Conformation of the linked C-atoms of monosaccharides

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http://web.me.com/whitby/Octahedron/Welcome.html

Reference

1. Octahedron1stEd.pdf
2. COgroups.pdf
3. COassys.pdf

Introduction

This document shows that the monosaccharides are based on the conformation of their C-atom linkages. The structural basis of the triose is the C-atom triplet [See Figure 2]. The structural basis of the tetrose is the C-atom quadruplet [See Figure 3]. The quadruplet is formed by the addition of a C-atom to an end of a triplet. The structural basis of the pentose is the C-atom quintuplet which is formed by the addition of a C-atom to an end of a quadruplet [See Figure 4]. The structural basis of the hexose is the C-atom sextuplet which is formed by the addition of a C-atom to an end of a quintuplet [See Figures 6 and 8].

Figure 1 shows the eight distinct orientations of the C-atom for the given octahedral view. Only four of the orientations are used in the formation of the monosaccharide assemblies–B1, B2, B3, C1. Each has a different color which is used throughout the figures of this document.

Figure 2 shows the three possible triplets. The assemblies which appear in this document are based only on the two asymmetric triplets because each occurs in glyceraldehyde

Adding a C-atom to an end of a triplet produces four different quadruplets [See Figure 3]. Each of the added C-atoms has one of two possible orientations, there are two ends, thus, four quadruplets. Three of the quadruplets have two C-atoms with the same orientation. In the fourth quadruplet, each C-atom has an orientation which differs from that of each of the other C-atoms.

There are two ways to add a C-atom to the end of a quadruplet to produce a given quintuplet [See Figure 4]. This results in only four distinct quintuplets each of which is produced by the addition of a C-atom to each of two different quadruplets. The C-atoms of two of the quintuplets are in three different orientations–one has three C-atoms with a common orientation, the other has two sets of two C-atoms with a common orientation. The C-atoms of the other quintuplets are in four different orientations–each has two atoms with the same orientation.

Figure 5 shows how the addition of a C-atom to one of the quintuplets produces the glucose sextuplet which is cleavable into identical asymmetrical triplets [See Figure 6]. It shows another sextuplet which fits neither glucose nor fructose. It is cleavable into two symmetrical triplets.

The joins between the C-atoms of the glucose sextuplet are all of one kind. D-glucose has only left-hand joins and L-glucose has only right-hand joins. The cleavability of glucose into two identical asymmetric triplets calls into question the notion that it should be converted to fructose before being cleaved, because the symmetrical triplet would, then, have to be reconverted to its original asymmetrical form.

Figure 7 shows two sextuplets which have the fructose conformation consisting of one asymmetrical triplet and one symmetrical triplet. The sextuplets result from the addition of a C-atom to two different quintuplets but they are identical except for their orientations.

Figure 8 shows that glucose, the identical fructoses, and the di-symmetrical triplet have the same four C-atom group and that they differ by the orientations of the C-atoms at its termini.

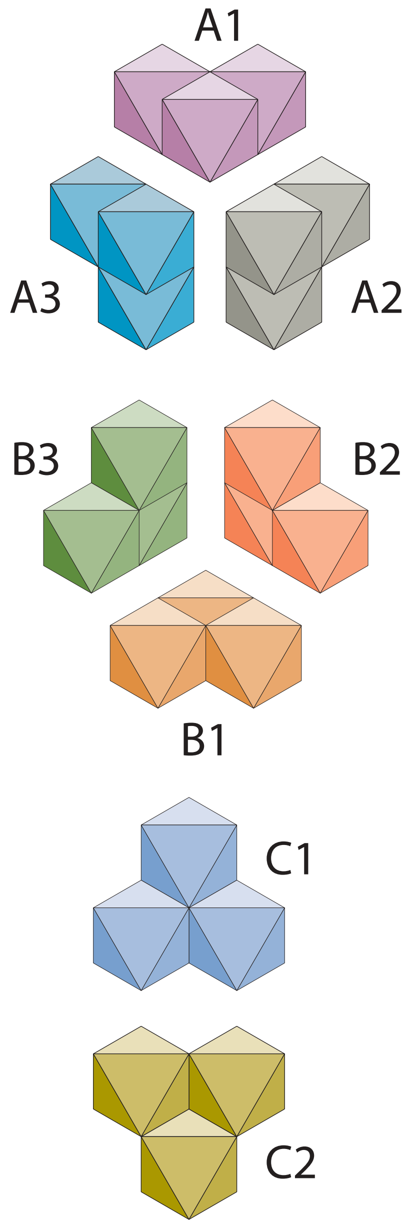


Fig. 1 C-atom orientation coding

The figure shows the orientations of the C-atoms in the octahedral facial view. Each orientation has a separate color. Each orientation has a two digit code. The letter designates the principal orientation–A for one-on-two, B for two-on-one, C for planar.

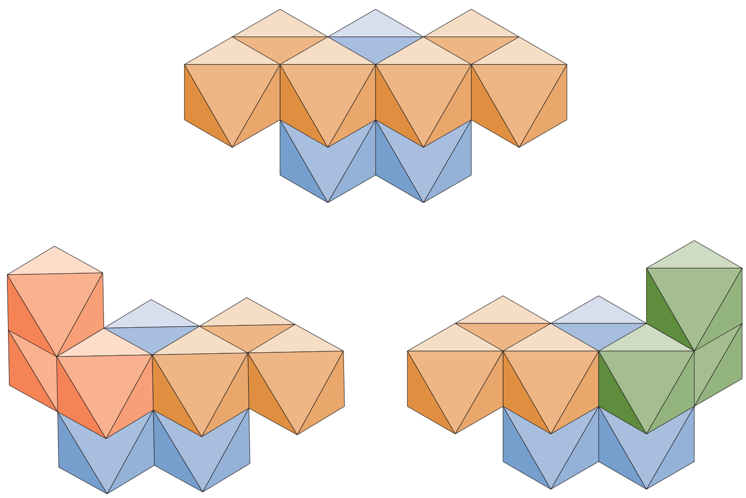


Fig. 2 C-atom triplets

The triplets shown here are the bases for the monosaccharides. In addition, glucose and fructose consist of pairings of these triplets. The top triplet is symmetrical; the bottom triplets are asymmetrical. The triplet on the right is the L-triplet. Each of the joins between its C-atoms is left-handed. The triplet on the left is the D-triplet. Each of the joins between its C-atoms is right-handed.

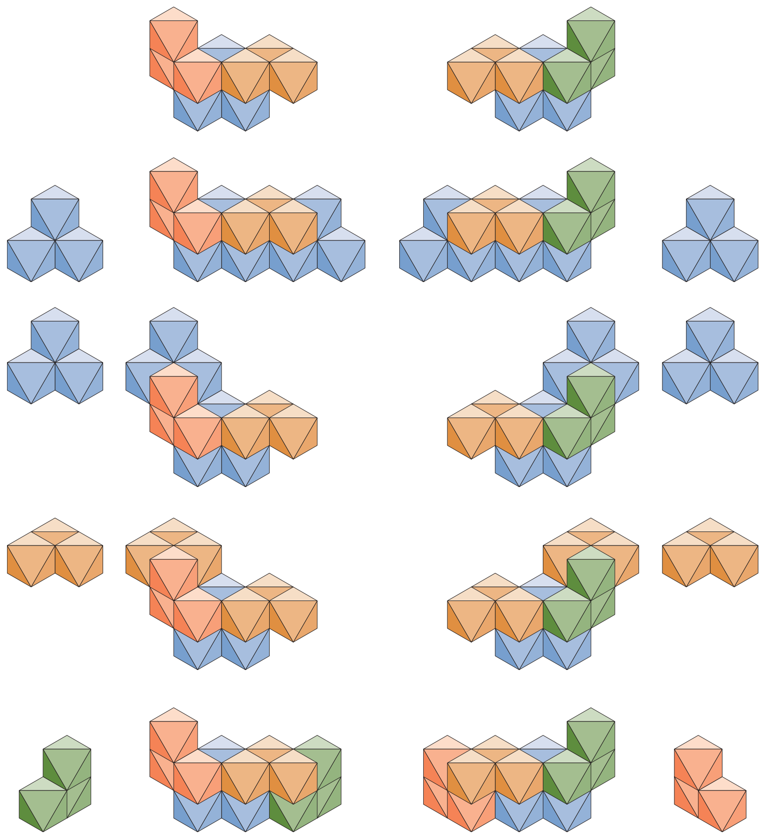
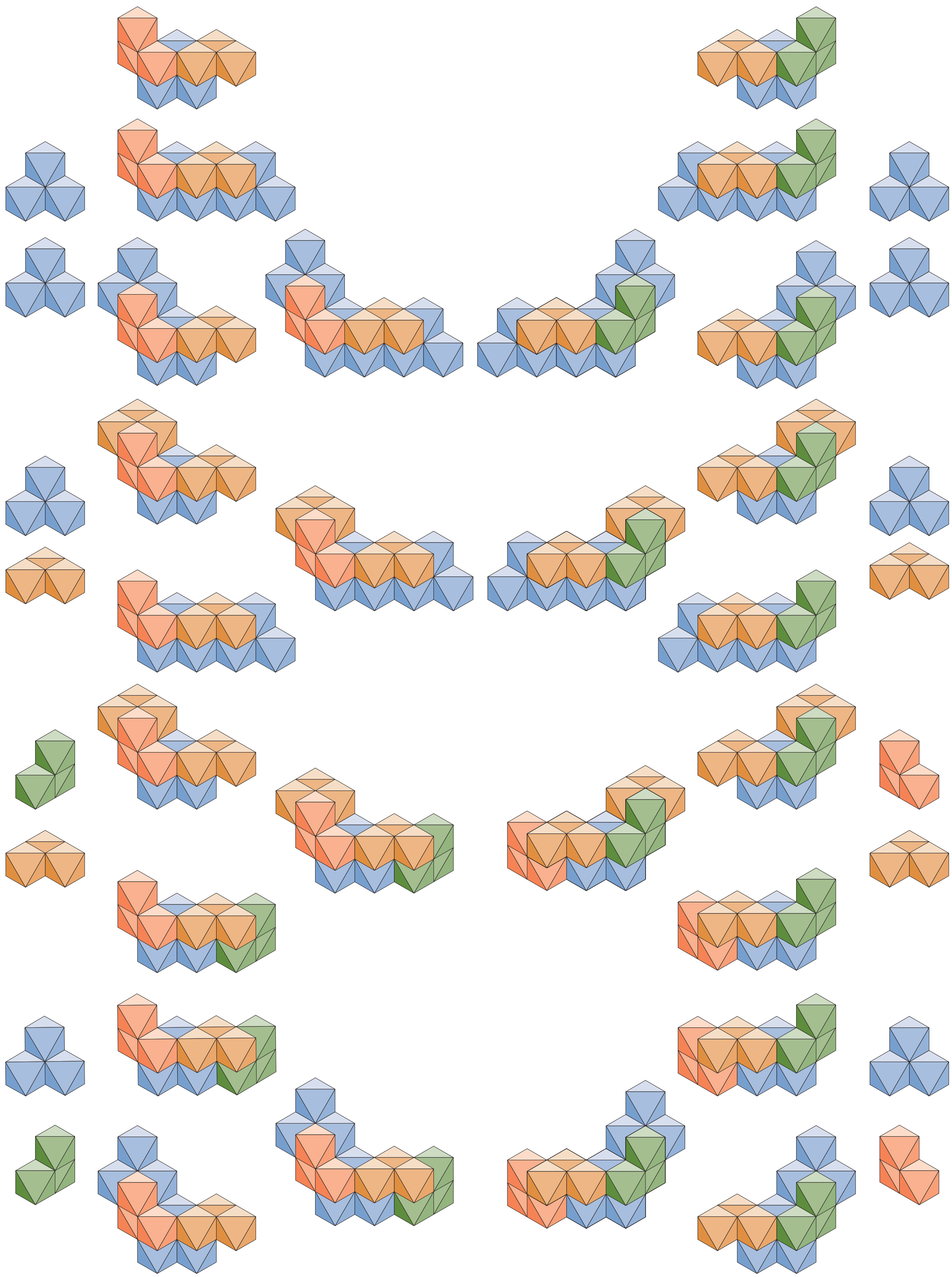


Fig. 3 C-atom quadruplets

The figure shows the C-atom quadruplets which result from adding a C-atom to either end of a C-atom triplet. The quadruplets derived from the D-triplet are on the left; the quadruplets derived from the L-triplet are on the right. Of the four quadruplets in each column, three have two C-atoms in the same orientation. Only the bottom one in each column consists of four C-atoms with different orientations.

Fig. 4 C-atom quintuplets

The figure shows the C-atom quintuplets which result from adding a C-atom to either end of a C-atom quadruplet. Each quintuplet can be produced from two different quadruplets. A triplet heads each column of quadruplets showing their derivation. D-triplet assemblies are on the left; L-triplet assemblies are on the right.



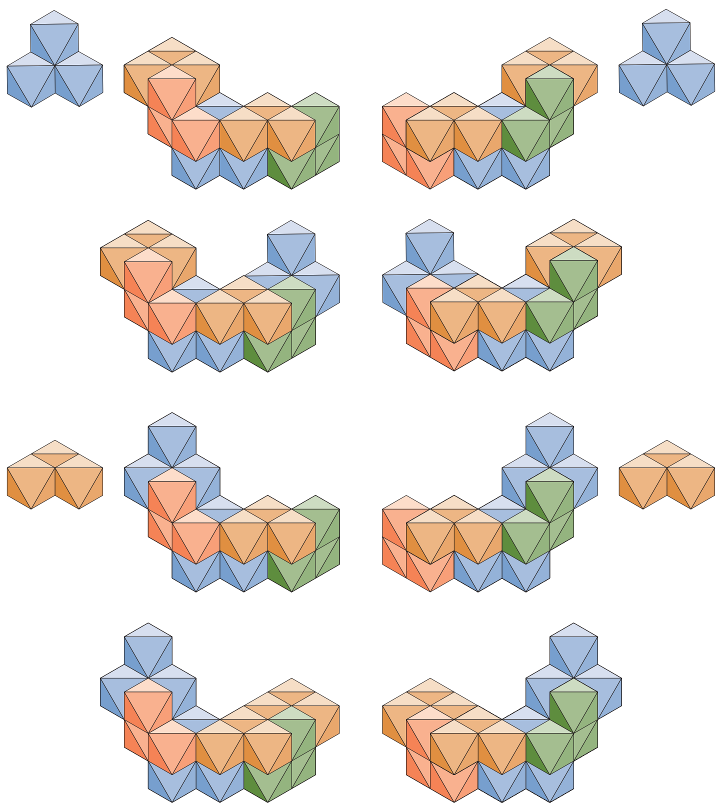


Fig. 5 C-atom sextuplets–glucose

At the top, the figure shows how the addition of a C-atom to a C-atom quintuplet results in a glucose assembly. An assembly consisting of two symmetrical triplets is formed in the same manner at the bottom of the figure. The L-hexoses are on the left and the D-hexoses are on the right.

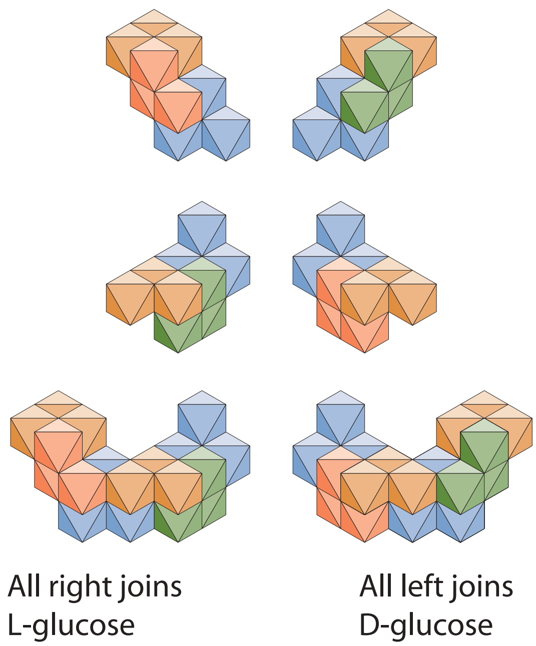


Fig. 6 The triplets of glucose

D-glucose consists of two L-triplets; L-glucose consists of two D-triplets. The triplets are shown above each glucose assembly.

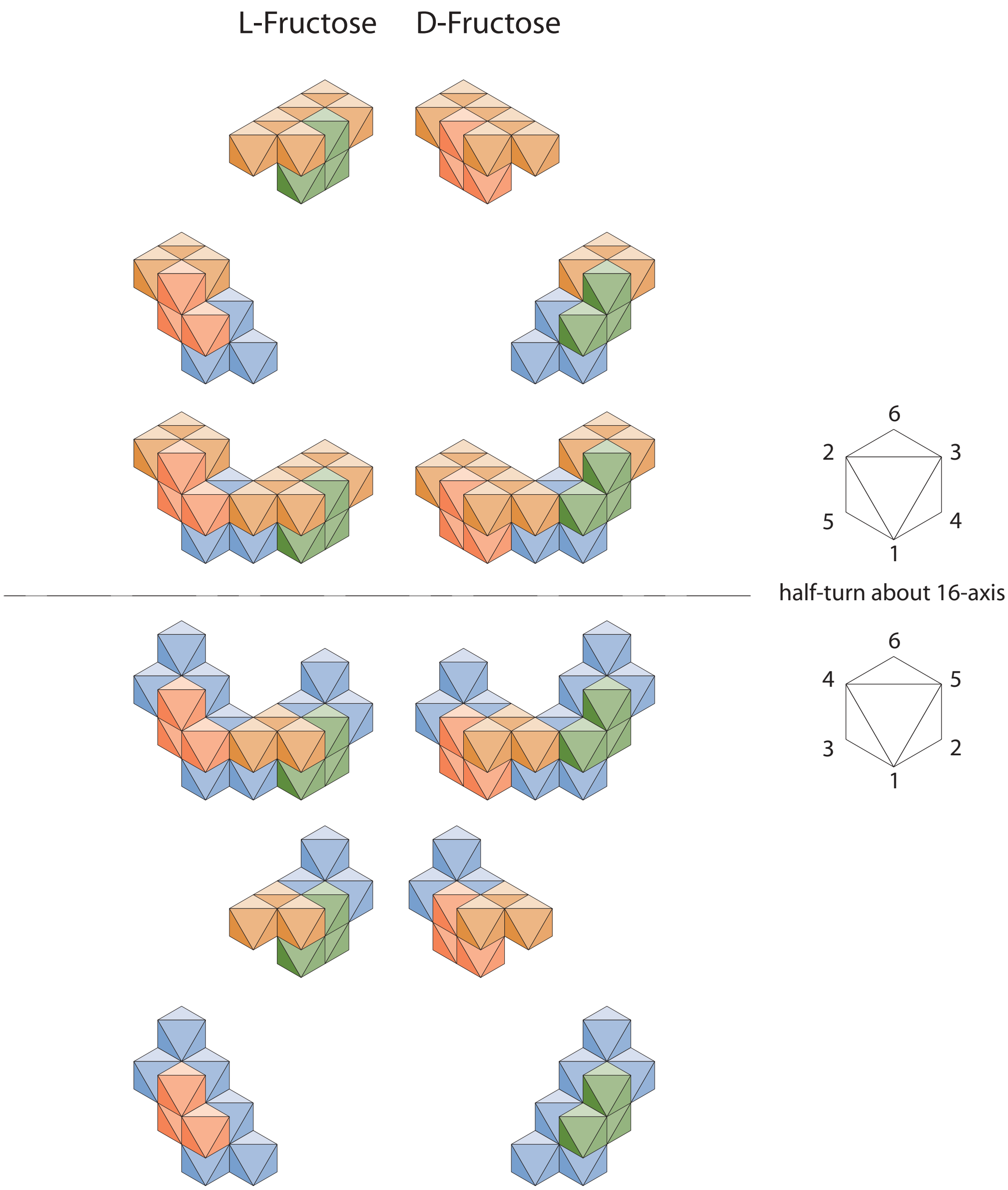


Fig. 7 C-atom sextuplets–fructose

Fructose consists of two triplets, one symmetrical and one asymmetrical. The triplets are shown for each of the four fructose assemblies in the middle of the figure. Although the two assemblies shown for D-fructose arise from the addition of a C-atom to different quadruplets, they are identical assemblies. They differ only by orientation. The same is true for the two L-fructose assemblies.

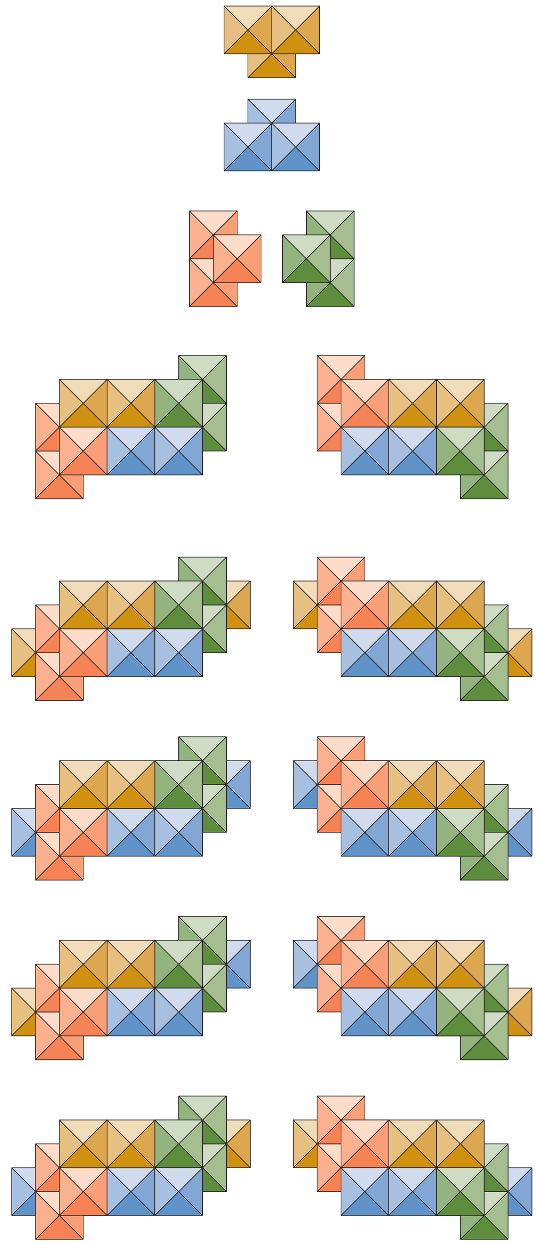


Fig. 8 Assembly of fructose and glucose–vertexial view

The four orientations of the C-atoms used in glucose and fructose are shown at the top of the figure. Each assembly of four C-atoms is common to the C-atom assemblies in its column.

Each of the six C-atom assemblies was formed by the addition of a C-atom having either the blue or the orange orientation to each end of the common four atom assembly. If the added atoms are of the same color, the resulting assembly is fructose. If a blue atom is added to the red atom and an orange atom to the green atom, the resulting assembly is glucose. If an orange atom is added to the red atom and a blue atom is added to the green atom, the resulting assembly consists of two symmetrical triplets.

Each four atom assembly can be rotated one-half turn about an axis normal to the graphics plane and have the same appearance. The blue atom and the orange atom differ by the same rotation. Because of this, the two fructose assemblies are identical except for a half turn rotation.