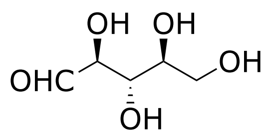
Review Activity: Fischer Projections

You should be able to quickly complete the following questions before starting the Fischer Projections activity. Ask your instructor if you need help.

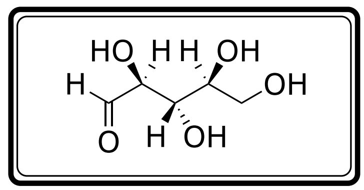
1) Identify one of the functional groups present in the structure shown.

A. Aldehyde
B. Carboxylic Acid
C. Ester
D. Ether
E. Ketone



2) Identify the biomolecule shown below.

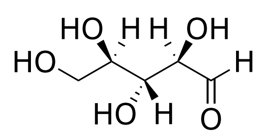
A. Carbohydrate (monosaccharide)
B. Carbohydrate (disaccharide)
C. Amino Acid
D. Nucleotide of DNA
E. Nucleotide of RNA



3) What is the relationship of L-ribose (shown in question 2) to the structure shown below?

You may find it helpful to use the "Molecules" function of the ARCar app to pull up the 3D structure of L-ribose.

A. They are constitutional isomers
B. They are enantiomers
C. They are diastereomers
D. They are the same molecule (meso)
E. They are the same molecule (not meso)



4) What is the relationship of L-ribose (shown in question 2) to the structure shown below?

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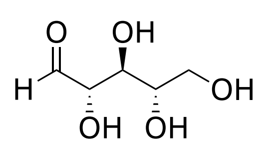
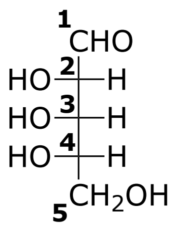


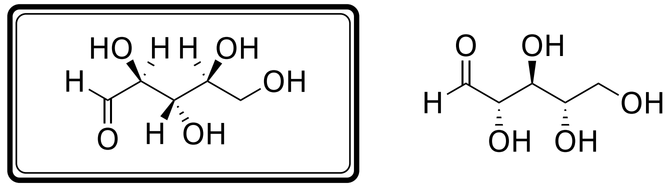
Activity: Fischer Projections Part A

Learning Objective: Convert Fischer projections to zigzag (hashed/wedged) conformations and vice-versa.

Model 1: Zigzag conformations and Fischer projections of L-ribose



Fischer projection



Zigzag conformations

1) Carbohydrates can be used as an energy source for the body, providing the "fuel" needed for many metabolic pathways. They are often represented using Fischer projections, which convey stereochemistry without wedges and dashes. In a Fischer projection, horizontal lines point towards you and vertical lines point away from you.

On the right, redraw the Fisher projection in the model using hashed and wedged lines.

2) Draw in the hydrogens on the zigzag structure on the right, then number the carbons on both zigzag conformations so they correspond with the Fischer projection (i.e., the aldehyde carbon is carbon #1).

3) Use the "Molecules" function of the ARCar app to pull up the 3D structure of L-ribose. This image is most similar to the zigzag conformations. On the zigzag conformations:

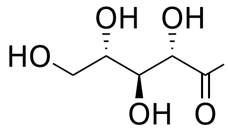
a) Circle the groups that stick out at you when view the molecule from the bottom.

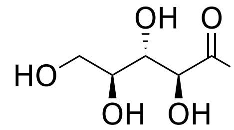
b) Box the groups that stick out at you when you view the molecule from the top.

c) Explain to your teammates how you rotate the 3D structure in the app to correspond to the Fisher projection.

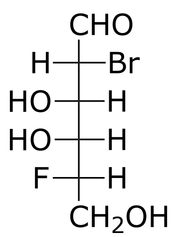
4) Develop a rule (or set of rules) for converting a Fischer projection to a zigzag conformation.

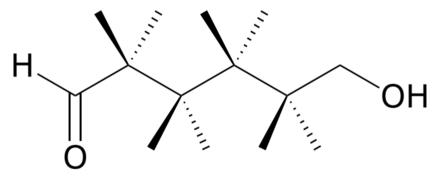
5) The two zigzag conformations drawn below are also the same as the Fischer projection in Model 1. Using these images, revise your rule(s) in question #4 as needed.

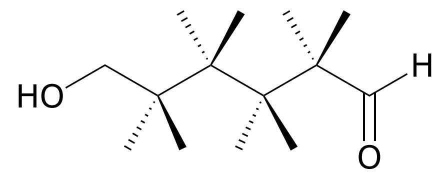


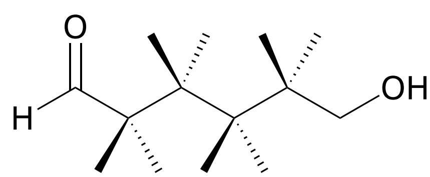


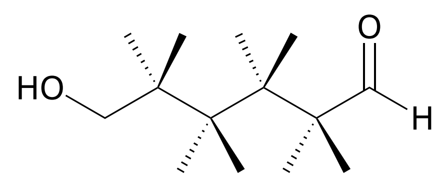
6) Convert the Fischer projection shown below to the zigzag conformations. Revise your rules in question #4 if needed.







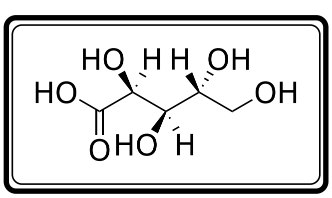


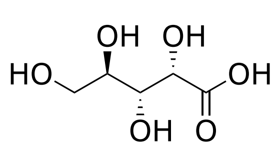


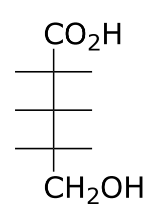
7) Develop a rule (or set of rules) for converting a zigzag structure to a Fischer projection.

8) Convert the zigzag conformations of D-arabinoic shown below to a Fischer projection. Revise your rules in question #7 if needed.

You may find it helpful to use the "Molecules" function of the ARCar app to pull up the 3D structure of D-arabinoic acid.





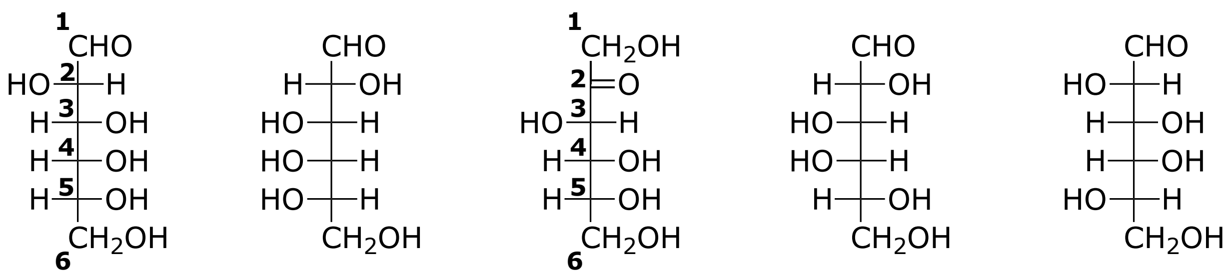


Activity: Fischer Projections Part B

Learning Objective 1: Classify acyclic monosaccharides using the D/L system.

Learning Objective 2: Identify if a pair of molecules drawn in Fischer projections are constitutional isomers, conformers, enantiomers, or diastereomers.

Model 2: Fischer projections of various carbohydrates



D-Altrose **L-Altrose** **D-Fructose** **D-Galactose** **L-Galactose**

9) Using D-altrose and D-fructose as examples, add numbers to each carbohydrate so the carbonyl carbon has the lowest number.

10) Complete the following table. First, compare the molecules indicated and determine at which carbons they differ. Then, identify their relationship.

Molecules to compare	At which carbon(s) do they differ?	What is their relationship?
D-altrose and L-altrose		
D-altrose and D-fructose		
D-altrose and D-galactose		
L-altrose and D-galactose		
L-altrose and L-galactose		

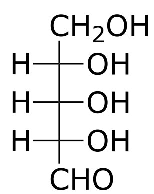
11) Based on your answers, develop a rule (or set of rules) for determining if an acyclic monosaccharide is D or L.

12) Using the names only (i.e., without looking up the structures), identify the relationship between D-glucose and L-glucose.

13) Using the names only (i.e., without looking up the structures), identify one way that D-glucose and D-mannose are the same.

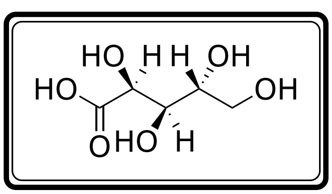
14) Consider the Fischer projection of L-ribose (shown below). Redraw L-ribose so it is consistent with your rules in question #11. Revise your rules if needed.

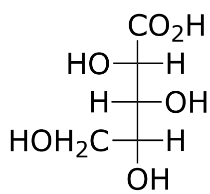
You may find it helpful to use the "Molecules" function of the ARCar app to pull up the 3D structure of L-ribose.

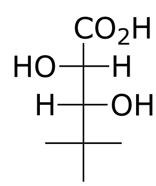


15) Consider the Fischer projection of D-arabinoic acid (shown below). Redraw D-arabinoic acid (shown below) so the CH_2OH group is on the bottom of the Fischer projection. Revise your rules in question #11 if needed.

You may find it helpful to use the "Molecules" function of the ARCar app to pull up the 3D structure of D-arabinoic acid.







16) Determine if the molecule below is D or L.