**Organic Chemistry 212**
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Notes: *Chapter Twelve - Carbohydrates*

**Carbohydrates [ hydrates of carbon: $C_n(H_2O)_m$ ]**

- most abundant organic compounds in the plant world
- storehouses of chemical energy
- supportive structures in plants
- essential components of nucleic acids

Write the formula for glucose and for sucrose in the form above:

There are exceptions to the formula given above – some carbohydrates have extra oxygen, some have less than the formula requires, some have nitrogen but the class of these compounds includes these molecules.

The simplest members of the carbohydrate family are the saccharides (sweet taste) – monosaccharides, oligosaccharides, polysaccharides depending on the number of simple sugars in the molecule.

Be familiar with the use of **Fischer projections.**

You should understand that D and L labeling of stereocenters do not correspond to R and S labeling. They represent a different system that is based on the behavior of glyceraldehyde in responding to polarized light.

Draw Fischer projection for D-Glucose. Draw a Fischer projection for D-Fructose.

What is an amino sugar? Draw D-Glucosamine.

Physical properties of monosaccharides:

1. colorless
2. crystalline solids
3. water soluable

Monosaccharides exist as five and six membered cyclic hemiacetals. What is a Haworth projection?

When a cyclic hemiacetal is formed – a new stereocenter is formed. Aldoses have an anomeric carbon on carbon-1 and ketoses have an anomeric carbon on carbon-2. An anomeric carbon is the carbon of the newly formed stereocenter.

Draw furan and pyran:

alpha and beta forms of a monosaccharide are formed when the hemiacetal ring closes in its two possible stereo configurations.

Draw the alpha and beta forms of D-glucopyranose using both Haworth and chair conformation drawings:

Draw the alpha and beta forms of D-fructofuranose:

What is mutarotation?

**Characteristic Reactions**

A glycoside is a cyclic acetal derived from a monosaccharide. You should be able to identify an anomeric carbon and a beta glycosidic bond.

alditols are formed from the reduction of the carbonyl group of a monasaccharide. Draw the structure of D-Sorbitol. Draw the structure of Xylitol. These two compounds are used to sweeten candy and gum.

Under what circumstances (conditions) is an aldonic acid formed?

What is the difference between an aldonic acid and a uronic acid?

Read the chemical connections article about blood types and answer the following questions:

1. What are the three most common monosaccharides that bind to the plasma cells of animals?

2. What is an antigen?

How many sugar units are contained in the following:

disaccharide

trisaccharide

oligosaccharide

polysaccharide

Write the structure of sucrose:

What are the three most important polysaccharides?

Why is it possible for termites to digest wood as food when we can't?

Describe the structure and function of:

Hyaluronic Acid

Heparin