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Preferred names of constitutional units for use in structure-based names of polymers

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Preferred names of constitutional units for use in structure-based names of polymers (IUPAC Recommendations 2016) *

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ABSTRACT: A list of constitutional units (CU) used for naming polymers according to IUPAC nomenclature rules is provided. This list contains CUs of commercial and well-known polymers as well as CUs which have been used in polymer-nomenclature-related IUPAC documents. A preferred name is provided for each constitutional unit. Other acceptable names, and names which must not be used because they are outdated or incorrect although they may have been correct in the past or in a different context are also listed. A second table contains names of common polymers: structure-based, source-based, retained traditional polymer names and not acceptable names, again because they are outdated or incorrect. These tables supersede similar tables and names in previous documents. The rules given in those documents are still valid but names of constitutional units should be checked for agreement with the present document. The preferred names of constitutional units in Table 1 should be used in structure-based names of regular and irregular polymers.

KEYWORDS: IUPAC nomenclature; polymer nomenclature; names of constitutional units; names of common polymers

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PNP-0 INTRODUCTION

The development of chemical nomenclature for polymeric substances is an ongoing endeavor. Over recent decades, some of the general principles and also details on how to name polymers have undergone changes. Thus, the first IUPAC document on structure-based nomenclature of single-strand polymers [1] named, for example, the polymer obtained from tetrahydrofuran (oxolane) through cationic polymerization, poly(oxytetramethylene). At that time, polypropylene was a systematic name, the constitutional unit $–CH_2–CH_2–$ was named ethylene, and the $–CH=CH–CH_2–CH_2–$ unit was named 1-butenylene to give only few examples of then up-to-date nomenclature. As organic-chemical nomenclature developed, a necessary revision of [1] appeared in 2002 [2]. The "polymethylene" names (e.g., hexamethylene) as well as the alkylene names for constitutional units (e.g., butylene) were abandoned in favour of alkane-1,*x*-diyl and further changes were made to accord with organic-chemical nomenclature [3, 4]. Minor revisions of [2] were also made in the 2nd edition of the Compendium of Polymer Terminology and Nomenclature, "The Purple Book" [5]. Changes in the recently issued new editions of the IUPAC Nomenclature of Organic Chemistry ("The Blue Book") [6] and Inorganic Chemistry ("The Red Book") [7] again have implications on naming polymers.

There are two principal approaches to naming polymers [5], source-based nomenclature and structure-based nomenclature. Source-based nomenclature uses the IUPAC names of the monomer or monomers from which the polymer is presumed to have been prepared. Structure-based nomenclature uses IUPAC nomenclature for the constitutional units of the constituent macromolecules. In this document, constitutional units are collated only for structure-based names; for source-based names of polymers, the names of units, the monomer units, to be used are those recommended in the IUPAC nomenclature of organic [6] and inorganic [7] chemistry and in the new document on source-based nomenclature [8].

Published rules [2, 5] give clear instructions on how to determine constitutional repeating units (CRUs) and the order of their subunits in a regular macromolecule. These rules lead to a single, preferred CRU, i.e., a unique structure (sequence of constitutional units), which is the basis for naming a polymer by structure-based nomenclature. However, for many constitutional units (CUs) there is more than one possibility of naming them which results in a number of different possible structure-based names for a given polymer. These different possibilities have been favoured differently at different times, and have thus been sources of inconsistencies.

One principal rule in polymer nomenclature is that the names of constitutional units and monomer units must be those recommended in organic-chemical nomenclature. Therefore, in structure-based polymer nomenclature the names of the corresponding groups in organic chemistry should be used for each CU. There should hence seem to be no need to discuss the naming of CUs or CRUs. However, polymer nomenclature has some specific requirements, which in a number of cases will nevertheless lead to a different name. One of these requirements is expressed in the very basic rule used in structure-based nomenclature: groups not constituting the backbone of a macromolecule are always named as substituents. This rule overrides the above-mentioned principal rule, which results in the situation that in practice a large number of CRUs will have names that differ from the names that these groups have in organic-chemical nomenclature.

One example is the group $–CH(CH_3)–CH_2–$, called propane-1,2-diyl in organic chemistry. This name is not used in polymer nomenclature because at least with the order of locants (-1,2-) it would refer to a different orientation of the constitutional unit. If one follows the selection rules for the determination of the preferred CRU the name would have to be propane-2,1-diyl. More importantly, however, the general rule for naming groups that do not constitute the backbone (here the methyl group) as substituents, leaves a substituted $–CH_2–CH_2–$ group in the backbone. This results in the name 1-methylethylene for this example, or more systematically, 1-methylethane-1,2-diyl. As with this example, a number of preferred names in the context of organic-chemical nomenclature will therefore have to be stated as being incorrect in contexts within polymer nomenclature. However, for each part of the constitutional unit (structure) the corresponding component name should still be that used in organic-chemical nomenclature. These principles also apply to the naming of inorganic or hybrid organic-inorganic polymers.

Another example is the group $–CH_2–CH_2–$, a very important CU in the naming of polymers, probably being the most

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frequently occurring CU in polymer nomenclature. There are two names for this constitutional unit:

– the traditional name ethylene and

– the systematic name ethane-1,2-diyl.

The former is in common usage, while in [6] the latter is recommended to be used in a preferred IUPAC name (PIN), the argument being that this name is more systematic.

Replacement of the name ethylene with ethane-1,2-diyl as done in the Purple Book [5] would result in new and longer names for a large number of polymers (in particular polymers of industrial importance) without gaining any advantage. Therefore it is recommended that the preferred name for the group $–CH_2–CH_2–$ in structure-based polymer nomenclature remains ethylene. The unfortunate change of the respective names in the Purple Book [5] was based on the erroneous assumption that the Blue Book [6] would abandon the name ethylene completely.

Recommendations in this document attempt to remove inconsistencies in structure-based polymer nomenclature and aim at making a clear statement as to which of the diverse names of CUs are still recommended and which of several alternative acceptable names is the preferred one. The document is restricted to single-strand polymers, because the vast majority of polymers have this structural feature.

This document consists mainly of tables together with explanatory footnotes and a section on how to use the tables. As the whole document will be searchable, the authors hope that anyone having to deal with polymer nomenclature will use this collection of constitutional units for correctly naming polymers.

The preferred names of constitutional units in Table 1 should be used in structure-based names of regular and irregular polymers (e.g., constitutional repeating units, subunits of constitutional repeating units, junction units, and single constitutional units in names of irregular polymers).

PNP-1 PRINCIPLES OF STRUCTURE-BASED NOMENCLATURE FOR POLYMERS

The principles of structure-based polymer nomenclature have been described in detail in Refs. [2], [5], [9]and [12] for regular and irregular polymers. Concise versions are given in Refs. [10], [11] and [14]. Depending on how detailed available knowledge of the structure is, the structure-based name of a polymer is long and application of the rules of organic-chemical nomenclature in the frame of polymer nomenclature. Examples can be found in the IUPAC recommendations on cyclic organic macromolecules [12].

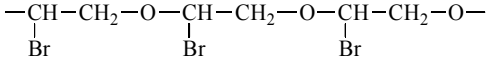
Regular polymers consist of macromolecules, the structure of which essentially comprises the repetition of a single constitutional unit with all units connected identically with respect to directional sense (definition from Ref. [5], p. 4). In the vast majority of cases regular polymers are idealized structures where irregularities are neglected.

A constitutional unit (CU) is an atom or a group of atoms (with pendant atoms or groups, if any) comprising a part of the essential structure of a macromolecule, an oligomer molecule, a regular block, or a regular chain (definition from Ref. [5], p. 5).

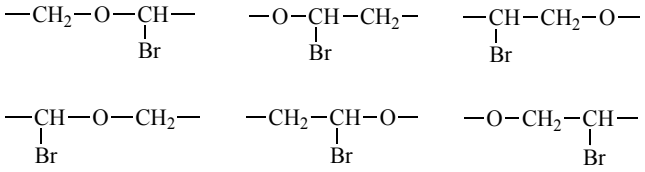
A constitutional repeating unit (CRU) is the smallest constitutional unit, the repetition of which constitutes a regular macromolecule, a regular oligomer molecule, a regular block, or a regular chain (definition from Ref. [5], p. 5).

Structure-based nomenclature of regular polymers uses the name of the preferred CRU. It is determined as follows:

(i) a part of the polymer chain large enough to show the structural repetition is drawn, typically,



(ii) the smallest repeating portion is a CRU so all possibilities in either direction are identified, in this case:



(iii) the next step is to identify the subunits that make up each of these structures, i.e., the largest groups that can be named using IUPAC nomenclature of organic or (when appropriate) inorganic chemistry,

(iv) the correct order of the subunits, that of decreasing seniority is then determined, then if this leaves a choice

(v) the preferred CRU is chosen as that with the lowest possible locant(s) for substituents.

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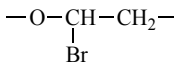
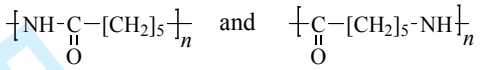
Commonly the preferred CRU of a polymer is written citing its subunits in decreasing order of seniority from left to right, i.e., for the above example as follows:



Using the CU names of entries 152 and 29 in Table 1 the name of this polymer will then be:
poly[oxy(1-bromoethylene)].
However, it should be noted that the correct name for the preferred CRU is independent of how the formula is actually drawn:

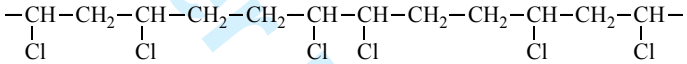


Both structural representations are correct, the correct name for both is poly[azanediyl(1-oxohexane-1,6-diyl)] applying the above mentioned rules for determination of the CRU with entries 159 and 93 from Table 1.

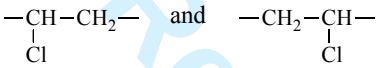
Irregular polymers consist of macromolecules, the structure of which essentially comprises the repetition of more than one type of constitutional unit or of macromolecules the structure of which comprises constitutional units not all connected identically with respect to directional sense (definition from Ref. [5], p. 4).

Irregular polymers are named by placing the prefix “poly” before the structure-based names of the constitutional units, collectively enclosed in parentheses or brackets, with the individual constitutional units separated by oblique strokes.

A simple example of an irregular polymer is the polymer derived from chloroethene, the units of which are linked both head-to-tail and head-to-head:



The constitutional units are:



The name of the polymer is: poly[(1-chloroethylene)/(2-chloroethylene)] with entries 32 and 33 from Table 1.
For details on structure-based nomenclature of irregular polymers see Ref. [9].

PNP-2 CONSTITUTIONAL UNITS FOR NAMING POLYMERS

Constitutional units (CUs) for naming common polymers (commercial or otherwise well-known) and CUs that have been used in IUPAC documents on polymer nomenclature and terminology have been identified and collected in Table 1. This table includes the chemical formula of each CU and its preferred name, which should be used when naming a polymer. The column headed “Other acceptable names of CU” contains acceptable alternative names. The next column lists names for these CUs, which should no longer be used because they are outdated, ambiguous or incorrect for various reasons, typically:

– a change of the position of locants in a name, e.g., “but-1-ene-1,4-diyl” not “1-butene-1,4-diyl”;
– the use of a substituted “ethylene” instead of alkane-1,2-diyl, e.g., “1-methylethylene” not “propane-1,2-diyl”;
– formerly used for different structures, e.g., propylene,
– etc.

Formulae in Table 1 are drawn with "open" bonds for free valences as common in polymer chemistry when the element symbols of the atoms with the free valences are shown. A wavy line perpendicular to the end of each bond line indicating a free valence of a CU is used in accordance with [22] if any element symbol of an atom with a free valence in this CU is not shown.

Names of CUs which are always enclosed in enclosing marks (substituted subunits) are shown with the corresponding enclosing marks in the table. CUs without enclosing marks in Table 1 are not parenthesised in a polymer name - except when they constitute the only and complete CRU.

In Table 1, these names have been arranged to facilitate location of a constitutional unit for the convenience of the reader. Entries are arranged in 6 groups:

1. carbon chains according to number of chain atoms and degree of unsaturation;
2. carbon rings according to ring size and degree of unsaturation;

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3. chains containing hetero atoms;
4. heterocycles according to ring size and number and type of hetero atoms;
5. spiro units;
6. units with connectivity greater than two.

Entries within these groups are listed in order of increasing complexity (unsubstituted, mono- and multiply-substituted, number and size of rings). Structural formulae in most cases are written in decreasing order of seniority of subunits as they will appear in a preferred CRU (see PNP-1) when reading from left to right. In some cases (e.g. blocks linked to each other in a particular way, or single [linking] constitutional units, or irregular polymers) a different order or orientation of constitutional units will result, and the name of the corresponding CU in the polymer name will reflect this. Some names that deviate from a name for a preferred CRU (if the polymer is composed of this CU only) are exemplified in entries 33 and 76 in Table 1.

Reasons as to why some names of CUs are no longer acceptable are given in the corresponding column or explained in footnotes, which can be found at the end of the table (p. ##).

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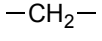
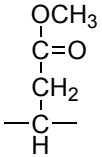
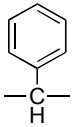
Table 1 Structure, preferred names, other acceptable names and not acceptable names of constitutional units for naming polymers

Footnotes to this table are found at the end of the table on p. ##.

No.	Chemical structure of CU	Preferred name of CU	Other acceptable names of CU	Not acceptable names of CU	Document (source)
1		methylene	methanediyl		[1, 2, 12, 13, 14, 15]
2		methanylylidene		methylidyne [1, 3]; methylylidene	[2, 12, 13]
3		(aminomethylene)			[12]
4		(bromomethylene)			[12]
5		(chloromethylene)			[1, 9, 12]
6		[(2-methoxy-2-oxoethyl)methylene]	{[(methoxycarbonyl)methyl]methylene}	[2-(methoxycarbonyl)ethylidene] [2, 3]	[1]
7		(methylmethylene)		ethylidene [2, 3]; ethane-1,1-diyl[2]	[1, 2, 12, 13]
8		(propylmethylene)		butane-1,1-diyl [2]; butylidene [2, 3]	[2]
9		(phenylmethylene)		benzylidene [2, 3]	[1, 2, 12, 16]
10		[(trichloromethyl)methylene]			[17]

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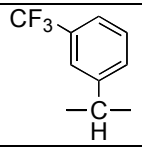
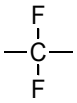
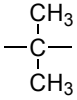
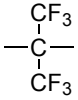
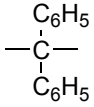
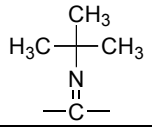
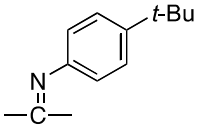
11		{[3-(trifluoromethyl)phenyl]methylene}			[2]
12		(dichloromethylene)			[9]
13		(difluoromethylene)		tetrafluoroethylene [3]; (1,1-difluoromethylene)	[1, 2], 14, 15]
14		(dimethylmethylene)		isopropylidene [2, 3]; 1-methylethane-1,1-diyl [2]; propane-2,2-diyl[2]	[2, 13, 14, 18]
15		[bis(trifluoromethyl)methylene]			[13]
16		(diphenylmethylene)			[2]
17		(methylidenemethylene)		vinylidene [3, 4]; ethene-1,1-diyl[2]	[2]
18		carbonimidoyl	(iminomethylene)	iminocarbonyl [5]	[2, 9]
19		(*tert*-butylcarbonimidoyl)	[(*tert*-butylimino)methylene]		[17]
20		[(4-*tert*-butylphenyl)carbonimidoyl]	{[(4-*tert*-butylphenyl)imino]methylene}	({[4-(2-methylpropan-2-yl)phenyl]imino}methylene)	[13]
21		carbonothioyl	thiocarbonyl		[1, 2]

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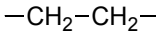
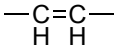
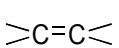
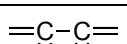
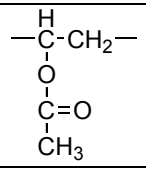
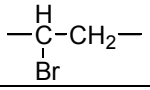
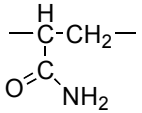
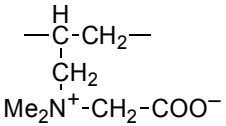
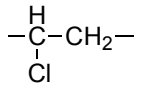
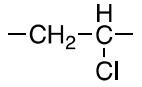
22		carbonyl			[1, 2, 12, 13, 16]
23		ethylene	ethane-1,2-diyl		[2]
24		ethene-1,2-diyl		vinylene	[1, 2, 12, 13, 14]
25		ethenetetrayl		ethenediylidene [3] (only for =C=C=)	[12]
26		ethanediylidene			[2, 12]
27		ethynediyl		ethyne-1,2-diyl	[13]
28		(1-acetoxyethylene)	(1-acetoxyethane-1,2-diyl); [1-(acetyloxy)ethane-1,2-diyl]		[1, 2, 9, 14, 15]
29		(1-bromoethylene)	(1-bromoethane-1,2-diyl)		[1, 2, 14]
30		(1-carbamoylethylene)	(1-carbamoylethane-1,2-diyl)		[18]
31		(1-{[(carboxylatomethyl)dimethylazaniumyl]methyl}ethylene)	(1-{[(carboxylatomethyl)dimethylammonio]methyl}ethylene); (1-{[(carboxylatomethyl)dimethylammonio]methyl}ethane-1,2-diyl)		[13]
32		(1-chloroethylene)	(1-chloroethane-1,2-diyl)		[1, 2, 9, 12, 14, 15, 18]
33		(2-chloroethylene)	(2-chloroethane-1,2-diyl)	Preferred CRU of homopolymer: (1-chloroethylene)	[9]

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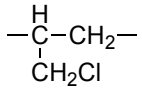
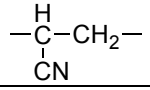
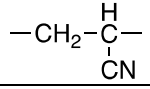
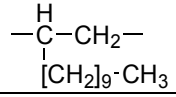
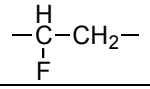
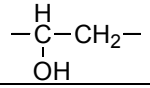
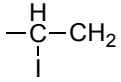
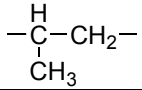
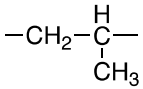
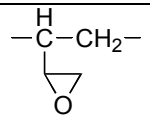
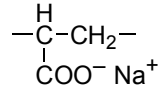
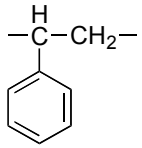
34		[1-(chloromethyl)ethylene]	[1-(chloromethyl)ethane-1,2-diyl]		[14]
35		(1-cyanoethylene)	(1-cyanoethane-1,2-diyl)		[1, 2, 9, 14, 15]
36		(2-cyanoethylene)	(2-cyanoethane-1,2-diyl)		[9]
37		(1-decylethylene)	(1-decylethane-1,2-diyl)	dodecane-2,1-diyl [2)]	[2]
38		(1-fluoroethylene)	(1-fluoroethane1,2-diyl)		[1, 2, 14]
39		(1-hydroxyethylene)	(1-hydroxyethane-1,2-diyl)		[1, 2, 9, 14]
40		(1-iodoethylene)	(1-iodoethane1,2-diyl)		[1]
41		(1-methylethylene)	(1-methylethane-1,2-diyl)	propylene [2)]; propane-2,3-diyl[2]	[1, 2, 12, 13, 14, 19, 15]
42		(2-methylethylene)	(2-methylethane-1,2-diyl)	preferred CRU of homopolymer: (1-methylethylene)	[2]
43		[1-(oxiranyl)ethylene]	[1-(oxiranyl)ethane-1,2-diyl]; [1-(oxiran-2-yl)ethane-1,2-diyl]		[18]
44		(sodium 1-carboxylatoethylene)	(sodium 1-carboxylatoethane-1,2-diyl)		[1, 2]
45		(1-phenylethylene)	(1-phenylethane-1,2-diyl)	benzylidenemethylene [6)]; 1-phenyldimethylene	[1, 2, 9, 13, 14, 15, 18, 20]

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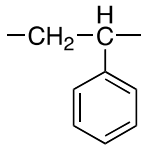
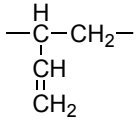
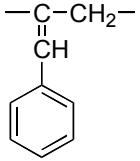
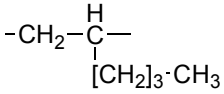
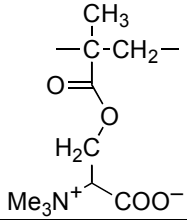
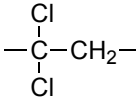
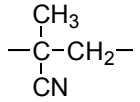
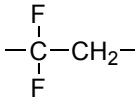
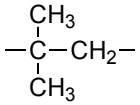
46		(2-phenylethylene)	(2-phenylethane-1,2-diyl)	preferred CRU of homopolymer: (1-phenylethylene)	[9]
47		(1-ethenylethylene)	(1-vinylethylene); (1-ethenylethane-1,2-diyl); (1-vinylethane-1,2-diyl)		[9, 13, 14, 19 18]
48		(1-benzylideneethylene)	[1-(phenylmethylidene)ethylene]; [1-(phenylmethylidene)ethane-1,2-diyl]		[13]
49		(2-butylethylene)	(2-butylethane-1,2-diyl)		[1, 2]
50		(1-{[2-carboxylato-2-(trimethylazaniumyl)ethoxy]carbonyl}-1-methylethylene)	(1-{[2-carboxylato-2-(trimethylammonio)ethoxy]carbonyl}-1-methylethylene); (1-{[2-carboxylato-2-(trimethylammonio)ethoxy]carbonyl}-1-methylethane-1,2-diyl)		[13]
51		(1,1-dichloroethylene)	(1,1-dichloroethane1,2-diyl)		[1]
52		(1-cyano-1-methylethylene)	(1-cyano-1-methylethane-1,2-diyl)		[1, 16]
53		(1,1-difluoroethylene)	(1,1-difluoroethane-1,2-diyl)		[1, 14, 19 15]
54		(1,1-dimethylethylene)	(1,1-dimethylethane-1,2-diyl)	isobutylene	[1, 2, 13, 14, 16, 15]

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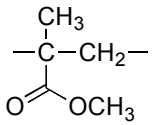
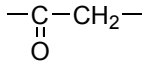
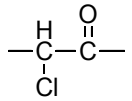
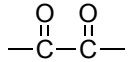
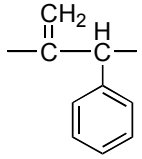
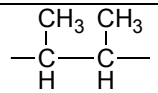
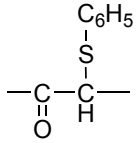
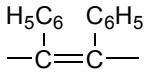
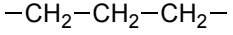
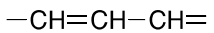
55		[1-(methoxycarbonyl)-1-methylethylene]	[1-(methoxycarbonyl)-1-methylethane-1,2-diyl]		[1, 9, 14]
56		(1-oxoethylene)	(1-oxoethane-1,2-diyl)		[16]
57		(1-chloro-2-oxoethylene)	(1-chloro-2-oxoethane-1,2-diyl)		[1, 2]
58		oxalyl	ethanedioyl; 1,2-dioxoethane-1,2-diyl		[1, 2]
59		(1-methylidene-2-phenylethylene)	(1-methylidene-2-phenylethane-1,2-diyl)		[1, 13]
60		(1,2-dimethylethylene)	(1,2-dimethylethane-1,2-diyl)	(butane-2,3-diyl) [2]	[2, 19, 17]
61		[1-oxo-2-(phenylsulfanyl)ethylene]	[1-oxo-2-(phenylsulfanyl)ethane-1,2-diyl]	[1-oxo-2-(phenylthio)ethylene]; [1-oxo-2-(phenylthio)ethane-1,2-diyl]	[1, 2]
62		(1,2-diphenylethene-1,2-diyl)			[2]
63		propane-1,3-diyl		trimethylene	
64		prop-1-en-1-yl-3-ylidene		1-propen-1-yl-3-ylidene	[1, 2]
65		prop-2-en-3-yl-1-ylidene		2-propen-3-yl-1-ylidene	[1, 2]

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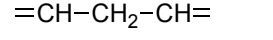
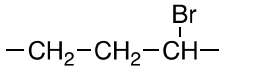
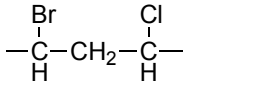
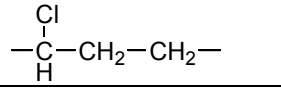
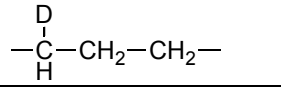
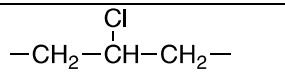
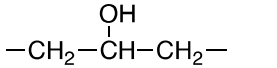
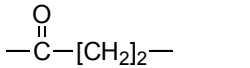
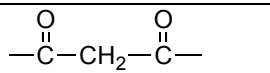
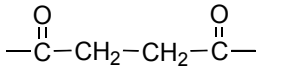
66		propane-1,3-diylidene		1,3-propanediylidene	[1, 2]
67		propan-1-yl-3-ylidene			
68		propan-3-yl-1-ylidene			[12]
69		(3-bromopropane-1,3-diyl)		(3-bromotrimethylene)	[1]
70		(1-bromo-3-chloropropane-1,3-diyl)		1-bromo-3-chlorotrimethylene	[2]
71		(1-chloropropane-1,3-diyl)		1-chlorotrimethylene	[1, 2]
72		[(1-$^{2}H_{1}$)propane-1,3-diyl]		trimethylene-*1-d*	[2]
73		(2-chloropropane-1,3-diyl)		(2-chlorotrimethylene)	[1, 2]
74		(2-hydroxypropane-1,3-diyl)			[18]
75		(1-oxopropane-1,3-diyl)			[18]
76		propanedioyl	malonyl; (1,3-dioxopropane-1,3-diyl)	preferred CRU in homopolymer: (1,2-dioxopropane-1,3-diyl)	[2]
77		butane-1,4-diyl		tetramethylene	[2, 9, 12, 13, 14, 18]
78		but-1-ene-1,4-diyl		1-butenylene	[1, 2, 9, 13, 14, 18]
79		but-2-ene-1,4-diyl		2-butenylene	[9, 2]
80		butanedioyl	succinyl; (1,4-dioxobutane-1,4-diyl)	(1,2-dioxotetramethylene); preferred CRU in homopolymer: (1,2-dioxobutane-1,4-diyl)	[1, 13, 14]

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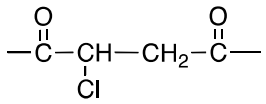
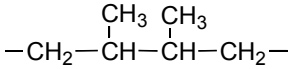
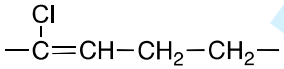
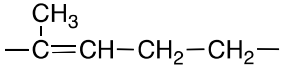
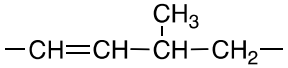
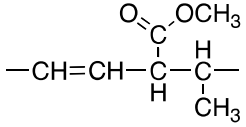
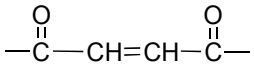
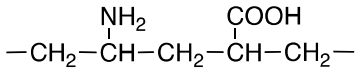
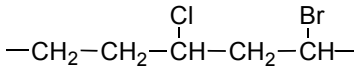
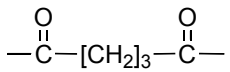
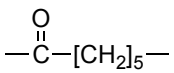
81		(2-chlorobutanedioyl)		(2-chlorosuccinyl); preferred CRU in homopolymer: (1,2-dioxo-3-chlorobutane-1,4-diyl)	[1, 16]
82		(2,3-dimethylbutane-1,4-diyl)		preferred CRU in homopolymer: (1,2-dimethylbutane-1,4-diyl)	[19]
83		(1-chlorobut-1-ene-1,4-diyl)		(1-chloro-1-butenylene)	[16],
84		(1-methylbut-1-ene-1,4-diyl)		1-methyl-1-butenylene	[1, 2, 14, 15, 19]
85		(3-methylbut-1-ene-1,4-diyl)			[19]
86		[3-(methoxycarbonyl)-4-methylbut-1-ene-1,4-diyl]			[19]
87		butenedioyl	fumaroyl (*E*), maleoyl (*Z*)		[2, 13],
88		pentane-1,5-diyl		pentamethylene	[2]
89		(2-amino-4-carboxypentane-1,5-diyl)		(2-amino-4-carboxypentamethylene)	[1, 2]
90		(5-bromo-3-chloropentane-1,5-diyl)		(5-bromo-3-chloropentamethylene); preferred CRU in homopolymer: (1-bromo-3-chloropentane-1,5-diyl)	[1, 2]
91		pentanedioyl	glutaryl; (1,5-dioxopentane-1,5-diyl)	preferred CRU in homopolymer: (1,2-dioxopentane-1,5-diyl)	[2]
92		hexane-1,6-diyl		hexamethylene	[1, 2, 9, 12, 13, 14, 16, 18]
93		(1-oxohexane-1,6-diyl)		1-oxohexamethylene; hexanoyl (monofunctional)	[1, 2, 13, 14, 20]

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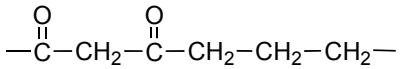
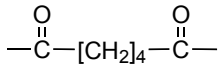
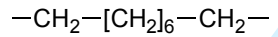
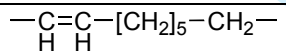
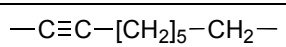
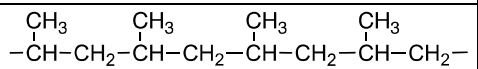
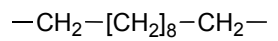
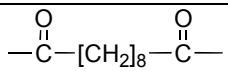
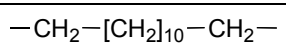
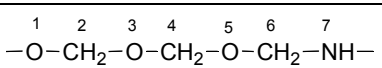
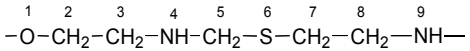
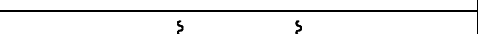
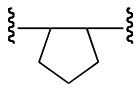
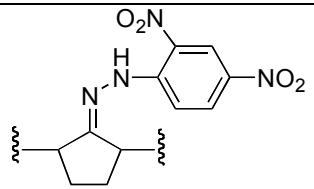
94		(1,3-dioxohexane-1,6-diyl)		1,3-dioxohexamethylene	[1, 2]
95		hexanedioyl	adipoyl; (1,6-dioxohexane-1,6-diyl)	1,6-dioxohexamethylene; preferred CRU in homopolymer: (1,2-dioxohexane-1,6-diyl)	[1, 2, 9, 13, 14, 15]
96		octane-1,8-diyl			[13]
97		oct-1-ene-1,8-diyl			[12]
98		oct-1-yne-1,8-diyl			[13]
99		(1,3,5,7-tetramethyloctane-1,8-diyl)		in case of homopoylmer: poly(1-methylethylene)	[19]
100		decane-1,10-diyl			[13]
101		decanedioyl	1,10-dioxodecane-1,10-diyl	sebacyl	[1, 2, 12, 13]
102		dodecane-1,12-diyl			[13]
103		oxymethyleneoxymethyleneoxymethyleneazanediyl		(1,3,5-trioxa-7-azaheptane-1,7-diyl) [7] (see oxy, methylene, azanediyl)	[2]
104		oxyethyleneazanediylmethylenesulfanediylethyleneazanediyl		(1-oxa-6-thia-4,9-diazanonane)-1,9-diyl [7]; oxyethyleneiminomethylenethioethyleneimino [5]; (see oxy, ethylene, azanediyl, sulfanediyl, methylene)	[1, 2]
105		oxymethyleneoxymethyleneazanediylethylenesulfanediylmethyleneazanediylethylene		(1,3-dioxa-8-thia-5,10-diazadodecane-1,12-diyl) [7]; oxymethyleneoxymethyleneiminoethylenesulfanediylmethyleneiminoethylene [5]	[2]
106		cyclopentane-1,2-diyl		1,2-cyclopentylene	[1, 2, 19]
107		{2-[(2,4-dinitrophenyl)hydrazinylidene]cyclopentane-1,3-diyl}		{2-[2,4-dinitrophenyl)hydrazono]-1,3-cyclopentylene}; {2-[(2,4-dinitrophenyl)hydrazono]cyclopentane-1,3-diyl}	[1, 2]

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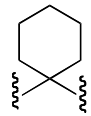
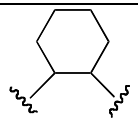
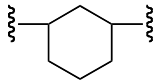
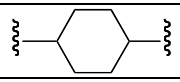
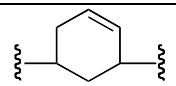
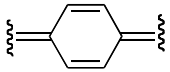
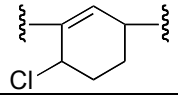
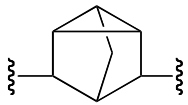
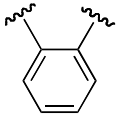
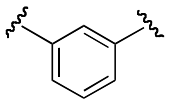
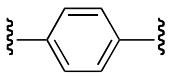
108		cyclohexane-1,1-diyl		cyclohexylidene [3)]	[2, 12]
109		cyclohexane-1,2-diyl			[14]
110		cyclohexane-1,3-diyl		1,3-cyclohexylene	[1, 2, 14]
111		cyclohexane-1,4-diyl		1,4-cyclohexylene	[1, 2, 16]
112		cyclohex-4-ene-1,3-diyl		4-cyclohexen-1,3-ylene	[1, 2]
113		(cyclohexa-2,5-diene-1,4-diylidene)			[2]
114		(6-chlorocyclohex-1-ene-1,3-diyl)		(6-chloro-1-cyclohexen-1,3-ylene)	[1, 2]
115		tricyclo[2.2.1.$0^{2,6}$]heptane-3,5-diyl		tricyclo[2.2.1.$0^{2,6}$]hept-3,5-ylene	[1]
116		1,2-phenylene	benzene-1,2-diyl	*o*-phenylene [8)]	[14]
117		1,3-phenylene	benzene-1,3-diyl	*m*-phenylene [8)]	[2, 9], 14]
118		1,4-phenylene	benzene-1,4-diyl	*p*-phenylene [8)]	[1, 2, 9, 12, 13, 14, 16, 15]

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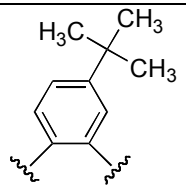
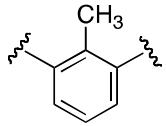
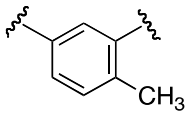
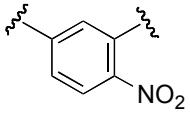
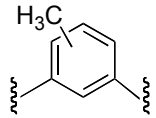
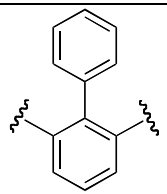
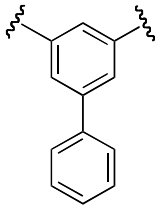
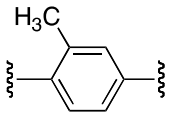
119		(4-*tert*-butyl-1,2-phenylene)	(4-*tert*-butylbenzene-1,2-diyl); [4-(1,1-dimethylethyl)-1,2-phenylene]	(4-*tert*-butyl-*o*-phenylene) [8)]	[12]
120		(2-methyl-1,3-phenylene)			[13]
121		(4-methyl-1,3-phenylene)			[13]
122		(4-nitro-1,3-phenylene)			[1, 2]
123		(*x*-methyl-1,3-phenylene)			[2]
124		(2-phenyl-1,3-phenylene)		(2,6-biphenylylene) [2)]	[1, 2, 16]
125		(5-phenyl-1,3-phenylene)		biphenyl-3,5-diyl [2)]	[2, 16],
126		(2-methyl-1,4-phenylene)			[13]

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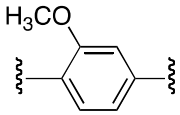
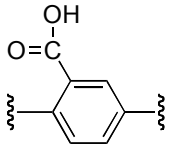
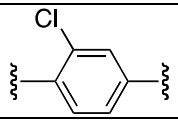
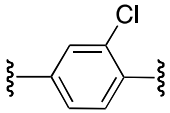
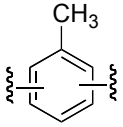
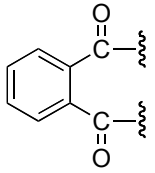
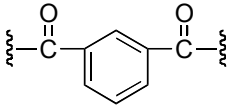
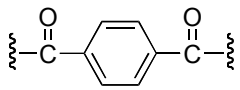
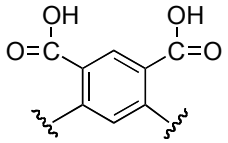
127		(2-methoxy-1,4-phenylene)			[13, 16]
128		(2-carboxy-1,4-phenylene)			[13]
129		(2-chloro-1,4-phenylene)	(2-chlorobenzene-1,4-diyl)	(2-chloro-*p*-phenylene)	[12]
130		(3-chloro-1,4-phenylene)		preferred CRU in homopolymer: (2-chloro-1,4-phenylene)	[1, 2]
131		(methylphenylene)			[2]
132		phthaloyl	carbonyl-1,2-phenylenecarbonyl	benzene-1,2-dicarbonyl [9)]	[2], [13]
133		isophthaloyl	carbonyl-1,3-phenylenecarbonyl	benzene-1,3-dicarbonyl [9)]	[2]
134		terephthaloyl	carbonyl-1,4-phenylenecarbonyl	benzene-1,4-dicarbonyl [9)]	[1, 2, 13, 14, 15, 16, 18]
135		(4,6-dicarboxy-1,3-phenylene)			[13, 18]

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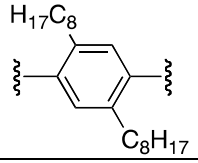
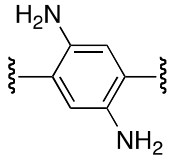
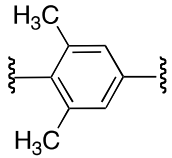
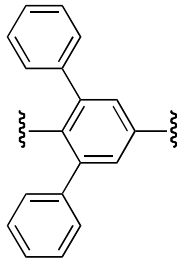
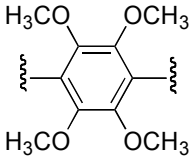
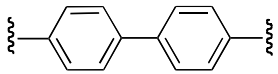
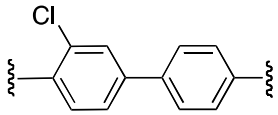
136		(2,5-dioctyl-1,4-phenylene)			[13]
137		(2,5-diamino-1,4-phenylene)			[18]
138		(2,6-dimethyl-1,4-phenylene)			[13]
139		(2,6-diphenyl-1,4-phenylene)		1,1':3',1"-terphenyl-2',5'-diyl [2)]	[13]
140		(2,3,5,6-tetramethoxy-1,4-phenylene)	(tetramethoxy-1,4-phenylene)		[2]
141		[1,1'-biphenyl]-4,4'-diyl	biphenyl-4,4'-diyl	4,4'-biphenylene; 4,4'-biphenylylene	[2]
142		(3-chloro[1,1'-biphenyl]-4,4'-diyl)	(3-chlorobiphenyl-4,4′-diyl)	(3-chloro-4,4'-biphenylylene)	[1, 2]

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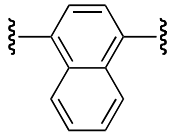
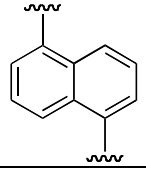
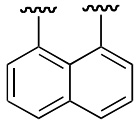
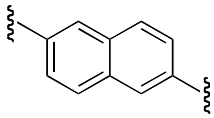
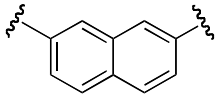
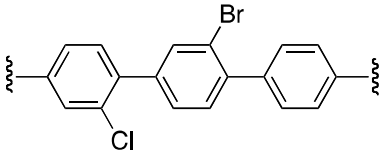
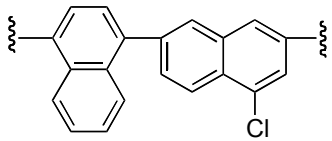
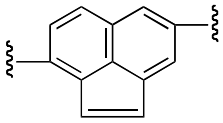
143		naphthalene-1,4-diyl			[13]
144		naphthalene-1,5-diyl			[2]
145		naphthalene-1,8-diyl			[2]
146		naphthalene-2,6-diyl			[2]
147		naphthalene-2,7-diyl		2,7-naphthylene; 2,7-naphthalenediyl	[1, 2]
148		(3'-bromo-2-chloro[1,1':4',1"-terphenyl]-4,4"-diyl)		(3'-bromo-2-chloro-*p*-terphenyl-4,4"-ylene)	[1, 2]
149		(5′-chloro[1,2′-binaphthalene]-4,7′-diyl)		(5'-chloro-1,2'-binaphthyl-4,7'-ylene)	[1, 2]
150		acenaphthylene-3,7-diyl			[2]

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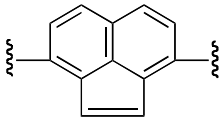
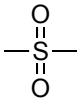
151		acenaphthylene-3,8-diyl		3,8-acenaphthylenylene	[1, 2]
152	—O—	oxy			[1, 2, 13, 14, 16]
153	—O–O—	peroxy		dioxy	[2]
154	—S—	sulfanediyl		thio	[1, 2, 12, 13, 14, 16]
155	—S–S—	disulfanediyl		dithio	[2, 13]
156		sulfinyl	thionyl		[1, 2]
157		sulfonyl	sulfuryl		[1, 2, 12, 13, 14]
158	—Se—	selanediyl			[12]
159		azanediyl		imino [11]	[1, 2, 12, 13, 14]
160		(hydroxyazanediyl)		(hydroxyimino) [11]	[2]
161		(methylazanediyl)		(methylimino) [11]	[1, 2] 12]
162		(ethylazanediyl)		(ethylimino) [11]	[14]
163		(alkylazanediyl)		(alkylimino) [11]	[13]

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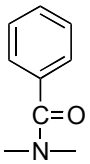
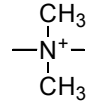
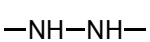
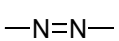
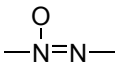
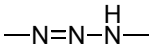
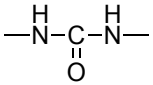
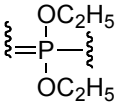
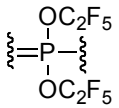
164		(phenylazanediyl)		(phenylimino) [11)]	[2, 12, 13]
165		(benzoylazanediyl)		(benzoylimino)[11)]	[2]
166		azaniumdiyl		iminio [11)]	[2, 13]
167		(dimethylazaniumdiyl)		(dimethyliminio) [11)]	[1, 2, 13, 16]
168		azanylylidene		nitrilo[3)]	[1, 2, 12, 13]
169		hydrazine-1,2-diyl	diazane-1,2-diyl	hydrazo	[1, 2, 13, 14, 18]
170		diazenediyl	azo		[2]
171		(1-oxidodiazen-1-ium-1,2-diyl)	(*ONN*-azoxy)		[1, 2]
172		triaz-1-ene-1,3-diyl	triazene-1,3-diyl	triazenediyl; azoimino	[2]
173		azanediylcarbonylazanediyl		iminocarbonylimino [5)]; ureylene, carbonylbisazanediyl [10)]	[13]
174		(diethoxy-λ^5-phosphanylylidene)		(diethoxy-λ^5-phosphanetriyl)	[2]
175		[bis(pentafluoroethoxy)-λ^5-phosphanylylidene]			[13]

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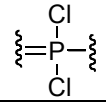
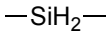
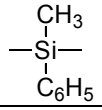
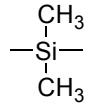
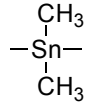
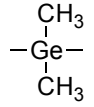
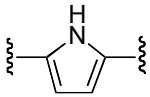
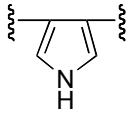
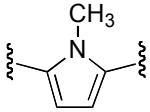
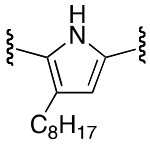
176		(dichloro-λ^5-phosphanylylidene)			[13]
177		silanediyl		silylene	[1, 2, 14]
178		[methyl(phenyl)silanediyl]		(methylphenylsilylene)	[2]
179		(dimethylsilanediyl)		(dimethylsilylene)	[12, 13, 14, 21]
180		(dimethylstannanediyl)		(dimethylstannylene)	[9, 13, 21]
181		(dimethylgermanediyl)		(dimethylgermylene)	[13]
182		1*H*-pyrrole-2,5-diyl	pyrrole-2,5-diyl		[13]
183		1*H*-pyrrole-3,4-diyl	pyrrole-3,4-diyl		[1, 2]
184		(1-methyl-1*H*-pyrrole-2,5-diyl)	(1-methylpyrrole-2,5-diyl)		[13]
185		(3-octyl-1*H*-pyrrole-2,5-diyl)	(3-octylpyrrole-2,5-diyl)		[13]

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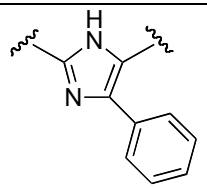
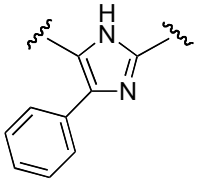
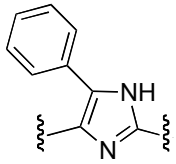
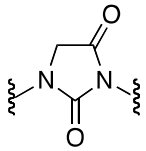
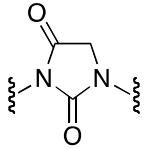
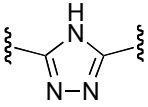
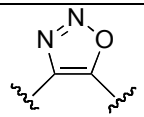
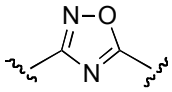
186		(4-phenyl-1*H*-imidazole-2,5-diyl)	(4-phenylimidazole-2,5-diyl)		[13]
187		(4-phenyl-1*H*-imidazole-5,2-diyl)	(4-phenylimdiazole-5,2-diyl)		[13]
188		(5-phenyl-1*H*-imidazole-4,2-diyl)	(5-phenylimidazole-4,2-diyl)		[13]
189		(2,4-dioxoimidazolidine-1,3-diyl)			[13]
190		(2,5-dioxoimidazolidine-1,3-diyl)			[13]
191		4*H*-1,2,4-triazole-3,5-diyl			[1], [2], [16]
192		1,2,3-oxadiazole-4,5-diyl			[13]
193		1,2,4-oxadiazole-3,5-diyl			[13, 18]

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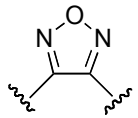
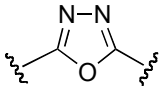
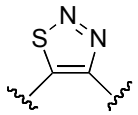
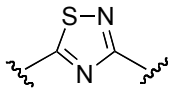
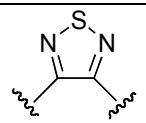
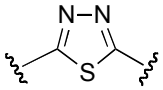
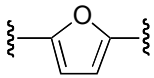
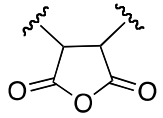
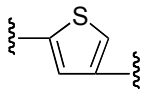
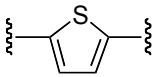
194		1,2,5-oxadiazole-3,4-diyl			[13]
195		1,3,4-oxadiazole-2,5-diyl			[13, 18]
196		1,2,3-thiadiazole-5,4-diyl		preferred CRU in homopolymer: 1,2,3-thiadiazole-4,5-diyl	[13]
197		1,2,4-thiadiazole-5,3-diyl		preferred CRU in homopolymer: 1,2,4-thiadiazole-3,5-diyl	[13]
198		1,2,5-thiadiazole-3,4-diyl			[13]
199		1,3,4-thiadiazole-2,5-diyl			[13]
200		furan-2,5-diyl			[13]
201		(2,5-dioxooxolane-3,4-diyl)	(2,5-dioxotetrahydrofuran-3,4-diyl)		[14, 15]
202		thiophene-2,4-diyl			[14]
203		thiophene-2,5-diyl			[13, 14],

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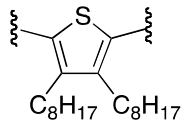
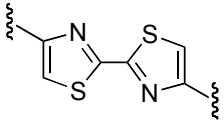
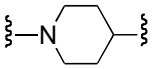
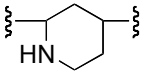
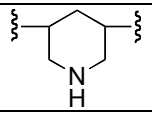
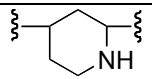
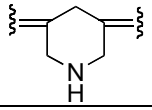
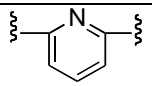
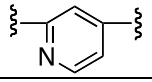
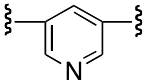
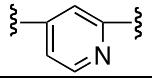
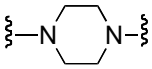
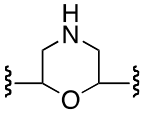
204		(3,4-dioctylthiophene-2,5-diyl)			[13]
205		([2,2'-bi(1,3-thiazole)]-4,4'-diyl)			[13]
206		piperidine-1,4-diyl			[2, 12]
207		piperidine-2,4-diyl		2,4-piperidinediyl	[1, 2]
208		piperidine-3,5-diyl			[2, 14]
209		piperidine-4,2-diyl		4,2-piperidinediyl	[1, 2]
210		piperidine-3,5-diylidene			[2]
211		pyridine-2,6-diyl			[13]
212		pyridine-2,4-diyl		2,4-pyridinediyl; pyridin-2,4-ylene	[1, 2]
213		pyridine-3,5-diyl		3,5-pyridinediyl	[1, 2, 14, 16]
214		pyridine-4,2-diyl		4,2-pyridinediyl	[1, 2, 16]
215		piperazine-1,4-diyl			[14]
216		morpholine-2,6-diyl		2,6-morpholinediyl	[1, 2]

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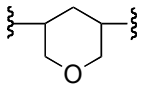
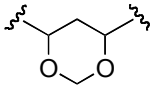
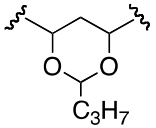
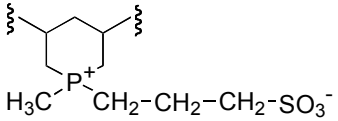
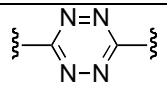
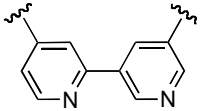
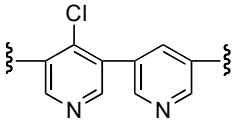
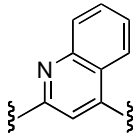
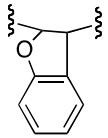
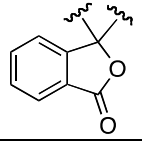
217		oxane-3,5-diyl	(tetrahydropyran-3,5-diyl)		[1, 2]
218		1,3-dioxane-4,6-diyl			[13]
219		(2-propyl-1,3-dioxane-4,6-diyl)			[1, 2, 13, 14, 16, 15]
220		[1-methyl-1-(3-sulfonatopropyl)phosphinan-1-ium-3,5-diyl]			[13]
221		1,2,4,5-tetrazine-3,6-diyl			[13]
222		[2,3'-bipyridine]-4,5'-diyl		(2,3'-bipyridine)-4,5'-diyl	[1, 2]
223		(4-chloro-[3,3'-bipyridine]-5,5'-diyl)			[1, 2]
224		quinoline-2,4-diyl			[13]
225		(2,3-dihydro-1-benzofuran-2,3-diyl)			[17]
226		(3-oxo-2-benzofuran-1,1(3*H*)-diyl)		(3-oxo-1,3-dihydro-2-benzofuran-1,1-diyl)	[13]

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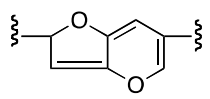
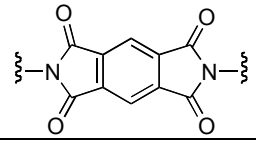
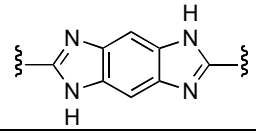
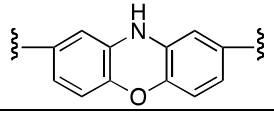
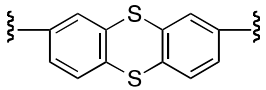
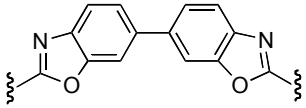
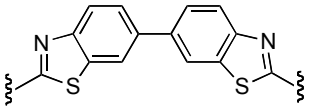
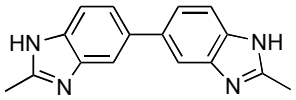
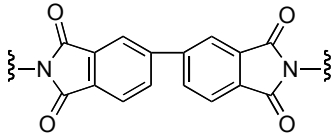
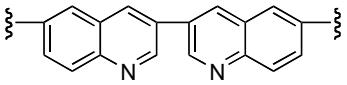
227		2*H*-furo[3,2-*b*]pyran-2,6-diyl			[1, 2]
228		(1,3,5,7-tetraoxo-5,7-dihydrobenzo[1,2-*c*:4,5-*c*']dipyrrole-2,6(1*H*,3*H*)-diyl) [12)]	(1,3,5,7-tetraoxo-1,2,3,5,6,7-hexahydrobenzo[1,2-*c*:4,5-*c*']dipyrrole-2,6-diyl) [12)]		[13, 18]
229		(1,5-dihydrobenzo[1,2-*d*:4,5-*d*']diimidazole-2,6-diyl)			[13]
230		10*H*-phenoxazine-2,8-diyl		2,8-phenoxazinediyl	[1, 16]
231		thianthrene-2,8-diyl		2,8-thianthrenediyl	[1, 2]
232		[6,6'-bi(1,3-benzoxazole)]-2,2'-diyl			[13]
233		[6,6'-bi(1,3-benzothiazole)]-2,2'-diyl			[13]
234		1*H*,1'*H*-[5,5'-bibenzimidazole]-2,2'-diyl	[5,5'-bibenzimidazole]-2,2'-diyl		[13]
235		(1,1′,3,3′-tetraoxo[5,5′-biisoindoline]-2,2′-diyl)			[2]
236		[3,3'-biquinoline]-6,6'-diyl		[6,6'-biquinoline]-3,3'-diyl; (3,3'-biquinoline)-6,6'-diyl	[1, 2]

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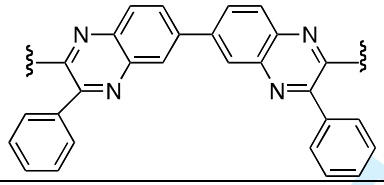
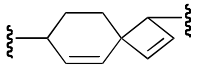
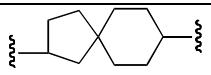
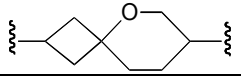
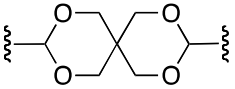
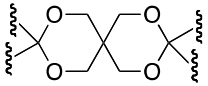
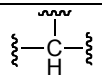
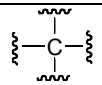
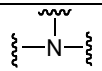
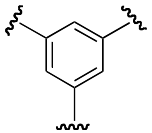
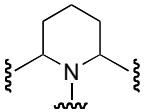
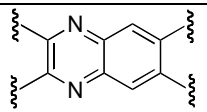
237		(3,3'-diphenyl[6,6'-biquinoxaline]-2,2'-diyl)			[13]
238		spiro[3.5]nona-2,5-diene-7,1-diyl		spiro[3.5]nona-2,5-dien-7,1-ylene	[1, 2]
239		spiro[4.5]decane-2,8-diyl		spiro[4.5]dec-2,8-ylene	[1, 2, 16]
240		(5-oxaspiro[3.5]nonane-2,7-diyl)		(5-oxaspiro[3.5]non-2,7-ylene)	[1]
241		(2,4,8,10-tetraoxaspiro[5.5]undecane-3,9-diyl)			[2]
242		(2,4,8,10-tetraoxaspiro[5.5]undecane-3,3,9,9-tetrayl)			[18]
243		methanetriyl			[12]
244		methanetetrayl			[12]
245		nitrilo	azanetriyl		
246		germanetetrayl			[12]
247		benzene-1,3,5-triyl		1,3,5-benzenetriyl	[2, 12]
248		piperidine-1,2,6-triyl			[12]
249		quinoxaline-2,3:6,7-tetrayl			[13]

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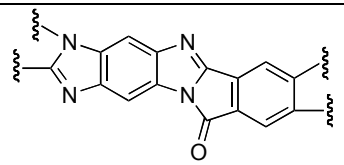
250		(10-oxoimidazo[4,5-*f*]isoindolo[2,1-*a*]benzimidazole-2,3(10*H*):7,8-tetrayl)		(10-oxo-3,10-dihydroimidazo[4,5-*f*]isoindolo[2,1-*a*]benzimidazole-2,3:7,8-tetrayl) [12)]	[13]

1. Methylidyne is the name of the group H–C≡ with a carbon-triple bond.
2. Name is no longer used for CRUs, because side groups must be treated as substituents.
3. Name refers to a different structure.
4. Vinylidene is the name of the group CH_2=C= (ethenylidene).
5. Iminocarbonyl is a former name for the constitutional unit –NH–CO–, the correct name is azanediylcarbonyl.
6. Ambiguous because it is also used for different structure.
7. In IUPAC organic-chemical nomenclature 'a' nomenclature is applicable for hetero-chains containing 4 or more heteroatom units (see P-51.4.1.1 [6]). CRUs of the type shown in entries 103–105 have been used in [2] for demonstration of seniority of units and heteroatoms. Names based on 'a' nomenclature were given as additional names in that document. Such units are highly unlikely to occur as CRUs in real regular polymers or as constitutional units in irregular polymers. The use of 'a' nomenclature for acyclic components is not acceptable in polymer nomenclature.
8. The letters *o*, *m*, and *p* as locants have been in use for *ortho*, *meta*, and *para*, respectively, to designate the 1,2-, 1,3-, and 1,4- isomers of disubstituted benzene. This usage is no longer retained in IUPAC nomenclature (P-14.3.1 [6]).
9. All constitutional units within the polymer backbone must be named consecutively.
10. Multiplicative operations cannot be used to name subunits for a C(R)U because all constitutional units within the polymer backbone must be named consecutively.
11. The traditional name for both the groups >NH (or –NH–) and =NH has been imino. As these names can lead to ambiguity the name of –NH– in agreement with [6] is azanediyl, the name of =NH remains imino.
12. Hydro prefixes have not been alphabetised together with substituent prefixes since 1993, but placed after the substituent prefixes right at the beginning of the modified parent hydride name, see R-4.1, Note 49 [3] and P-31.2.1 [6].

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PNP-3 STRUCTURE-BASED, SOURCE-BASED AND TRADITIONAL NAMES OF COMMON POLYMERS

A number of common polymers, in addition to structure-based names have source-based names and semisystematic or trivial names that are well established by usage because they are also used for regulatory purposes. So a change to a correct structure- or source-based name would require changes in many official and legal documents. The most important of these names are included in the following table. In general, however, the use of semisystematic or trivial names for polymers should be kept to a minimum. In particular ambiguous names or names not based on any systematic type of nomenclature should not be used at all.

The following Table 2 contains idealized structural representations, structure-based names and source-based names. Equivalent names for close analogues of these polymers [e.g., other alkyl ester analogues of poly(methyl acrylate) or ester analogues of poly(vinyl acetate)] are also acceptable as long as the alkyl and acid names, respectively, are retained names [6]. Further, Table 2 contains a limiting list of retained traditional polymer names.

The terminology used in this context is mainly derived from usage in the so-called IUPAC "Blue Book", "Nomenclature of Organic Chemistry" [6]. The relevant terms and their meanings are given in the following.

Preferred IUPAC name (PIN)
A name preferred among two or more names generated from two or more IUPAC recommendations including the many synonyms that have been coined and used over the years.

General IUPAC nomenclature
The principles, rules, and conventions by which IUPAC names other than preferred IUPAC names (PINs) are generated.

Retained name
A traditional or a name in common use either as the preferred IUPAC name or as an alternative name in general IUPAC nomenclature.

In addition, the following term is important in the context of classifying polymer names.

Traditional name
A name in common use within one or more sectors of the chemical community.

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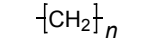
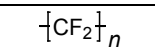
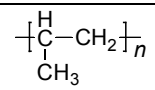
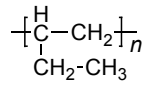
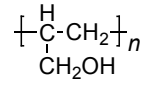
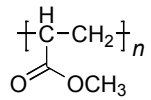
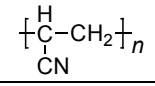
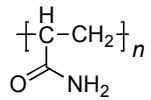
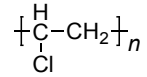
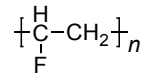
Table 2: Structure-based, source-based and traditional names of common polymers

PIN = preferred IUPAC name;
bold face type = preferred amongst several source-based polymer names;
footnotes to this table are found at the end of the table on p. ##.

Polymer structure	Structure-based polymer name[1)]	Source-based polymer name	Retained traditional polymer name[2)]	No longer acceptable polymer names
	poly(methylene)	polyethene	polyethylene (PIN) [3)]	
	poly(difluoromethylene)	poly(tetrafluoroethene)	polytetrafluoroethylene [3)]	
	poly(1-methylethylene)	polypropene	polypropylene	
	poly(1-ethylethylene)	poly(but-1-ene)		polybutylene
	poly[1-(hydroxymethyl)ethylene]	poly(allyl alcohol), poly(prop-2-en-1-ol)		
	poly[1-(methoxycarbonyl)ethylene]	poly(methyl acrylate)		
	poly(1-cyanoethylene)	polyacrylonitrile, poly(prop-2-enenitrile)		
	poly(1-carbamoylethylene)	polyacrylamide, poly(prop-2-enamide)		
	poly(1-chloroethylene)	**poly(vinyl chloride)**, poly(chloroethene), poly(ethenyl chloride),		
	poly(1-fluoroethylene)	**poly(vinyl fluoride)**, poly(ethenyl fluoride), poly(fluoroethene)		

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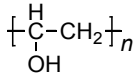
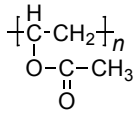
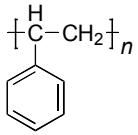
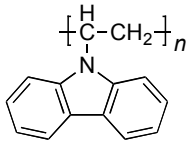
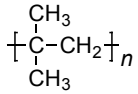
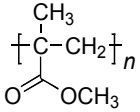
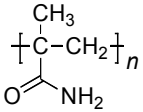
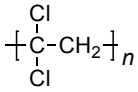
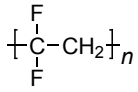
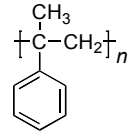
	poly(1-hydroxyethylene)	**poly(vinyl alcohol)**, poly(ethenol)		
	poly(1-acetoxyethylene), poly[1-(acetyloxy)ethylene]	**poly(vinyl acetate)**, poly(ethenyl acetate)		
	poly(1-phenylethylene)	**polystyrene**, poly(ethenylbenzene), poly(vinylbenzene)		
	poly[1-(9*H*-carbazol-9-yl)ethylene]	poly(9-vinyl-9*H*-carbazole) poly(9-ethenyl-9*H*-carbazole)	poly(9-vinylcarbazole)	poly(*N*-vinylcarbazole), poly(vinylcarbazole)
	poly(1,1-dimethylethylene)	poly(2-methylpropene), poly(2-methylprop-1-ene)	polyisobutene	polyisobutylene
	poly[1-(methoxycarbonyl)-1-methylethylene]	poly(methyl methacrylate)		
	poly(1-carbamoyl-1-methylethylene)	polymethacrylamide, poly(2-methylprop-2-enamide)		
	poly(1,1-dichloroethylene)	poly(1,1-dichloroethene)		poly(vinylidene chloride)
	poly(1,1-difluoroethylene)	poly(1,1-difluoroethene)		poly(vinylidene fluoride)
	poly(1-methyl-1-phenylethylene)	poly[(isopropenyl)benzene], poly[(prop-1-en-2-yl)benzene]		poly(α-methylstyrene)

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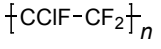
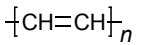
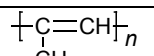
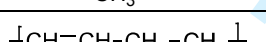
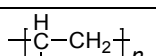
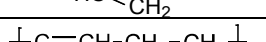
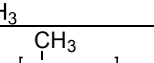
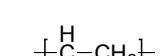
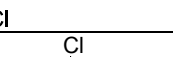
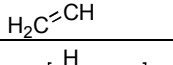
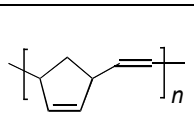
	poly(chlorotrifluoroethylene), poly(1-chloro-1,2,2-trifluoroethylene)	poly(chlorotrifluoroethene)		polychlorotrifluoroethylene
	poly(ethene-1,2-diyl)	**polyacetylene** [4], polyethyne		
	poly(1-methylethene-1,2-diyl)	polypropyne		polymethylacetylene
	poly(but-1-ene-1,4-diyl) *1,4-polymerization*	poly(buta-1,3-diene)	polybutadiene[5]	
	poly(1-vinylethylene), poly(1-ethenylethylene) *1,2-polymerization*			
	poly(1-methylbut-1-ene-1,4-diyl) *1,4-polymerization*	**polyisoprene** [5], poly(2-methylbuta-1,3-diene)		
	poly(1-ethenyl-1-methylethylene), poly(1-methyl-1-vinylethylene) *1,2-polymerization*			
	poly[1-(1-methylethenyl)ethylene], poly[1-(1-methylvinyl)ethylene], poly(1-isopropenylethylene), poly[1-(prop-1-en-2-yl)ethylene] *3,4-polymerization*			
	poly(1-chlorobut-1-ene-1,4-diyl) *1,4-polymerization*	poly(2-chlorobuta-1,3-diene)	polychloroprene	
	poly(1-chloro-1-ethenylethylene), poly(1-chloro-1-vinylethylene) *1,2- polymerization*			
	poly[1-(1-chloroethenyl)ethylene], poly[1-(1-chlorovinyl)ethylene] *3,4-polymerization*			
	poly(cyclopent-4-ene-1,3-diylethene-1,2-diyl) *for linear polymer (ROMP) – other polymerization methods usually give a network polymer*	poly(bicyclo[2.2.1]hepta-2,5-diene)	poly(norbornadiene)	

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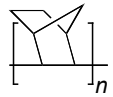
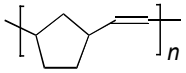
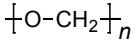
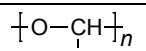
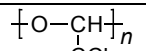
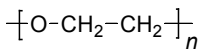
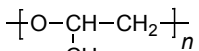
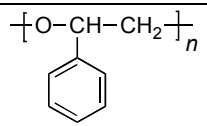
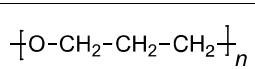
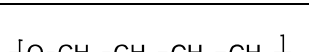
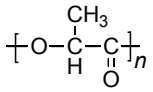
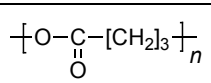
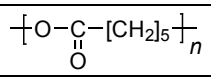
	poly(bicyclo[2.2.1]heptane-2,3-diyl)	poly(bicyclo[2.2.1]hept-2-ene), poly(8,9,10-trinorborn-2-ene)	poly(norbornene)	
	poly(cyclopentane-1,3-diylethene-1,2-diyl) *ring opening metathesis polymerization (ROMP)*			
	poly(oxymethylene)	**polyformaldehyde**, polymethanal		
	poly[oxy(methylmethylene)]	**polyacetaldehyde**, polyethanal		
	poly{oxy[(trichloromethyl)methylene]}	poly(trichloroacetaldehyde), poly(trichloroethanal)		polychloral
	poly(oxyethylene)	**poly(oxirane)**, poly(ethene oxide)	poly(ethylene oxide)	poly(ethylene glycol), polyethylene oxide, polyethylene glycol
	poly[oxy(1-methylethylene)]	**poly(2-methyloxirane)**, poly(propene oxide)	poly(propylene oxide)	poly(propylene glycol), polypropylene oxide, polypropylene glycol
	poly[oxy(1-phenylethylene)]	**poly(2-phenyloxirane)**, poly(phenyloxirane), poly(styrene oxide)		
	poly(oxypropane-1,3-diyl)	poly(oxetane)		poly(trimethylene ether glycol), polyoxetane
	poly(oxybutane-1,4-diyl)	**poly(oxolane)**, polytetrahydrofuran		poly(tetramethylene ether glycol), poly(tetramethylene oxide)
	poly[oxy(1-methyl-2-oxoethylene)]	**poly(lactic acid)** poly(2-hydroxypropanoic acid), poly(3-methyloxiran-2-one)		
	poly[oxy(1-oxobutane-1,4-diyl)]	**poly(oxolan-2-one)**, poly(butano-4-lactone), poly(4-hydroxybutanoic acid)		poly(γ-butyrolactone)
	poly[oxy(1-oxohexane-1,6-diyl)]	**poly(oxepan-2-one)**, poly(hexano-6-lactone)	poly(ε-caprolactone)	polycaprolactone

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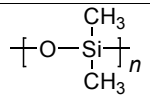
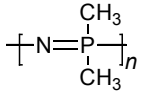
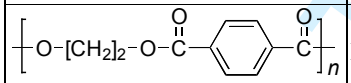
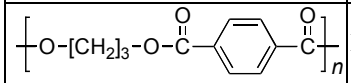
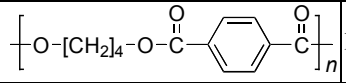
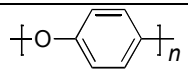
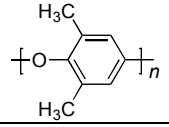
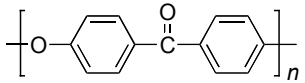
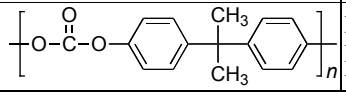
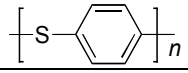
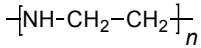
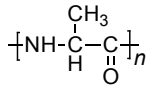
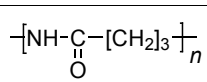
	poly[oxy(dimethylsilanediyl)], *catena*-poly[(dimethylsilicon)-μ-oxido][6]		poly(dimethylsiloxane)	poly[oxy(dimethylsilylene)]
	poly[azanylylidene(diethoxy-λ^5-phosphanylylidene)]		poly(diethoxyphosphazene)	
	poly(oxyethyleneoxyterephthaloyl)	poly(ethylene terephthalate)		
	poly(oxypropane-1,3-diyloxyterephthaloyl)	poly(propane-1,3-diyl terephthalate)		poly(trimethylene terephthalate)
	poly(oxybutane-1,4-diyloxyterephthaloyl)	poly(butane-1,4-diyl terephthalate)		poly(butylene terephthalate)
	poly[oxy(1,4-phenylene)]	polyphenol	poly(1,4-phenylene oxide)	poly(phenylene oxide)[7]
	poly[oxy(2,6-dimethyl-1,4-phenylene)]	poly(2,6-dimethylphenol)	poly(2,6-dimethyl-1,4-phenylene oxide)	poly(phenylene oxide)[7]
	poly(oxy-1,4-phenylenecarbonyl-1,4-phenylene)			
	poly[oxycarbonyloxy-1,4-phenylene(dimethylmethylene)-1,4-phenylene]	poly[(dimethylmethylene)bis(4,1-phenylene) carbonate]		
	poly(sulfanediyl-1,4-phenylene)	polybenzenethiol, poly(1,4-phenylene sulfide)		poly(thiophenol)
	poly(azanediylethylene)	poly(aziridine)	polyethylenimine	
	poly[azanediyl(1-methyl-2-oxoethylene)]	**polyalanine**, poly(2-aminopropanoic acid), poly(3-methylaziridin-2-one),		poly[imino(1-oxopropane-1,2-diyl)], poly[imino(1-methyl-2-oxoethylene)]
	poly[azanediyl(1-oxobutane-1,4-diyl)]	**poly(pyrrolidin-2-one)**, poly(4-aminobutanoic acid), poly(butano-4-lactam)		poly(γ-butyrolactam), poly[imino(1-oxobutane-1,4-diyl)]

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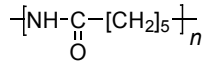
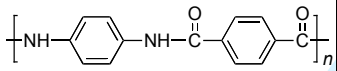
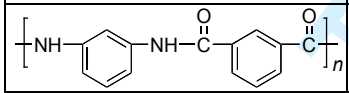
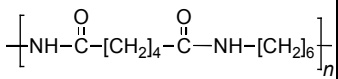
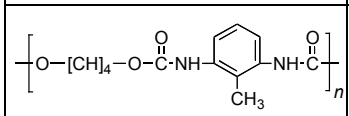
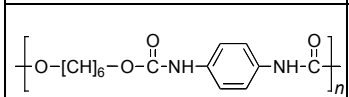
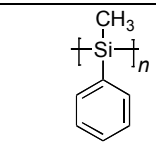
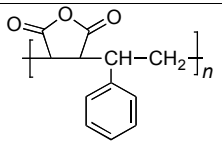
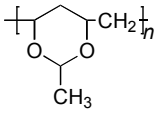
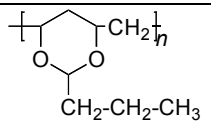
	poly[azanediyl(1-oxohexane-1,6-diyl)]	**poly(azepan-2-one)**, poly(6-aminohexanoic acid), poly(hexano-6-lactam)	poly(ε-caprolactam)	polycaprolactam, poly[imino(1-oxohexane-1,6-diyl)]
	poly(azanediyl-1,4-phenyleneazanediylterephthaloyl)	poly[*N*,*N*'-(1,4-phenylene)terephthalamide]		
	poly(azanediyl-1,3-phenyleneazanediylisophthaloyl)	poly[*N*,*N*'-(1,3-phenylene)isophthalamide]		
	poly(azanediyladipoylazanediylhexane-1,6-diyl), poly(azanediylhexanedioylazanediylhexane-1,6-diyl)	poly[*N*,*N*'-(hexane-1,6-diyl)hexanediamide], poly[*N*,*N*'-(hexane-1,6-diyl)adipamide]		poly(hexamethylene adipamide)
	poly[oxybutane-1,4-diyloxycarbonylazanediyl(2-methyl-1,3-phenylene)azanediylcarbonyl]	poly[(butane-1,4-diol)-*alt*-(1,3-diisocyanato-2-methylbenzene)], poly[(butane-1,4-diol)-*alt*-(2,6-diisocyanatotoluene)]		
	poly(oxyhexane-1,6-diyloxycarbonylazanediyl-1,4-phenyleneazanediylcarbonyl)	poly[(1,4-diisocyanatobenzene)-*alt*-(hexane-1,6-diol)], poly[hexane-1,6-diyl *N*,*N*'-(1,4-phenylene)dicarbamate]		
	poly[methyl(phenyl)silanediyl], *catena*-poly[methyl(phenyl)silicon][6]	poly[methyl(phenyl)silane]		poly[methyl(phenyl)silylene]
	poly[(2,5-dioxotetrahydrofuran-3,4-diyl)(1-phenylethylene)]	poly[(maleic anhydride)-*alt*-styrene]		
	poly[(2-methyl-1,3-dioxane-4,6-diyl)methylene]	poly(acetaldehyde divinyl acetal)	poly(vinyl acetal)	polyvinyl acetal[8]
	poly[(2-propyl-1,3-dioxane-4,6-diyl)methylene]	poly(butanal divinyl acetal)	poly(vinyl butyral)	

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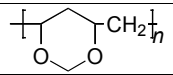
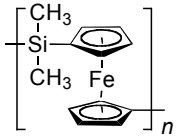
	poly(1,3-dioxane-4,6-diylmethylene)	poly(formaldehyde divinyl acetal)	poly(vinyl formal)	
	poly[(ferrocene-1,1'-diyl)(dimethylsilanediyl)], *catena*-poly{[1,1'-bis(η^5-cyclopentadienyl)iron]-μ-(dimethylsilicon)}[6]	poly[1,1'-(dimethylsilanediyl)ferrocene]		

1) Structure-based polymer names based on 'ethylene' are preferred to the equivalent names for such constitutional units based on 'ethane-1,2-diyl', which are also acceptable. It should be kept in mind, however, that substituents in substituted ethane-1,2-diyl must have locants.

2) Because of their widespread use within industry and academia a limited number of well-established traditional names of homopolymers are retained. These are found in this column.

3) The formulae $-[CH_2CH_2]_n-$ and $-[CF_2CF_2]_n-$ are more often used; they are acceptable due to past usage and also an attempt to retain some similarity to the formulae of homopolymers derived from other ethene derivatives.

4) Polyacetylene is the source-based name of poly(ethene-1,2-diyl) and also a class name. [13]

5) Polybutadiene (polyisoprene) can be used as name for a polymer made from butadiene (isoprene), if the structure is not known.

6) Name according to the rules for linear inorganic polymers. Similar names are adopted for other polysiloxanes, polysilanes and their analogues. [21]

7) Poly(phenylene oxide) was originally a trade name for poly(2,6-dimethyl-1,4-phenylene oxide) that was accepted into common usage. As it indicates a non-substituted ring system it is a misnomer and its use is therefore not acceptable.

8) Polyvinyl acetal is a class name.

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PNP-4 SUMMARY

A number of existing IUPAC recommendations on polymer nomenclature and terminology have been screened in terms of naming and names of polymers. From these, a list of constitutional units (CU) used for naming polymers according to IUPAC nomenclature rules has been made (PNP-2). This list comprises also CUs of commercial and well-known polymers. A preferred name is provided for each CU. Other acceptable names, and names which are not acceptable because they are outdated or ambiguous or incorrect, although they may have been correct in the past or in a different context, are also listed. In a second table (PNP-3) names of common polymers are given. This table includes structure-based names, source-based names, retained traditional polymer names and not acceptable names. These tables replace similar tables in previous documents. The preferred names of constitutional units in Table 1 should be used in structure-based names of regular and irregular polymers. It is hoped that in the printed version of this document, entries of tables can be searched by the functions provided in programs for reading pdf-files; this should enable or facilitate construction of names using the names for CUs and common polymers given in the tables.

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‡ = Deceased

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