

P-67 Mononuclear and polynuclear noncarbon acids and their functional replacement analogues as parents for naming organic compounds

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P-67.0 Introduction

Mono-, di-, and polynuclear noncarbon oxoacids and their chalcogen analogues having retained names are used as parent structures to generate names of carbon containing compounds. In these recommendations, the names for these compounds are preselected names (see P-12)

Names of chalcogen analogues of oxoacids are formed by functional replacement nomenclature. This type of nomenclature is also used to create derived classes, for example, acid halides and pseudohalides, amides, hydrazides, and amidines. With regard to functional replacement, mono- di- and polynuclear acids do not constitute a homogeneous group. Names of mononuclear oxoacids are modified by infixes, with the exception of silicic acid, nitrous acid, nitric acid and halogen acids. Names of di- and polynuclear oxoacids are modified by prefixes. Functional class nomenclature is used to generate names for esters, organic anhydrides, carbon containing pseudohalides such as cyanides and isocyanates, and organic derivatives of amides, imides, and hydrazides.

Mononuclear oxoacids are discussed first, then di- and polynuclear oxoacids such as diphosphoric acid, $(\text{HO})_2\text{P}(\text{O})\text{-O-P}(\text{O})(\text{OH})_2$, that are named as acids, not as anhydrides, and hypodiphosphoric acid, $(\text{HO})_2\text{P}(\text{O})\text{-P}(\text{O})(\text{OH})_2$. Systematization has been achieved, taking into consideration the nomenclature of inorganic compounds (ref. 14), that has restricted the use of retained names and of prefixes such as 'hypo', 'ortho', 'iso' added to the names of mononuclear oxoacids to generate retained names. However, the traditional nomenclature of organic compounds derived from mono- di-, and polynuclear oxoacids has been maintained.

For carbonic, cyanic, oxalic, and the polynuclear carbonic acids, see P-65.

P-67.1 Mononuclear noncarbon acids

Retained names for mononuclear noncarbon oxoacids have the following elements as central atoms: N, P, As, Sb, Si, B, S, Se, Te, F, Cl, Br, and I. They are used as parent structures and also for derivation of prefixes to be used in the presence of classes that have seniority for being named as parent compounds. These parent structures have retained names that are traditional names used as preselected names (see P-12). They may also have systematic additive or substitutive names, but these names are not recommended for generating preselected names (see P-17).

Functional replacement nomenclature is discussed first; next the formation of esters and anhydrides using functional class nomenclature; and finally, substitutive nomenclature using prefixes is described. Application of the seniority order of oxoacids and their derivatives, described in Section P-42, is discussed. The Section ends with the nomenclature of *aci*-nitro compounds that are named as derivatives of azinic acid.

- P-67.1.1 Names for mononuclear acids and their derivatives
- P-67.1.2 Functional replacement nomenclature applied to acids
- P-67.1.3 Esters and anhydrides of acids
- P-67.1.4 Derived substituent groups expressed as prefixes
- P-67.1.5 Seniority order among acids and derivatives
- P-67.1.6 *aci*-Nitro compounds

P-67.1.1 Names for mononuclear acids and their derivatives

Preselected names (see P-12.2) of the mononuclear noncarbon oxoacids used for deriving preferred IUPAC names for organic compounds and names for general organic nomenclature are noted in the following list, given in alphabetical order.

$\text{H}_2\text{As}(\text{O})(\text{OH})$	arsinic acid
$\text{H}_2\text{As}(\text{OH})$	arsinous acid
$\text{HAs}(\text{O})(\text{OH})_2$	arsonic acid
$\text{HAs}(\text{OH})_2$	arsonous acid
$\text{As}(\text{O})(\text{OH})_3$	arsoric acid (formerly arsenic acid)
$\text{As}(\text{OH})_3$	arsorous acid (formerly arsen(i)ous acid)
$\text{H}_2\text{N}(\text{O})(\text{OH})$	azinic acid
$\text{H}_2\text{N}(\text{OH})$	azinous acid
$\text{HN}(\text{O})(\text{OH})_2$	azonic acid
$\text{HN}(\text{OH})_2$	azonous acid
$\text{N}(\text{O})(\text{OH})_3$	azoric acid (hypothetical)
$\text{N}(\text{OH})_3$	azorous acid (hypothetical)
$\text{B}(\text{OH}_3)$	boric acid
$\text{H}_2\text{B}-\text{OH}$	borinic acid
$\text{HB}(\text{OH})_2$	boronic acid
$\text{Br}(\text{O})_2(\text{OH})$	bromic acid
$\text{Br}(\text{O})(\text{OH})$	bromous acid
$\text{Cl}(\text{O})_2(\text{OH})$	chloric acid
$\text{Cl}(\text{O})(\text{OH})$	chlorous acid
$\text{Br}(\text{OH})$	hypobromous acid
$\text{Cl}(\text{OH})$	hypochlorous acid
$\text{F}(\text{OH})$	hypoflurous acid
$\text{I}(\text{OH})$	hypoiodous acid
$\text{I}(\text{O})_2(\text{OH})$	iodic acid
$\text{I}(\text{O})(\text{OH})$	iodous acid
$\text{HO}-\text{NO}_2$	nitric acid

HO-NO	nitrous acid
Br(O) ₃ (OH)	perbromic acid
Cl(O) ₃ (OH)	perchloric acid
F(O) ₃ (OH)	perfluoric acid
I(O) ₃ (OH)	periodic acid
H ₂ P(O)(OH)	phosphinic acid
H ₂ P(OH)	phosphinous acid
HP(O)(OH) ₂	phosphonic acid
HP(OH) ₂	phosphonous acid
P(O)(OH) ₃	phosphoric acid
P(OH) ₃	phosphorous acid
Se(O) ₂ (OH) ₂	selenic acid
Se(O)(OH) ₂	selenous acid
Si(OH) ₄	silicic acid (formerly orthosilicic acid)
H ₂ Sb(O)(OH)	stibinic acid
H ₂ Sb(OH)	stibinous acid
HSb(O)(OH) ₂	stibonic acid
HSb(OH) ₂	stibonous acid
Sb(O)(OH) ₃	stiboric acid (formerly antimonic acid)
Sb(OH) ₃	stiborous acid (formerly antimonous acid)
S(O) ₂ (OH) ₂	sulfuric acid
S(O)(OH) ₂	sulfurous acid
Te(O) ₂ (OH) ₂	telluric acid
Te(O)(OH) ₂	tellurous acid

P-67.1.2 Functional replacement nomenclature applied to mononuclear oxo acids

Mononuclear oxo acids are modified by either infixes or prefixes in functional replacement nomenclature.

P-67.1.2.1 Mononuclear acids modified by infixes

P-67.1.2.2 Mononuclear acids modified by prefixes

P-67.1.2.3 General methodology for functional replacement nomenclature

P-67.1.2.4 Acids modified by functional replacement nomenclature

P-67.1.2.5 Acid halides and pseudohalides

P-67.1.2.6 Amides and hydrazides

P-67.1.2.1 Mononuclear acids modified by infixes, The following acids are modified by infixes; they are listed in group order B, N, P, As, Sb, S, Se, Te:

$B(OH_3)$	boric acid
$HB(OH)_2$	boronic acid
H_2B-OH	borinic acid
$N(O)(OH)_3$	azoric acid (hypothetical)
$N(OH)_3$	azorous acid (hypothetical)
$HN(O)(OH)_2$	azonic acid
$H_2N(O)(OH)$	azinic acid
$H_2N(OH)$	azinous acid
$HN(OH)_2$	azonous acid
$P(O)(OH)_3$	phosphoric acid
$P(OH)_3$	phosphorous acid
$P(O)(OH)_2$	phosphonic acid
$HP(OH)_2$	phosponous acid
$H_2P(O)(OH)$	phosphinic acid
$H_2P(OH)$	phosphinous acid
$As(O)(OH)_3$	arsoric acid (formerly arsenic acid)
$As(OH)_3$	arsorous acid (formerly arsen(i)ous acid)
$HAs(O)(OH)_2$	arsonic acid
$HAs(OH)_2$	arsonous acid
$H_2As(O)(OH)$	arsinic acid
$H_2As(OH)$	arsinous acid
$Sb(O)(OH)_3$	stiboric acid (formerly antimonic acid)
$Sb(OH)_3$	stiborous acid (formerly antimonous acid)
$HSb(O)(OH)_2$	stibonic acid
$HSb(OH)_2$	stibonous acid
$H_2Sb(O)(OH)$	stibinic acid
$H_2Sb(OH)$	stibinous acid
$S(O)_2(OH)_2$	sulfuric acid
$S(O)(OH)_2$	sulfurous acid
$Se(O)_2(OH)_2$	selenic acid
$Se(O)(OH)_2$	selenous acid

$\text{Te}(\text{O})_2(\text{OH})_2$	telluric acid
$\text{Te}(\text{O})(\text{OH})_2$	tellurous acid

P-67.1.2.2 Mononuclear acids modified by prefixes. The following acids are modified by prefixes; they are listed in the order Si, N, F, Cl, Br, I.

$\text{Si}(\text{OH})_4$	silicic acid (formerly orthosilicic acid)
$\text{HO}-\text{NO}_2$	nitric acid
$\text{HO}-\text{NO}$	nitrous acid
$\text{F}(\text{O})_3(\text{OH})$	perfluoric acid
$\text{F}(\text{O})_2(\text{OH})$	fluoric acid
$\text{F}(\text{O})(\text{OH})$	fluorous acid
$\text{F}(\text{OH})$	hypofluorous acid
$\text{Cl}(\text{O})_3(\text{OH})$	perchloric acid
$\text{Cl}(\text{O})_2(\text{OH})$	chloric acid
$\text{Cl}(\text{O})(\text{OH})$	chlorous acid
$\text{Cl}(\text{OH})$	hypochlorous acid
$\text{Br}(\text{O})_3(\text{OH})$	perbromic acid
$\text{Br}(\text{O})_2(\text{OH})$	bromic acid
$\text{Br}(\text{O})(\text{OH})$	bromous acid
$\text{Br}(\text{OH})$	hypobromous acid
$\text{I}(\text{O})_3(\text{OH})$	periodic acid
$\text{I}(\text{O})_2(\text{OH})$	iodic acid
$\text{I}(\text{O})(\text{OH})$	iodous acid
$\text{I}(\text{OH})$	hypoiodous acid

P-67.1.2.3 General methodology for functional replacement nomenclature using infixes

Functional replacement nomenclature (see P-15.5) using infixes generates functional class names for the following classes: acid halides and pseudo halides (azides, cyanides, isocyanides, and isocyanates), amides, hydrazides, and also imidic, hydrazonic and nitridic acids. Chalcogen analogues are also described by infixes.

Preferred IUPAC names are retained names modified by functional nomenclature. The use of infixes is restricted to acids listed in P-67.1.2.1 and leads to preferred IUPAC names. Prefixes are used as recommended for acids listed in P-67.1.2.2, and in general nomenclature for all mononuclear acids. Substitutive names and names modified by prefixes are used only in special occasions (see P-67.1.4.1.1 (f) and P-67.3.1).

$(C_6H_5)_2P-SH$	diphenylphosphinothious acid (PIN) (not diphenylphosphanethiol) (not diphenyl(sulfanyl)phosphane)
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P-67.1.2.3.1 The following infixes are used to describe the replacement of =O and -OH by chalcogen analogues (in decreasing order of seniority):

- | | |
|--------------------|---------------------------------------------------------|
| (1) -OO- | peroxo |
| (2) -OS- or -SO- | thioperoxo (similarly, selenoperoxo, telluroperoxo) |
| (3) -SS- | dithioperoxo (similarly, diselenoperoxo, telluroperoxo) |
| (4) -SSe- or -SeS- | selenothioperoxo (similarly for other mixed chalcogens) |
| (5) -S- or =S | thio |
| (6) -Se- or =Se | seleno |
| (7) -Te- or =Te | telluro |

P-67.1.2.3.2 Infixes denoting classes (in decreasing order of seniority except for halides that have the same rank but are cited in alphabetical order and pseudohalides that have the same rank but are cited in alphabetical order)

- | | | | |
|---------------------|--------------|-------------------------|--------------------|
| (1) -Br | bromido | -NCS | isothiocyanatido |
| -Cl | chlorido | -NCSe | isoselenocyanatido |
| -F | fluorido | -NCTe | isotellurocyanatid |
| -I | iodido | (3) -NH ₂ | amido |
| (2) -N ₃ | azido | (4) -NH-NH ₂ | hydrazido |
| -CN | cyanido | (5) ≡N | nitrido |
| -NC | isocyanido | (6) =NH | imido |
| -NCO | isocyanatido | (7) =NNH ₂ | hydrazono |

P-67.1.2.3.3 Prefixes denoting chalcogen analogues of acids by replacing oxygen atoms (in decreasing order of seniority):

- | | | |
|-----|----------------|---------------------------------------------------------|
| (1) | –OO– | peroxy |
| (2) | –OS– or –SO– | thioperoxy (similarly, selenoperoxy, telluroperoxy) |
| (3) | –SS– | dithioperoxy (similarly, diselenoperoxy, telluroperoxy) |
| (4) | –SSe– or –SeS– | selenothioperoxy (similarly for other mixed chalcogens) |
| (5) | –S– or =S | thio |
| (6) | –Se– or =Se | seleno |
| (7) | –Te– or =Te | telluro |

P-67.1.2.3.4 Prefixes denoting classes (in decreasing order of seniority except for halides that have the same rank but are cited in alphabetical order and pseudohalides that have the same rank but are cited in alphabetical order)

- | | | | | |
|-----|-----------------|------------|-------------------------|-------------------|
| (1) | –Br | bromo | –NCS | isothiocyanato |
| | –Cl | chloro | –NCSe | isoselenocyanato |
| | –F | fluoro | –NCTe | isotellurocyanato |
| | –I | iodo | (3) –NH ₂ | amido |
| (2) | –N ₃ | azido | (4) –NH–NH ₂ | hydrazido |
| | –CN | cyano | (5) ≡N | nitrido |
| | –NC | isocyano | (6) =NH | imido |
| | –NCO | isocyanato | (7) =NNH ₂ | hydrazono |

P-67.1.2.3.5 The appropriate infix is indicated (in alphabetical order if more than one) before the ‘ic acid’ or ‘ous acid’ ending in the parent name, with elision of the letter ‘o’ before a vowel, with the exception of the infixes ‘thio’, ‘seleno’, telluro’ and ‘peroxy’ which are cited as such, with no elision of the letter ‘o’, before the ‘ic ending’. A euphonic letter ‘o’ also may be added when necessary. Multiplying an infix by multiplying prefixes ‘di’ or tri’ does not change its place in the alphabetical order.

The appropriate prefix is indicated (in alphabetical order if there is more than one) before the name of the acid; no elision is recommended. Multiplying a prefix by multiplying prefixes ‘di’ or tri’ does not change its place in the alphabetical order.

P-67.1.2.4 Mononuclear acids modified by functional replacement

Mononuclear noncarbon acids have preselected names used for deriving preferred IUPAC names for organic compounds.

As long as there is at least one –OH group left in an acid having a retained name, the acid modified by functional replacement is classified as an acid and denoted by class name ‘acid’.

P-67.1.2.4.1 Acids with substitutable hydrogen atoms

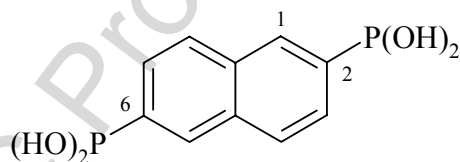
P-67.1.2.2.1 Acids with hydrogen atoms attached to the central atom (substitutable hydrogen)

Acids of the type $\text{HE}(\text{O})(\text{OH})_2$, $\text{HE}(\text{OH})_2$, $\text{H}_2\text{E}(\text{O})(\text{OH})$, or $\text{H}_2\text{E}(\text{O})(\text{OH})$ where E is B, N, P, As, or Sb having hydrogen atoms attached directly to the central atom are named substitutively by organyl groups, leading to names such as ethylphosphonic acid. Another method has been suggested which would treat the acid as a suffix (like sulfonic acid leading to names such as benzenephosphonic acid. This suggestion has been rejected because in cases where the acid has two substitutable hydrogen atoms, the use of additional letter locants would be required leading to unnecessarily more cumbersome names.

Acids with hydrogen atoms attached to the central atom may be substituted by organyl groups and preferred IUPAC names are formed substitutively. Use of acid names as suffixes is not recommended.

Examples:

$\text{C}_2\text{H}_5\text{-P}(\text{O})(\text{OH})_2$	ethylphosphonic acid (PIN) (not ethanephosphonic acid)
$(\text{C}_2\text{H}_5)_2\text{P}(\text{O})(\text{OH})$	diethylphosphinic acid (PIN) (not <i>P</i> -ethyl-diethanephosphinic acid)
$(\text{C}_6\text{H}_5)_2\text{As}(\text{OH})$	diphenylarsinous acid (PIN)
$\text{C}_6\text{H}_5\text{Sb}(\text{OH})_2$	phenylstibonous acid (PIN)



naphthalene-2,6-bis(phosphonous acid) (PIN)

P-67.1.2.4.2 Functional replacement of the oxoacids specifically listed in P-67.1.2 is expressed by infixes or prefixes. Substitution of nonacidic hydrogen atoms is indicated by prefixes, with a letter locant *B*, *N*, *P*, *As* or *Sb* as needed. Tautomers may be distinguished by prefixing italic elements symbols, such as *S* and *O*, to the term ‘acid’. Parentheses are needed to enclose infixes modified by

prefixes, for example, 'thioperoxoic'. In addition to infixes and prefixes listed in P-67.1.2.3, the prefix 'cyanato' and the infix 'cyanatido', for $-\text{OCN}$, are used to modify acids as indicated in P-67.1.2.4.2.3.

P-67.1.2.4.2.1 Examples of acids modified by infixes:

$\text{CH}_3\text{-B(OH)(SH)}$	methylboronothioic acid (PIN)
$\text{CH}_3\text{-B(NH-CH}_3\text{)(OH)}$	<i>B,N</i> -dimethylboronamidic acid (PIN)
$\text{CH}_3\text{-N(OH)(SH)}$	methylazonothious acid
$(\text{C}_2\text{H}_5)_2\text{P(S)(SH)}$	diethylphosphinodithioic acid (PIN)
$(\text{CH}_3)_2\text{N-P(O)(OH)}_2$	<i>N,N</i> -dimethylphosphoramidic acid (PIN)
$(\text{C}_6\text{H}_5)_2\text{P(=N-CH}_3\text{)(OH)}$	<i>N</i> -methyl- <i>P,P</i> -diphenylphosphinimidic acid (PIN)
$\text{C}_6\text{H}_5\text{-P(=N-C}_6\text{H}_5\text{)(Cl)(SH)}$	<i>N,P</i> -diphenylphosphonochloridimidodithioic acid (PIN)
$\text{C}_6\text{H}_5\text{-P(S)(NH-CH}_3\text{)(OH)}$	<i>N</i> -methyl- <i>P</i> -phenylphosphonamidothioic <i>O</i> -acid (PIN)
$\text{CH}_3)_2\text{N-P(O)(NCS)(SH)}$	<i>N,N</i> -dimethylphosphoramido(isothiocyantido)thioic <i>S</i> -acid (PIN)
$(\text{CH}_3)_2\text{N-P(=N-C}_6\text{H}_5\text{)(SCN)(OH)}$	<i>N,N</i> -dimethyl- <i>N'</i> -phenylphosphoramidimido(thiocyantidic) <i>O</i> -acid (PIN)
$(\text{C}_6\text{H}_5)\text{P(OH)(SH)}$	phenylphosphonothious <i>S</i> -acid (PIN)
$\text{C}_6\text{H}_5\text{-P(}\equiv\text{N)(OH)}$	phenylphosphonitridic acid (PIN)
$\text{C}_6\text{H}_5\text{-P(O)(Cl)(OH)}$	phenylphosphorochloridic acid (PIN)
$\text{CH}_3\text{-CH}_2\text{-P(Se)(OH)}_2$	ethylphosphonoselenoic <i>O,O</i> -acid (PIN)
$\text{CH}_3\text{-CH}_2\text{-P(O)(OH)(SeH)}$	ethylphosphonoselenoic <i>Se</i> -acid (PIN)
$\text{P(=NH)(NH-NH}_2\text{)(OH)}_2$	phosphorohydrazidimidic acid (preselected name)

$P(O)(OH)(SH)(SSH)$	phosphoro(dithioperoxo)thioic <i>S</i> -acid (preselected name)
$P(O)(OH)_2(OSH)$	phosphoro(thioperoxoic) <i>OS</i> -acid (preselected name)
$As(O)(OH)(SH)_2$ or $As(S)(OH)_2(SH)$	arsorodithioic acid (preselected name)
$As(S)(OH)_3$	arsorothioic <i>O,O,O</i> -acid (preselected name)
$(C_6H_5)_2As(SH)$	diphenylarsorothious acid (PIN)
$HO-SO_2-SH$	sulfurothioic <i>S</i> -acid (preselected name)
H_2N-SO_2-OH	sulfamic acid (preselected name) (a contraction of sulfuramidic acid)
$H_2S_2O_3$	sulfurothioic acid (preselected name; the position of the sulfur atom is undetermined)
$HO-SO_2-NC$	sulfurisocyanidic acid (preselected name)
$HO-SO-NCS$	sulfuro(thiocyanatidic) acid (preselected name)
$HO-SO_2-CN$	sulfurocyanidic acid (preselected name)
$HS-SO_2-NH_2$	sulfamothioic <i>S</i> -acid (preselected name) sulfuramidothioic <i>S</i> -acid
$HS-TeO_2-NH_2$	telluramidothioic acid (preselected name)

P-67.1.2.4.2.2 Examples of acids modified by prefixes:

$Si(OH)_3(SH)$	thiosilicic acid (preselected name)
$S=N-OH$	thionitrous <i>O</i> -acid (preselected name)
$Cl(S)_2-OH$	dithiochloric <i>O</i> -acid (preselected name)

P-67.1.2.4.2.3 Specific use of the prefix 'cyanato' and the infix 'cyanatido'

When attached to the central atom of an oxo acid, the group $-\text{OCN}$ creates an anhydride linkage (see P-67.1.3.3). In order to respect the seniority order of classes, this group is used, therefore, in functional replacement nomenclature to name acids; acids are senior to anhydrides. For the prefixes 'cyanato', 'thiocyanato', 'selenocyanato' and 'tellurocyanato', see P-65.2.2.

Examples:

$\text{CH}_3\text{-P(OCN)OH}$	methylphosphonocyanatidic acid (PIN)
$\text{P(O)(OCN)}_2\text{OH}$	phosphorodicyanatidic acid (PIN)
Si(OCN)(OH)_3	cyanatosilicic acid

P-67.1.2.4.3 Comment on name construction. The names phosphinous, phosphinic, phosphonic and phosphinic acid (and similarly for arsenic and antimony acids) can only be used when P, As or Sb is attached to atoms of hydrogen, carbon or another atom of a parent hydride such as N, As, Si. Thus, $\text{C}_6\text{H}_5\text{-P(O)Cl(OH)}$ is phenylphosphonochloridic acid and not chlorophenylphosphinic acid; $(\text{C}_5\text{H}_{10}\text{N})\text{-P(O)Cl(OH)}$ is piperidin-1-ylphosphonochloridic acid and not chloropiperidin-1-ylphosphinic acid; and ClP(O)(OH)_2 is phosphorochloridic acid and not chlorophosphonic acid.

P-67.1.2.5 Acid halides and pseudohalides

Except for the boron acids and silicic acid, preferred IUPAC names of acid halides and pseudohalides are formed by adding the class name(s) of a halide or pseudohalide to that of the acid. Exceptionally, in accordance with tradition and the recommended nomenclature of inorganic compounds (ref. 14), halides and pseudohalides formed of identical atoms or groups derived from phosphoric acid, sulfuric acid, selenic acid and telluric acid are named by adding the class name(s) to the acyl group name 'phosphoryl', 'sulfuryl', 'sulfamoyl', 'selenonyl' and 'telluronyl', and not to the name of the acid itself. In accordance with the seniority order of halides and pseudohalides, names are formed on the basis of the senior class, as described in P-67.1.2.1.

Preferred IUPAC names of acid halides and pseudohalides derived from the boron acids and silicic acid are formed on the basis of the parent hydride names borane and silane, respectively..

Examples:

$\text{CH}_3\text{-N(O)-Cl}_2$	methylazonic dichloride
P(O)(NCO)_3	phosphoryl triisocyanate (PIN)
$(\text{C}_6\text{H}_5)_2\text{P-Cl}$	diphenylphosphinous chloride (PIN)
$(\text{C}_6\text{H}_5)_2\text{Sb-NCO}$	diphenylstibinous isocyanate (PIN)
$\text{C}_6\text{H}_5\text{-PCl}_2$	phenylphosphonous dichloride (PIN)

$C_6H_5-PBrCl$	phenylphosphonous bromide chloride (PIN) phenylphosphonobromidous chloride
$(C_6H_5)_2P(=N-C_6H_5)Cl$	<i>N,P,P</i> -triphenylphosphinimidic chloride (PIN)
$(CH_3-CH_2)_2P(S)Cl$	diethylphosphinothioic chloride (PIN)
$C_6H_5-P(O)Cl_2$	phenylphosphonic dichloride (PIN)
$CH_3-CH_2-P(O)[N(CH_3)_2]Cl$	<i>P</i> -ethyl- <i>N,N</i> -dimethylphosphonamidic chloride (PIN)
$(CH_3)_2N-P(O)(NCO)Cl$	<i>N,N</i> -dimethylphosphoramidisocyanatidic chloride (PIN)
$HP(O)(NCO)_2$	phosphonic diisocyanate (PIN)
$P(=NH)(NCS)_3$	phosphorimidic tris(isothiocyanate) (PIN)
$(CH_3)_2PN_3$	dimethylphosphinous azide (PIN)
$SO_2(NCO)_2$	sulfuryl diisocyanate (PIN)
$S(=NH-CH_3)-Cl_2$	<i>N</i> -methylsulfurimidous dichloride (PIN)
$F-SO_2-NCO$	sulfurisocyanatidic fluoride (PIN)
$F-S(=NH)(NCO)$	sulfurimidisocyanatidous fluoride (PIN)
$CH_3-NH-SO_2Cl$	<i>N</i> -methylsulfamoyl chloride (PIN)
$C_6H_5-B(Cl)(Br)$	chloro(bromo)phenylborane (PIN) phenylboronic bromide chloride phenylboronobromidic chloride

SiCl ₄	tetrachlorosilane (preselected name) (not silicic tetrachloride) silicon tetrachloride
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P-67.1.2.6 Amides and hydrazides

Amides and hydrazides are named by functional class nomenclature by replacing the term 'acid' in the name of the corresponding acid by 'amide' or 'hydrazide'. Amides and hydrazides of nitric acid and nitrous acid have been discussed in P-61.5.3; azorous acid, azinous acid and azonous acid are exceptions discussed below. Preferred IUPAC names of amides and hydrazides are denoted by the class name 'amide' or 'hydrazide':

- (a) when all –OH groups in the corresponding acid have been replaced by –NH₂ or –NH–NH₂ groups, and
- (b) when the amide or hydrazide is the principal functional group in accordance with the following order of seniority:

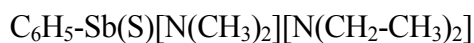
Br, Cl, F, I, N₃, CN, NC, NCO, ONC, NH₂ (amide), NHNH₂ (hydrazide)

Note that this order is not quite the same as that used by CAS (where amide follow the halogens and precedes the pseudohalogens) but it is consistent with the order of compound classes in P-41.

Substituents on the nitrogen atoms are denoted by letter locants such as, *N* (primed and double primed as required), in addition to *P*, *As*, and *Sb*. Locants to denote hydrazides are 1 and 2, primed and double primed as required.

Examples:

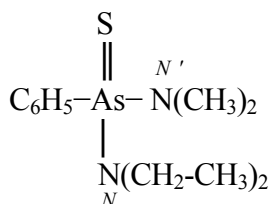
[(CH ₃) ₂ N] ₃ PO	hexamethylphosphoric triamide (PIN) hexamethylphosphoramide (not phosphoric tris(dimethylamide))
(CH ₃) ₂ P(O)[N(CH ₃) ₂]	<i>N,N,P,P</i> -tetramethylphosphinic amide (PIN) (not dimethylphosphinic dimethylamide)
C ₆ H ₅ -P(O)(NHCH ₃) ₂	<i>N,N'</i> -dimethyl- <i>P</i> -phenylphosphonic diamide (PIN) (not phenylphosphonic bis(methylamide))
C ₆ H ₅ -P(S)[N(CH ₃) ₂] ₂	<i>N,N,N',N'</i> -tetramethyl- <i>P</i> -phenylphosphonothioic diamide (PIN)



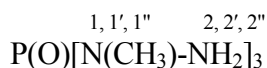
N,N-diethyl-*N',N'*-dimethyl-*Sb*-phenylstibonothioic diamide (PIN)



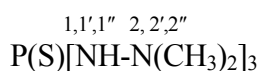
N,N-dimethylphosphoramidic dichloride (PIN)



N,N-diethyl-*N',N'*-dimethyl-*As*-phenylarsonothioic diamide (PIN)



1,1',1''-trimethylphosphoric trihydrazide (PIN)



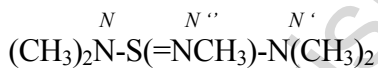
2,2,2',2',2'',2''-hexamethylphosphorothioic trihydrazide (PIN)
 (not phosphorothioic tris(2,2-dimethylhydrazide))



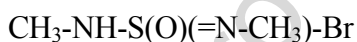
N-methylsulfurous diamide (PIN)



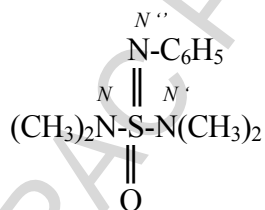
N,N-dimethylsulfuric diamide (PIN)
 (not *N,N*-dimethylsulfamide)



pentamethylsulfurimidous diamide (PIN)



N,N'-dimethylsulfurimidic bromide (PIN)



N,N,N',N'-tetramethyl-*N''*-phenylsulfurimidic diamide (PIN)



boric triamide (preselected name)
 (not boranetriamine)

$\overset{1,1',1''}{\text{B}}(\text{NH}-\text{NH}_2)_3$	boric trihydrazide (preselected name) (not 1,1',1''-boranetriyltris(hydrazine))
$\text{Si}(\text{NH}_2)_4$	silicic tetramide (preselected name) (not silanetetramine)
$\overset{1}{\text{Si}}(\overset{2}{\text{NH}}-\text{NH}_2)_4$	silicic tetrahydrazide (preselected name) (not 1,1',1'',1'''-silanetetrayltetrakis(hydrazine))

Exceptions: names of amides and hydrazides of azorous acid, azinous acid and azonous acid are exceptions to the general rule. They are named as di- and polyazanes.

Examples:

$\text{H}_2\text{N}-\text{N}(\text{NH}_2)-\text{NH}_2$	2-aminotriazane (preselected name) (not azorous trimide)
$\text{H}_2\text{N}-\text{NH}_2$	hydrazine (retained name) (not azinous amide)
$\text{H}_2\text{N}-\text{NH}-\text{NH}_2$	triazane (not azinous hydrazide)

P-67.1.3 Salts, esters and anhydrides

The methodology discussed in this section is applicable to all mononuclear oxo acids whether or not they have retained names or names using infixes or prefixes.

P-67.1.3.1 Salts

P-67.1.3.2 Esters

P-67.1.3.3 Anhydrides

P-67.1.3.1 Salts

Neutral salts of oxo acids are named by citing the cation(s) followed by the name of the anion as a separate word. Names of anions are formed by changing the 'ic acid' ending to 'ate' and the 'ous acid' ending to 'ite'. Different cations are cited in alphabetical order.

Examples:

$\text{Na}_2(\text{CH}_3-\text{PO}_2)$	disodium methylphosphonite (PIN)
$\text{K}[(\text{CH}_3)_2\text{As}(\text{O})\text{O}]$	potassium dimethylarsinate (PIN)

Acid salts of polybasic acids are named in the same way as neutral salts, the remaining acid hydrogen atom(s) being indicated by the word ‘hydrogen’ (or ‘dihydrogen’, etc., as appropriate) inserted between the name of the cation(s) and the name of the anion from which it is separated by spaces.

Example:



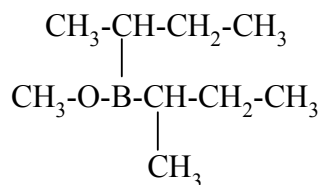
P-67.1.3.2 Esters

Esters of noncarbon acids are named in the same way as esters of organic acids (see P-65.6.3). Alkyl groups, aryl groups, etc. are cited as separate words, in alphanumerical order when more than one, and followed by the name of the appropriate anion. Partial (acid) esters of polybasic acids are named by citing alkyl groups, aryl groups, etc. as separate word, in alphanumerical order if more than one, followed by the word ‘hydrogen’ (with the appropriate multiplying prefix denoting multiplicity) also cited as a separate word, and the name of the appropriate anion. Salts of partial (acid esters) are named by citing the name of the cation before the name of the organic group; remaining acids groups are denoted by the word ‘hydrogen’ as described above. Structural specificity for esters of chalcogen acids is provided by the appropriate italic element symbols *O*, *S*, *Se*, and *Te*, prefixed to the name of the group, as needed.

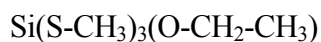
Examples:

$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-O-NO}$	pentyl nitrite (PIN)
$\text{CH}_3\text{-S-NO}_2$	<i>S</i> -methyl thionitrate
$(\text{C}_6\text{H}_5)_2\text{P-O-CH}_3$	methyl diphenylphosphinite (PIN)
$\text{CH}_3\text{-P}(\text{Cl})(\text{S-CH}_2\text{-CH}_3)$	ethyl methylphosphonochloridothioite (PIN)
$\text{CH}_3\text{-P}(\text{NH-CH}_3)(\text{OCH}_3)$	methyl <i>N,P</i> -dimethylphosphonamidite (PIN)
$\text{P}(\text{OCH}_3)_3$	trimethyl phosphite (PIN)
$\text{P}(\text{Cl})[\text{N}(\text{CH}_3)_2](\text{O-CH}_3)$	methyl <i>N,N</i> -dimethylphosphoramidochloridite (PIN)
$\text{P}(\text{O})(\text{CH}_3)_3$	trimethyl phosphate (PIN)
$\text{P}(\text{O})(\text{O-C}_2\text{H}_5)(\text{O-CH}_3)(\text{O-C}_6\text{H}_5)$	ethyl methyl phenyl phosphate (PIN)

$\text{P}(\text{O})(\text{O}-\text{CH}_3)(\text{OH})_2$	methyl dihydrogen phosphate (PIN)
$\text{C}_6\text{H}_5-\text{HAs}(\text{S})(\text{O}-\text{CH}_3)$	<i>O</i> -methyl phenylarsinothioate
$\text{CH}_3-\text{O}-\text{P}(\text{O})(\text{OH})-\text{O}^- \text{Na}^+$	sodium methyl hydrogen phosphate (PIN)
$\text{HP}(\text{O})(\text{O}-\text{CH}_3)_2$	dimethyl phosphonate (PIN)
$(\text{CH}_3-\text{CH}_2)_2\text{P}(\text{S})(\text{S}-\text{CH}_2-\text{CH}_3)$	ethyl diethylphosphinodithioate (PIN)
$(\text{CH}_3)_2\text{As}(\text{O})(\text{S}-\text{CH}_3)$	<i>S</i> -methyl dimethylarsinothioate (PIN)
$\text{CH}_3-\text{P}(\text{O})(\text{O}-\text{CH}_2-\text{CH}_3)_2$	diethyl methylphosphonate (PIN)
$\text{C}_6\text{H}_5-\text{P}(\text{O})(\text{O}-\text{CH}_3)(\text{S}-\text{CH}_2-\text{CH}_3)$	<i>S</i> -ethyl <i>O</i> -methyl phenylphosphonothioate (PIN)
$\text{C}_6\text{H}_5-\text{P}(\text{O})(\text{Cl})(\text{O}-\text{CH}_3)$	methyl phenylphosphonochloridate (PIN)
$(\text{CH}_3)_2\text{N}-\text{P}(\text{O})(\text{O}-\text{CH}_3)_2$	dimethyl <i>N,N</i> -dimethylphosphoramidate (PIN)
$(\text{CH}_3-\text{CH}_2)_2\text{N}-\text{P}(\text{O})(\text{NCS})(\text{O}-\text{CH}_2-\text{CH}_3)$	ethyl <i>N,N</i> -diethylphosphoramido(isothiocyanatidate) (PIN)
$\text{As}(\text{O})(\text{F})(\text{O}-\text{CH}_3)_2$	dimethyl arsorofluoridate (PIN)
$\text{Sb}(\text{O})(\text{F}_2)(\text{S}-\text{CH}_3)$	<i>S</i> -methyl stiborodifluoridothioate (PIN)
$(\text{CH}_3)_2\text{B}-\text{O}-\text{C}_6\text{H}_5$	phenyl dimethylborinate (PIN)
$\text{CH}_3-\text{O}-\text{SO}_2-\text{OH}$	methyl hydrogen sulfate (PIN)
$\text{C}_6\text{H}_5-\text{O}-\text{F}$	phenyl hypofluorite (PIN)
$\text{CH}_3-\text{S}-\text{Cl}$	methyl thiohypochlorite (PIN)
$\text{CH}_3-\text{CO}-\text{CH}_2-\text{CH}_2-\text{O}-\text{BrO}_2$	3-oxobutyl bromate (PIN)



methyl bis(1-hydroxypropan-2-yl)borinate (PIN)



O-ethyl *S,S,S*-trimethyl silicate (PIN)

P-67.1.3.2 Anhydrides

Neutral anhydrides formed between acids named by suffixes and mononuclear oxoacids described in P-67.1.1 are named in the way described for anhydrides derived from carboxylic acids and sulfur acids named by suffixes (see P-65.7). The names of the acids are cited in alphabetical order followed by the name of the class 'anhydride' prefixed by a numerical term indicating the number of anhydride linkages (the numerical prefix mono is not used); such names lead to preferred IUPAC names rather than names formed acyl groups substituting the name of the phosphorus, arsenic or antimony oxoacid modified by the ending 'ate'. Halogen oxoacids form anhydrides with acids expressed by suffixes.

Acidic anhydrides are named as described in P-67.3.1 by using the senior acid as parent, or by using systematic substitutive nomenclature.

Examples:

$(\text{CH}_3)_2\text{B-O-CO-CH}_3$ acetic dimethylborinic anhydride (PIN)

$\text{CH}_3\text{-CO-O-As}(\text{O})(\text{CH}_3)_2$ acetic dimethylarsinic anhydride (PIN)
 acetyl dimethylarsinate

$[(\text{CH}_3)_2\text{CH}]_2\text{Sb-S-C}(\text{S})\text{-N}(\text{CH}_2\text{-CH}_3)_2$
 diethylcarbamoithioic di(propan-2-yl)stibinous thioanhydride (PIN)

$\text{B}(\text{O-CO-CH}_3)_3$ triacetic boric trianhydride (PIN)

$\text{C}_6\text{H}_5\text{-CO-O-I}$ benzoic hypoiodous anhydride (PIN)

$(\text{CH}_3)_2\text{B-O-O-B}(\text{CH}_3)_2$ dimethylborinic peroxyanhydride (PIN)

$\text{B}(\text{OCN})_3$ tricyanic boric trianhydride (PIN)

$\text{CH}_3\text{-HP}(\text{O})(\text{OCN})$ cyanic methylphosphinic anhydride (PIN)

P-67.1.4 Substituent prefix groups

- P-67.1.4.1 Substituent groups derived from nitrogen, phosphorus, arsenic, and antimony acids
- P-67.1.4.2 Substituent groups derived from boric acid and silicic acid
- P-67-1.4.3 Substituent groups derived from nitric and nitrous acids
- P-67.1.4.4 Substituent groups derived from sulfur, selenium and tellurium acids
- P-67.1.4.5 Substituent groups derived from halogen acids

P-67.1.4.1 Substituent groups derived from nitrogen, phosphorus, arsenic, and antimony acids

- P-67.1.4.1.1 Preselected names
- P-67.1.4.1.2 Substituent groups for general nomenclature
- P-67.1.4.1.3 Compound and complex substituent groups

P-67.1.4.1.1 Substituent prefix groups have retained names and systematic names corresponding to simple or compound acyl groups. The preselected names are formed by applying the following seniority order, in the order given, until a decision is reached.

(a) Retained names

A few names denoting monovalent acidic groups are retained. These names are preselected names when unsubstituted or for chalcogen analogues when the position of chalcogen atoms introduced by functional replacement is not known or it is not necessary to specify their position(s): the chalcogen atoms are expressed by prefixes.

$-\text{N}(\text{O})(\text{OH})_2$	azono (preselected name)
$-\text{P}(\text{O})(\text{OH})_2$	phosphono (preselected name)
$-\text{As}(\text{O})(\text{OH})_2$	arsono (preselected name)
$-\text{Sb}(\text{O})(\text{OH})_2$	stibono (preselected name)
$-\text{P}(\text{O})(\text{OH})(\text{SH})$ or $-\text{P}(\text{S})(\text{OH})_2$	thiophosphono (preselected name)
$-\text{P}(\text{S})(\text{SH})_2$	trithiophosphono (preselected name)

(b) Basic acyl groups

Acyl prefix groups are formed by removing all -OH groups from an oxo acid having the general structures $\text{E}(=\text{O})(\text{OH})_3$, $\text{R}-\text{E}(=\text{O})(\text{OH})_2$ or $\text{R,R}'\text{E}(=\text{O})\text{OH}$, where R and R' = H or an organyl group. Names of acyl groups derived from the names of acids, modified or not by functional replacement, by elimination of all hydroxy groups or their chalcogen analogues, are formed by changing the 'ic acid' ending in the name of the acid to 'oyl', with the exception

of 'azoryl' (preferred to 'nitrolyl' $-N(O)<$); 'phosphoryl', $-P(O)<$; 'arsoryl', $-As(O)<$; and 'stiboryl', $-Sb(O)<$. Names formed in this manner are preferred IUPAC names. For example, the group 'phosphoryl' $-P(O)<$, is derived from phosphoric acid, $P(O)(OH)_3$ or phosphorothioic *S*-acid, $P(O)(OH)_2(SH)$.

The name 'azoryl', for the acyl group $>N(O)-$, derived from the hypothetical acid $N(O)(OH)_3$, named azoric acid, has been recommended in 1993 (see R-3.3, ref. 2). The name 'azoryl' is the preferred IUPAC name; it is preferred to 'nitrolyl'.

Examples:

$N(O)(OH)_3$	azoric acid (preselected name) nitroic acid	$>N(O)-$	azoryl (preselected name) nitrolyl
$P(O)(OH)_3$	phosphoric acid (preselected name)	$>P(O)-$	phosphoryl (preselected name)
$As(O)(OH)_3$	arsoric acid (preselected name) (not arsenic acid)	$>As(O)-$	arsoryl (preselected name) (not arsenyl)
$Sb(O)(OH)_3$	stiboric acid (preselected name) (not antimonic acid)	$>Sb(O)-$	stiboryl (preselected name) (not antimonyl)
$NH(O)(OH)_2$	azonic acid (preselected name)	$>NH(O)$	azonoyl (preselected name)
$NH_2(O)(OH)$	azinic acid (preselected name)	$-NH_2(O)$	azinoyl (preselected name)
$PH(O)(OH)_2$	phosphonic acid (preselected name)	$>PH(O)$	phosphonoyl (preselected name)
$PH_2(O)(OH)$	phosphinic acid (preselected name)	$-PH_2(O)$	phosphinoyl (preselected name)
$AsH(O)(OH)_2$	arsonic acid (preselected name)	$>AsH(O)$	arsonoyl (preselected name)

$\text{AsH}_2(\text{O})\text{OH}$	arsinic acid (preselected name)	$-\text{AsH}_2(\text{O})$	arsinoyl (preselected name)
$\text{SbH}(\text{O})(\text{OH})_2$	stibonic acid (preselected name)	$>\text{SbH}(\text{O})$	stibonoyl (preselected name)
$\text{SbH}_2(\text{O})\text{OH}$	stibinic acid (preselected name)	$-\text{SbH}_2(\text{O})$	stibinoyl (preselected name)

(c) Names of substituted basic acyl groups

Names of substituted basic acyl groups are formed directly from those of the acids generated by the method described in P-67.1.2.2.1. Preferred IUPAC names of acyl groups are those derived from the preferred names of acids. The addition of hydrogen atoms to acyl groups by the method of concatenation, described in P-67.1.4.1.2, is not allowed.

Examples:

$\text{CH}_3\text{-P}(\text{O})(\text{OH})_2$ methylphosphonic acid (PIN)	$\text{CH}_3\text{-P}(\text{O})<$ methylphosphonoyl (PIN)
$\text{CH}_3\text{-CH}_2\text{-SbH}(\text{O})\text{OH}$ ethylstibinic acid (PIN)	$\text{CH}_3\text{-CH}_2\text{-SbH}(\text{O})-$ ethylstibinoyl (PIN)
$\text{C}_6\text{H}_5\text{-As}(\text{CH}_3)(\text{O})\text{OH}$ methyl(phenyl)arsenic acid (PIN)	$\text{C}_6\text{H}_5\text{-As}(\text{CH}_3)(\text{O})-$ methyl(phenyl)arsinoyl (PIN)

(d) Names of acyl groups modified by functional replacement nomenclature

Preferred IUPAC names are formed by the methodology indicated in Section P-65.2.1.5 for acyl groups derived from carbonic acids modified by the infixes and prefixes in functional replacement nomenclature. All infixes and prefixes listed in Table 1.6 and cited in P-65.2.1.5 are allowed. Applied to the B, N, P, As and Sb oxo acids, the method consists of achieving functional replacement in acids, then removing all remaining $-\text{OH}$ groups. Preselected names use infixes to denote functional replacement.

Examples:

$\text{P}(\text{S})(\text{OH})_3$ phosphorothioic <i>O,O,O</i> -acid (preselected name) thiophosphoric <i>O,O,O</i> -acid	$>\text{P}(\text{S})-$ phosphorothioyl (preselected name) thiophosphoryl
---------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------

$\text{As}(=\text{NH})(\text{OH})_3$ arsorimidic acid (preselected name) imidoarsoric acid	$>\text{As}(=\text{NH})-$ arsorimidoyl (preselected name) imidoarsoryl
$\text{Sb}(=\text{NNH}_2)(\text{OH})_3$ stiborohydrazoneic acid (preselected name) hydrazonostiboric acid	$>\text{Sb}(=\text{NNH}_2)-$ stiborohydrazoneoyl (preselected name) hydrazonostiboroyl
$\text{NH}(\text{S})(\text{OH})_2$ azonothioic acid (preselected name) thioazonic acid	$>\text{NH}(\text{S})$ azonothioyl (preselected name) thioazonoyl
$\text{PH}_2(=\text{NH})(\text{OH})$ phosphinimidic acid (preselected name) imidophosphinic acid	$-\text{PH}_2(=\text{NH})$ phosphinimidoyl (preselected name) imidophosphinoyl
$(\text{CH}_3)_2\text{P}(\text{Se})(\text{OH})$ dimethylphosphinoselenoic acid (PIN) dimethyl(selenophosphinic acid)	$(\text{CH}_3)_2\text{P}(\text{Se})-$ dimethylphosphinoselenoyl (PIN) dimethyl(selenophosphinoyl)
$\text{C}_6\text{H}_5-\text{P}(\text{O})\text{Cl}(\text{OH})$ phenylphosphonochloridic acid (PIN) phenyl(chlorophosphonic acid)	$\text{C}_6\text{H}_5-\text{P}(\text{O})(\text{Cl})-$ phenylphosphonochloridoyl (PIN) phenyl(chlorophosphonoyl)
$\text{P}(\equiv\text{N})(\text{OH})_2$ phosphoronitridic acid (preselected name) nitridophosphoric acid	$>\text{P}(\equiv\text{N})$ phosphoronitridoyl (preselected name) nitridophosphoryl
$\text{P}(=\text{NH})(\text{NHNH}_2)(\text{OH})_2$ phosphorohydrazidimidic acid (preselected name) hydrazidimidophosphoric acid	$>\text{P}(=\text{NH})(\text{NHNH}_2)$ phosphorohydrazidimidoyl (preselected name) hydrazidimidophosphoryl
$\text{P}(\text{O})\text{Cl}_2(\text{OH})$ phosphorodichloridic acid (preselected name) dichlorophosphoric acid	$\text{P}(\text{O})(\text{Cl})_2-$ phosphorodichloridoyl (preselected name) dichlorophosphoryl

$(\text{CH}_3)_2\text{N-P(O)(OH)}_2$
 dimethylphosphoramidic acid (PIN)
 (dimethylamido)phosphoric acid

$(\text{CH}_3)_2\text{N-P(O)}<$
 dimethylphosphoramidoyl (PIN)
 (dimethylamido)phosphoryl

$\text{P(O)(OH)}_2(\text{OOH})$
 phosphoroperoxoic acid (preselected name)
 peroxyphosphoric acid

$>\text{P(O)(OOH)}$
 phosphoroperoxoyl (preselected name)
 peroxyphosphoryl

$\text{P(O)(OH)}_2(\text{OSH})$ or $\text{P(O)(OH)}_2(\text{SOH})$
 phosphoro(thioperoxoic) acid (preselected name)
 (thioperoxy)phosphoric acid

$>\text{P(O)(OSH)}$ or $>\text{P(O)(SOH)}$
 phosphoro(thioperoxoyl) (preselected name)
 (thioperoxy)phosphoryl

(e) Names of acyl groups and substituted acyl groups formed by concatenation

Concatenation is used to generate preferred IUPAC names or preselected names of acyl groups substituted by hydroxy groups or their chalcogen and peroxy analogues; this is the recommended method to reintroduce in substituent groups the hydroxyl groups and their chalcogen analogues or to introduce groups that are not treated as infixes in functional replacement nomenclature, such as ‘-OR’, ‘-SR’, etc. It is important to respect the concatenation procedure that is an additive operation using acyl groups only. The following acyl groups are allowed: basic acyl groups described in (b) above, substituted basic acyl groups described in (c) above, and acyl groups modified by functional replacement described in (d) above. Substitution of hydrogen atoms attached to the central atom (substitutable hydrogen) in the basic acyl groups described in (b) above is not allowed.

Examples:

$-\text{NH(O)(OH)}$ hydroxyazonoyl (preselected name)

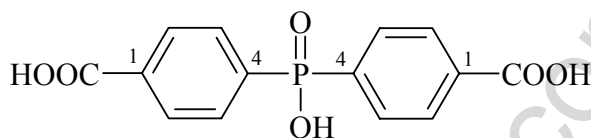
$-\text{P(Se)(OCH}_3)_2$ dimethoxyphosphoroselenoyl (PIN)
 dimethoxy(selenophosphoryl)

$-\text{P(O)(OH)(SH)}$ hydroxy(sulfanyl)phosphoryl (preselected name)

$-\text{P(O)(SH)}_2$ bis(sulfanyl)phosphoryl (preselected name)

$-\text{PH(O)(SeH)}$ selanylphosphinoyl (preselected name)

$-\text{PH}(\text{S})(\text{SH})$	sulfanylphosphinothioyl (preselected name) sulfanyl(thiophosphinoyl)
$>\text{P}(\text{O})(\text{OSH})$	(sulfanyloxy)phosphoryl (preselected name) (<i>OS</i> -thiohydroperoxy)phosphoryl
$-\text{P}(\text{S})(\text{SOH})$	(hydroxysulfanyl)phosphorothioyl (preselected name) (<i>SO</i> -thiohydroperoxy)thiophosphoryl
$\text{CH}_3-\text{P}(\text{O})(\text{OH})-$	hydroxy(methylphosphonoyl) (PIN)



4,4'-(hydroxyphosphoryl)dibenzoic acid (PIN)

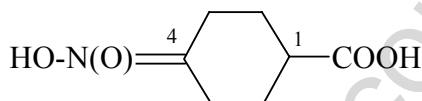
(f) Names formed by substitutive nomenclature

Substitutive nomenclature based on parent hydrides BH_3 , PH_3 , AsH_3 , SbH_3 , PH_5 , AsH_5 , and SbH_5 is used to generate names of substituent groups for which acyl group names cannot be generated by the methods in P-67.1.4.1.1.1 through P-67.1.4.1.1.5, for example 'phosphonous acid', 'phosphinous acid', and the corresponding As and Sb acids. It is also used to indicate a different type of free valencies, for example an 'ylidene' type instead of the 'diyl' observed in a substituent group derived from the acid in criteria (b) and (d).

Examples:

$-\text{P}(\text{OH})_2$	dihydroxyphosphanyl (preselected name)
$-\text{AsH}(\text{OH})$	hydroxyarsanyl (preselected name)
$-\text{AsHCl}$	chloroarsanyl (preselected name)
$-\text{P}(\text{NH}_2)$	diaminophosphanyl
$>\text{Sb}(\text{OH})$	hydroxystibanedyl (preselected name)
$=\text{P}(\text{OH})$	hydroxyphosphanylidene (preselected name)

$=\text{B}(\text{O}-\text{CH}_3)$	methoxyboranylidene (preselected name)
$-\text{P}(\text{O}-\text{CH}_3)_2$	dimethoxyphosphanyl (PIN)
$=\text{P}(\text{O})(\text{OH})$	hydroxy(oxo)- λ^5 -phosphanylidene (preselected name)
$=\text{As}(\text{O})(\text{OCH}_3)$	methoxy(oxo)- λ^5 -arsanylidene (PIN)
$=\text{N}(\text{O})\text{OH}$	4-[hydroxy(oxo)- λ^5 -azanylidene] (preselected name) (no longer <i>aci</i> -nitro; see P-67.1.6)



4-[hydroxy(oxo)- λ^5 -azanylidene]cyclohexane-1-carboxylic acid (PIN)
(see *aci*-nitro compounds, P-67.1.6)

P-67.1.4.1.2 The prefix hydro may be added by concatenation for use in general nomenclature only.

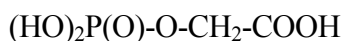
Examples:

$>\text{PH}(\text{O})$	hydrophosphoryl phosphonoyl (preselected name)
$>\text{PH}(\text{S})$	hydro(thiophosphoryl) phosphonothioyl (preselected name)

P-67.1.4.1.3 Compound and complex substituent groups

If a B, N, P, As, or Sb containing group is attached by an oxygen or other chalcogen atom or a nitrogen atom to a compound that also contains another substituent having priority over the B, N, P, As, or Sb containing group for citation as principal group, then the B, N, P, As, or Sb containing group is named by a compound or complex prefix built from prefixes described above and arranged in the order in which the components occur in the compound.

Examples:



2-(phosphonoxy)acetic acid (PIN)



3-[(dimethoxyphosphoryl)sulfanyl]propanoic acid (PIN)



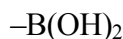
3-[[hydroxy(sulfanyl)phosphorothioyl]amino}propanoic acid (PIN)

P-67.1.4.2 Substituent groups derived from the boron acids and silicic acid

All substituent groups from boron and silicon mononuclear compounds are all formed by substituting the parent hydride names 'borane' and 'silane'. The name borono, for $-\text{B}(\text{OH})_2$, is retained and in the preferred IUPAC name.

The name boryl has been used for the substituent group $\text{H}_2\text{B}-$, now named boranyl as the preferred IUPAC name, and consequently is not be used for the prefix group derived from boric acid by removal of all three $-\text{OH}$ groups.

Examples:



borono (preselected name)



boranyl (preselected name)
(not borinoyl)



boranediyl (preselected name)
(not boronoyl)



boranetriyl (preselected name)
(not boryl)



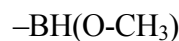
boranylidene (preselected name)
(not boronoyl)



boranylidyne (preselected name)
(not boryl)



diaminoboranyl (preselected name)
(not borodiamidoyl)



methoxyboranyl (PIN)
(not hydromethoxyboryl)

$-\text{Si}(\text{OH})_3$ trihydroxysilyl (preselected name) $-\text{Si}(\text{OH})_2(\text{SH})$ dihydroxy(sulfanyl)silyl (preselected name)

$-\text{SiCl}_2(\text{NH}_2)$ aminodichlorosilyl (preselected name) $-\text{Si}(\text{O}-\text{CH}_3)_3$ trimethoxysilyl (PIN)

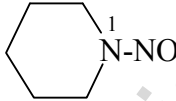
P-67.1.4.3 Substituent groups derived from nitric acid, nitrous acid, and the analogous phosphorus and arsenic acids.

The names 'nitro', 'nitroso', phospho, phosphoso, arso, and arsoroso are used to denote the groups $-\text{NO}_2$, $-\text{NO}$, $-\text{PO}_2$, $-\text{PO}$, $-\text{AsO}_2$, and AsO , respectively. These names can be modified by functional replacement nomenclature using prefixes. These prefixes are treated as compulsory prefixes (see P-61.5). Traditionally, the groups 'nitro' and 'nitroso' are added to a nitrogen atom, thus constituting an exception to the principle of using the longest possible chain as parent hydride.

Examples:

$-\text{N}=\text{S}$ thionitroso (PIN) $-\text{O}-\text{NO}_2$ nitrooxy (PIN)

$-\text{S}-\text{N}=\text{S}$ (thionitroso)sulfanyl (PIN) $-\text{NH}-\text{NO}_2$ nitramido (PIN)


1-nitrosopiperidine (PIN)

$\text{CH}_3-\text{O}-\text{P}(\text{O})_2$
(phosphooxy)methane (PIN)
methoxy- λ^5 -phosphanedione
(formerly methyl metaphosphate)

P-67.1.4.4 Substituent groups derived from chalcogen acids

P-67.1.4.4.1 Acyl groups

There are two methods to generate names of acyl groups derived from the chalcogen acids for use as substituent groups.

- (1) The methodology described in P-65.3.2.3 in which infixes denote functional replacement by $-\text{S}-$, $-\text{Se}-$, $-\text{Te}-$, $=\text{NH}$, and $=\text{NNH}_2$, and concatenation is used for other atoms or groups.

- (2) The general method described in P-65.2.1.5 for deriving acyl groups from derivatives of carbonic acid, and applied in P-67.1.4.1.2.2 for acyl groups derived from phosphoric, phosphonic and phosphinic acids and their arsenic and antimony congeners is applied to sulfuric acid and its functional replacement analogues.

Method (1) produces preselected names.

Examples:

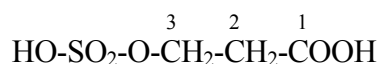
$-\text{SO}_2-$	sulfonyl (preselected name) sulfuryl
$-\text{S}(\text{O})(\text{S})-$	sulfonylthioyl (preselected name) sulfurothioyl
$-\text{S}(\text{S})_2-$	sulfonodithioyl (preselected name) sulfurodithioyl
$-\text{S}(\text{O})(=\text{NH})-$	sulfonimidoyl (preselected name) sulfurimidoyl
$-\text{S}(=\text{NH})_2-$	sulfonodiimidoyl (preselected name) sulfurodiimidoyl
$-\text{S}(\text{O})(=\text{NNH}_2)-$	sulfonohydrazonoyl (preselected name) sulfurohydrazonoyl
$-\text{S}(=\text{NNH}_2)_2-$	sulfonodihydrazonoyl (preselected name) sulfurodihydrazonoyl
$-\text{SO}_2-\text{Cl}$	chlorosulfonyl (preselected name) sulfurochloridoyl
$-\text{SO}_2-\text{CN}$	cyanosulfonyl (PIN) sulfurocyanidoyl
$-\text{SO}_2-\text{NCS}$	isothiocyanatosulfonyl (PIN) sulfuroisothiocyanatidoyl
$-\text{S}(\text{O})(\text{S})-\text{NCS}$	isothiocyanatosulfonylthioyl (PIN) sulfuro(isothiocyanatido)thioyl
$-\text{SO}_2-\text{O}-\text{CH}_3$	methoxysulfonyl (PIN) methoxysulfuryl

$-\text{S}(=\text{O})-\text{Cl}$ chlorosulfinyl (preselected name)

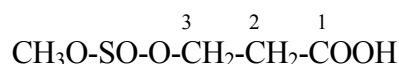
Method (2) cannot be applied to sulfurous acid, selenic acid and selenous acid, and telluric acid and tellurous acid, because of ambiguous results.

P-67.1.4.4.2 If a sulfur containing group is attached by oxygen (chalcogen) or nitrogen to a compound that contains also another substituent having priority over the sulfur-containing group for citation as principal group, then the sulfur-containing group is named by an appropriate prefix as described in P-65.3 and P-67.1.4.4.1.

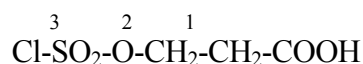
Examples:



3-(sulfooxy)propanoic acid (PIN)

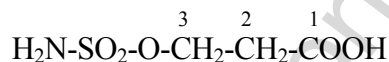


3-[(methoxysulfinyl)oxy]propanoic acid (PIN)



3-[(chlorosulfonyl)oxy]propanoic acid (PIN)

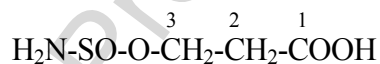
3-(sulfurochloridoyloxy)propanoic acid



3-(sulfamoyloxy)propanoic acid (PIN)

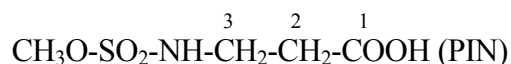
3-(sulfuramidoyloxy)propanoic acid

[not (sulfonamidoyloxy)propanoic acid; the name
sulfonamidic acid is not an approved name]



3-[(aminosulfinyl)oxy]propanoic acid (PIN)

[not 3-(sulfonamidoyloxy)propanoic acid; the name
sulfonamidic acid is not an approved name]



3-[(methoxysulfonyl)amino]propanoic acid

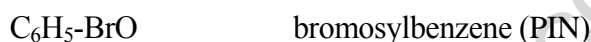
P-67.1.4.5 Substituent groups derived from halogen acids

Names of prefixes derived from halogen acids and their chalcogen analogues are used as compulsory prefixes in substitutive nomenclature. They are listed in Table 5.1 and discussed in P-61.3.2.

OCl-	chlorosyl (preselected name)
SCl-	thiochlorosyl (preselected name)
O ₂ Cl-	chloryl (preselected name)
O ₃ Cl-	perchloryl (preselected name)

The corresponding Br, F and I groups are named in a similar manner..

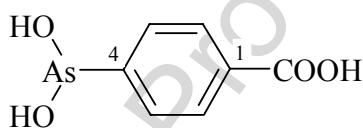
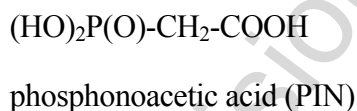
Example:



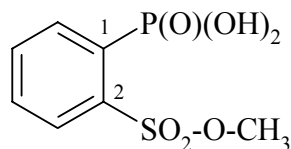
P-67.1.5 Seniority order for inorganic acids and their derivatives

P-67.1.5.1 When a characteristic group having priority to be cited as principal group is present (see seniority order of classes, P-42, and of acids, P-44), prefixes having retained names or names systematically formed (see Tables 6.3 and 6.4) are used to denote inorganic acids.

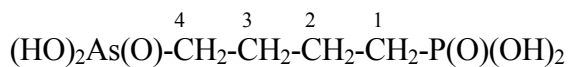
Examples:



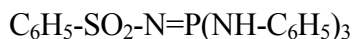
(dihydroxyarsanyl)benzoic acid (PIN)
 [-COOH is senior to -As(OH)₂]



2-[(methoxysulfonyl)phenyl]phosphonic acid (PIN)
 (an acid is senior to an ester)



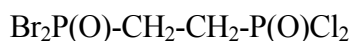
(4- arsonobutyl)phosphonic acid (PIN)
 (a phosphorus acid is senior to an arsenic acid)



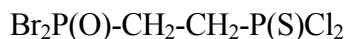
N-[tris(phenylamino)- λ^5 -phosphanylidene]benzenesulfonamide (PIN)
(not *N,N',N''*-triphenyl-*N'''*-benzenesulfonylphosphorimidic triamide;
nor *N'''*-benzenesulfonylphosphorimidic tris(phenylamide))

P-67.1.5.2 When derivatives of mononuclear acids are named by functional class nomenclature, the seniority order is established in accordance with the greater number of atoms linked to the central atom and appearing as early as possible in the list: O, OO, S, Se, Te for the acids, then F, Cl, Br, I, then the pseudohalides in the order N₃, CN, NC, NCO, NCS, NCSe, NCTe, then amides and hydrazides.

Examples:



(2-phosphorodibromidoylethyl)phosphonic dichloride (PIN)
(Cl is senior to Br in the seniority order of classes)



(2-phosphorodichloridothioylethyl)phosphonic dibromide (PIN)
(phosphonic dibromide is preferred to phosphonothioic dichloride;
O > S is considered before Cl > Br)



2-(phosphoramidochloridoxy)ethyl phosphorodichloridate (PIN)
(phosphorodichloridic acid preferred to phosphoramidochloridic acid)

P-67.1.6 *aci*-Nitro compounds

aci-Nitro compounds deserve a special mention. They are tautomers of nitro compounds and have the general structure R=N(O)OH or R₂N(O)OH and are named as derivatives of azinic acid, H₂N(O)OH. The substitutive prefix '*aci*-nitro' is no longer recommended to denote the principal characteristic group.

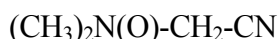
Example:



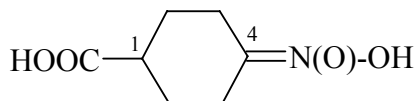
methylideneazinic acid (PIN)
(no longer *aci*-nitromethane)

When needed, the R₂N(O)- group is designated by a prefix derived from 'azinoyl', that is preferred to 'nitrolyl' (see P-67.1.4.1.5). The group =N(O)OH is named 'hydroxy(oxo)- λ^5 -azanylidene'.

Examples:



(dimethylazinoyl)acetonitrile (PIN)
[not (dimethylnitro)acetonitrile]



4-[hydroxy(oxo)- λ^5 -azanylidene]cyclohexane-1-carboxylic acid (PIN)
(formerly *aci*-nitro)

P-67.2 Polynuclear noncarbon acids

Like mononuclear acids, polynuclear acids have retained names that are used as preselected names. Substitutive or additive names are not recommended. Retained names are used as parents and are modifiable by functional replacement in the same manner that mononuclear acids are, except that only prefixes are used for functional replacement.

Di- and polynuclear acids, whose central atoms are B, P, As, Sb, S, Se, are described here. They are divided into three types. Di- and trinuclear are exemplified for each central atom. In some cases higher polynuclear acids are known. Their names are formed by using the appropriate multiplying prefixes to indicate the number of central atoms. Di- and polynuclear noncarboxylic carbon acids are discussed in Sections P-65.2 and P-66.1.5.

Insofar as their structures are known and conform to those of the phosphorus acids, arsenic and antimony acids are named in the same way as those of phosphorus, with 'ars' and 'stib', respectively, in place of 'phosp'. Similarly, tellurium acids are named in the same way as those of selenium, by changing 'selen' to 'tellur' in the names of acids.

P-67.2.1 Preselected names

P-67.2.2 Functional replacement nomenclature

P-67.2.3 Acid halides and pseudohalides

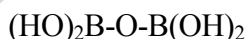
P-67.2.4 Amides and hydrazides

P-67.2.5 Esters and anhydrides

P-67.2.6 Substituent groups cited as prefixes

P-67.2.1 Preselected names

The following traditional names are retained as preselected names (for consistency in the names of polynuclear oxoacids, the numerical infix 'di' has been uniformly used in naming dinuclear 'hypo' acids). Although the 'meta' acids are for general nomenclature only, they are preferred IUPAC names if the structure is unknown.



diboric acid (preselected name)

$(\text{HO})\text{BH-O-BH}(\text{OH})$	diboronic acid (preselected name)
$(\text{HO})\text{HP}(\text{O})\text{-O-HP}(\text{O})(\text{OH})$	diphosphonic acid (preselected name)
HO-PH-O-PH-OH	diphosponous acid (preselected name)
$(\text{HO})_2\text{P}(\text{O})\text{-O-P}(\text{O})(\text{OH})_2$	diphosphoric acid (preselected name)
$(\text{HO})_2\text{P-O-P}(\text{OH})_2$	diphosphorous acid (preselected name)
$\text{HO-SeO}_2\text{-O-SeO}_2\text{-OH}$	diselenic acid (preselected name)
$\text{HO-SO}_2\text{-O-SO}_2\text{-OH}$	disulfuric acid (preselected name)
HO-SO-SO-OH	disulfurous acid (preselected name)
$(\text{HO})_2(\text{O})\text{P-P}(\text{O})(\text{OH})_2$	hypodiphosphoric acid (preselected name)
$(\text{HO})_2\text{P-P}(\text{OH})$	hypodiphosphorous acid (preselected name)
$\text{HO-SO}_2\text{-SO}_2\text{-OH}$	hypodisulfuric acid (preselected name) dithionic acid (see below for polythionic acids)
$[\text{HAsO}_3]_n = (-\text{As}(\text{O})(\text{OH})\text{O-})_n$	metaarsoric acid (preselected name; for general nomenclature only)
$[\text{HAsO}_2]_n = (-\text{As}(\text{OH})\text{O-})_n$	metaarsorous acid (preselected name; for general nomenclature only)
$[\text{HBO}_{2n}] = (-\text{B}(\text{OH})\text{O-})_n$	metaboric acid (preselected name; for general nomenclature only)
$[\text{HPO}_3]_n = (-\text{P}(\text{O})(\text{OH})\text{O-})_n$	metaphosphoric acid (preselected name; for general nomenclature only)
$[\text{HPO}_2]_n = (-\text{P}(\text{OH})\text{O-})_n$	metaphosphorous acid (preselected name; for general nomenclature only)
$[\text{H}_2\text{SiO}_3]_n = (-\text{Si}(\text{OH})_2\text{O-})_n$	metasilicic acid (preselected name; for general nomenclature only)
$[\text{HSbO}_3]_n = (-\text{Sb}(\text{O})(\text{OH})\text{O-})_n$	metastiboric acid (preselected name; for general nomenclature only)

$[\text{HSbO}_2]_n = (-\text{Sb}(\text{OH})\text{O}-)_n$	metastiborous acid (preselected name; for general nomenclature only)
$(\text{HO})\text{HP}(\text{O})\text{-O-HP}(\text{O})(\text{OH})\text{-O-HP}(\text{O})(\text{OH})$	triphosphonic acid (preselected name)
$(\text{HO})_2\text{P}(\text{O})\text{-O-P}(\text{O})(\text{OH})\text{-O-P}(\text{O})(\text{OH})_2$	triphosphoric acid (preselected name)
$\text{HO-SeO}_2\text{-O-SeO}_2\text{-O-SeO}_2\text{-OH}$	triselenic acid (preselected name)
$\text{HO-SO}_2\text{-O-SO}_2\text{-O-SO}_2\text{-OH}$	trisulfuric acid (preselected name)

P-67.2.2 Derivatives formed by functional replacement

P-67.2.2.1 General methodology

P-67.2.2.2 Replacement by $-\text{OO}-$, $-\text{S}-$, $=\text{S}$, $-\text{Se}-$, $=\text{Se}$, $-\text{Te}-$, $=\text{Te}$, and $=\text{NH}$

P-67.2.2.1 General methodology

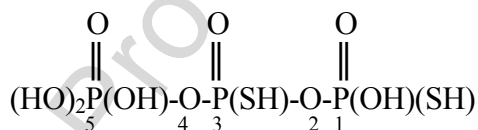
Prefixes are used to indicate functional replacement. They are listed in Table 4.2.. Each acid is numbered from one end to the other, starting from and finishing at a central atom. Prefixes are cited in alphabetical order in front of the retained name of the polyacid, with appropriate locants as required.

P-67.2.2.2 Replacement by $-\text{OO}-$, $-\text{S}-$, $=\text{S}$, $-\text{Se}-$, $=\text{Se}$, $-\text{Te}-$, $=\text{Te}$, $-\text{NH}-$, and $=\text{NH}$

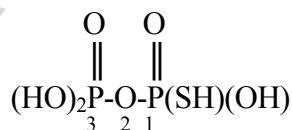
Functional replacement of oxygen atom(s) is denoted by prefixes, i.e., peroxy, for $-\text{OO}-$; thio, for $-\text{S}-$ or $=\text{S}$; seleno, for $-\text{Se}-$ or $=\text{Se}$; telluro, for $-\text{Te}-$ or $=\text{Te}$; and imido, for $-\text{NH}-$ or $=\text{NH}$. The position of each replaced oxygen atom is denoted by the appropriate a numerical locant.

Italic letter locants *N*, *N'*, etc. are used to designate substitution on nitrogen atoms that are not linkages between central atoms (aza anhydrides).

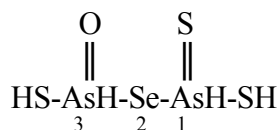
Examples:



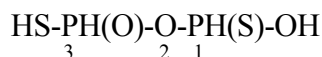
1,3-dithiotriphosphoric 1-*S*,3-*S*-acid (preselected name)



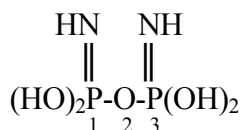
1-thiodiphosphoric 1-*S*-acid
(preselected name)



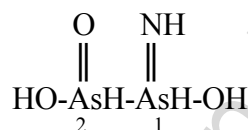
2-seleno-1,1,3-trithiodiarsonic 3-*S*-acid
(preselected name)



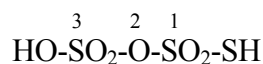
1,3-dithiodiphosphonic 1-*O*,3-*S*-acid (preselected name)



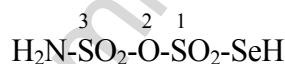
1,3-diimidodiphosphoric acid
 (preselected name)



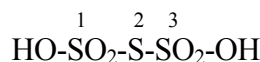
1-imidohypodiarsonic acid
 (preselected name)



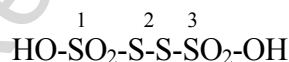
1-thiodisulfuric 1-*S*-acid
 (preselected name)



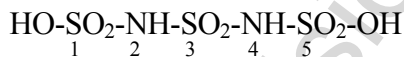
3-amido-1-selenodisulfuric 1-*Se*-acid
 (preselected name)



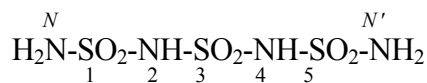
2-thiodisulfuric acid (PIN)
 sulfanedisulfonic acid
 trithionic acid (traditional name)



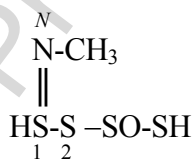
2-(dithioperoxy)disulfuric acid (PIN)
 disulfanedisulfonic acid
 tetrathionic acid (traditional name)



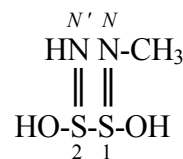
2,4-diimidotrisulfuric acid
 (preselected name)



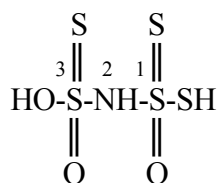
2,4-diimidotrisulfuric diamide
 (preselected name)



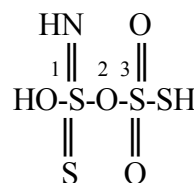
N-methyl-1-imido-1,2-dithiodithionous 2-*S*-acid
 (preselected name)
 (not 1-(methylimido)-1,2-dithionous 2-*S*-acid)



N-methyl-1,2-diimidodithionous acid
 (preselected name)



2-imido-1,1,3-trithiodisulfuric 1-S,3-O-acid
 (preselected name)

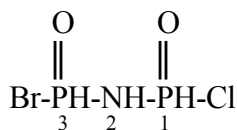


1-imido-1,3-dithiodisulfuric 1-O,3-S-acid
 (preselected name)

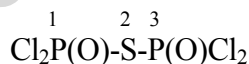
P-67.2.3 Acid halides and pseudohalides

Acid halides and pseudohalides, in which all OH groups have been replaced by halides or pseudohalide atoms or groups, are named by functional class nomenclature by replacing the name 'acid' by the name of the appropriate halide or pseudohalide. Halides are cited in alphabetical order. When halides and pseudohalides are present, the seniority order for selecting the principal class is as follows: halides (in alphabetical order), N₃, CN, NC, NCO, NCS, NCSe, NCTe.

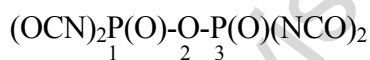
Examples:



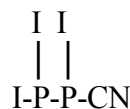
2-imidodiphosphonic bromide chloride
 (preselected name)



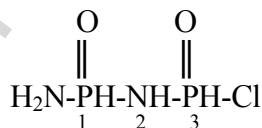
2-thiodiphosphoric tetrachloride
 (preselected name)



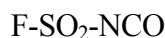
diphosphoric tetrakisocyanate
 (preselected name)



cyanohypodiphosphorous triiodide
 (preselected name)



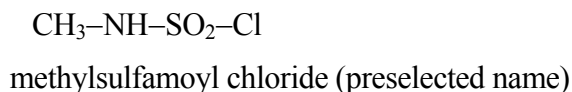
1-amido-2-imidodiphosphonic chloride (preselected name)



isocyanatosulfuric fluoride
 (preselected name)



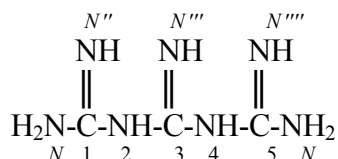
sulfurimidoisocyanatous fluoride
 (preselected name)



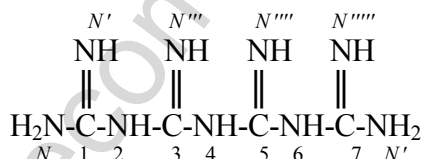
P-67.2.4 Amides and hydrazides

Polynuclear carbonic compounds in which all $-\text{OH}$ groups have been replaced by $-\text{NH}_2$ or $-\text{NHNH}_2$ groups are named as amides or hydrazides, respectively by functional class nomenclature. The amide groups are expressed by the class name 'amide', preceded by an appropriate multiplying prefix, 'di', 'tri', etc. Amides of imidodicarbonimidic acid, diimidotricarbonimidic amide, etc., are biuret, triuret, etc., for which see P-66.1.5.6.1.2. Substituents are described by prefixes cited before the whole name, not in front of the class name.

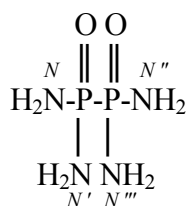
Examples:



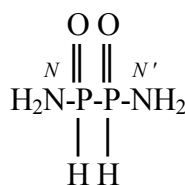
pentaimidotricarbonic diamide
 (preselected name)



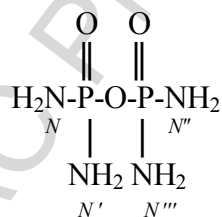
heptaimidotetracarbonic diamide
 (preselected name)



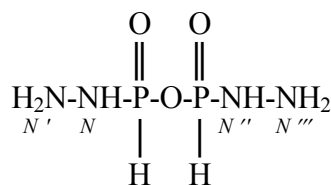
hypodiphosphoric tetraamide
 (preselected name)



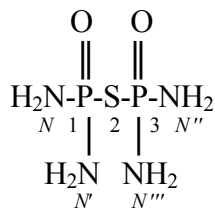
hypodiphosphonic diamide
 (preselected name)



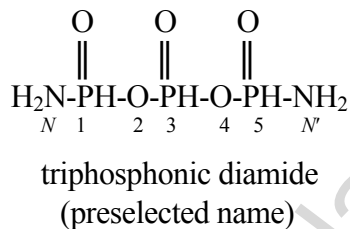
diphosphoric tetraamide
 (preselected name)



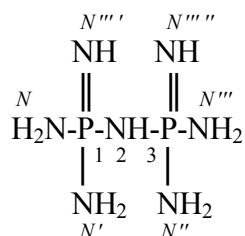
diphosphonic dihydrazide
 (preselected name)



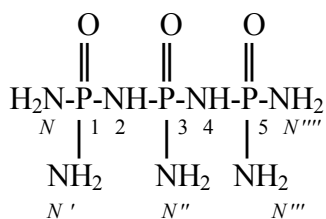
2-thiodiphosphoric tetraamide
 (preselected name)



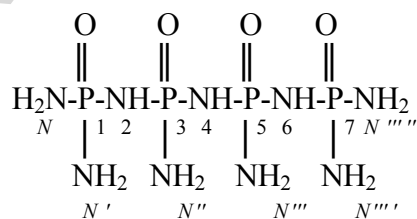
triposphonic diamide
 (preselected name)



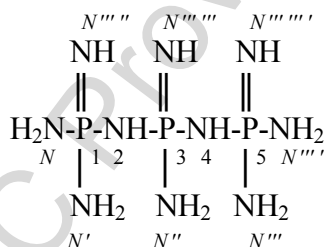
1,2,3-triimidodiphosphoric tetraamide (preselected name)



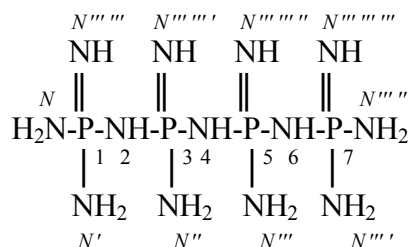
2,4-diimidotriphosphoric pentaamide
 (preselected name)



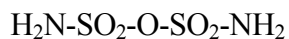
2,4,6-triimidotetraphosphoric hexaamide
 (preselected name)



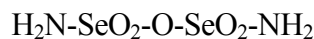
pentaimidotriphosphoric pentaamide
 (preselected name)



heptaimidoimidotetraphosphoric hexaamide
 (preselected name)



disulfuric diamide (preselected name)



diselenic diamide (preselected name)

P-67.2.2.5 Esters and anhydrides

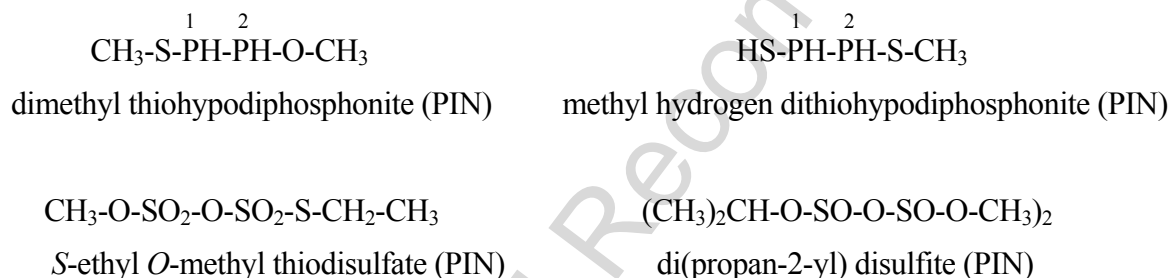
P-67.2.2.5.1 Esters

P-67.2.2.5.2 Anhydrides

P-67.2.2.5.1 Esters

Fully esterified acids are named as neutral salts, except that names of allowed groups (alkyl groups, aryl groups, etc.), cited in alphanumerical order when more than one, replace the name of the cations. Partial (acid) esters of polybasic acids and their salts are named by the procedures for neutral esters and acid salts, except that the name 'hydrogen' denoting acid hydrogen atoms is indicated by the separate word 'hydrogen' (with the appropriate multiplying prefix denoting multiplicity) inserted between the name of the cation or of the organic group and the name of the anion.

Examples:

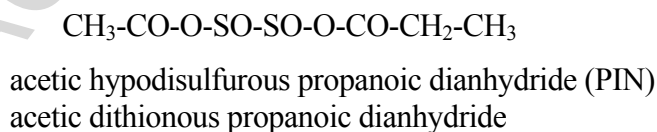
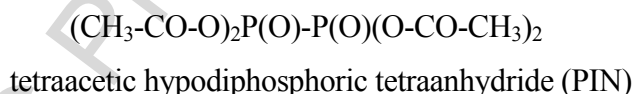


P-67.2.2.5.2 Anhydrides

Neutral anhydrides formed between organic acids and polynuclear noncarbon acids having preselected names are named by citing, in alphabetical order, the names of the acids followed by the name of the class 'anhydride'; multiplying prefixes 'di', 'tri', etc. are used to indicate the multiplicity of the anhydride linkages.

Acidic anhydrides are named using the senior acid as parent or by using systematic substitutive nomenclature as described in P-67.3.1.

Examples:



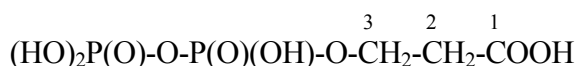
P-67.2.2.6 Substituent groups derived from polyacids

In presence of a characteristic group having precedence for citation as principal group, oxoacids are cited as prefixes. The names of these prefixes are formed by:

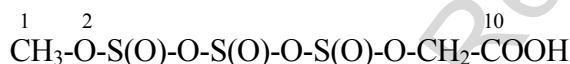
- (1) combinations of acyl groups;
- (2) on the basis of the names of the group which includes the greatest number of P, As, Sb, S, Se, and Te central atoms.
- (3) skeletal replacement nomenclature, when conditions for its use are satisfied.

When there is a choice for parent substituent, seniority is given to parent substituents having the largest size, then, if needed, to alphanumerical order.

Examples:



3-(1,3,3-trihydroxy-1,3-dioxo-1 λ^5 ,3 λ^5 -diphosphoxan-1-yl)propanoic acid (PIN)
3-[[[(phosphonooxy)phosphoryl]oxy]oxy]propanoic acid



3,5,7-trioxo-2,4,6,8-tetraoxa-3 λ^4 ,5 λ^4 ,7 λ^4 -trithiadecan-10-oic acid (PIN)
[[[(methoxysulfinyl)oxy]sulfinyl]oxy]sulfinyl]oxy]acetic acid
(5-methoxy-1,3,5-trioxo-1 λ^4 ,3 λ^4 ,5 λ^4 -trisulfoxan-1-yl)acetic acid



3,5-disulfanylidene-2,3 λ^4 ,4,5 λ^4 ,6-pentathianonan-9-oic acid (PIN)
3-(5-methyl-2,4-sulfanylidene-2 λ^4 ,4 λ^4 -pentasulfanyl)propanoic acid
3-[[[(methylsulfanyl)sulfinothiyl]sulfanyl]sulfinothiyl]sulfanyl]propanoic acid

P-67.3 Substitutive names and functional class names of polyacids

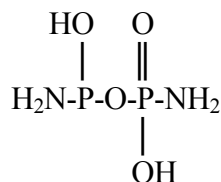
P-67.3.1 Names of polyacids that cannot be formed from basic acids are either class names such as anhydrides or they are formed substitutively. Anhydride names are preferred to substitutive names.

Some names are also included in this Section because their structure does not correspond to the name implied by a diacid or a hypodiacid, for example the name 'disulfurous acid', exemplified below.

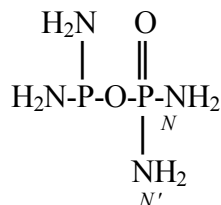
Names of derivatives of acids that cannot be formed directly by functional replacement are generated by substitution of acids with preferred names such as phosphonic acid and phosphinic acid; or they are class names such as 'anhydride'. The parent is chosen in accordance with the seniority order of classes: acids, acid halides, azides, amides, hydrazides, cyanides, isocyanides, isocyanates

(and chalcogen analogues in the order O > S > Se > Te), imides, and nitrides and the maximum number of groups representing senior classes.

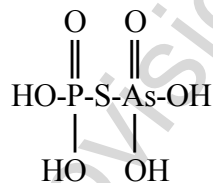
Examples:



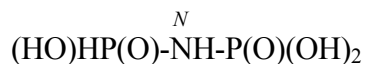
{[amino(hydroxy)phosphanyl]oxy}phosphonamidic acid (preselected name)
(phosphonamidic acid is senior to phosphonamidous acid)
phosphoramidic phosphoramidous monoanhydride
(an acid is preferred to an anhydride in the seniority order of classes)



phosphorodiamidic phosphorodiamidous anhydride (preselected name)
[(diaminophosphanyl)oxy]phosphonic diamide
(an anhydride is senior to an amide)



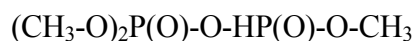
(arsonosulfanyl)phosphonic acid (preselected name)
arsoric phosphoric thiomonoanhydride
(an acid is senior to an anhydride; the phosphorus acid is senior to the arsenic acid)



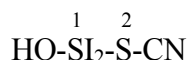
N-(hydroxyphosphonyl)phosphoramidic acid
(a substitutive name only is possible in this case)



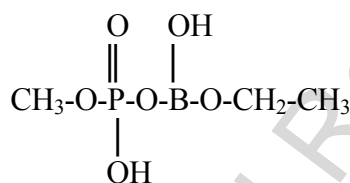
(dihydroxyphosphanyl)phosphinic acid (preselected name)



methyl [(dimethoxyphosphoryl)oxy]phosphinate (PIN)
(phosphonic acid is preferred to phosphoric acid; see P-41)
(formerly trimethyl isohypophosphate)



1-hydroxy-1,1-diodo-1 λ^4 -disulfane-2-carbonitrile (preselected name)
(formerly diiodo(thiocyanatido)orthosulfurous acid)
(not orthosulfurodiiodidothiocyanatous acid)



methyl hydrogen ([ethoxy(hydroxy)boranyl]oxy} phosphonate (PIN)
(ethyl dihydrogen borate) (methyl dihydrogen phosphate) anhydride

$\text{CH}_3\text{-CO-O-P(OH)}_2$ (acetyloxy)phosphonic acid (PIN)
acetic phosphoric monoanhydride
monoacetyl phosphate

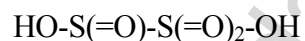
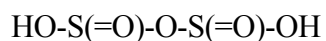
$\text{HO-SeO}_2\text{-O-SO}_2\text{-OH}$ (selenonoxy)hydroxy- λ^6 -sulfanedione (preselected name)
selenic sulfuric anhydride

$\text{CH}_3\text{-CH}_2\text{-CO-O-B(OH)}_2$ (propanoyloxy)boronic acid (PIN)
boric propanoic monoanhydride

$\text{CH}_3\text{-CO-O-CO-O-CO-OH}$ {[acetyloxy]carbonyl]oxy} formic acid (PIN)
acetic dicarbonic monoanhydride

P-67.3.2 The disulfurous acid name dilemma

The name disulfurous acid must correspond to the structure HO-SO-O-SO-OH implied for all homogeneous diacids in accordance with the definition given in P-67.2. As the reported structure is HO-SO-SO₂-OH, a different name must be assigned to this structure. A substitutive name is appropriate in this situation.



disulfurous acid (preselected name) 1,2-dihydroxydisulfane-1,1,2-trione (preselected name)