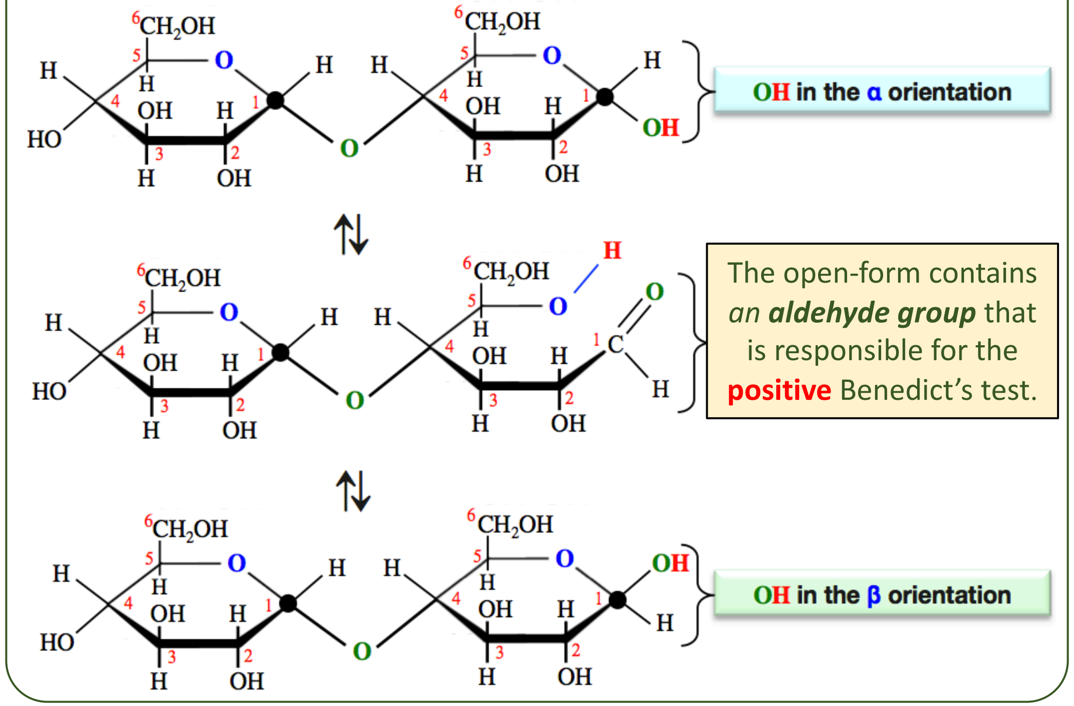
negative

There is not a *hemiacetal carbon* in this molecule, so both residues are "locked" in their ***cyclic forms***. For this reason, neither rings is able to interconvert to their *open-chain* forms.



positive

If the **open-chain form** of an oligosaccharide contains an ***aldehyde group***, it will give a positive Benedict's test.



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For more details: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

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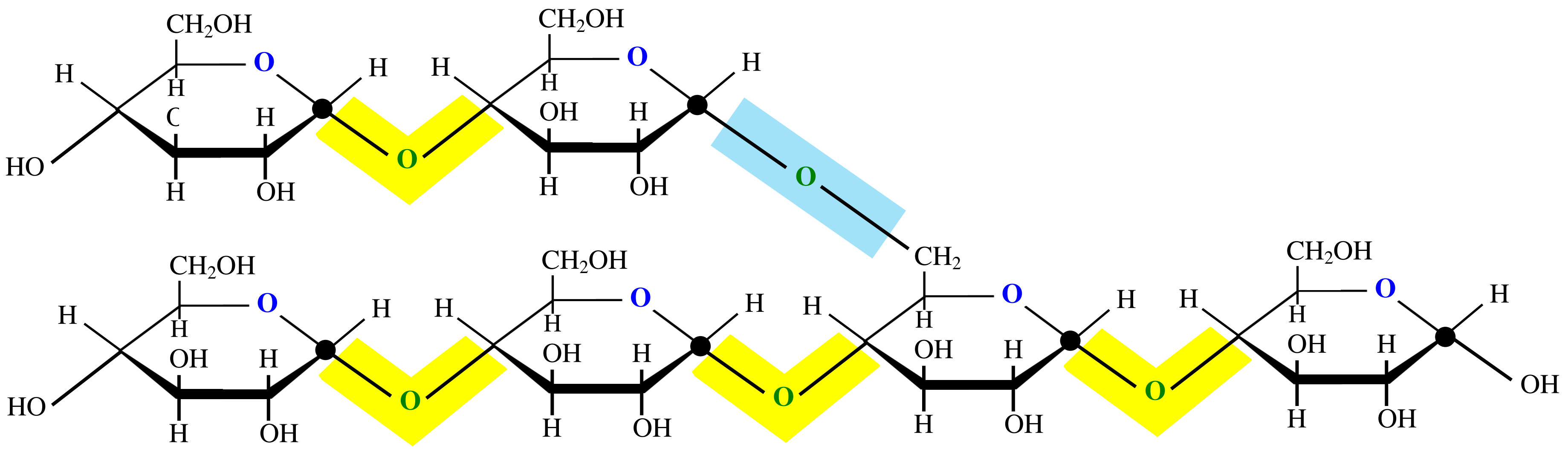
11.27)

i) The glycosidic bond that is highlighted yellow is a(n) ________________.

a) **β**-(1⟶ 4) glycosidic bond
b) **β**-(1⟶ 6) glycosidic bond
c) **α**-(1⟶ 4) glycosidic bond
d) **α**-(1⟶ 6) glycosidic bond

ii) The glycosidic bond that is highlighted blue is a(n) ________________.

a) **β**-(1⟶ 4) glycosidic bond
b) **β**-(1⟶ 6) glycosidic bond
c) **α**-(1⟶ 4) glycosidic bond
d) **α**-(1⟶ 6) glycosidic bond



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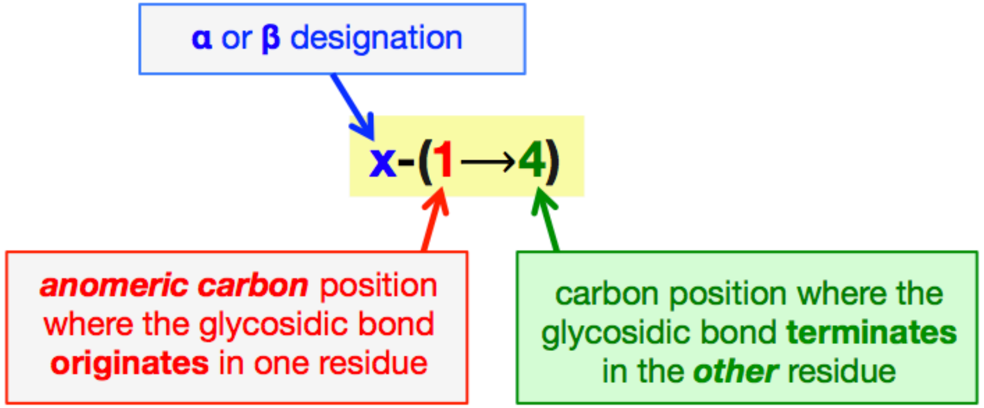
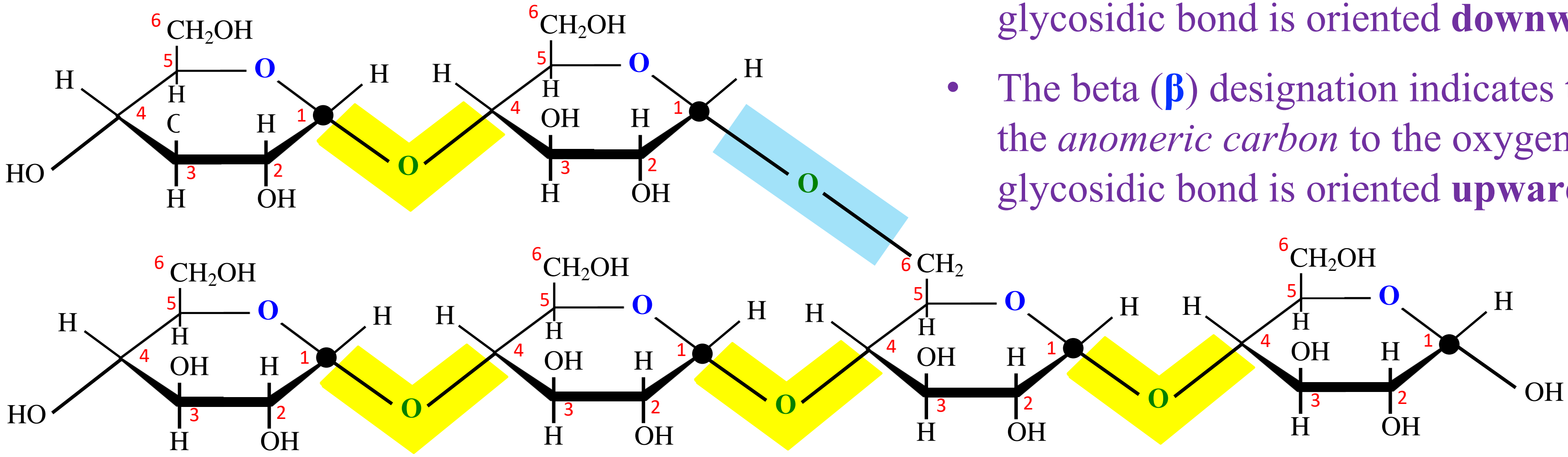
b) **β**-(1⟶ 6) glycosidic bond
c) **α**-(1⟶ 4) glycosidic bond
d) **α**-(1⟶ 6) glycosidic bond

HINT:

The carbon atoms are now numbered (red font) for you.



- The alpha (**α**) designation indicates that the bond from the *anomeric carbon* to the oxygen (**O**) in the glycosidic bond is oriented **downward** from the ring.
- The beta (**β**) designation indicates that the bond from the *anomeric carbon* to the oxygen (**O**) in the glycosidic bond is oriented **upward** from the ring.



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- The alpha (**α**) designation indicates that the bond from the *anomeric carbon* to the oxygen (**O**) in the glycosidic bond is oriented **downward** from the ring.
- The **(1⟶ 4)** designation indicates that the glycosidic bond originates at carbon **1** (an anomeric carbon) and terminates at carbon **4**.

ii) The glycosidic bond that is highlighted blue is a(n) ________________.

a) **β**-(1⟶ 4) glycosidic bond
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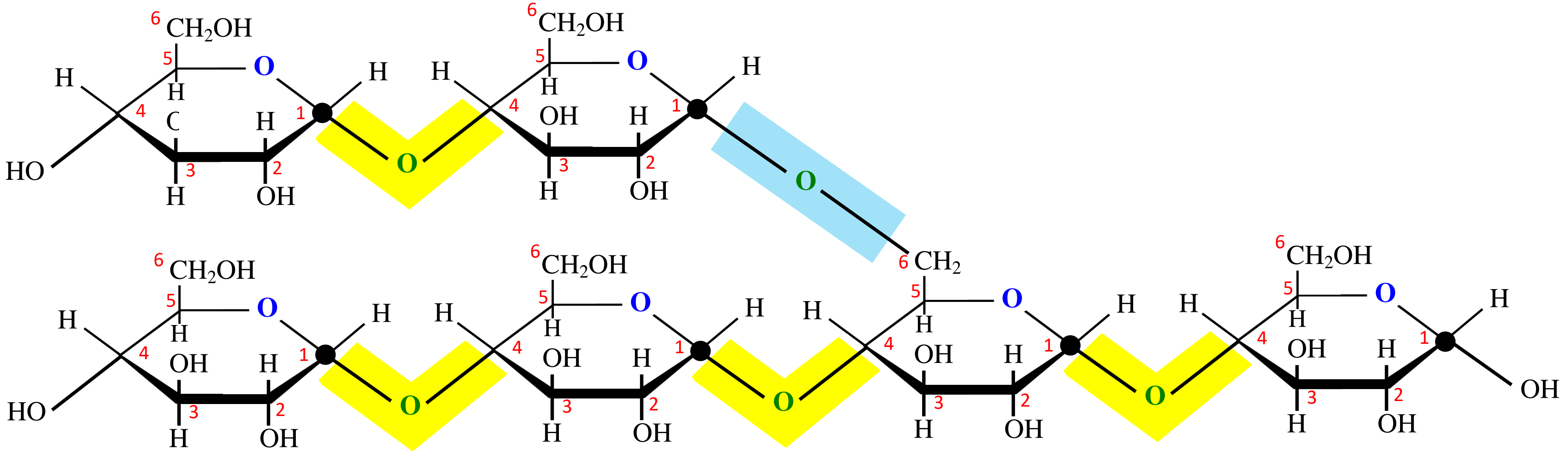
- The **(1⟶ 6)** designation indicates that the glycosidic bond originates at carbon **1** (an anomeric carbon) and terminates at carbon **6**.



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For more details: See chapter 11 part 5 video or chapter 11 section 5 in the textbook.

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11.28) A sweetener is a compound that is added to food in order to impart the sweet taste of sucrose, but with significantly fewer calories. Sweeteners can be classified as "*artificial sweeteners*" or "*natural sweeteners*."

Using one or two *complete sentences*, explain the difference between "*artificial sweeteners*" or "*natural sweeteners*."

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Go to next question

11.28) A sweetener is a compound that is added to food in order to impart the sweet taste of sucrose, but with significantly fewer calories. Sweeteners can be classified as "*artificial sweeteners*" or "*natural sweeteners*."

Using one or two *complete sentences*, explain the difference between "*artificial sweeteners*" or "*natural sweeteners*."

HINT:

Natural sweeteners are carbohydrates, _____________ occurring carbohydrate derivatives, or other _____________ occurring non carbohydrate compounds.

Artificial sweeteners do not occur in _____________; they are synthesized in _____________ _______________.

For more help: See chapter 11 part 6 video or chapter 11 section 5 in the textbook.

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Go to next question

11.28) A sweetener is a compound that is added to food in order to impart the sweet taste of sucrose, but with significantly fewer calories. Sweeteners can be classified as "*artificial sweeteners*" or "*natural sweeteners*."

Using one or two *complete sentences*, explain the difference between "*artificial sweeteners*" or "*natural sweeteners*."

ANSWER (should be something like this):

Natural sweeteners are carbohydrates, naturally occurring carbohydrate derivatives, or other naturally occurring non carbohydrate compounds. ***Artificial sweeteners*** do not occur in nature; they are synthesized in commercial laboratories.

For more details: See chapter 11 part 6 video or chapter 11 section 5 in the textbook.

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Go to next question

11.29)

i) Polysaccharides are composed of ***more than*** ______ residues.

a) one
b) two
c) ten
d) nineteen

ii) Homopolysaccharides are composed of ____________________ residue(s).

a) only glucose and fructose
b) natural sweetener
c) only one type of
d) more than one type of

iii) Heteropolysaccharides are composed of _____________________ residue(s).

a) only glucose
b) artificial sweetener
c) only one type of
d) more than one type of

11.29)

i) Polysaccharides are composed of ***more than*** ______ residues.

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d) more than one type of

iii) Heteropolysaccharides are composed of _____________________ residue(s).

HINT: a) only glucose
~~b) artificial sweetener~~
c) only one type of
d) more than one type of

For more help: See chapter 11 part 7 video or chapter 11 section 6 in the textbook.

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For more details: See chapter 11 part 7 video or chapter 11 section 6 in the textbook.

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Go to next question

11.30) Identify the following as properties of **amylose**, **amylopectin**, ***both* amylose** and **amylopectin**, or ***neither* amylose** nor **amylopectin**.

a) contains **α-(1→6)** glycosidic bonds

b) heteropolysaccharide

c) contains glucose residues only

d) contains **α-(1→4)** glycosidic bonds

e) contains *only* **α-(1→4)** glycosidic bonds

f) does not contain branching points

g) contains **β-(1→6)** glycosidic bonds

h) more quickly digested (amylose or amylopectin?)

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Click here for a **hint**

Click here to **check your answer**

Go to next question

11.30) Identify the following as properties of **amylose**, **amylopectin**, ***both*** **amylose** and **amylopectin**, or ***neither*** **amylose** nor **amylopectin**.

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d) contains **α-(1→4)** glycosidic bonds

e) contains *only* **α-(1→4)** glycosidic bonds

f) does not contain branching points

g) contains **β-(1→6)** glycosidic bonds

HINT:
Find and then consider the ***structures*** of **amylose** and **amylopectin** in your lecture notes or in the textbook.

h) more quickly digested (amylose or amylopectin?)
Molecules that have a larger number of endpoints are more quickly digested because the digestive enzymes attach to starch molecules at the *endpoints*. Based on their structures, would you expect amylose or amylopectin to have more *endpoints*?

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For more help: See chapter 11 part 7 video or chapter 11 section 6 in the textbook.

Click here to **check your answer**

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11.30) Identify the following as properties of **amylose**, **amylopectin**, ***both* amylose and amylopectin**, or ***neither* amylose nor amylopectin**.

a) contains **α-(1→6)** glycosidic bonds **amylopectin**

b) heteropolysaccharide ***neither* amylose nor amylopectin**

c) contains glucose residues only ***both* amylose and amylopectin**

d) contains **α-(1→4)** glycosidic bonds ***both* amylose and amylopectin**

e) contains *only* **α-(1→4)** glycosidic bonds **amylose**

f) does not contain branching points **amylose**

g) contains **β-(1→6)** glycosidic bonds ***neither* amylose nor amylopectin**

EXPLANATION:
Consider the structures of amylose and amylopectin.

h) more quickly digested (amylose or amylopectin?) **amylopectin**
Because of branching, amylopectin molecules have a large number of endpoints. Since the amylase digestive enzymes attach to starch molecules at the endpoints, amylopectin can be digested more quickly than amylose.

For more details: See chapter 11 part 7 video or chapter 11 section 6 in the textbook.

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11.31) Identify the following as properties of either **amylose**, **cellulose**, ***both* amylose and cellulose**, or ***neither* amylose nor cellulose**.

a) contains **α-(1→6)** glycosidic bonds

b) contains **β-(1→6)** glycosidic bonds

c) contains **β-(1→4)** glycosidic bonds

d) contains glucose residues only

e) homopolysaccharide

f) heteropolysaccharide

g) has a helical structure

h) found in plants

i) can be digested by humans

j) long and straight molecules that lie next to each other in a side-by-side fashion

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11.31) Identify the following as properties of either **amylose**, **cellulose**, ***both*** **amylose** and **cellulose**, or ***neither*** **amylose** nor **cellulose**.

a) contains **α-(1→6)** glycosidic bonds

b) contains **β-(1→6)** glycosidic bonds

c) contains **β-(1→4)** glycosidic bonds

d) contains glucose residues only

e) homopolysaccharide

f) heteropolysaccharide

g) has a helical structure

HINT:
Consider the structures of amylose and cellulose.

h) found in plants

i) can be digested by humans

j) long and straight molecules that lie next to each other in a side-by-side fashion

Use your lecture notes or the textbook to review the information on amylose and cellulose.

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For more help: See chapter 11 part 7 video or chapter 11 section 6 in the textbook.

Click here to **check your answer**

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11.31) Identify the following as properties of either **amylose**, **cellulose**, ***both*** **amylose** and **cellulose**, or ***neither*** **amylose** nor **cellulose**.

a) contains **α-(1→6)** glycosidic bonds ***neither*** **amylose** nor **cellulose**

b) contains **β-(1→6)** glycosidic bonds ***neither*** **amylose** nor **cellulose**

c) contains **β-(1→4)** glycosidic bonds **cellulose**

d) contains glucose residues only ***both*** **amylose** and **cellulose**

e) homopolysaccharide ***both*** **amylose** and **cellulose**

f) heteropolysaccharide ***neither*** **amylose** nor **cellulose**

g) has a helical structure **amylose**

EXPLANATION: Consider the structures of amylose and cellulose.

h) found in plants ***both*** **amylose** and **cellulose**

i) can be digested by humans **amylose**

j) long and straight molecules that lie next to each other in a side-by-side fashion **cellulose**

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For more details: See chapter 11 part 7 video or chapter 11 section 6 in the textbook.

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11.32) Identify the following as properties of either **glycogen**, **amylopectin**, ***both* glycogen** and **amylopectin**, or ***neither* glycogen** nor **amylopectin**.

a) contains **α-(1→6)** glycosidic bonds

b) contains **β-(1→6)** glycosidic bonds

c) contains **β-(1→4)** glycosidic bonds

d) contains glucose and fructose residues only

e) homopolysaccharide

f) heteropolysaccharide

g) branching occurs less frequently (glycogen ***or*** amylopectin)

h) contains helical structures

i) found in plants

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Click here for a **hint**

Click here to **check your answer**

This is the last problem.

11.32) Identify the following as properties of either **glycogen**, **amylopectin**, ***both*** **glycogen** and **amylopectin**, or ***neither*** **glycogen** nor **amylopectin**.

a) contains **α-(1→6)** glycosidic bonds

b) contains **β-(1→6)** glycosidic bonds

c) contains **β-(1→4)** glycosidic bonds

d) contains glucose and fructose residues only

e) homopolysaccharide

f) heteropolysaccharide

g) branching occurs less frequently (glycogen ***or*** amylopectin)

h) contains helical structures

HINT: Consider the structures of glycogen and amylopectin.

i) found in plants **HINT**: Review how plants and animals store excess glucose.

For more help: See chapter 11 part 7 video or chapter 11 section 6 in the textbook.

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Click here to **check** your answer

This is the last problem.

11.32) Identify the following as properties of either **glycogen**, **amylopectin**, ***both* glycogen and amylopectin**, or ***neither* glycogen nor amylopectin**.

a) contains **α-(1→6)** glycosidic bonds ***both* glycogen and amylopectin**

b) contains **β-(1→6)** glycosidic bonds ***neither* glycogen nor amylopectin**

c) contains **β-(1→4)** glycosidic bonds ***neither* glycogen nor amylopectin**

d) contains glucose and fructose residues only ***neither* glycogen nor amylopectin**

e) homopolysaccharide ***both* glycogen and amylopectin**

f) heteropolysaccharide ***neither* glycogen nor amylopectin**

g) branching occurs less frequently (glycogen ***or*** amylopectin) **amylopectin**

h) contains helical structures ***both* glycogen and amylopectin**

EXPLANATION: Consider the structures of glycogen and amylopectin.

i) found in plants **amylopectin** Plants store excess glucose as **starch *(amylose* *and* *amylopectin)***; animals and fungi store excess glucose as **glycogen**.

For more details: See chapter 11 part 7 video or chapter 11 section 6 in the textbook.

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This is the last problem.