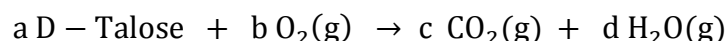


Chemistry 4055 (Spring 2013)
Biochemistry I- Introduction to the Chemistry of the Animal Cell
Chapter 7 HW Assignment

For problems 1 and 2, a quick General Chemistry refresher will help.

1. Simple carbohydrates, whether aldoses or ketoses, have the empirical formula CH_2O and the molecular formula $(\text{CH}_2\text{O})_n$ where n is the number of repeat formula units. You are given the elemental analysis results for the %C, %H, and %O by mass of two compounds. Compound A has a molecular weight of 90.08 g/mol and contains 40.00 %C, 6.71 %H, and 53.29 %O by mass. Compound B has a molecular weight of 152.15 g/mol and contains 39.47 %C, 7.95 %H, and 52.58 %O by mass. What are the molecular formulas for Compound A and Compound B? Are these compounds carbohydrates based on elemental analysis?

2. A combustion reaction can be performed to determine the elemental analysis for the %C, %H, and %O by mass of a simple carbohydrate. In this reaction a carbohydrate is reacted with $\text{O}_2(\text{g})$ and yields $\text{CO}_2(\text{g})$ and $\text{H}_2\text{O}(\text{g})$. Write a balanced equation for the combustion of D-Talose using the following:



where a , b , c , and d are coefficients for the balanced equation.

Given 5.00 grams of D-Talose and 5.00 grams of O_2 , what mass of CO_2 is produced?

3. How many stereoisomers would a 7-carbon ketose have? Draw all of the linear form D-stereoisomers and highlight the chiral carbons in your structures.

4. D-monosaccharides rotate plane-polarized light to the right while L-monosaccharides rotate to the left but to the same extent. The optical activity of a stereoisomer is expressed quantitatively by its optical rotation, the number of degrees by which plane-polarized light is rotated on passage through a given path length of a solution of the compound at a given concentration. The specific rotation $[\alpha]_D^{25^\circ\text{C}}$ of an optically active compound at a set wavelength is defined:

$$[\alpha]_D^{25^\circ\text{C}} = \frac{\text{observed optical rotation } (^\circ)}{\text{optical path length (dm)} \times \text{concentration } \left(\frac{\text{g}}{\text{mL}}\right)}$$

A freshly prepared solution of α -D-glucose shows a specific rotation of $+114^\circ$. A freshly prepared solution of β -D-glucose shows a specific rotation of $+22^\circ$. Both solutions reach an equilibrium value of $[\alpha]_D^{25^\circ\text{C}} = +51^\circ$. Calculate the percentage of each of the two forms of D-glucose present at equilibrium.

5. The enzyme invertase transforms sucrose into an equimolar mixture of D-glucose (specific rotation $+51^\circ$) and D-fructose (specific rotation -95°). If invertase acts on a 0.15 g/mL solution of sucrose, what will be the observed optical rotation of the solution in a 1 dm cell?

6. Draw all epimers of D-Allose.
7. Illustrate the reaction that leads from D-Altrose to β -D-altropyranose.
8. Draw a chair conformation of D-galactose.
9. The glucose oxidase assay is used to quantify the amount of D-glucose present in a solution. The molar absorptivity of oxidized o-dianisidine is $\epsilon = 1.13 \times 10^4 \text{ M}^{-1}\text{cm}^{-1}$ at 460 nm. What is the concentration of D-glucose if the absorbance of oxidized o-dianisidine is 0.563?
10. Show the glycosidic bond that can form between α -D-glucopyranose and α -D-galactose in a condensation reaction leading to a nonreducing product when α -D-glucopyranose behaves as a hemiacetal and α -D-galactose behaves as an alcohol. Name the product that forms using the abbreviation system.
11. What are three main roles played by different polysaccharides? List representative polysaccharide examples that exhibit these roles.
12. How are storage polysaccharides structurally different from structural polysaccharide?
13. Describe the difference between how syndecan and glypican proteoglycans are anchored to the cell membrane?
14. How can lectin-carbohydrate interactions be detrimental to cell survival?