Glucose is by far the most common carbohydrate and classified as a monosaccharide, an aldose, a hexose, and is a reducing sugar. It is also known as dextrose, because it is dextrorotatory (meaning that as an optical isomer is rotates plane polarized light to the right and also an origin for the D designation. Glucose is also called blood sugar as it circulates in the blood at a concentration of 65-110 mg/dL of blood.

### Introduction

Glucose is initially synthesized by chlorophyll in plants using carbon dioxide from the air and sunlight as an energy source. Glucose is further converted to starch for storage.

![D-Glucose](image)

Up until now we have been presenting the structure of glucose as a chain. In reality, an aqueous sugar solution contains only 0.02% of the glucose in the chain form, the majority of the structure is in the cyclic chair form. Since carbohydrates contain both alcohol and aldehyde or ketone functional groups, the straight-chain form is easily converted into the chair form - hemiacetal ring structure. Due to the tetrahedral geometry of carbons that ultimately make a 6 membered stable ring, the -OH on carbon #5 is converted into the ether linkage to close the ring with carbon #1. This makes a 6 member ring - five carbons and one oxygen.

**Steps in the ring closure (hemiacetal synthesis):**

1. The electrons on the alcohol oxygen are used to bond the carbon #1 to make an ether (red oxygen atom).
2. The hydrogen (green) is transferred to the carbonyl oxygen (green) to make a new alcohol group (green).
The chair structures are always written with the orientation depicted below to avoid confusion.

![Chair form of beta-Glucose](image)

**Figure \( \PageIndex{2} \):** Hemiacetal Functional Group. Carbon #1 is now called the anomeric carbon and is the center of a hemiacetal functional group. A carbon that has both an ether oxygen and an alcohol group is a hemiacetal.

**Compare Alpha and Beta Glucose in the Chair Structures**

The position of the -OH group on the anomeric carbon (#1) is an important distinction for carbohydrate chemistry. The Beta position is defined as the -OH being on the same side of the ring as the C #6. In the chair structure this results in a horizontal projection. The Alpha position is defined as the -OH being on the opposite side of the ring as the C #6. In the chair structure this results in a downward projection. The alpha and beta label is not applied to any other carbon - only the anomeric carbon, in this case #1.

![Beta-glucose](image) ![Alpha-glucose](image)

**Figure \( \PageIndex{3} \):** Compare Alpha and Beta Glucose in the Haworth Structures. The Beta position is defined as the -OH being on the same side of the ring as the C #6. In the Haworth structure this results in an upward projection. The Alpha position is defined as the -OH being on the opposite side of the ring as the C #6. In the Haworth structure this also results in a downward projection.
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