Lecture 8: Carbohydrates

Discussion Section Problems Solutions

1. \[
\begin{align*}
\text{D-Aldohexose} & \quad \text{L-Ketopentose} \\
\text{Hexose = six carbon backbone} & \\
\text{Aldo = aldehyde} & \quad \text{Keto = ketone} \\
\text{α} = \text{anomeric OH and CH}_2\text{OH groups are trans.} & \quad \text{L = This OH points to the left} \\
\text{D} = \text{OH at last stereocenter in acyclic} & \quad \text{when the carbonyl is at the top.} \\
\text{form points to the right. Gluco = glucose. Pyranose = carbohydrate in its six-} & \\
\text{membered ring form.} & \\
\end{align*}
\]

2. \(\alpha = \text{anomeric OH and CH}_2\text{OH groups are trans.} \quad \text{D} = \text{OH at last stereocenter in acyclic form points to the right. Gluco = glucose. Pyranose = carbohydrate in its six-membered ring form.}\)

\[
\begin{align*}
\text{Most stable} & \quad \text{Least stable} \\
\end{align*}
\]

3. \(\text{D-glucose and D-mannose differ only in the stereochemistry at one carbon (shown in bold). This stereochemical difference is manifested in the acyclic and pyranose forms. The stereochemical difference shifts the C2 hydroxyl group from an equatorial to axial position.}\)

\[
\begin{align*}
\text{D-glucose} & \quad \alpha-\text{D-glucopyranose} \\
\text{D-mannose} & \quad \alpha-\text{D-mannopyranose} \\
\end{align*}
\]

4. Check out the student-written tutorial "Converting Between Cyclic and Acyclic Monosaccharides". This is student tutorial #12 at the tutorials section of the course web site.
5. β-D-galactopyranose  β-D-galactopyranose trisaccharide

6. (a) 1,3’-β-D-allopyanosyl-α-D-glucopyranose.

(b) Digestion involves hydrolysis of the glycoside linkage between the monosaccharides. The given molecule is a β-disaccharide, which suggests it is not easily digested. An enzyme is required to achieve this task. (The hemiacetal group is not hydrolyzed during digestion so its stereochemistry is irrelevant to the question.)

(c) The two monosaccharides formed upon hydrolysis are D-allopyranose and D-glucopyranose. The wavy line OH (OH) indicates a mixture of isomers (in this case an α/β mixture).

7. Here is a catchy little haiku created by a Chem 14C student:

Both reach for the sky
Primary, anomeric
Beta, bad for food

There are of course many other possible solutions.