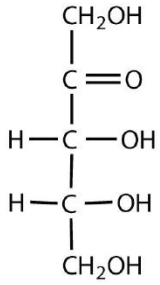
6.E: Carbohydrates (Exercises)

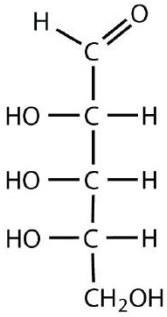
Additional Exercises

1. When an aqueous solution of an unknown carbohydrate was heated, four molecules of glucose were produced. What type of carbohydrate does this compound represent?
2. Classify the following based on the chemical composition (functional group and number of carbon) and then as a D sugar or an L sugar.

a.



b.

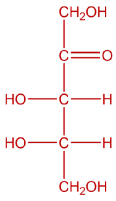


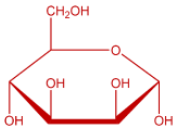
3. Use the structures shown above in problem 2 to answer the following problems:
   a. How many chiral centers are present in the molecule shown in 2a?
   b. What is the maximum number of stereoisomers possible for the molecule shown in 2a?
   c. Draw the enantiomer of the molecule shown in 2a. Is this a D-sugar or L-sugar?
4. What hexose would you expect to be most abundant in each food?
   a. honey
   b. milk
5. Given that the aldohexose D-mannose differs from D-glucose only in the configuration at the second carbon atom, draw the cyclic structure for α-D-mannose.
6. Indicate whether the following would yield a positive Benedict's test
   a. L-galactose
   b. levulose
   c. D-glucose
7. Cellobiose is a disaccharide composed of two glucose units joined by a β-1,4-glycosidic linkage.
   a. Draw the structures of α-cellobiose and β-cellobiose.
   b. Is cellobiose a reducing or nonreducing sugar? Justify your answer.

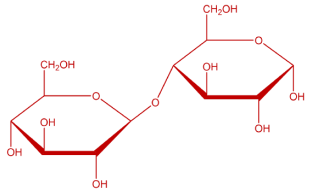
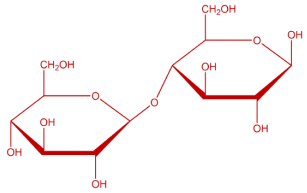
8. Describe the similarities and differences between amylose and cellulose.

Answers

1. Oligosaccharide because four monosaccharides are present.

3. a. 2 chiral centers (carbons 3 and 4)
   b. 8 possible stereoisomers. There are 3 chiral centers and using $2^n = 2^3 = 8$ possible arrangements that will result in molecules that have the same connectivity around the chiral centers, but with different arrangements.
   c.  , this is an L-sugar.

5. 

7. 
   a. α-cellobiose
   
   β-cellobiose
   b. Cellobiose is a reducing sugar because it has a free anomeric carbon on the second glucose molecule.
