IUPAC Commission on the Nomenclature of Organic Chemistry (CNOC) and IUPAC-IUB Commission on Biochemical Nomenclature (CBN)

Tentative Rules for Carbohydrate Nomenclature

Part 1, 1969 *

CONTENTS

In 1964 the Commission on the Nomenclature of Organic Chemistry of the International Union of Pure and Applied Chemistry (IUPAC) formed a Special Committee on Carbohydrate Nomenclature[1] to consider the existing Anglo-American Rules of Carbohydrate Nomenclature and to prepare a set of IUPAC Rules for Carbohydrate Nomenclature. These Rules are now issued jointly by the IUPAC Commission on the Nomenclature of Organic Chemistry[2] and the IUPAC-IUB Commission on Biochemical Nomenclature[3].

PREAMBLE

SCOPE OF THE RULES

These Rules deal with the acyclic and cyclic forms of monosaccharides and their simple derivatives; oligosaccharides are also dealt with briefly.

Carbohydrate chemistry continues to provide a very fruitful field of research, such that it will be necessary, in the near future, to promulgate further Rules to cover the needs of developing areas, *e.g.* branched-chain and unsaturated monosaccharides, other carbohydrate acyclic and heterocyclic derivatives, conformational problems, polysaccharides.

USE OF THE RULES

These Rules are additional to the Definitive Rules for the Nomenclature of Organic Chemistry [1] and are intended to

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* These Rules have been approved by the IUPAC Commission on the Nomenclature of Organic Chemistry (CNOC) and by the IUPAC-IUB Commission on Biochemical Nomenclature (CBN) and are published by permission of IUPAC and IUB.

The Commissions will welcome comments and criticisms on and the notification of errors in this text of Tentative Rules for Carbohydrate Nomenclature; these should be sent to the chairman or secretary of either commission.

Commission on the Nomenclature of Organic Chemistry (Chairman: Prof. P. E. Verkade, Ary Schefferstraat 217, s'Gravenhage, The Netherlands; Secretary: Mr. S. P. Klesney, Central Report Index, 566 Building, Dow Chemical Co., Midland, Michigan 48640, U.S.A.), or to the:

Commission on Biochemical Nomenclature (Chairman: Prof. O. Hoffmann-Ostenhof, Lehrkanzel für Biochemie der Universität, Währingerstraße 38, A-1090 Wien, Austria; Secretary: Dr. W. E. Cohn, Biology Division, Oak Ridge National Laboratory, P.O. Box Y, Oak Ridge, Tennessee 37830, U.S.A.).

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[2] Composition: P. E. Verkade (chairman), L. C. Cross, G. M. Dyson, K. L. Loening, N. Lozac'h, J. Rigaudy, S. P. Klesney and S. Veibel. Associate members: R. S. Cahn and H. Grünewald. Observers: K. A. Jensen and W. Klyne.

[3] Present composition: O. Hoffmann-Ostenhof (chairman), A. E. Braunstein, W. E. Cohn (secretary), P. Karlson, B. Keil, W. Klyne, C. Liébecq, E. C. Slater, E. C. Webb and W. J. Whelan. Observers: R. Dybkaer, K. L. Loening and S. Veibel. J. S. Fruton was a member of the Commission during the preparation of this document.

govern those aspects of the nomenclature of carbohydrates not covered by those rules.

1. The Structure Named

These Rules are designed to name first a parent monosaccharide represented in the Fischer projection of the acyclic form and then its cyclic forms and derivatives.

The numbering system used in monosaccharides is based on the location of the (potential) carbonyl group. Modification of that group or introduction of further similar groups can therefore often destroy the uniqueness of the numbering system and permit a derivative to be named from more than one parent. In order to determine the unique systematic name of a derivative it is important to follow the procedure of establishing the Fischer projection of the appropriate parent monosaccharide, naming that according to the Rules, and thereafter deriving the name of any derivative.

2. Conventional Representations

a) *The Fischer Projection.* In this representation of a monosaccharide the carbon chain is written vertically with carbon atom number 1 at the top. The groups projecting to left and right of the carbon chain are considered as being in front of the plane of the paper. The optical antipode with the hydroxyl group at the highest-numbered asymmetric carbon atom on the right is then regarded as belonging to the D-series. It is now know that this convention represents the absolute configuration.

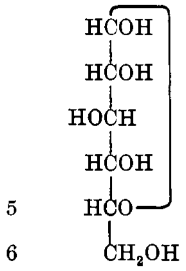
b) *The Haworth Representation.* The Haworth representation of the cyclic forms of monosaccharides can be derived from the Fischer projection, as follows. The monosaccharide is depicted with the carbon-chain horizontal and in the plane of the paper, the potential carbonyl group being to the right. The oxygen bridge is then depicted as being formed behing the plane of the paper.

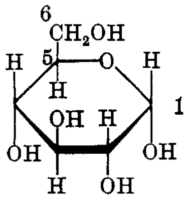
The heterocyclic ring is therefore located in a plane approximately perpendicular to the plane of the paper and the groups attached to the carbon atoms of that ring are above and below the ring. The carbon atoms of the ring are not shown.

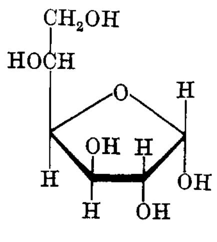
Groups that appear to the right of the vertical chain in the Fischer projection (A, D, below) then appear below the plane of the ring in the Haworth representation (B, C, E below). However, at the asymmetric carbon atom (C-5 in A; C-4 in D) involved via oxygen in ring formation with the carbon atom of the carbonyl group a formal double inversion must be envisaged to obtain the correct Haworth representation.

In the pyranose forms of D-aldohexoses C-6 will always be above the plane. In the furanose forms of D-aldohexoses the position of C-6 will depend on the configuration at C-4; it will, for example, be above the plane in D-glucofuranoses (*e.g.* C) but below the plane in D-galactofuranoses (*e.g.* E).

Examples:



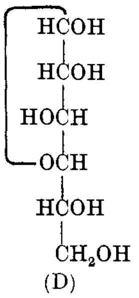


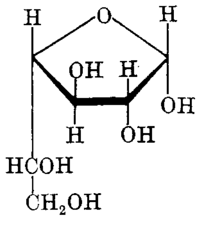


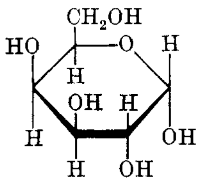
(A) (B) (C)

α-D-Glucopyranose (Fischer) (Haworth)

α-D-Glucofuranose (Haworth)







(D) (E) (F)

α-D-Galactofuranose (Fischer) (Haworth)

α-D-Galactopyranose (Haworth)

3. The Reference Carbon Atom and the Anomeric Prefix

a) *The Reference Carbon Atom.* This is defined as the highest-numbered asymmetric carbon atom in the monosaccharide chain.

b) *The Anomeric Prefix.* In a definitive name, the anomeric prefix (α or β) relates the configuration at the anomeric (or glycosidic) center to that of the reference carbon atom.

The anomer having the same orientation, in the Fischer projection, at the anomeric carbon atom and at the reference carbon atom is designated α; the anomer having opposite orientations, in the Fischer projection, is designated β.

The anomeric prefix (α or β) can only be used in conjunction with, and having the above-defined relation to, the configurational prefix (D or L) denoting the configuration at the reference carbon atom. Further, it may be used only when the locant of the anomeric center is smaller than that of the reference carbon atom.

4. Numbering of Monosaccharides

The basic principle for the numbering of monosaccharides gives the (potential) carbonyl group the lower of the possible numbers (*cf.* Rule Carb-4). This numbering system is usually retained even when a modification introduces a group which, on the basis of general organic chemical nomenclature, would have priority over the (potential) carbonyl group [*e.g.* in uronic acids the (potential) carbonyl group retains locant 1, despite the normal priority of the carboxyl group].

In ketoaldonic acids, the carboxyl group that replaces the original (formal) aldehyde group retains the locant 1.

5. New Asymmetric Centers

Not infrequently, derivatives of monosaccharides contain asymmetric carbon atoms not present in the parent monosaccharide. Examples include benzylidene derivatives, certain other acetals, ortho ester structures, etc. When the stereochemistry at such a carbon atom is known it will be indicated in the name by use of the appropriate Sequence Rule symbol, *R* or *S* [2].

BASIS OF NOMENCLATURE

Rule Carb-1

The basis for the naming and numbering of a monosaccharide or monosaccharide derivative is the structure of the parent monosaccharide ($C_nH_{2n}O_n$), represented in the Fischer projection of the acyclic form.

CHOICE OF PARENT STRUCTURE

Rule Carb-2

If, in naming a derivative, a choice of parent monosaccharide is possible, the selection of parent is made according to the following order of preference, treated in the order given until a decision is reached:

a) The monosaccharide, of which the first letter of the trivial name (Rule Carb-5), or of the configurational prefix, or of the first cited configurational prefix of a systematic name (Rule Carb-8), occurs earliest in the alphabet. If two possible parents have the same initial letter, then the choice will be made according to the letter at the first point of difference in the trivial name, the configurational prefix of the systematic name, etc. Examples: allose before glucose, glucose before gulose, *allo-* before *gluco-*, *gluco-* before *gulo-*.

b) The configurational symbol D- before L-.

c) The monosaccharide which gives the point(s) of modification of the >CH(OH) chain the lowest locant(s)[4].

d) The monosaccharide which gives the lowest locants[4] to the substituents, present in the derivative.

e) The monosaccharide which, when the substituents have been placed in alphabetical order, results in the first-cited substituent having the lowest locant[4].

TRIVIAL AND SYSTEMATIC NAMES

Rule Carb-3

In naming monosaccharides or monosaccharide derivatives, either trivial or systematic names can be used for the parent monosaccharide.

Trivial names are defined in Rule Carb-5.

Systematic names are formed by adding one or more configurational prefixes (Rule Carb-8) to the appropriate stem name (Rule Carb-6).

Rule Carb-4

The names 'aldose' and 'ketose' are used in a generic sense to denote monosaccharides in which the (potential) carbonyl group is terminal (aldehydic) or non-terminal (ketonic), respectively. In an aldose, the carbon atom of the (potential) carbonyl group is atom number one; in a ketose it has the lower number possible.

Rule Carb-5

The trivial names of the acyclic aldoses with three, four, five, or six carbon atoms are retained, and are used in preference to their systematic names for the aldoses and for the formation of names of their derivatives. The trivial names of these aldoses are:

Triose:	glyceraldehyde (glycerose is not recommended)
Tetroses:	erythrose, threose
Pentoses:	arabinose, lyxose, ribose, xylose
Hexoses:	allose, altrose, galactose, glucose, gulose, idose, mannose, talose.

Rule Carb-6

The 'stem names' of the acyclic aldoses having three, four, five, six, seven, eight, nine, ten etc., carbon atoms in the chain are triose, tetrose, pentose, hexose, heptose, octose, nonose, decose etc.

The 'stem names' of the acyclic ketoses having four, five, six, seven, eight, nine, ten, etc., carbon atoms in the chain are tetrulose, pentulose, hexulose, heptulose, octulose, nonulose, deculose, etc.

CONFIGURATIONAL SYMBOLS AND PREFIXES

Rule Carb-7

Configurational relationships are denoted by the symbols D and L which in print will be small capital roman letters and which are not abbreviations for 'dextro' and 'laevo'. Racemic forms may be indicated by DL. Such symbols are affixed by a hyphen immediately before the monosaccharide trivial name (Rule Carb-5) or before each configurational prefix (Rule Carb-8) of a systematic name, and are employed only with compounds that have been related definitely to the reference standard glyceraldehyde (see Rule Carb-8). The configurational symbol should not be omitted, if known.

If the sign of the optical rotation under specified conditions is to be indicated, this is done by adding (+) or (−). Racemic forms may be indicated by (±). With compounds optically compensated intramolecularly the prefix '*meso*' is used where appropriate.

Examples: D-Glucose or D(+)-glucose, D-fructose or D(−)-fructose, DL-glucose or (±)-glucose.

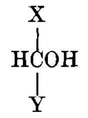
Rule Carb-8

The configuration of a >CHOH group or a set of two, three or four contiguous >CHOH groups (or wholly or partly derivative groups, such as >$CHOCH_3$, >$CHOCOCH_3$, or >$CHNH_2$) is designated by the appropriate one of the following configurational prefixes, which are (except for *glycero-*) derived from the trivial names of the aldoses mentioned in Rule Carb-5. When used in systematic names these prefixes are to be uncapitalized and are italicized in print. They are affixed by a hyphen to the stem name defined in Rule Carb-6. There may be more than one configurational prefix in a name.

Each prefix is D or L according to whether the configuration at the reference carbon atom in the Fischer projection is the same as, or the opposite of, that in D(+)-glyceraldehyde.

Only the Fischer projections of the D-prefixes are given below; X is the group with the lowest-numbered carbon atom(s).

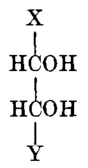
One >CHOH group:



$$\begin{array}{c} X \\ | \\ HCOH \\ | \\ Y \end{array}$$

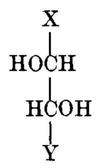
D-*glycero*-

Two >CHOH groups:



$$\begin{array}{c} X \\ | \\ HCOH \\ | \\ HCOH \\ | \\ Y \end{array}$$

D-*erythro*-



$$\begin{array}{c} X \\ | \\ HOCH \\ | \\ HCOH \\ | \\ Y \end{array}$$

D-*threo*-

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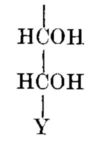
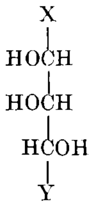
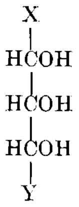
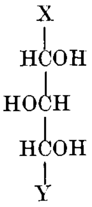
[4] Lowest locants are defined as follows: when a series of locants containing the same number of terms are compared term by term that series is 'lowest' which contains the lowest number on the occasion of the first difference (see IUPAC Nomenclature of Organic Chemistry, Section C, 1965, p. 23, footnote).

Three $>$CHOH groups:

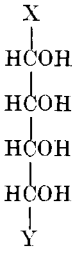

D-*arabino*-

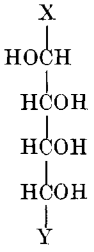

D-*lyxo*-

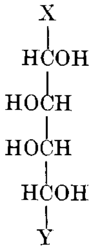

D-*ribo*-

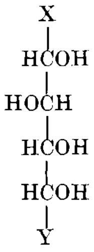

D-*xylo*-

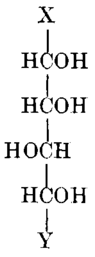
Four $>$CHOH groups:

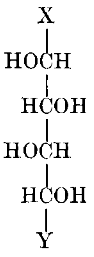

D-*allo*-

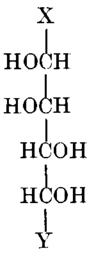

D-*altro*-

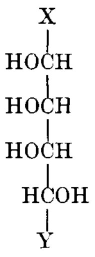

D-*galacto*-


D-*gluco*-


D-*gulo*-


D-*ido*-


D-*manno*-


D-*talo*-

The systematic name for a monosaccharide is then formed by using the configurational symbols and prefixes with the appropriate stem name (Rule Carb-6).

For sets of more than four contiguous $>$CHOH groups see Rule Carb-9.

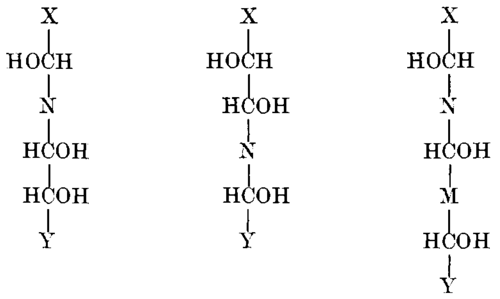
The trivial names, which are preferred, of the acyclic aldoses with four to six carbon atoms (Rule Carb-5) thus correspond to the following systematic names.

Trivial	Systematic
D-Erythrose	D-*erythro*-tetrose
D-Threose	D-*threo*-tetrose
D-Arabinose	D-*arabino*-pentose
D-Lyxose	D-*lyxo*-pentose
D-Ribose	D-*ribo*-pentose
D-Xylose	D-*xylo*-pentose
D-Allose	D-*allo*-hexose
D-Altrose	D-*altro*-hexose
D-Galactose	D-*galacto*-hexose
D-Glucose	D-*gluco*-hexose
D-Gulose	D-*gulo*-hexose
D-Idose	D-*ido*-hexose
D-Mannose	D-*manno*-hexose
D-Talose	D-*talo*-hexose

Note: Anglo-American Usage

Since 1952, usage in the United States and the United Kingdom has been based on a different significance for configurational prefixes in that they have been related to a sequence of *consecutive but not necessarily contiguous asymmetric groups.*

Examples:


all D-*arabino*

N and M are each a single non-asymmetric carbon center or a sequence of non-asymmetric carbon centers.

Ketoses and Deoxysaccharides. Prefixes with this significance were used when N is the methylene group of a deoxy compound or the keto group of a ketose containing not more than four asymmetric carbon centers, but not the keto group of a higher-sugar ketose.

Examples: Names according to this usage are given in notes to the subsequent Rules.

MULTIPLE CONFIGURATIONAL PREFIXES

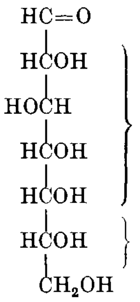
Rule Carb-9

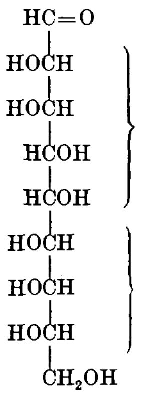
An acyclic monosaccharide containing more than four contiguous asymmetric carbon atoms is named by adding two or more prefixes, together indicating the configurations at all the asymmetric carbon atoms, to the stem name defined in Rule Carb-6.

The configurational prefixes employed are given in Rule Carb-8. The sequence of ($4n + m$; where n is 1 or more and m is 0, 1, 2, or 3) asymmetric carbon atoms is divided, beginning at the asymmetric carbon atom next to the functional group, into (n) sets of four asymmetric carbon atoms, and a final set (m) of less than four. The order of citation of these prefixes commences at the end farthest from carbon number one.

The locants corresponding to the configurational prefixes may be inserted in the name, if desired. In such cases, all locants are given and immediately precede the appropriate configurational prefixes.

Examples:


D-*glycero*-D-*gluco*-Heptose
or 6-D-*glycero*-2,3,4,5-D-*gluco*-Heptose



L-*ribo*-D-*manno*-Nonose
or 6,7,8-L-*ribo*-2,3,4,5-D-*manno*-Nonose

Comment. Compounds that require multiple configurational prefixes but which do not necessarily contain more than four contiguous asymmetric carbon atoms are covered by Rules Carb-10 (ketoses) and Carb-14 (deoxysaccharides).

KETOSES

Rule Carb-10

Ketoses are classified as 2-ketoses, 3-ketoses, etc., according to the position of the (potential) carbonyl group (see Rule Carb-4).

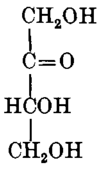
The systematic name of an individual ketose is obtained by affixing, before the stem name (Rule Carb-6) and by means of a hyphen, the locant of the (potential) carbonyl group. The locant is preceded by the configurational prefix or prefixes (Rule Carb-8) for the groups of asymmetric centers present.

If more than one configurational prefix is needed, the order of their citation commences at the end farthest from carbon atom number one.

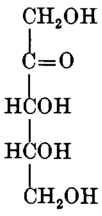
The locant 2 may be omitted from the name of a 2-ketose when no ambiguity can arise[5].

When the carbonyl group is at the middle carbon atom of a ketose containing an uneven number of carbon atoms in the chain two names are possible. That name will be selected as accords with the order of precedence given in Rule Carb-2.

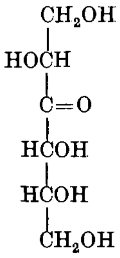
Examples:



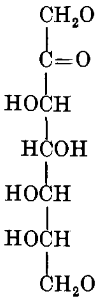
D-*glycero*-2-Tetrulose



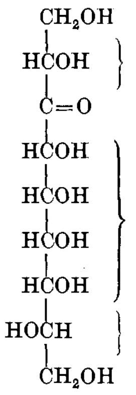
D-*erythro*-2-Pentulose



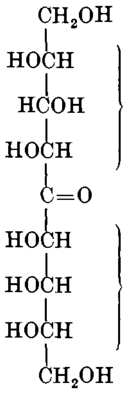
D-*erythro*-L-*glycero*-
3-Hexulose[6]



L-*gluco*-2-Heptulose



L-*glycero*-D-*allo*-
D-*glycero*-3-Nonulose



L-*ribo*-L-*xylo*-5-Nonulose not
D-*xylo*-D-*ribo*-5-Nonulose
[see Rule Carb-2(a)]

The following are examples of non-systematic names of ketoses that are established by usage and may be retained.

D-Ribulose	for	D-*erythro*-2-pentulose
D-Xylulose	for	D-*threo*-2-pentulose
Sedoheptulose	for	D-*altro*-2-heptulose
D-Fructose	for	D-*arabino*-2-hexulose
D-Psicose	for	D-*ribo*-2-hexulose
D-Sorbose	for	D-*xylo*-2-hexulose
D-Tagatose	for	D-*lyxo*-2-hexulose

DIKETOSES

Rule Carb-11

Monosaccharide derivatives containing two (potential) ketonic carbonyl groups have the general name diketose.

The systematic name of an individual diketose is derived by use of the termination 'odiulose' in place of the termination 'ulose' characteristic of the monoketose (Rule Carb-6). The locants of the (potential)carbonyl groups are the lowest possible numbers (see Rule Carb-4) and are inserted together with a hyphen before the stem name. They are in turn preceded by configurational prefixes, the latter as prescribed in Rules Carb-8 and Carb-9. The order of citation of these prefixes commences at the end farthest from carbon atom number one.

Note. It sometimes happens that, when the carbonyl groups are symmetrically placed along the carbon chain, two systematic names are possible; that name is selected as accords with the order of precedence given in Rule Carb-2.

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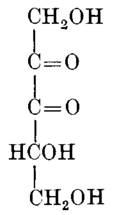
[5] In this text, the locant is always retained for the sake of clarity.

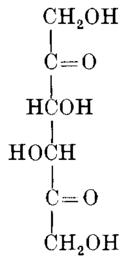
[6] Name according to Anglo-American usage: D-*arabino*-3-hexulose.

Examples:



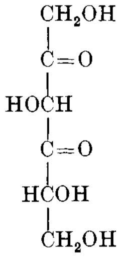
$$\begin{array}{c}\mathrm{CH_2OH}\\ \mid\\ \mathrm{C{=}O}\\ \mid\\ \mathrm{C{=}O}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{CH_2OH}\end{array}$$

D-*glycero*-2,3-Pentodiulose



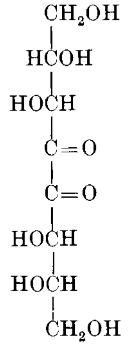
$$\begin{array}{c}\mathrm{CH_2OH}\\ \mid\\ \mathrm{C{=}O}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{HOCH}\\ \mid\\ \mathrm{C{=}O}\\ \mid\\ \mathrm{CH_2OH}\end{array}$$

L-*threo*-2,5-Hexodiulose



$$\begin{array}{c}\mathrm{CH_2OH}\\ \mid\\ \mathrm{C{=}O}\\ \mid\\ \mathrm{HOCH}\\ \mid\\ \mathrm{C{=}O}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{CH_2OH}\end{array}$$

D-*glycero*-L-*glycero*-2,4-Hexodiulose[7](a)
(not D-*glycero*-L-*glycero*-3,5-Hexodiulose)
[See Rule Carb-2(b)]



$$\begin{array}{c}\mathrm{CH_2OH}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{HOCH}\\ \mid\\ \mathrm{C{=}O}\\ \mid\\ \mathrm{C{=}O}\\ \mid\\ \mathrm{HOCH}\\ \mid\\ \mathrm{HOCH}\\ \mid\\ \mathrm{CH_2OH}\end{array}$$

L-*erythro*-L-*threo*-4,5-Octodiulose[7](b)
(not L-*threo*-D-*erythro*-4,5-Octodiulose)
[See Rule Carb-2(a)]

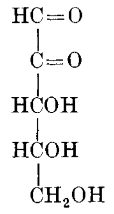
ALDOKETOSES

Rule Carb-12

Monosaccharide derivatives containing a (potential) aldehydic carbonyl group and a (potential) ketonic carbonyl group have the general name aldoketose.

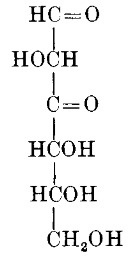
Names of individual aldoketoses are formed in the same way as those of diketoses, but by the use of the termination 'osulose' in place of the termination 'ose' of the corresponding aldose (Rule Carb-6). The carbon atom of the (potential) aldehydic carbonyl group is numbered one, and this locant is not cited in the name. The locant of the (potential) ketonic carbonyl group is given unless it is 2; it may then be omitted[8].

Examples:



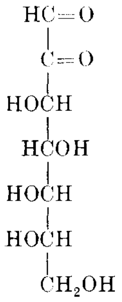
$$\begin{array}{c}\mathrm{HC{=}O}\\ \mid\\ \mathrm{C{=}O}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{CH_2OH}\end{array}$$

D-*erythro*-2-Pentosulose



$$\begin{array}{c}\mathrm{HC{=}O}\\ \mid\\ \mathrm{HOCH}\\ \mid\\ \mathrm{C{=}O}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{CH_2OH}\end{array}$$

D-*erythro*-L-*glycero*-3-Hexosulose[9]



$$\begin{array}{c}\mathrm{HC{=}O}\\ \mid\\ \mathrm{C{=}O}\\ \mid\\ \mathrm{HOCH}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{HOCH}\\ \mid\\ \mathrm{HOCH}\\ \mid\\ \mathrm{CH_2OH}\end{array}$$

L-*gluco*-2-Heptosulose

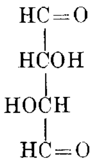
Comment: 2-aldoketoses have also been named as 'osones' but this practice is not recommended.

DIALDOSES

Rule Carb-13

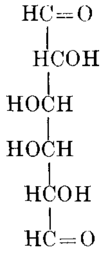
Monosaccharide derivatives containing two (potential) aldehydic carbonyl groups have the general name 'dialdose'. Names of individual dialdoses are formed in the same way as those of diketoses, but by the use of the termination 'odialdose' in place of the termination 'odiulose'. Locants are not needed.

Examples:



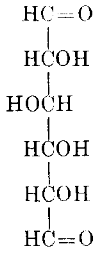
$$\begin{array}{c}\mathrm{HC{=}O}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{HOCH}\\ \mid\\ \mathrm{HC{=}O}\end{array}$$

L-*threo*-Tetrodialdose



$$\begin{array}{c}\mathrm{HC{=}O}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{HOCH}\\ \mid\\ \mathrm{HOCH}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{HC{=}O}\end{array}$$

meso-galacto-Hexodialdose[10]



$$\begin{array}{c}\mathrm{HC{=}O}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{HOCH}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{HCOH}\\ \mid\\ \mathrm{HC{=}O}\end{array}$$

D-*gluco*-Hexodialdose not L-*gulo*-Hexodialdose

DEOXY-MONOSACCHARIDES AND AMINO-MONOSACCHARIDES

Rule Carb-14

a) The replacement of an alcoholic hydroxyl group of a monosaccharide, or monosaccharide derivative, by a hydrogen atom is expressed by using the prefix 'deoxy', preceded by the appropriate locant and followed by a hyphen together with a systematic or trivial name (Rule Carb-3). The systematic name consists of a stem name with such configurational prefixes as express the configurations at the

---

[7] Names according to Anglo-American usage: (a) D-*threo*-2,4-hexodiulose, (b) L-*altro*-4,5-octodiulose.

[8] In this text, the locant is always retained for the sake of clarity.

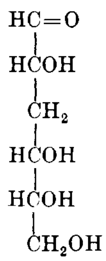
[9] Name according to Anglo-American usage: D-*arabino*-3-hexosulose.

[10] The prefix *meso*- may precede the name of such symmetrical compounds, for the sake of clarity.

asymmetric centers present in the deoxy-compound. The order of citation of the configurational prefixes commences at the end farthest from carbon atom number one.

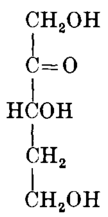
A trivial name may be used only if the transformation of the saccharide into the deoxy-compound does not alter the configuration at any asymmetric center.

Examples:



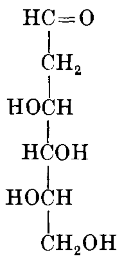
$$\begin{array}{c}\mathrm{HC{=}O}\\ \mathrm{HCOH}\\ \mathrm{CH_2}\\ \mathrm{HCOH}\\ \mathrm{HCOH}\\ \mathrm{CH_2OH}\end{array}$$

3-Deoxy-D-*erythro*-D-*glycero*-hexose[11]



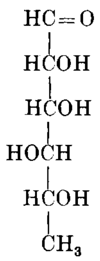
$$\begin{array}{c}\mathrm{CH_2OH}\\ \mathrm{C{=}O}\\ \mathrm{HCOH}\\ \mathrm{CH_2}\\ \mathrm{CH_2OH}\end{array}$$

4-Deoxy-D-*glycero*-2-pentulose



$$\begin{array}{c}\mathrm{HC{=}O}\\ \mathrm{CH_2}\\ \mathrm{HOCH}\\ \mathrm{HCOH}\\ \mathrm{HOCH}\\ \mathrm{CH_2OH}\end{array}$$

2-Deoxy-L-*xylo*-hexose

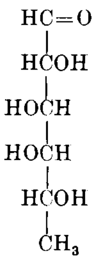


$$\begin{array}{c}\mathrm{HC{=}O}\\ \mathrm{HCOH}\\ \mathrm{HCOH}\\ \mathrm{HOCH}\\ \mathrm{HCOH}\\ \mathrm{CH_3}\end{array}$$

6-Deoxy-D-gulose

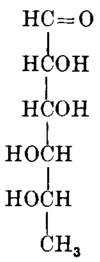
Trivial names of 6-deoxy-hexoses established by usage may be retained and used for the formation of names of derivatives.

Examples:



$$\begin{array}{c}\mathrm{HC{=}O}\\ \mathrm{HCOH}\\ \mathrm{HOCH}\\ \mathrm{HOCH}\\ \mathrm{HCOH}\\ \mathrm{CH_3}\end{array}$$

D-Fucose
(6-Deoxy-D-galactose)



$$\begin{array}{c}\mathrm{HC{=}O}\\ \mathrm{HCOH}\\ \mathrm{HCOH}\\ \mathrm{HOCH}\\ \mathrm{HOCH}\\ \mathrm{CH_3}\end{array}$$

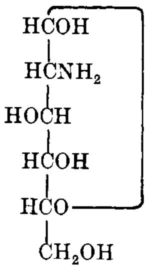
L-Rhamnose
(6-Deoxy-L-mannose)

The following is established as a trivial name for biochemical use: deoxyribose for 2-deoxy-D-*erythro*-pentose.

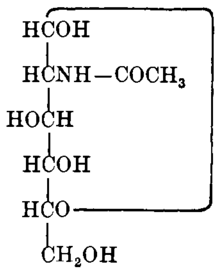
b) The replacement of an alcoholic hydroxyl group of a monosaccharide, or monosaccharide derivative, by an amino group is envisaged as substitution of the appropriate hydrogen atom of the corresponding deoxy-monosaccharide by the amino group.

Substitution in the amino group is indicated by use of the prefix *N* (Rule Carb-15) unless the substituted amino group has a trivial name (for example: CH_3CONH-, acetamido).

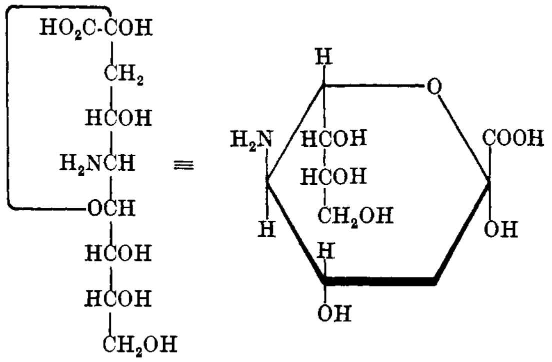
The stereochemistry at the carbon atom carrying the amino group is expressed according to Rule Carb-8.



2-Amino-2-deoxy-α-D-glucopyranose

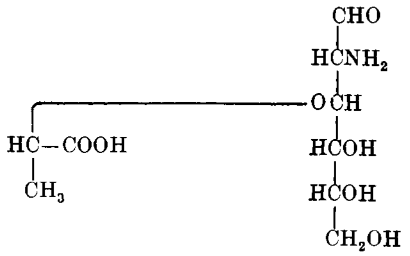


2-Acetamido-2-deoxy-α-D-glucopyranose



(A)

(A) 5-Amino-3,5-dideoxy-α-D-*glycero*-D-*galacto*-2-nonulopyranosonic acid



(B)

(B) 2-Amino-3-*O*-[1-(*S*)-carboxyethyl]-2-deoxy-*aldehydo*-D-glucose

Trivial names accepted for biochemical usage:

D-Galactosamine for 2-amino-2-deoxy-D-galactopyranose (the name chondrosamine is not recommended)
D-Glucosamine for 2-amino-2-deoxy-D-glucopyranose
D-Mannosamine for 2-amino-2-deoxy-D-mannopyranose
Neuraminic acid for 5-amino-3,5-dideoxy-α-D-*glycero*-D-*galacto*-2-nonulopyranosonic acid
Muramic acid for 2-amino-3-*O*-[1-(*S*)-carboxyethyl]-2-deoxy-aldehydo-D-glucose

When the complete name of the derivative includes other prefixes, 'deoxy' takes its place in the alphabetical order[12] of detachable prefixes; in citation the alphabetical order is preferred to numerical order.

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[11] Name according to Anglo-American usage: 3-deoxy-D-*ribo*-hexose.

[12] See IUPAC Nomenclature of Organic Chemistry, Section C, 1965, Rules C-16.1 and C-16.4.

Examples:
4-Amino-4-deoxy-3-*O*-methyl-D-*erythro*-2-pentulose
4-Deoxy-4-(ethylamino)-D-*erythro*-2-pentulose

O-SUBSTITUTION

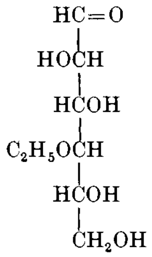
Rule Carb-15

Replacement of the hydrogen atom of an alcoholic hydroxyl group of a saccharide or saccharide derivative by another atom or group is denoted by placing the name of this atom or group before the name of the parent compound. The name of the atom or group is preceded by an italic capital letter *O* (for oxygen), followed by a hyphen in order to make clear that substitution is on oxygen. The *O* prefix need not be repeated for multiple replacements by the same atom or group.

Replacement of hydrogen attached to nitrogen or sulfur by another atom or group is indicated in a similar way with the use of italic capital letters *N* or *S* (for examples see Rules Carb-24 and Carb-36).

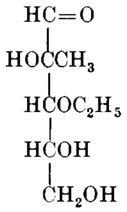
The italic capital letter *C* may be used to indicate replacement of hydrogen attached to carbon, to avoid possible ambiguity[12].

Examples:



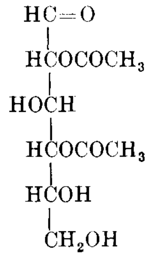
$$\begin{array}{c}\mathrm{HC{=}O}\\|\\\mathrm{HOCH}\\|\\\mathrm{HCOH}\\|\\\mathrm{C_2H_5OCH}\\|\\\mathrm{HCOH}\\|\\\mathrm{CH_2OH}\end{array}$$

4-*O*-Ethyl-D-idose



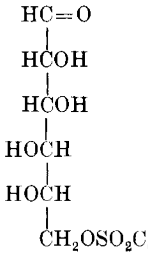
$$\begin{array}{c}\mathrm{HC{=}O}\\|\\\mathrm{HOCCH_3}\\|\\\mathrm{HCOC_2H_5}\\|\\\mathrm{HCOH}\\|\\\mathrm{CH_2OH}\end{array}$$

3-*O*-Ethyl-2-*C*-methyl-D-arabinose



$$\begin{array}{c}\mathrm{HC{=}O}\\|\\\mathrm{HCOCOCH_3}\\|\\\mathrm{HOCH}\\|\\\mathrm{HCOCOCH_3}\\|\\\mathrm{HCOH}\\|\\\mathrm{CH_2OH}\end{array}$$

2,4-Di-*O*-acetyl-D-glucose



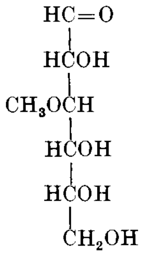
$$\begin{array}{c}\mathrm{HC{=}O}\\|\\\mathrm{HCOH}\\|\\\mathrm{HCOH}\\|\\\mathrm{HOCH}\\|\\\mathrm{HOCH}\\|\\\mathrm{CH_2OSO_2C_6H_4CH_3\text{-}\mathit{p}}\end{array}$$

6-*O*-Tosyl-L-mannose

Rule Carb-16 (Alternative to Rule Carb-15)

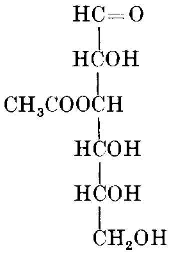
O-Substitution products of saccharides or saccharide derivatives may be named as esters, ethers, etc., following the procedures prescribed for that purpose in IUPAC Nomenclature of Organic Chemistry, Section C, 1965.

Examples:



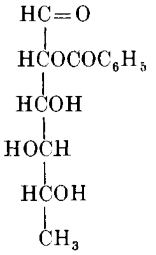
$$\begin{array}{c}\mathrm{HC{=}O}\\|\\\mathrm{HCOH}\\|\\\mathrm{CH_3OCH}\\|\\\mathrm{HCOH}\\|\\\mathrm{HCOH}\\|\\\mathrm{CH_2OH}\end{array}$$

D-Glucose 3-methyl ether



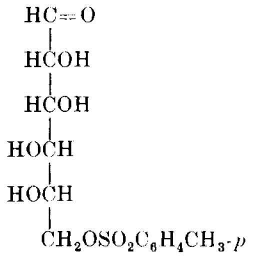
$$\begin{array}{c}\mathrm{HC{=}O}\\|\\\mathrm{HCOH}\\|\\\mathrm{CH_3COOCH}\\|\\\mathrm{HCOH}\\|\\\mathrm{HCOH}\\|\\\mathrm{CH_2OH}\end{array}$$

D-Glucose 3-acetate



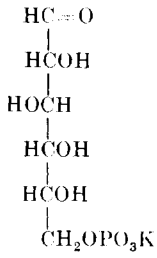
$$\begin{array}{c}\mathrm{HC{=}O}\\|\\\mathrm{HCOCOC_6H_5}\\|\\\mathrm{HCOH}\\|\\\mathrm{HOCH}\\|\\\mathrm{HCOH}\\|\\\mathrm{CH_3}\end{array}$$

6-Deoxy-D-gulose 2-benzoate



$$\begin{array}{c}\mathrm{HC{=}O}\\|\\\mathrm{HCOH}\\|\\\mathrm{HCOH}\\|\\\mathrm{HOCH}\\|\\\mathrm{HOCH}\\|\\\mathrm{CH_2OSO_2C_6H_4CH_3\text{-}\mathit{p}}\end{array}$$

L-Mannose 6-*p*-toluenesulfonate
not 6-tosylate;
(see Rule C-641.5, examples)



$$\begin{array}{c}\mathrm{HC{=}O}\\|\\\mathrm{HCOH}\\|\\\mathrm{HOCH}\\|\\\mathrm{HCOH}\\|\\\mathrm{HCOH}\\|\\\mathrm{CH_2OPO_3K_2}\end{array}$$

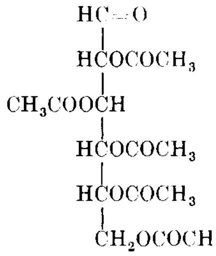
D-Glucose 6-(dipotassium phosphate)
(permitted biochemical usage: glucose 6-phosphate)

ACYCLIC FORMS

Rule Carb-17

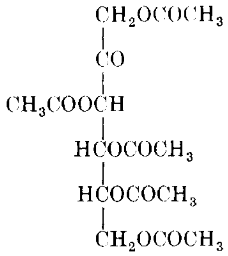
The acyclic nature of a monosaccharide or monosaccharide derivative containing an uncyclised carbonyl group may be stressed by inserting the italicized prefix '*aldehydo*' or '*keto*' respectively, immediately before the configurational prefix(es) or before the trivial name. These prefixes may be abbreviated to '*al*' and '*ke*'.

Examples:



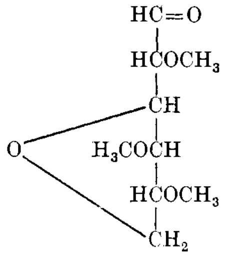
$$\begin{array}{c}\mathrm{HC{=}O}\\|\\\mathrm{HCOCOCH_3}\\|\\\mathrm{CH_3COOCH}\\|\\\mathrm{HCOCOCH_3}\\|\\\mathrm{HCOCOCH_3}\\|\\\mathrm{CH_2OCOCH_3}\end{array}$$

2,3,4,5,6-Penta-*O*-acetyl-*aldehydo*-D-glucose
aldehydo-D-Glucose 2,3,4,5,6-pentaacetate

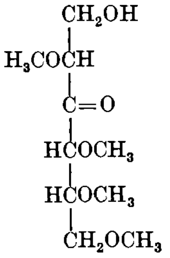


$$\begin{array}{c}\mathrm{CH_2OCOCH_3}\\|\\\mathrm{CO}\\|\\\mathrm{CH_3COOCH}\\|\\\mathrm{HCOCOCH_3}\\|\\\mathrm{HCOCOCH_3}\\|\\\mathrm{CH_2OCOCH_3}\end{array}$$

1,3,4,5,6-Penta-*O*-acetyl-*keto*-D-fructose
keto-D-Fructose 1,3,4,5,6-pentaacetate



3,6-Anhydro-2,4,5-tri-*O*-methyl-*aldehydo*-D-galactose



2,4,5,6-Tetra-*O*-methyl-*keto*-D-*erythro*-L-*glycero*-3-hexulose[13]

RING SIZE IN CYCLIC FORMS

Rule Carb-18

The size of the ring in the cyclic form of a monosaccharide (aldose or ketose) or monosaccharide derivative may be indicated by replacing the terminal letters 'se' of the name of the acyclic form by 'furanose' for the 5-atom ring, 'pyranose' for the 6-atom ring, and 'septanose' for the 7-atom ring.

Rule Carb-19 (Alternative to Rule Carb-18)

The size of the ring in the cyclic form of a monosaccharide (aldose or ketose) or monosaccharide derivative may be indicated by two numerals, placed in parentheses and joined to the end of the name of the acyclic compound by a hyphen. These numerals denote the two carbon atoms to which the ring oxygen atom is attached, the carbon atom of the potential carbonyl group being cited first.

Rule Carb-20

For cyclic forms of ketoses, diketoses, dialdoses, and aldoketoses, the names constructed according to Rule Carb-18 may, when necessary, be followed by a pair of numerals, these numerals having the same significance as in Rule Carb-19.

Comment. Examples of the application of Rules Carb-18—Carb-20 are given in Rules Carb-21—Carb-23. The system of Rule Carb-18 is preferred, but that of Rule Carb-19 is advantageous in special cases.

ANOMERS

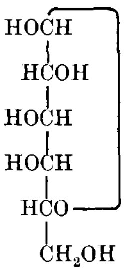
Rule Carb-21

The free hydroxyl group belonging to the internal hemiacetal grouping of the cyclic form of a monosaccharide or monosaccharide derivative is termed the 'anomeric' or 'glycosidic' hydroxyl group.

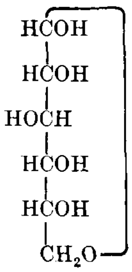
The two cyclic forms of an aldose or ketose, or aldose or ketose derivative (termed anomers), are distinguished with the aid of the anomeric prefixes α and β, relating the configuration at the anomeric carbon atom to that at the reference asymmetric carbon atom of the compound; the anomer having the same configuration, in the Fischer projection, at the anomeric and the reference carbon atom is designated α.

The anomeric prefix, α or β, followed by a hyphen, is placed immediately in front of the configurational symbol, D or L, of the trivial name or of the configurational prefix denoting the group of asymmetric carbon atoms that includes the reference carbon atom (see Preamble, paragraph 3).

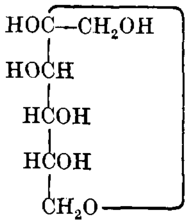
Examples:



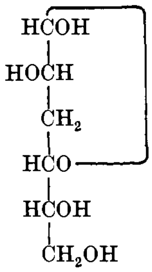
(a)[14] β-D-Galactopyranose
(b) β-D-Galactose-(1,5)



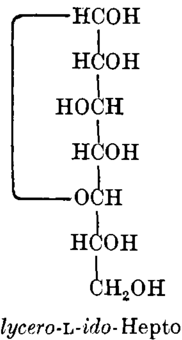
α-D-Glucoseptanose
α-D-Glucose-(1,6)



(a)[14] β-D-Fructopyranose
(b) β-D-Fructose-(2,6)



(a) 3-Deoxy-α-D-*erythro*-L-*glycero*-hexofuranose[15]
(b) 3-Deoxy-α-D-*erythro*-L-*glycero*-hexose-(1,4)



(a) α-D-*glycero*-L-*ido*-Heptopyranose
(b) α-D-*glycero*-L-*ido*-Hepotse-(1,5)

---

[13] Name according to Anglo-American usage: 2,4,5,6-tetra-*O*-methyl-*keto*-D-*arabino*-3-hexulose.

[14] (a), (b) and (c), here and subsequently, refer to names coined in terms of Rules Carb-18, Carb-19, and Carb-20, respectively.

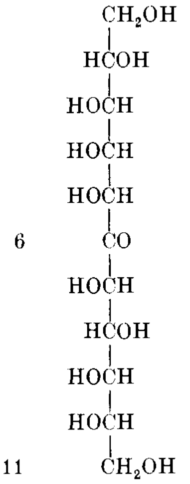
[15] Name according to Anglo-American usage: 3-deoxy-α-D-*arabino*-hexofuranose.

Rule Carb-22

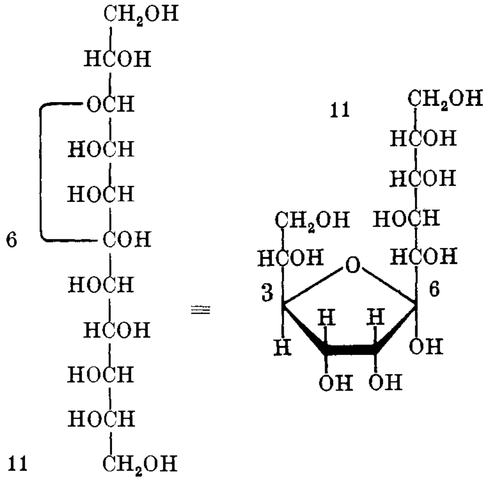
With ketoses that have the (potential) carbonyl group located between two >CHOH groups, each separated from the carbonyl group by two, three, or four carbon atoms of the chain, ring-closure may take place towards either end of that chain. Likewise, with dialdoses, diketoses and aldoketoses ring-closure may take place from either (potential) carbonyl group towards the center of the chain.

In each case both cyclic forms have the same monosaccharide parent that dictates the basis of the name and numbering of each form (*cf.* Rule Carb-2). In one form the locant of the anomeric or glycosidic hydroxyl group is lower than that of the reference carbon atom; that cyclic form is named according to Rules Carb-18 and Carb-21. In the other the locant of the anomeric or glycosidic hydroxyl group must be higher than that of the reference carbon atom. This precludes (see Preamble, paragraph 3) the use of α and β to define the two anomers (Rule Carb-21), and the appropriate Sequence Rule symbol, *R* or *S* (see Preamble, paragraph 5), must be used, in place of α or β, to indicate the configuration at the anomeric carbon atom.

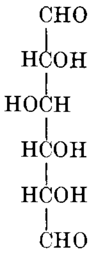
Examples:



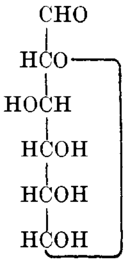
L-*gluco*-L-*altro*-6-Undeculose, not L-*talo*-D-*gulo*-6-Undeculose (*cf.* Rule Carb-2)



(b)[14] (6*S*)-L-*gluco*-L-*altro*-6-Undeculose-(6,3)
(c) (6*S*)-L-*gluco*-L-*altro*-6-Undeculofuranose-(6,3)



D-*gluco*-Hexodialdose, not L-*gulo*-hexodialdose (*cf.* Rules Carb-2 and Carb-11)



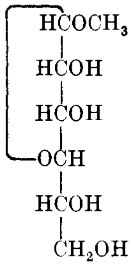
(c)[14] (6*R*)-D-*gluco*-Hexodialdopyranose-(6,2)
(b) (6*R*)-D-*gluco*-Hexodialdose-(6,2)

GLYCOSIDES

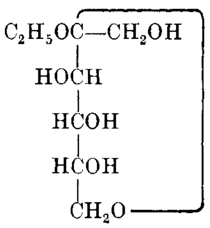
Rule Carb-23

Mixed acetals, resulting from the replacement of the hydrogen atom of the anomeric or glycosidic hydroxyl group by a group X, derived from an alcohol or phenol (XOH), are named 'glycosides'. The term 'glycoside' is used in a generic sense only, and may not be applied to specific compounds. Glycosides are named by replacing the terminal 'e' of the name of the corresponding cyclic form of the saccharide or saccharide derivative by 'ide' and placing before the word thus obtained, as a separate word, the name of the group X.

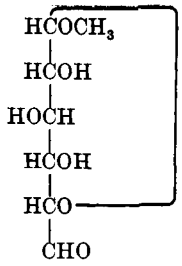
Examples:



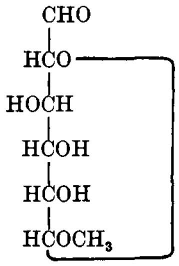
(a) Methyl α-D-gulofuranoside
(b) Methyl α-D-guloside-(1,4)



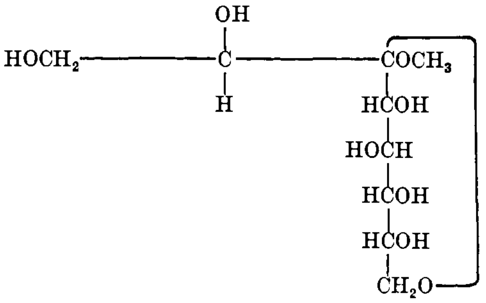
(a) Ethyl β-D-fructopyranoside
(b) Ethyl β-D-fructoside-(2,6)



(a) Methyl α-D-*gluco*-hexodialdopyranoside-(1,5)
(b) Methyl α-D-*gluco*-hexodialdoside-(1,5)



(a) Methyl (6*R*)-D-*gluco*-hexodialdopyranoside-(6,2)
(b) Methyl (6*R*)-D-*gluco*-hexodialdoside-(6,2)



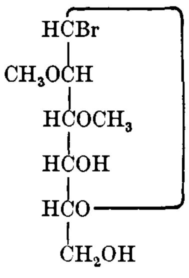
(a) Methyl α-D-*gluco*-D-*glycero*-3-octuloseptanoside
(b) Methyl α-D-*gluco*-D-*glycero*-3-octuloside-(3,8)

GLYCOSYL RADICALS AND GLYCOSYLAMINES

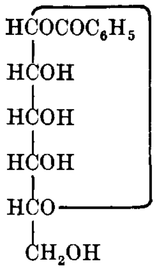
Rule Carb-24

a) The radical formed by detaching the anomeric or glycosidic hydroxyl group from the cyclic form of a monosaccharide or monosaccharide derivative is named by replacing the terminal 'e' of the name of the monosaccharide or monosaccharide derivative by 'yl'. The general name of these radicals is 'glycosyl' (glycofuranosyl, glycopyranosyl, glycoseptanosyl) radical.

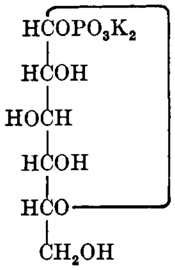
Examples:



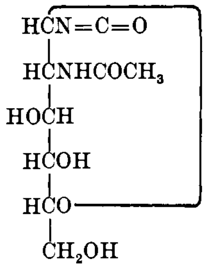
(a) 2,3-Di-*O*-methyl-α-D-altropranosyl bromide
(b) 2,3-Di-*O*-methyl-α-D-altrosyl-(1,5) bromide



(a) α-D-Allopyranosyl benzoate
(or 1-*O*-benzoyl-α-D-allopyranose)
(b) α-D-Allosyl-(1,5) benzoate
[or 1-*O*-benzoyl-α-D-allose-(1,5)]



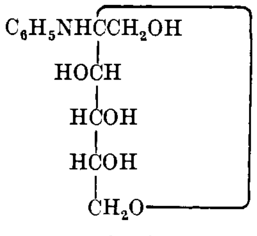
(a) α-D-Glucopyranosyl dipotassium phosphate
(b) α-D-Glucosyl-(1,5) dipotassium phosphate
(common name for biochemical usage:
α-glucose 1-phosphate)



(a) 2-Acetamido-2-deoxy-α-D-glucopyranosyl isocyanate
(b) 2-Acetamido-2-deoxy-α-D-glucosyl-(1,5) isocyanate

b) The replacement of the glycosidic hydroxyl group of a cyclic form of a monosaccharide derivative by an amino group is indicated by adding the suffix 'amine' to the name of the glycosyl radical.

Example:



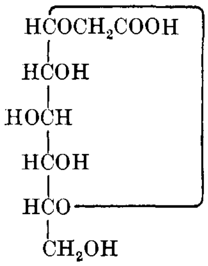
(a) *N*-Phenyl-β-D-fructopyranosylamine
(b) *N*-Phenyl-β-D-fructosyl-(2,6)-amine

GLYCOSYLOXY RADICALS

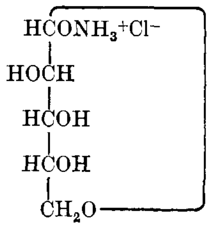
Rule Carb-25

The radical formed by removal of the hydrogen atom from the anomeric or glycosidic hydroxyl group of the cyclic form of a monosaccharide or monosaccharide derivative is named by replacing the terminal 'e' of the name of the saccharide by 'yloxy'.

Examples:



(a) α-D-Glucopyranosyloxyacetic acid
(b) α-D-Glucosyloxy-(1,5)-acetic acid



(a) α-D-Arabinopyranosyloxyammonium chloride
(b) α-D-Arabinosyloxy-(1,5)-ammonium chloride

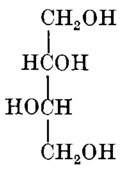
ALDITOLS

Rule Carb-26

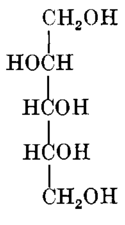
a) Names for the polyhydric alcohols (alditols) of the saccharide series are derived from the names of the corresponding acyclic aldoses by changing the suffix 'ose' to 'itol'.

If the same alditol can be derived from two different aldoses preference is given to that name which accords with the order of precedence given in Rule Carb-2.

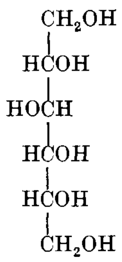
Examples:



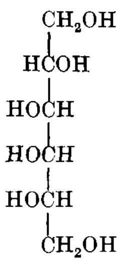
L(−)-Threitol



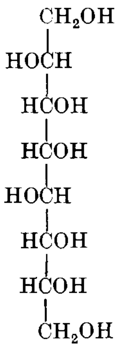
D-Arabinitol
(not D-lyxitol)



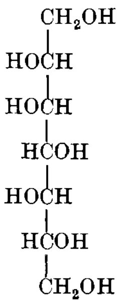
D-Glucitol
(not L-gulitol)
Non-preferred trivial name: sorbitol



L-Altritol
(not L-talitol)



D-*erythro*-L-*galacto*-Octitol
(not D-*threo*-L-*gulo*-octitol)



D-*glycero*-L-*gulo*-Heptitol
(not D-*glycero*-D-*ido*-heptitol)

Note. Names such as 'mannite' for mannitol are deprecated.

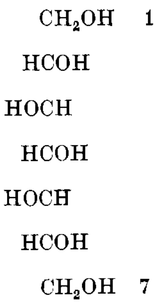
b) To the trivial names of alditols optically compensated intra molecularly, which have no D- or L- prefix, the prefix *meso*-may be added for the sake of clarity.

Examples: *meso*-erythritol, *meso*-ribitol, *meso*-xylitol, *meso*-allitol, *meso*-galactitol.

The prefixes D and L must however be used (i) in the names of *meso*-alditols containing more than four contiguous asymmetric carbon atoms in order to define the steric relation of the configurational prefixes cited and (ii) in naming derivatives of *meso*-alditols that have become asymmetric by substitution.

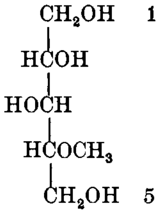
Examples:

(i)



meso-D-*glycero*-L-*ido*-Heptitol
(not L-*glycero*-D-*ido*-heptitol; *cf.* Rule Carb-2)

(ii)



$$\begin{array}{ll} \mathrm{CH_2OH} & 1 \\ \mathrm{HCOH} & \\ \mathrm{HOCH} & \\ \mathrm{HCOCH_3} & \\ \mathrm{CH_2OH} & 5 \end{array}$$

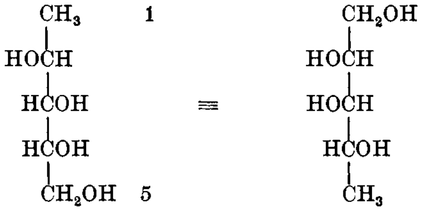
4-*O*-Methyl-D-xylitol
(not 2-*O*-methyl-L-xylitol; *cf.* Rule Carb-2)

ω-DEOXYALDITOLS

Rule Carb-27

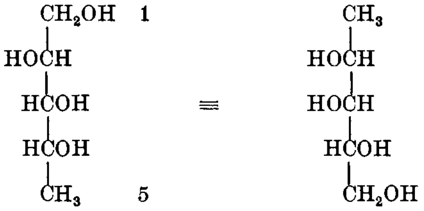
The name of an aldose derivative having a terminal CH_3 and CH_2OH group is derived from that of the appropriate alditol (Rule Carb-2) by use of the prefix 'deoxy')

Examples:



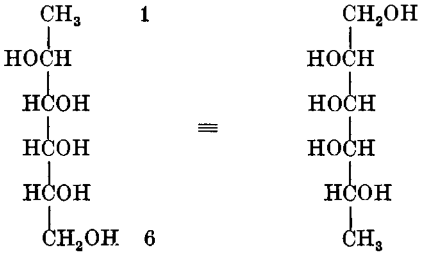
$$\begin{array}{llcl} \mathrm{CH_3} & 1 & & \mathrm{CH_2OH} \\ \mathrm{HOCH} & & & \mathrm{HOCH} \\ \mathrm{HCOH} & & \equiv & \mathrm{HOCH} \\ \mathrm{HCOH} & & & \mathrm{HCOH} \\ \mathrm{CH_2OH} & 5 & & \mathrm{CH_3} \end{array}$$

1-Deoxy-D-arabinitol (not 5-deoxy-D-lyxitol)



$$\begin{array}{llcl} \mathrm{CH_2OH} & 1 & & \mathrm{CH_3} \\ \mathrm{HOCH} & & & \mathrm{HOCH} \\ \mathrm{HCOH} & & \equiv & \mathrm{HOCH} \\ \mathrm{HCOH} & & & \mathrm{HCOH} \\ \mathrm{CH_3} & 5 & & \mathrm{CH_2OH} \end{array}$$

5-Deoxy-D-arabinitol (not 1-deoxy-D-lyxitol)



$$\begin{array}{llcl} \mathrm{CH_3} & 1 & & \mathrm{CH_2OH} \\ \mathrm{HOCH} & & & \mathrm{HOCH} \\ \mathrm{HCOH} & & & \mathrm{HOCH} \\ \mathrm{HCOH} & & \equiv & \mathrm{HOCH} \\ \mathrm{HCOH} & & & \mathrm{HCOH} \\ \mathrm{CH_2OH} & 6 & & \mathrm{CH_3} \end{array}$$

1-Deoxy-D-altritol (not 6-deoxy-D-talitol)

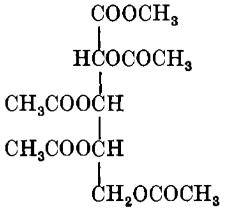
ALDONIC ACIDS

Rule Carb-28

Monocarboxylic acids formally derived from aldoses, having three or more carbon atoms in the chain, by oxidation of the aldehydic group, are named aldonic acids, and are divided into aldotrionic acid, aldotetronic acids, aldopentonic acids, aldohexonic acids, etc., according to the number of carbon atoms in the chain. The names of individual compounds of this type are formed by replacing the ending 'ose' of the systematic or trivial name of the aldose by 'onic acid'.

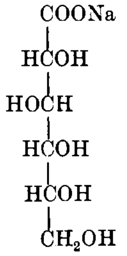
Derivatives of these acids formed by change in the carboxyl group (salts, esters, lactones, acyl halides, amides, nitriles, etc.,) are named according to the IUPAC Nomenclature of Organic Chemistry, Section C, 1965, Rules C-4.

Examples:



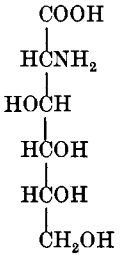
$$\begin{array}{c} \mathrm{COOCH_3} \\ \mathrm{HCOCOCH_3} \\ \mathrm{CH_3COOCH} \\ \mathrm{CH_3COOCH} \\ \mathrm{CH_2OCOCH_3} \end{array}$$

Methyl tetra-*O*-acetyl-L-arabinonate or methyl L-arabinonate tetraacetate
(*cf.* Rule C-463)



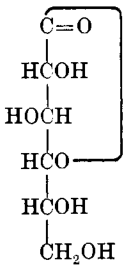
$$\begin{array}{c} \mathrm{COONa} \\ \mathrm{HCOH} \\ \mathrm{HOCH} \\ \mathrm{HCOH} \\ \mathrm{HCOH} \\ \mathrm{CH_2OH} \end{array}$$

Sodium D-gluconate
(*cf.* Rule C-461)

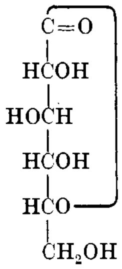


$$\begin{array}{c} \mathrm{COOH} \\ \mathrm{HCNH_2} \\ \mathrm{HOCH} \\ \mathrm{HCOH} \\ \mathrm{HCOH} \\ \mathrm{CH_2OH} \end{array}$$

2-Amino-2-deoxy-D-gluconic acid
(Common name for biochemical usage: D-Glucosaminic acid)

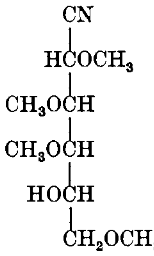


D-Glucono-1,4- lactone
or, less preferred,
D-glucono-γ-lactone



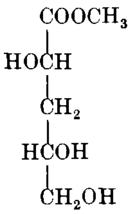
D-Glucono-1,5-lactone
or, less preferred,
D-glucono-δ-lactone

(*cf.* Rules C-472.1 and C-472.4)

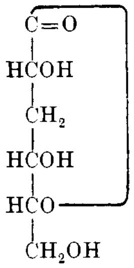


$$\begin{array}{c} \mathrm{CN} \\ \mathrm{HCOCH_3} \\ \mathrm{CH_3OCH} \\ \mathrm{CH_3OCH} \\ \mathrm{HOCH} \\ \mathrm{CH_2OCH_3} \end{array}$$

2,3,4,6-Tetra-*O*-methyl-L-altrononitrile



Methyl 3-deoxy-D-*glycero*-L-*glycero*-pentonate[16(a)]



3-Deoxy-D-*erythro*-D-*glycero*-hexono-1,5-lactone[16(b)]

KETOALDONIC ACIDS

Rule Carb-29

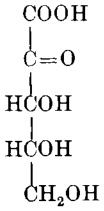
Keto-carboxylic acids formally derived by oxidation of a secondary alcoholic hydroxyl group of an aldonic acid have the general name ketoaldonic acids.

The carbon atom of the carboxyl group is numbered 1.

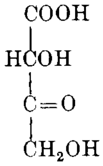
Names of individual ketoaldonic acids, or of the glycosides derived from such compounds, are formed by replacing the ending 'ose' or 'oside' of the appropriate ketose, or of the glycoside derived there from, by 'osonic acid' or 'osidonic acid' respectively.

Derivatives of these acids formed by modifying the carboxyl group (salts, esters, lactones, acyl halides, amides, nitriles, etc.) are named according to the IUPAC Nomenclature of Organic Chemistry, Section C, 1965, Rules C-4.

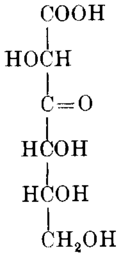
Examples:



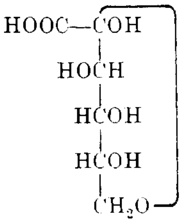
D-*erythro*-2-Pentulosonic acid



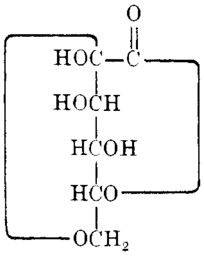
D-*glycero*-3-Tetrulosonic acid



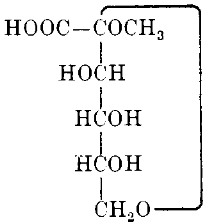
D-*erythro*-L-*glycero*-3-Hexulosonic acid[17]



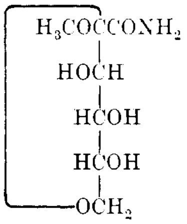
α-D-*arabino*-2-Hexulopyranosonic acid (Common name for biochemical usage: 2-Keto-D-gluconic acid)



β-D-*arabino*-2-Hexulopyranosono-1,5-lactone



Methyl α-D-*arabino*-2-hexulopyranosidonic acid



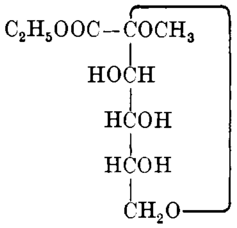
Methyl β-D-*arabino*-2-hexulopyranosidonamide

---

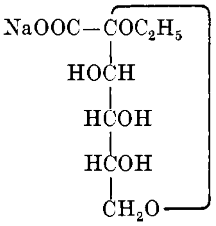
[16] Names according to Anglo-American usage: (a) methyl 3-deoxy-D-*threo*-pentonate, (b) 3-deoxy-D-*ribo*-hexono-1,5-lactone.

[17] Name according to Anglo-American usage: D-*arabino*-3-hexulosonic acid.

Comment. Parentheses are suitably inserted where it is necessary to distinguish between an ester alkyl group and the hemiacetal alkyl group of a glycoside of a ketoaldonic acid.



Ethyl (methyl α-D-*arabino*-2-hexulopyranosid)onate



Sodium (ethyl α-D-*arabino*-2-hexulopyranosid)onate

URONIC ACIDS

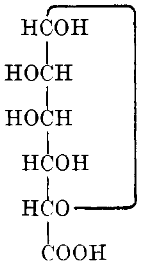
Rule Carb-30

The monocarboxylic acids formally derived by oxidation of the terminal CH_2OH group of aldoses having four or more carbon atoms in the chain, or of glycosides derived from these aldoses, to a carboxyl group are named 'uronic acids'. The names of the individual compounds of this type are formed by replacing (a) the 'ose' of the systematic or trivial name of the aldose by 'uronic' acid or (b) the 'oside' of the name of the glycoside by 'osiduronic acid'.

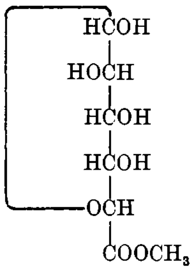
The carbon atom of the (potential) aldehydic carbonyl group (not that of the carboxyl group) is numbered 1.

Derivatives of these acids formed by change in the carboxyl group (salts, esters, lactones, acyl halides, amides, nitriles, etc.,) are named according to the IUPAC Nomenclature of Organic Chemistry, Section C, 1965, Rules C-4.

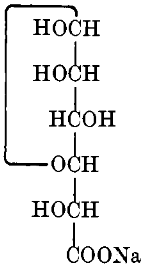
Examples:



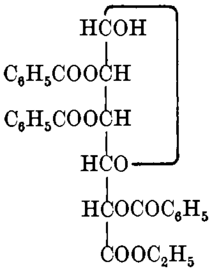
α-D-Mannopyranuronic acid



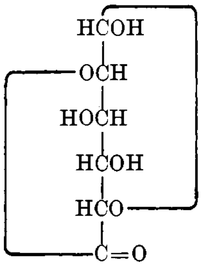
Methyl β-L-galactopyranuronate



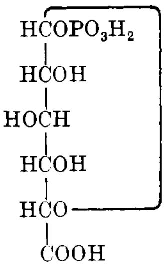
Sodium α-L-glucofuranuronate



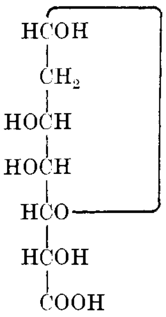
Ethyl 2,3,5-tri-*O*-benzoyl-α-D-mannofuranuronate



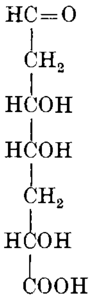
α-D-Mannopyranurono-6,2-lactone



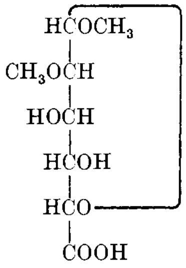
α-D-Glucopyranuronic acid 1-(dihydrogen phosphate)



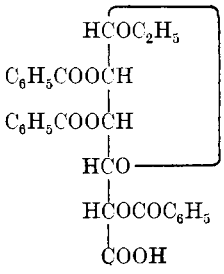
2-Deoxy-α-D-*manno*-heptopyranuronic acid



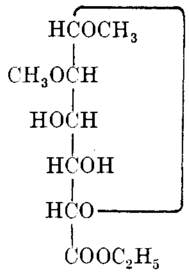
2,5-Dideoxy-*aldehydo*-D-*glycero*-D-*erythro*-hepturonic acid[18]



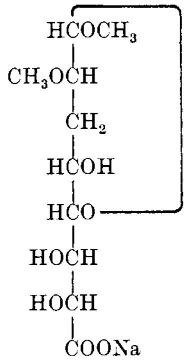
Methyl 2-*O*-methyl-α-D-mannopyranosiduronic acid



Ethyl 2,3,5-tri-*O*-benzoyl-α-D-mannofuranosiduronic acid



Ethyl (methyl 2-*O*-methyl-α-D-mannopyranosid)uronate



Sodium (methyl 3-deoxy-2-*O*-methyl-β-L-*manno*-L-*glycero*-octopyranosid)uronate[19]

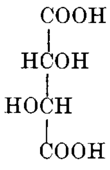
ALDARIC ACIDS

Rule Carb-31

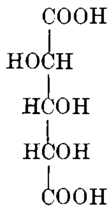
The dicarboxylic acids formed by oxidation of both terminal groups of an aldose to carboxyl groups are called 'aldaric acids'. Names of individual compounds of this type are formed by replacing the ending 'ose' of the systematic or trivial name of the corresponding aldose by 'aric acid'. Choice between the several possible names is based on the order of precedence given in Rule Carb-2.

Examples:

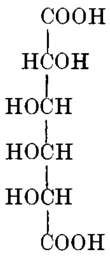
a) Names requiring D or L:



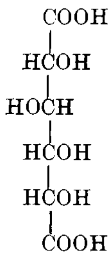
L-Threaric acid



D-Arabinaric acid (not D-lyxaric acid)



L-Altraric acid (not L-talaric acid)



D-Glucaric acid (not L-gularic acid)

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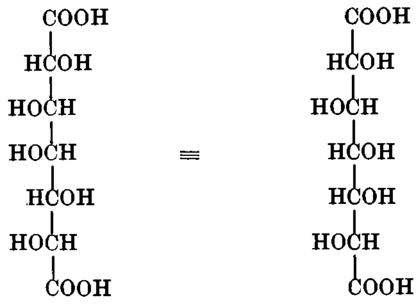
[18] Name according to Anglo-American usage: 2,5-dideoxy-*aldehydo*-D-*ribo*-hepturonic acid.

[19] Name according to Anglo-American usage: sodium (methyl 3-deoxy-2-*O*-methyl-L-*glycero*-β-L-*galacto*-octopyranosid)uronate.

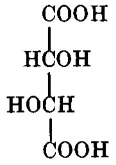


L-*glycero*-D-*galacto*-Heptaric acid
not L-*glycero*-D-*gluco*-Heptaric acid

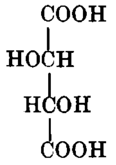
b) To the names of aldaric acids optically compensated intramolecularly, which therefore have no D or L prefix, the prefix *meso*- may be added for the sake of clarity. Examples: *meso*-erythraric acid, *meso*-ribaric acid, *meso*-xylaric acid, *meso*-allaric acid, *meso*-galactaric acid.

The D or L prefix must however be used when a *meso*-aldaric acid has become asymmetric as a result of substitution.

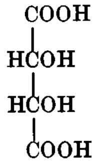
c) The following trivial names are preferred to the systematic names.



(+)-Tartaric acid
(L-threaric acid)
(*RR*-Tartaric acid)



(−)-Tartaric acid
(D-threaric acid)
(*SS*-Tartaric acid)



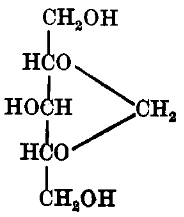
meso-Tartaric acid
(erythraric acid)
(*RS*-Tartaric acid)

CYCLIC ACETALS

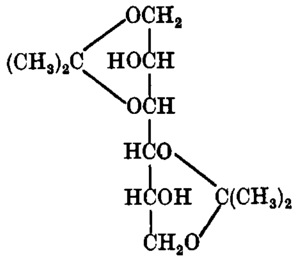
Rule Carb-32

Cyclic acetals formed by the reaction of saccharides or saccharide derivatives with aldehydes or ketones are named in accordance with Rule Carb-15, bivalent radical names being used as prefixes, the names of such radicals following the rules of general organic chemical nomenclature. In indicating more than one cyclic acetal grouping of the same kind, the appropriate pairs of locants are separated typographically when the exact placement of the acetal groups is known.

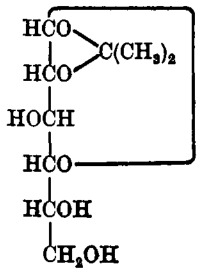
Examples:



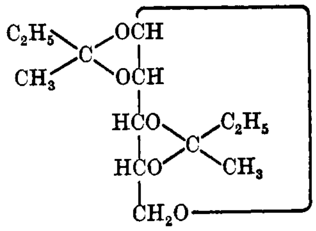
2,4-*O*-Methylenexylitol



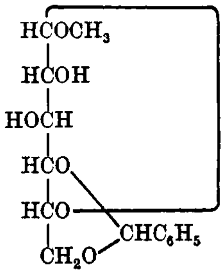
1,3:4,6-Di-*O*-isopropylidene-D-mannitol



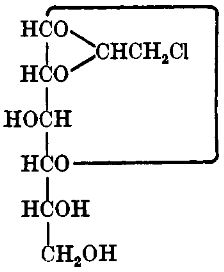
1,2-*O*-Isopropylidene-α-D-glucofuranose



1,2:3,4-Di-*O*-*sec*-butylidene-β-D-arabinopyranose



Methyl 4,6-*O*-benzylidene-α-D-glucopyranoside

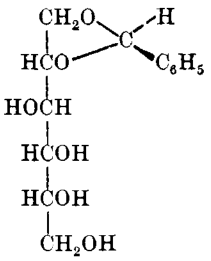


1,2-*O*-(2-Chloroethylidene)-α-D-glucofuranose

Note. It is to be noted that in the last three examples new asymmetric centers have been introduced at the carbonyl carbon atom of the aldehyde or ketone that has reacted with the saccharide.

When known, the stereochemistry at such a new center is indicated by use of the appropriate *R* or *S* symbol (see the Preamble, section 5), placed in parentheses, immediately before the name of the bivalent radical corresponding to the original aldehyde or ketone.

Example:



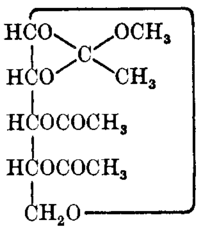
1,2-*O*-(*R*)-Benzylidene-D-glucitol

ORTHO ESTERS

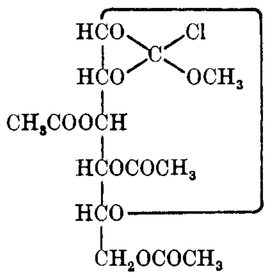
Rule Carb-33

The "glycosides of ortho ester structure" are named (a) as cyclic acetals, according to Rule Carb-32, or (b) as ortho esters, according to Rule C-464.1[20], with the name of the saccharide as the first term of the name.

Examples:



(a) 3,4-Di-*O*-acetyl-1,2-*O*-(1-methoxyethylidene)-α-D-ribopyranose
(b) α-D-Ribopyranose 3,4-diacetate 1,2-(methyl orthoacetate)



(a) 3,4,6-Tri-*O*-acetyl-1,2-*O*-(1-chloro-1-methoxymethylene)-α-D-glucopyranose
(b) α D-Glucopyranose 3,4,6-triacetate 1,2-(methyl chloroorthoformate)

Note. In each example a new asymmetric center has been introduced at the carbon atom of the hypothetical ortho acid.

When known, the stereochemistry at such a new center are indicated by use of the appropriate *RS* symbol (see the Preamble, section 5), placed in parentheses, immediately before that part of the name that includes the new asymmetric center.

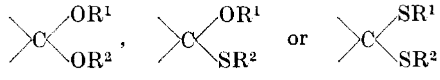
Examples:

a) 3,4,6-Tri-*O*-acetyl-1,2-*O*-(*R*)-(1-chloro-1-methoxymethylene)-α-D-glucopyranose
b) α-D-Glucopyranose 3,4,6-triacetate 1,2-(*R*)-(methyl chloroorthoformate)

ACETALS AND THIOACETALS

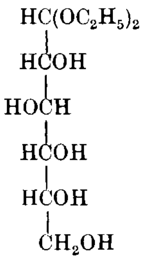
Rule Carb-34

The compounds obtained by transforming the carbonyl group of a saccharide or saccharide derivative into the grouping

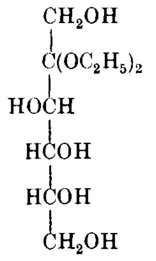


are named by placing after the name of the saccharide or saccharide derivative the term 'acetal', 'monothioacetal' or 'dithioacetal' as appropriate, preceded by the names of the radicals R^1 and R^2. With monothioacetals the mode of bonding of two different radicals R^1 and R^2 is indicated by the use of the prefixes *O* and *S*.

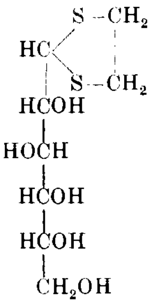
Examples:



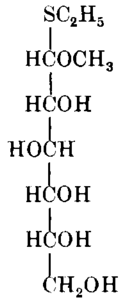
D-Glucose diethyl acetal



D-Fructose diethyl acetal



D-Glucose ethylene dithioacetal



D-Glucose *S*-ethyl *O*-methyl monothioacetal

Note. In the last example carbon atom number one has become asymmetric. When known, the stereochemistry at this new asymmetric center will be indicated by use of the Sequence Rule Symbol, *R* or *S* (see the Preamble, section 5), preceded by the locant of the new asymmetric center and both placed in parentheses, at the beginning of the name.

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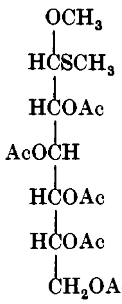
[20] IUPAC Nomenclature of Organic Chemistry, Section C: see ref. [1].

Example:



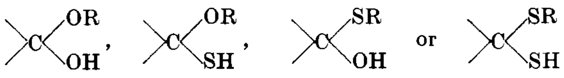
$$\begin{array}{r}\mathrm{OCH_3}\\ \mathrm{HCSCH_3}\\ \mathrm{HCOAc}\\ \mathrm{AcOCH}\\ \mathrm{HCOAc}\\ \mathrm{HCOAc}\\ \mathrm{CH_2OAc}\end{array}$$

(1*R*)-2,3,4,5,6-Penta-*O*-acetyl-D-glucose dimethyl monothioacetal

HEMIACETALS

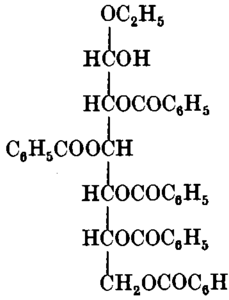
Rule Carb-35

The compounds obtained by transforming the carbonyl group of the acyclic form of a saccharide, or saccharide derivative, into the grouping



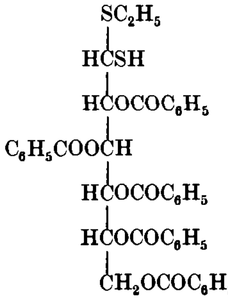
are named as indicated in Rule Carb-34, by using the endings 'hemiacetal', 'monothiohemiacetal', or 'dithiohemiacetal', as appropriate. The two isomers of a monothiohemiacetal are differentiated by use of *O* and *S* prefixes.

Examples:



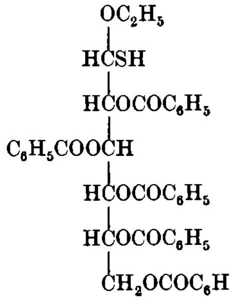
$$\begin{array}{r}\mathrm{OC_2H_5}\\ \mathrm{HCOH}\\ \mathrm{HCOCOC_6H_5}\\ \mathrm{C_6H_5COOCH}\\ \mathrm{HCOCOC_6H_5}\\ \mathrm{HCOCOC_6H_5}\\ \mathrm{CH_2OCOC_6H_5}\end{array}$$

2,3,4,5,6-Penta-*O*-benzoyl-D-glucose ethyl hemiacetal



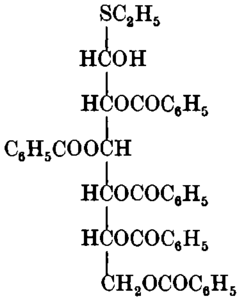
$$\begin{array}{r}\mathrm{SC_2H_5}\\ \mathrm{HCSH}\\ \mathrm{HCOCOC_6H_5}\\ \mathrm{C_6H_5COOCH}\\ \mathrm{HCOCOC_6H_5}\\ \mathrm{HCOCOC_6H_5}\\ \mathrm{CH_2OCOC_6H_5}\end{array}$$

2,3,4,5,6-Penta-*O*-benzoyl-D-glucose ethyl dithiohemiacetal



$$\begin{array}{r}\mathrm{OC_2H_5}\\ \mathrm{HCSH}\\ \mathrm{HCOCOC_6H_5}\\ \mathrm{C_6H_5COOCH}\\ \mathrm{HCOCOC_6H_5}\\ \mathrm{HCOCOC_6H_5}\\ \mathrm{CH_2OCOC_6H_5}\end{array}$$

2,3,4,5,6-Penta-*O*-benzoyl-D-glucose *O*-ethyl monothiohemiacetal



$$\begin{array}{r}\mathrm{SC_2H_5}\\ \mathrm{HCOH}\\ \mathrm{HCOCOC_6H_5}\\ \mathrm{C_6H_5COOCH}\\ \mathrm{HCOCOC_6H_5}\\ \mathrm{HCOCOC_6H_5}\\ \mathrm{CH_2OCOC_6H_5}\end{array}$$

2,3,4,5,6-Penta-*O*-benzoyl-D-glucose *S*-ethyl monothiohemiacetal

Note. In these compounds carbon atom number one has become asymmetric. When known, the stereochemistry at this new asymmetric center is indicated as described in the Note to Rule Carb-34.

OTHER SULFUR MONOSACCHARIDES

Rule Carb-36

Replacement of a hydroxyl oxygen atom of an aldose or ketose, or of the oxygen atom of the carbonyl group of the acyclic form of an aldose or ketose, by sulfur is indicated by placing the (non-detachable) affix 'thio', preceded by the appropriate locant, before the systematic or trivial name of the aldose or ketose.

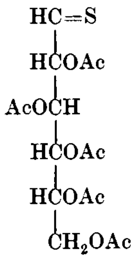
Replacement of the ring oxygen atom of the cyclic form of an aldose or ketose by sulfur is indicated in the same way, the number of the highest numbered carbon atom of the ring being used as locant.

Glycosides in which the glycosidic oxygen atom is replaced by sulfur are designated generically as 'thioglycosides'.

Selenium compounds are named analogously, by use of the affix 'seleno'.

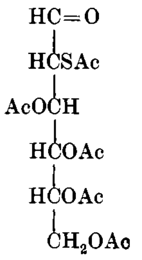
Note. It should be noted that the appropriate affix is thio, not thia; the latter is used in systematic organic chemical nomenclature to indicate replacement of CH_2 by S.

Examples:



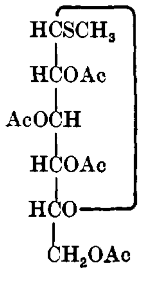
$$\begin{array}{r}\mathrm{HC{=}S}\\ \mathrm{HCOAc}\\ \mathrm{AcOCH}\\ \mathrm{HCOAc}\\ \mathrm{HCOAc}\\ \mathrm{CH_2OAc}\end{array}$$

2,3,4,5,6-Penta-*O*-acetyl-1-thio-*aldehydo*-D-glucose

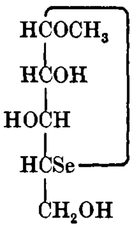


$$\begin{array}{r}\mathrm{HC{=}O}\\ \mathrm{HCSAc}\\ \mathrm{AcOCH}\\ \mathrm{HCOAc}\\ \mathrm{HCOAc}\\ \mathrm{CH_2OAc}\end{array}$$

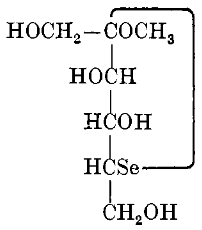
3,4,5,6-Tetra-*O*-acetyl-2-*S*-acetyl-2-thio-*aldehydo*-D-glucose



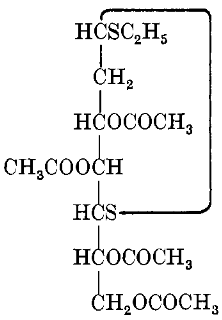
Methyl 2,3,4,6-tetra-*O*-acetyl-1-thio-α-D-glucopyranoside



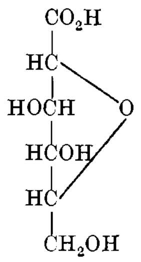
Methyl 4-seleno-α-D-xylofuranoside



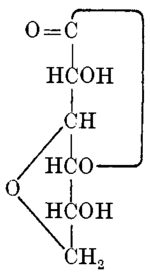
Methyl 5-seleno-α-D-fructofuranoside



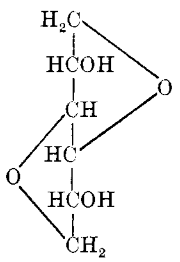
Ethyl 3,4,6,7-tetra-*O*-acetyl-2-deoxy-1,5-dithio-α-D-*gluco*-heptopyranoside



2,5-Anhydro-D-gluconic acid



3,6-Anhydro-D-glucono-1,4-lactone



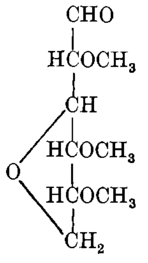
1,4:3,6-Dianhydro-D-glucitol (not 1,4:3,6-dianhydro-L-gulitol)

INTRAMOLECULAR ANHYDRIDES

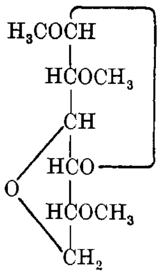
Rule Carb-37

An intramolecular ether (commonly called an intramolecular anhydride), formed by elimination of water from two alcoholic hydroxyl groups of a single molecule of a monosaccharide (aldose or ketose) or monosaccharide derivative, is named by attaching the (detachable) prefix 'anhydro' by a hyphen before the monosaccharide name; this prefix, in turn, is preceded by a pair of locants identifying the two hydroxyl groups involved.

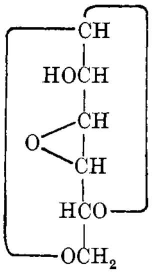
Examples:



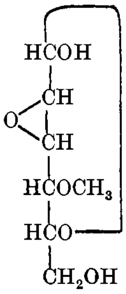
3,6-Anhydro-2,4,5-tri-*O*-methyl-*aldehydo*-D-glucose



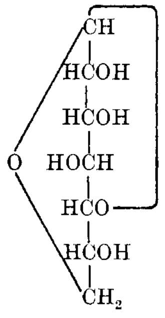
Methyl 3,6-anhydro-2,5-di-*O*-methyl-β-D-glucofuranoside



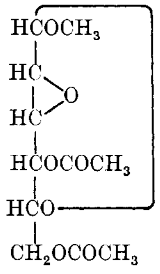
1,6:3,4-Dianhydro-β-D-talopyranose



2,3-Anhydro-4-*O*-methyl-α-D-mannopyranose

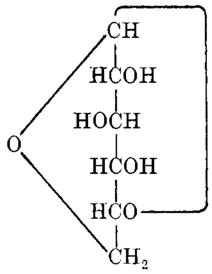


1,7-Anhydro-D-*glycero*-β-D-*gulo*-heptopyranose

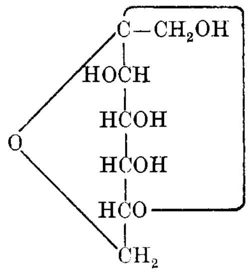


Methyl 4,6-di-*O*-acetyl-2,3-anhydro-α-D-allopyranoside

Trivial names for anhydro-monosaccharides established by usage but not recommended (because of possible confusion with polysaccharide names based on the use of the termination -an) are



Levoglucosan (preferred name: 1,6-anhydro-β-D-glucopyranose)



Sedoheptulosan (preferred name: 2,7-anhydro-β-D-*altro*-2-heptulopyranose)

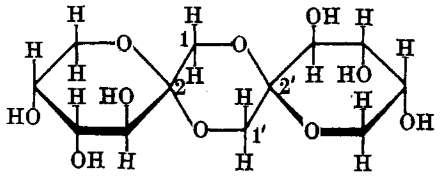
Note. The compounds usually known as monosaccharide anhydrides, glycose anhydrides, or glycosans (whose formation involves the reducing group), as well as the anhydro sugars (whose formation does not involve the reducing group) are not here differentiated in treatment.

INTERMOLECULAR ANHYDRIDES

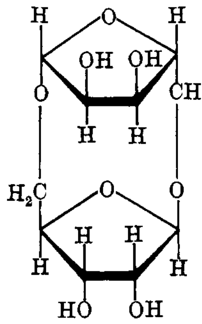
Rule Carb-38

An intermolecular cyclic acetal (commonly called an intermolecular anhydride), formed by condensation of two monosaccharide molecules with the elimination of two molecules of water, is named by placing the word 'dianhydride' after the names of the two parent monosaccharides. When the two parent monosaccharides are different, the sequence of their citation is according to the order of preference given in Rule Carb-2. The position of each anhydride link is indicated by a pair of locants showing the positions of the two hydroxyl groups involved; the locants relating to one monosaccharide (in a mixed dianhydride, the second monosaccharide named) is primed. Both pairs of locants immediately precede the word "dianhydride".

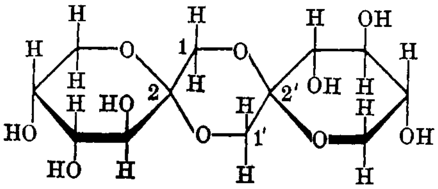
Examples:



Di-α-D-fructopyranose 1,2′;2,1′-dianhydride



Di-β-D-ribofuranose 1,5′;5,1′-dianhydride



α-D-Fructopyranose α-D-sorbopyranose 1,2′;2,1′-dianhydride

OLIGOSACCHARIDES

An oligosaccharide is a compound which, on complete hydrolysis, gives monosaccharide units only, in relatively small number per molecule (in contrast to the high-polymeric polysaccharides).

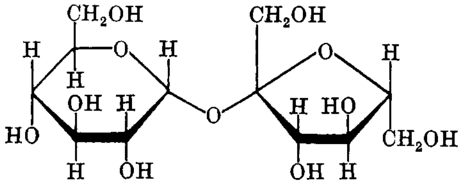
Comment. Most of the naturally occurring oligosaccharides have well-established and useful common names (for example, cellobiose, lactose, maltose, melizitose, raffinose, stachyose, and sucrose) which were assigned before their complete structures were known. Rational names may be assigned as described in the following Rules.

DISSACHARIDES

Rule Carb-39

a) *Nonreducing.* A nonreducing disaccharide is named, from its component monosaccharide parts, as a glycosyl glycoside.

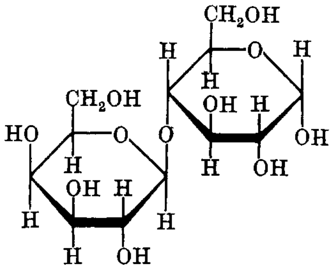
Example:



Sucrose: β-D-fructofuranosyl α-D-glucopyranoside (not α-D-glucopyranosyl β-D-fructofuranoside; alphabetical order of monosaccharide units, see Rule Carb-2)

b) *Reducing.* A reducing disaccharide is named, from its component monosaccharide parts, as a glycosylglycose.

Example:



α-Lactose: 4-*O*-β-D-galactopyranosyl-α-D-glucopyranose

A reducing disaccharide may also be named according to the method described in Rule Carb-40.

Example:

α-Lactose: *O*-β-D-galactopyranosyl-(1→4)-α-D-glucopyranose

c) *Derivatives.* Derivatives of disaccharides are named according to the rules for monosaccharides.

Examples:

Methyl α-lactoside: methyl 4-*O*-β-D-galactopyranosyl-α-D-glucopyranoside, or methyl *O*-β-D-galactopyranosyl-(1→4)-α-D-glucopyranoside

2-Amino-2-deoxy-4-*O*-(β-D-galactopyranosyl)-α-D-glucopyranose, or *O*-β-D-galactopyranosyl-(1→4)-2-amino-2-deoxy-α-D-glucopyranose

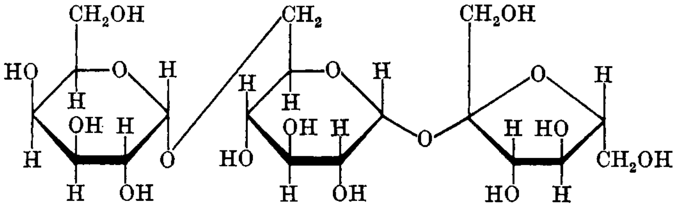
TRISACCHARIDES AND HIGHER OLIGOSACCHARIDES

Rule Carb-40

a) *Nonreducing.* A nonreducing trisaccharide is named as a glycosylglycosyl glycoside, from its component monosaccharide parts. Higher nonreducing oligosaccharides are named similarly.

Between the name of one glycosyl radical and the next are placed two locants which indicate the respective positions involved in this glycosidic union; these locants are separated by an arrow (pointing from the locant corresponding to the glycosyl carbon atom to the locant corresponding to the hydroxylic carbon atom involved) and are enclosed in parentheses.

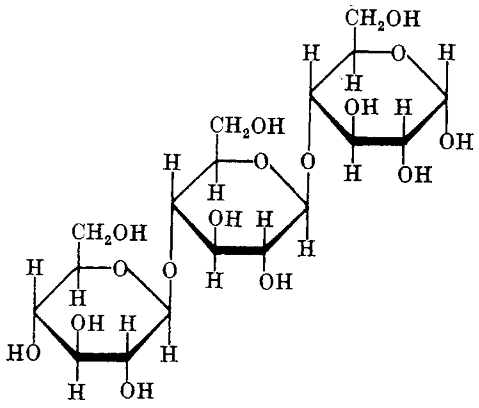
Example:



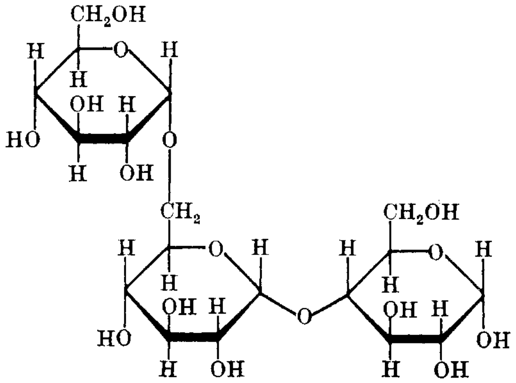
Raffinose: *O*-α-D-galactopyranosyl-(1→6)-α-D-glucopyranosyl β-D-fructofuranoside

b) *Reducing.* A reducing trisaccharide is named as a glycosylglycosylglycose, from its component monosaccharide parts. Higher reducing oligosaccharides are named similarly.

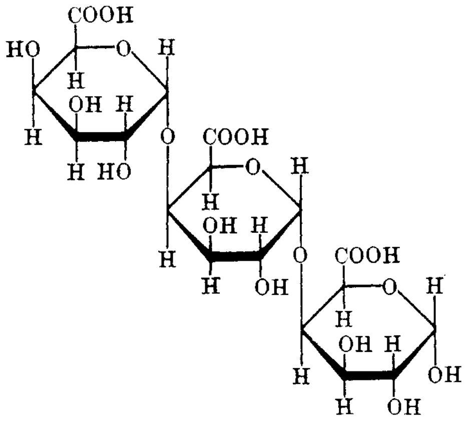
Examples:



α-Cellotriose: *O*-β-D-Glucopyranosyl-(1→4)-*O*-β-D-glucopyranosyl-(1→4)-α-D-glucopyranose

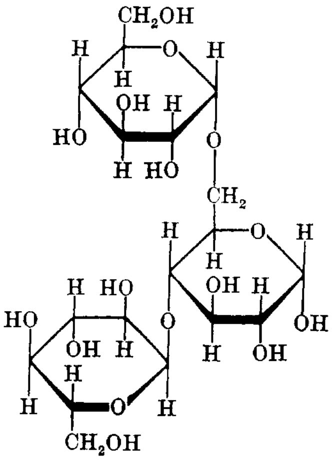


Panose: *O*-α-D-Glucopyranosyl-(1→6)-*O*-α-D-glucopyranosyl-(1→4)-α-D-glucopyranose



O-(α-D-Galactopyranosyluronic acid)-(1→4)-*O*-(α-D-galactopyranosyluronic acid)-(1→4)-α-D-galactopyranuronic acid

c) *Reducing, Branched.* By inserting one glycosyl substituent in brackets, it is distinguished from the second glycosyl substituent.



O-α-D-Glucopyranosyl-(1→4)-*O*-[α-D-glucopyranosyl-(1→6)]-α-D-glucopyranose

Synonym: 4,6-di-*O*-(α-D-glucopyranosyl)-α-D-glucopyranose (preferred name)

REFERENCES

1. *Nomenclature of Organic Chemistry.* (a) Section A and B, 1957 (2nd edition, 1966); (b) Section C, 1965. Published on behalf of the International Union of Pure and Applied Chemistry by Butterworths, London. [*Editorial note.* Section A and B are also to be found in *J. Amer. Chem. Soc.* 82 (1960) 5545; Section C in *Pure Appl. Chem.* 11 (1965) Nos 1 and 2].

2. Cahn, R. S., Ingold, C. K., and Prelog, V., *Angew. Chem.* 78 (1966) 413; *Angew. Chem. Int. Ed. Engl.* 5 (1966) 385; IUPAC Tentative Rules for the Nomenclature of Organic Chemistry, *IUPAC Information Bulletin,* 35 (1969) 71. [*Editorial note.* See also *Eur. J. Biochem.* 18 (1971) 151].

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