
O R G A N I C C H E M I S T R Y I

Nomenclature of the priority groups II

In the this lecture we continue and conclude the nomenclature of the priority groups.

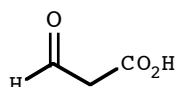
Aldehydes**As a parent**

The priority group ending is "al".

As a substituent

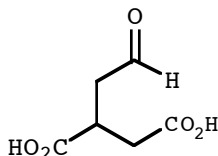
When the -CHO group is a substituent, it is called "oxo" (just like a ketone) if the carbon atom of the -CHO group is part of the parent or part of the main chain of a complex substituent; otherwise, the -CHO group is called "formyl".

Example Consider the following compounds in which the carboxylic acid outranks the aldehyde so the aldehyde must be treated as a substituent. In the first example, the carbon atom of the -CHO group is part of the parent so the substituent name "oxo" is appropriate:



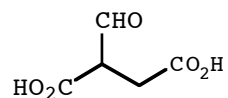
3-oxo-1-propanoic acid

When the carbon atom of the -CHO group is part of the main chain of a complex substituent, the -CHO group is also designated by "oxo". In the molecule below the parent is the four-carbon chain that includes the two carboxylic acid functionalities. The two-carbon chain that includes the -CHO group is treated as a complex substituent:



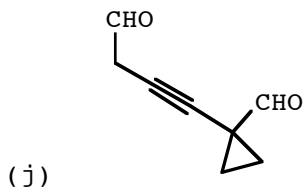
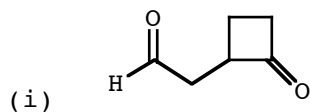
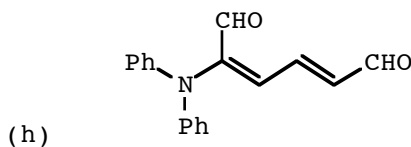
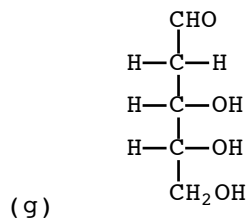
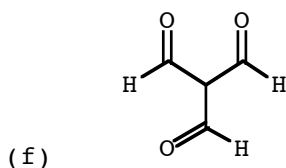
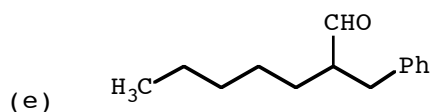
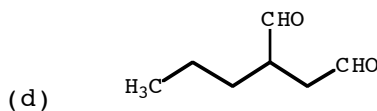
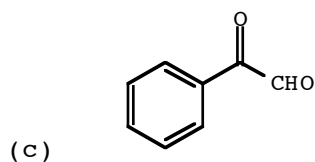
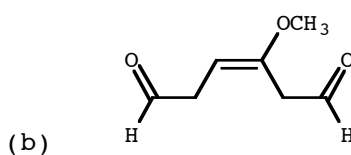
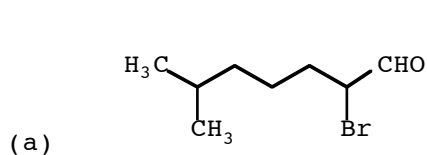
2-(2-oxoethyl)-1,4-butanedioic acid

In the next example, the parent is again the four-carbon chain that includes the two carboxylic acid functionalities so the carbon atom of the -CHO group is not part of the parent; the substituent name "formyl" is used:



2-formyl-1,4-butanedioic acid

Problem Write the systematic name of these compounds.



Answer (a) 2-bromo-6-methyl-1-heptanal (b) 3-methoxy-3-hexene-1,6-dial (c) 2-oxo-2-phenyl-1-ethanal (d) 2-propyl-1,4-butanedioal (e) 2-(1-phenylmethyl)-1-heptanal (f) 2-formyl-1,3-propanedioal (g) 3,4,5-trihydroxy-1-pentanal (h) 2-

- (*N,N*-diphenylamino)-2,4-hexadien-1,6-dial (i) 2-(2-oxocyclobutyl)-1-ethanal
 (j) 4-(1-formylcyclopropyl)-3-butyne-1-al

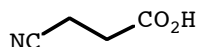
Nitriles

As a parent

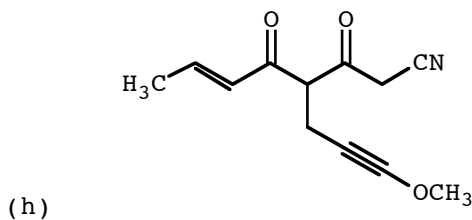
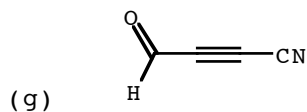
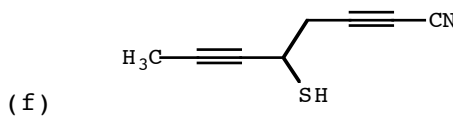
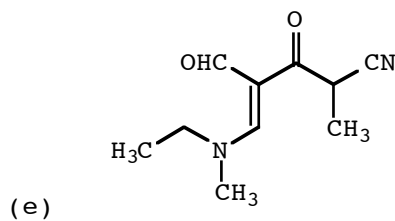
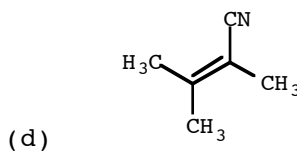
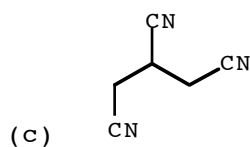
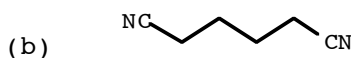
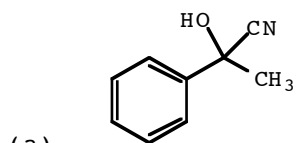
The priority group ending is "nitrile".

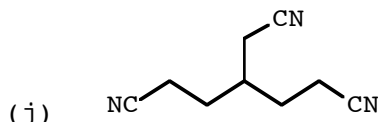
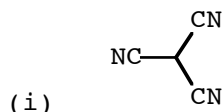
As a substituent

When the -CN group is a substituent, it is called "cyano" and its carbon atom is NOT counted when formulating the name of the parent. For example, in the compound below, the carboxylic acid outranks the nitrile so the nitrile is treated as a substituent at C3 of the parent chain; the nitrile carbon is excluded from the parent chain because it is part of a substituent. Thus, the compound is called 3-cyano-1-propanoic acid.



Problem Write the systematic name of these compounds.





Answer (a) 2-hydroxy-2-phenyl-1-propanenitrile (b) 1,6-hexanedinitrile (c) 3-cyano-1,5-pentanedinitrile (d) 2,3-dimethyl-2-butene-1-nitrile (e) 5-(*N*-ethyl-*N*-methylamino)-4-formyl-2-methyl-3-oxo-4-pentene-1-nitrile (f) 5-mercapto-2,6-octadiyne-1-nitrile (g) 4-oxo-2-butyne-1-nitrile (h) 4-(3-methoxy-2-propynyl)-3,5-dioxo-6-octene-1-nitrile (i) 2-cyano-1,3-propanedinitrile (j) 4-(1-cyanomethyl)-1,7-heptanedinitrile

Amides

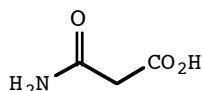
As a parent

The priority group ending is "amide".

As a substituent

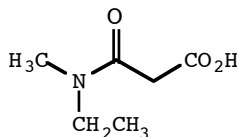
When the $-\text{CONH}_2$ group is a substituent, it is called "aminocarbonyl". When the amide is a substituent and the amide nitrogen has substituents of its own, the amide substituent is treated as a complex substituent: the entire complex amide substituent name is enclosed in parentheses and the name of the complex amide substituent is alphabetized as is, that is, replicating prefixes are not ignored. Finally, when the amide group is a substituent, its carbon atom is NOT counted when formulating the name of the parent.

Example Consider the following compounds in which the carboxylic acid outranks the amide so the amide must be treated as a substituent. In the first example, the amide nitrogen has no substituents so it is simply called "aminocarbonyl"; note that the amide carbon is not counted when formulating the parent because the amide carbon is part of a substituent.

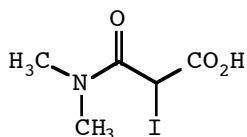


2-aminocarbonyl-1-ethanoic acid

In the next two examples, the amide nitrogen has substituents of its own and is treated as a complex substituent:



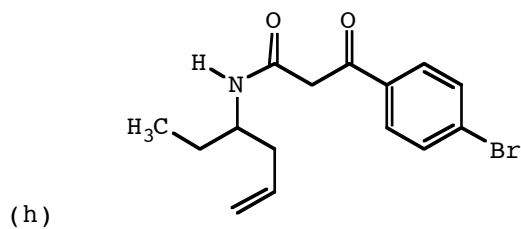
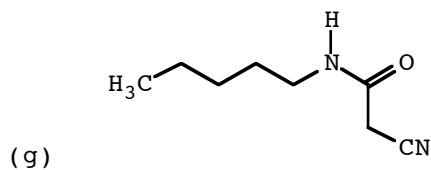
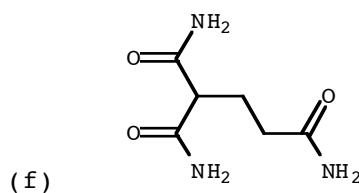
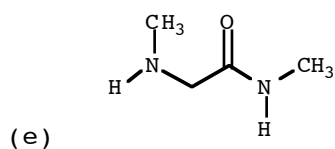
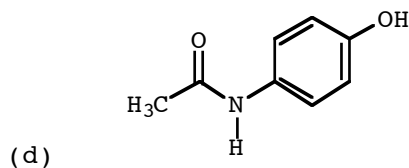
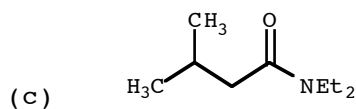
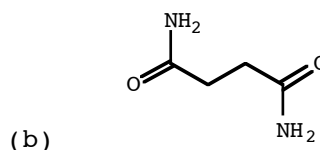
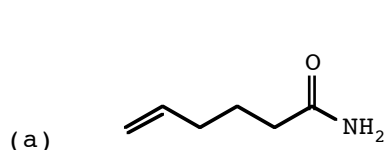
2-(*N*-ethyl-*N*-methylaminocarbonyl)-1-ethanoic acid



2-(*N,N*-dimethylaminocarbonyl)-2-iodo-1-ethanoic acid

Note that, in accord with the rules of complex substituents, the "di" of "dimethylamino" is not ignored when alphabetizing.

Problem Write the systematic name of these compounds.



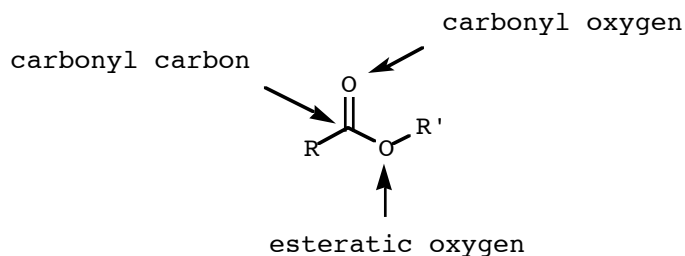
Answer (a) 5-hexen-1-amine (b) 1,4-butanediamide (c) *N,N*-diethyl-3-methyl-1-butanamide (d) *N*-(4-hydroxyphenyl)-1-ethanamide ("Tylenol") (e) *N*-methyl-2-(*N*-methylamino)-1-ethanamide (f) 2-aminocarbonyl-1,5-pentanediamide (g) 2-

cyano-*N*-pentyl-1-ethanamide (h) 3-(4-bromophenyl)-*N*-(1-ethyl-3-butenyl)-3-oxo-1-propanamide

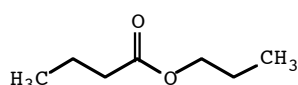
Esters

As a parent

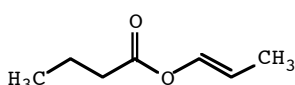
To make discussion of the nomenclature of esters more efficient, let's first define some landmarks of the ester functional group. The carbon-oxygen double bond unit is called the carbonyl group: carboxylic acids, esters, amides, aldehydes and ketones all contain the carbonyl group. In an ester, the oxygen atom bonded to the carbonyl carbon by a double bond is called the carbonyl oxygen whereas the oxygen atom bonded to the carbonyl carbon by a single bond is called the esteratic oxygen:



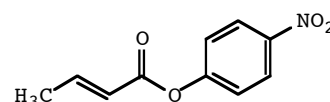
The priority group ending of an ester is "oate", but esters have two words in their names. The first word is the name of the substituent bonded to the esteratic oxygen and the second word is the name of the parent that contains the carbonyl carbon. Thus, the names of most esters follow the pattern ...yl ...oate:



propyl 1-butanoate



1-propenyl 1-butanoate

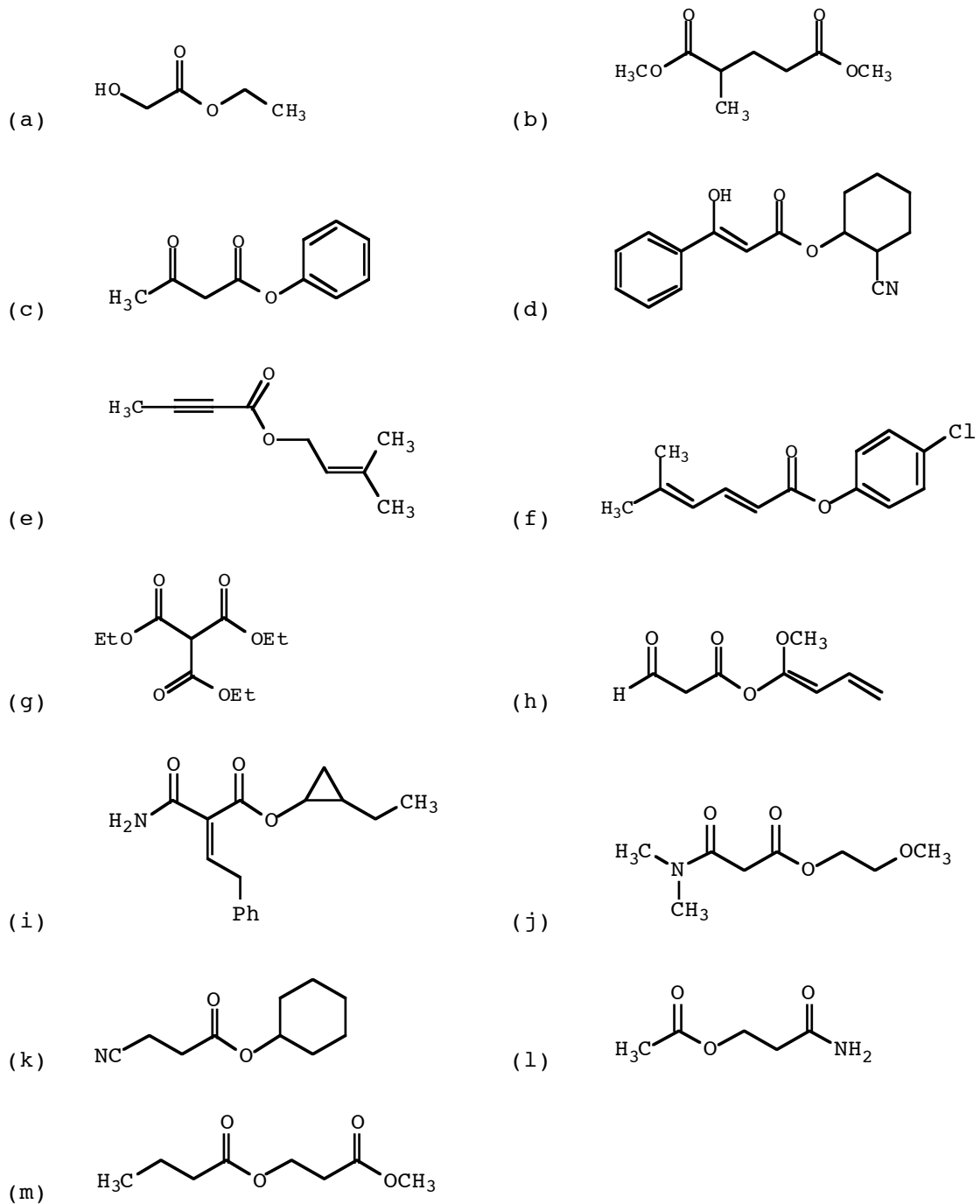


4-nitrophenyl 2-buten-1-oate

As a substituent

When the ester group is a substituent, it is called "methoxycarbonyl", "ethoxycarbonyl", "propoxycarbonyl", etc., depending on the identity of the substituent bonded to the esteratic oxygen. When the ester group is a substituent, the carbon atom of the ester is NOT counted when formulating the parent.

Problem Write the systematic name of these compounds.



Answer (a) ethyl 2-hydroxy-1-ethanoate (b) dimethyl 2-methyl-1,5-pentanedioate (c) phenyl 3-oxo-1-butanoate (d) 2-cyanocyclohexyl 3-hydroxy-3-phenyl-2-propenoate (e) 3-methyl-2-butenyl 2-butyn-1-oate (f) 4-chlorophenyl 5-methyl-2,4-hexadien-1-oate (g) diethyl 2-ethoxycarbonyl-1,3-propanedioate (h) 1-methoxy-1,3-butadienyl 3-oxo-1-propanoate (i) 2-

ethylcyclopropyl 2-aminocarbonyl-4-phenyl-2-buten-1-oate (j) 2-methoxyethyl 2-(*N,N*-dimethylaminocarbonyl)-1-ethanoate (k) cyclohexyl 3-cyano-1-propanoate (l) 2-aminocarbonylethyl 1-ethanoate (m) 2-methoxycarbonylethyl 1-butanoate

Sulfonic acids

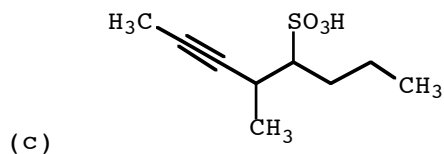
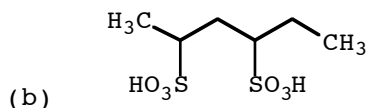
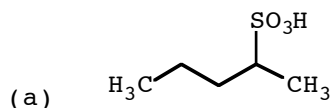
As a parent

The priority group ending is "sulfonic acid".

As a substituent

When the $-\text{SO}_3\text{H}$ group is a substituent, it is called "sulfonic acid".

Problem Write the systematic name of these compounds.



Answer (a) 2-pentanesulfonic acid (b) 2,4-hexanedisulfonic acid (c) 5-methyl-6-octyne-4-sulfonic acid

Carboxylic acids

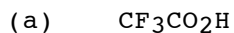
As a parent

The priority group ending is "oic acid".

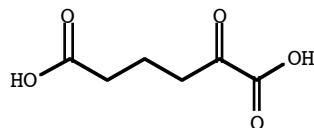
As a substituent

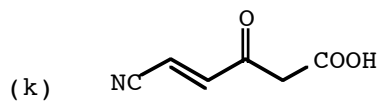
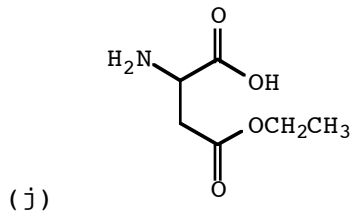
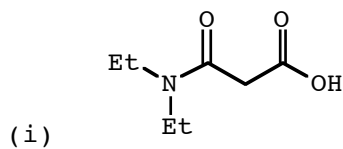
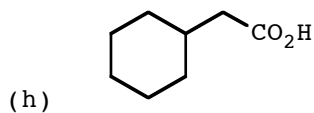
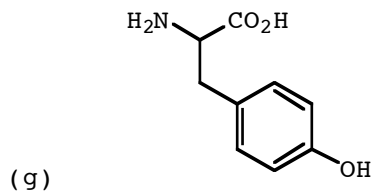
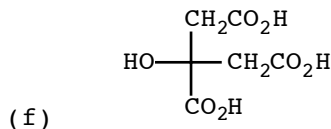
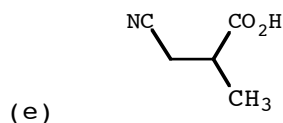
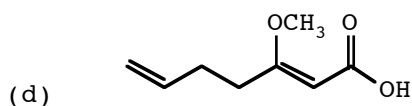
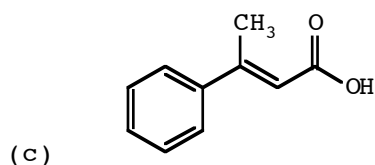
When the carboxylic acid group is a substituent, it is called "carboxy" and the carbon atom of the carboxylic acid is NOT counted when formulating the parent.

Problem Write the systematic name of these compounds.



(b)





Answer (a) 2,2,2-trifluoro-1-ethanoic acid (b) 2-oxo-1,6-hexanedioic acid
 (c) 3-phenyl-2-buten-1-oic acid (d) 3-methoxy-2,6-heptadien-1-oic acid (e) 3-cyano-2-methyl-1-propanoic acid (f) 3-carboxy-3-hydroxy-1,5-pentanedioic acid ("citric acid") (g) 2-amino-3-(4-hydroxyphenyl)-1-propanoic acid ("tyrosine") (h) 2-cyclohexyl-1-ethanoic acid (i) 2-(*N,N*-diethylaminocarbonyl)-1-ethanoic acid (j) 2-amino-3-ethoxycarbonyl-1-propanoic acid (l) 5-cyano-3-oxo-4-penten-1-oic acid