

Chem 352, Fundamentals of Biochemistry

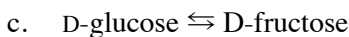
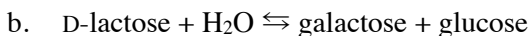
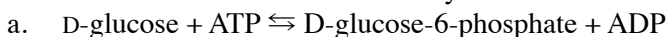
Lecture 5 – Supplemental Questions

1. Draw the Haworth projection for the glycoside D-galactopyranosyl- β (1 \rightarrow 4)-D-glucopyranose:

- a. What is the common name for this disaccharide? _____
- b. What glycosidic link is used to connect the two monosachharides? _____
- c. Is this disaccharide a *reducing sugar*? _____

2. Which compound is more soluble in water, 1-hexanol or D-glucose? Explain.

3. Write structures to show the chemistry of each of the following reactions:



4. For the reactions in question 3, what class of enzyme would catalyze each of these reactions?

5. What is the relationship between each pair of molecules:

- a. D-glyceraldehyde and dihydroxyacetone
- b. D-glucose and D-fructose
- c. D-glucose and D-mannose
- d. D-threose and D-erythrose
- e. D-2-glucosamine and D-2-galactosamine
- f. α -D-glucose and β -D-glucose
- g. D-glucose and L-glucose
- h. D-glucose and D-galactose

6. A solution of one enantiomer of a given monosaccharide rotates plane-polarized light to the left (counterclockwise) and is called the levorotatory isomer, designated (-); the other enantiomer rotates plane-polarized light to the same extent but to the right (clockwise) and is called the dextrorotatory isomer, designated (+). An equimolar mixture of the (+) and (-) forms does not rotate plane-polarized light.

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* $[\alpha]_{\lambda}^t$ of an optically active compound is defined as:

$$[\alpha]_{\lambda}^t = \frac{\text{observed optical rotation } ^{\circ}}{\text{optical path length (dm) x concentration (g/mL)}}$$

The temperature (t) and the wavelength of the light (λ) employed (usually, as here, the D line of sodium, 589 nm) must be specified.

A freshly prepared solution of α -D-glucose shows a specific rotation of $+112^{\circ}$. Over time, the rotation of the solution gradually decreases and reaches an equilibrium value corresponding to $[\alpha]_{\text{D}}^{25^{\circ}\text{C}} = +52.5^{\circ}$. In contrast, a freshly prepared solution of β -D-glucose has a specific rotation of $+19^{\circ}$. The rotation of this solution increases over time to the same equilibrium value as that shown by the α -anomer.

- Draw the Haworth structures for the α and β forms of D-glucose. What feature distinguishes the two forms?
 - Why does the specific rotation of the freshly prepared solution of the α form gradually decrease with time? Why do solutions of the α and β forms reach the same specific rotation at equilibrium?
 - Calculate the percent of each of the two forms of D-glucose present at equilibrium.
7. Draw the structural formula for α -D-glucosyl-(1 \rightarrow 6)-D-mannose and circle the part of this structure that makes the compound a reducing sugar.