Chem 352, Fundamentals of Biochemistry
Lecture 5 – Supplemental Questions

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1. Draw the Haworth projection for the glycoside D-galactopyranosyl-β(1→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:
   a. D-glucose + ATP ⇆ D-glucose-6-phosphate + ADP
   b. D-lactose + H_2O ⇆ galactose + glucose
   c. D-glucose ⇆ D-fructose
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 give in 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:

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

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

   a. Draw the Haworth structures for the α and β forms of D-glucose. What feature distinguishes the two forms?

   b. Why does the specific rotation of the freshly prepared solution of the αform gradually decrease with time? Why do solutions of the α and β forms reach the same specific rotation at equilibrium?

   c. 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→6)-D-mannose and circle the part of this structure that makes the compound a reducing sugar.