

The table below lists the priority group endings. Memorize the priority groups, their rank order and the priority group endings.

Priority group	Ending
carboxylic acids	oic acid
sulfonic acids	sulfonic acid
esters	oate
amides	amide
nitriles	nitrile
aldehydes	al
ketones	one
alcohols	ol
thiols	thiol
amines	amine
alkenes	ene
benzene	benzene
alkynes	yne
none	ane

- The parent is the longest chain or the biggest ring that contains the highest ranking priority group.

- The carbons in the parent are numbered so that the carbon that bears the highest ranking priority group gets the lowest possible number, but remember to start the numbering at the end of a chain.

- If there is a tie in the priority numbering, we break the tie by assigning the lowest number to a substituent. If there is a tie in the substituent numbering, we break the tie by assigning the lowest number to the substituent that is first alphabetically.

Alkynes

As a parent

The name of an alkyne is formed by changing the "ane" of the corresponding alkane to "yne" (e.g., "ethyne", "propyne", "butyne", etc.).

There are two peculiarities about naming alkynes. First, because the alkyne is a two-carbon functional group, the alkyne carbons must be numbered consecutively: if the first alkyne carbon has position number n , the second alkyne carbon must have position number $n + 1$. Second, if there is more than

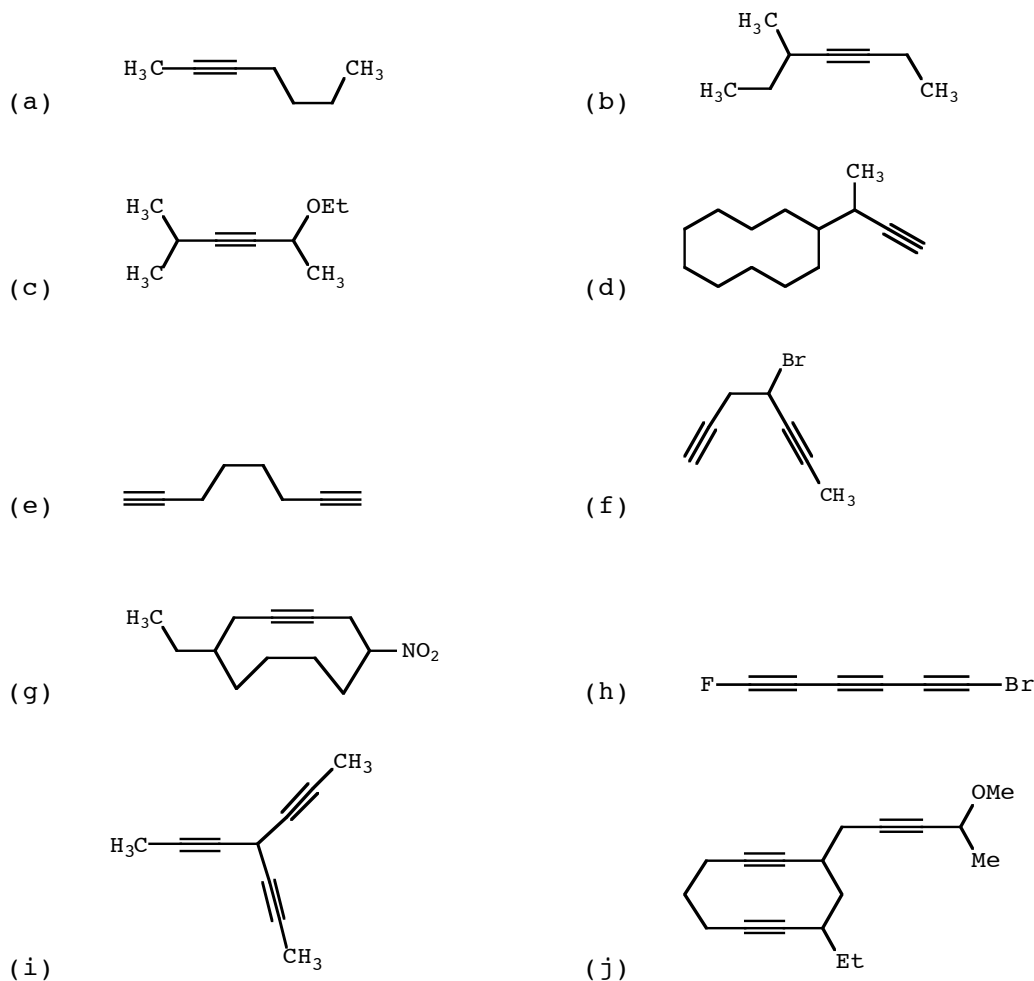
one alkyne in the parent chain, an "a" is added to the syllable that indicates the number of carbons in the parent. Thus, we say "butadiyne" (not "butdiyne") and "hexatriyne" (not "hextriyne"). The "a" is inserted for euphony.

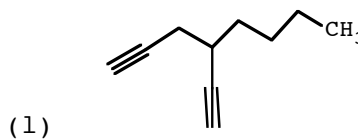
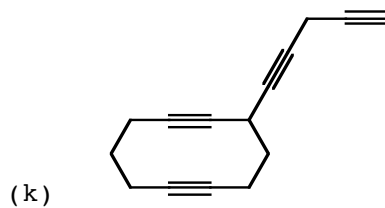
The position number(s) that specify the location of the alkyne(s) is written immediately in front of the syllables that indicate how many carbons are in the parent.

As a substituent

When alkynes are treated as substituents, they are called "ethynyl", "propynyl", "butynyl", "butadiynyl", etc.

Problem Write the systematic name of these compounds.





Answer (a) 2-heptyne (b) 5-methyl-3-heptyne (c) 2-ethoxy-5-methyl-3-hexyne (d) 3-cyclodecyl-1-butyne (e) 1,7-octadiyne (f) 4-bromo-1,5-heptadiyne (g) 4-ethyl-9-nitro-1-cyclodecyne (h) 1-bromo-6-fluoro-1,3,5-hexatriyne (i) 4-(1-propynyl)-2,5-heptadiyne; note that only two of the three alkynes can be placed on one unbranched parent chain of carbon atoms, that is, one of the alkynes must be excluded from the parent and treated as a substituent (j) 3-ethyl-5-(4-methoxy-2-pentynyl)-1,6-cyclodecadiyne (k) 3-(1,4-pentadiynyl)-1,6-cyclodecadiyne (l) 3-butyl-1,5-hexadiyne; a popular wrong answer would be to identify the parent as an eight-carbon chain that excludes one of the alkynes, but we want to place both priority groups on the parent chain if possible

Alkenes

As a parent

The name of an alkene is formed by changing the "ane" of the corresponding alkane to "ene" (e.g., "ethene", "propene", "butene", etc.).

Alkene carbons (like alkyne carbons) must be numbered consecutively: if the first alkene carbon has position number n , the second alkene carbon must have position number $n + 1$.

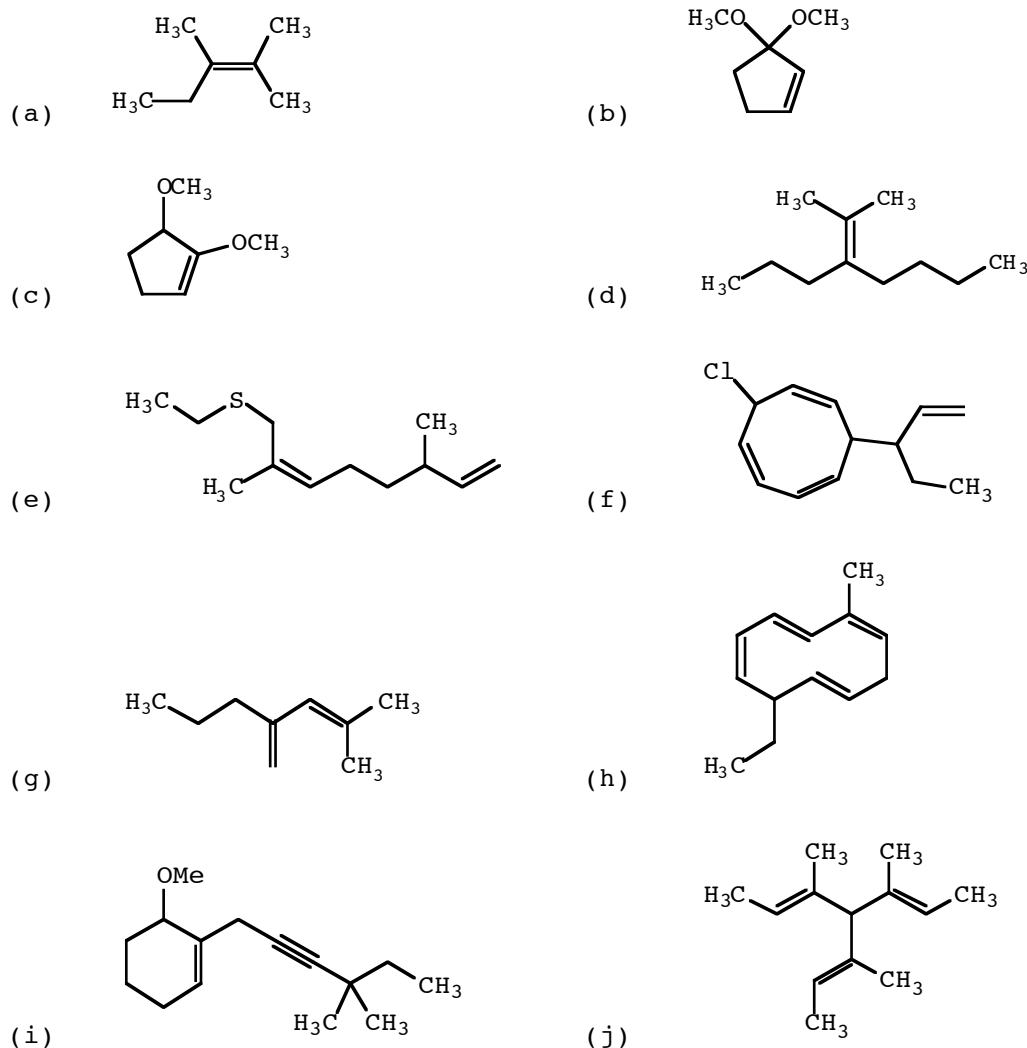
If there is more than one alkene in the parent chain, an "a" is added to the syllable that indicates the number of carbons in the parent. Thus, we say "propadiene" (not "propdiene") and "hexatriene" (not "hextriene").

The position number(s) that specify the location of the alkene(s) is written immediately in front of the syllables that indicate how many carbons are in the parent.

As a substituent

When alkenes are treated as substituents, they are called "ethenyl", "propenyl", "butenyl", "propadienyl", etc.

Problem Write the systematic name of these compounds.



Answer (a) 2,3-dimethyl-2-pentene (b) 3,3-dimethoxy-1-cyclopentene (c) 1,5-dimethoxy-1-cyclopentene (d) 2-methyl-3-propyl-2-heptene (e) 8-ethylthio-3,7-dimethyl-1,6-octadiene (f) 5-chloro-8-(1-ethyl-2-propenyl)-1,3,6-cyclooctatriene (g) 4-methyl-2-propyl-1,3-pentadiene (h) 7-ethyl-2-methyl-1,3,5,8-cyclodecatetraene (i) 1-(4,4-dimethyl-2-hexynyl)-6-methoxy-1-cyclohexene (j) 3,5-dimethyl-4-(1-methyl-1-propenyl)-2,5-heptadiene

Benzenes

As a parent

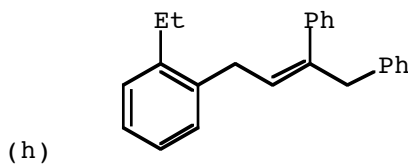
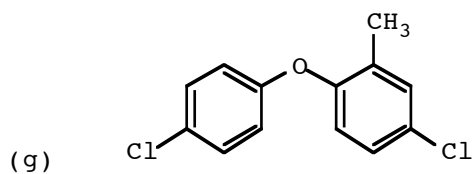
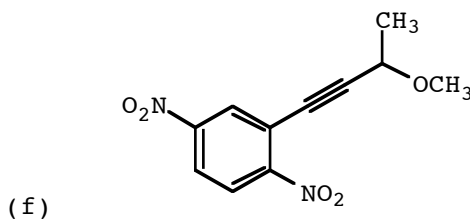
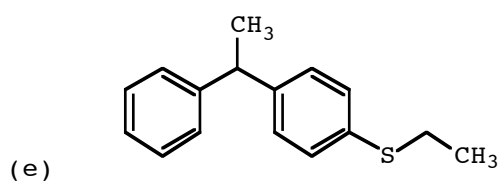
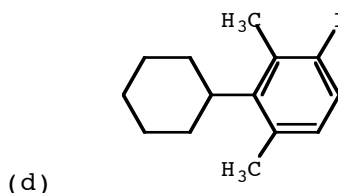
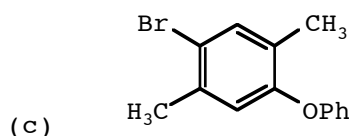
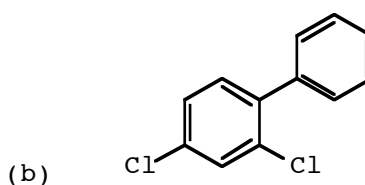
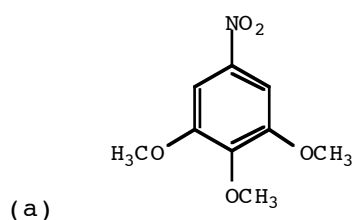
When benzene is the parent, it is called benzene; it is NEVER called "1,3,5-cyclohexatriene". The structure of benzene is represented as a triene for historical reasons: benzene isn't an alkene and it doesn't behave like an alkene. Consequently, benzene isn't named like an alkene: there is no need to

number across the double bonds of benzene in the same way that the carbons of an alkene must be numbered.

As a substituent

When the benzene ring is a substituent, it is called "phenyl". The benzene ring is abbreviated "Ph" just like a methyl group is abbreviated "Me". The corresponding ether substituent (-OPh) is called "phenoxy" and the corresponding sulfide substituent (-SPh) is called "phenylthio".

Problem Write the systematic name of these compounds.

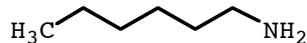


Answer (a) 1,2,3-trimethoxy-5-nitrobenzene (b) 2,4-dichloro-1-phenylbenzene
 (c) 1-bromo-2,5-dimethyl-4-phenoxybenzene (d) 3-cyclohexyl-1-iodo-2,4-dimethylbenzene
 (e) 1-ethylthio-4-(1-phenylethyl)benzene (f) 2-(3-methoxy-1-butynyl)-1,4-dinitrobenzene
 (g) 4-chloro-1-(4-chlorophenoxy)-2-methylbenzene (h) 1-(3,4-diphenyl-2-butenyl)-2-ethylbenzene

Unsaturation markers

At the priority group rank of an amine and higher, all names have unsaturation markers. If the parent has no carbon-carbon double or triple bonds, the unsaturation marker is "an" if immediately followed by a vowel or "ane" if immediately followed by a consonant. If the parent has a carbon-carbon double bond that is outranked by another priority functional group, the unsaturation marker is "en" if immediately followed by a vowel or "ene" if immediately followed by a consonant. If the parent has a carbon-carbon triple bond that is outranked by another priority functional group, the unsaturation marker is "yn" if immediately followed by a vowel or "yne" if immediately followed by a consonant.

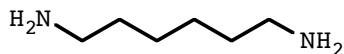
Example The compound below is called 1-hexanamine:



The name is deconstructed as follows:

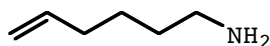
1-	position number of the highest ranking priority group
hex	number of carbons in the parent
an	unsaturation marker indicating that there are no carbon-carbon double or carbon-carbon triple bonds in the parent; the unsaturation marker is "an" and not "ane" because the priority group ending begins with a vowel
amine	highest ranking priority group ending

Example The compound below is called 1,6-hexanediamine:



Note that an "e" has crept into the unsaturation marker "ane" because it is immediately followed by the priority group ending "diamine", which begins with a consonant. We do not say "1,6-hexandiamine" (no "e"): this is considered ugly sounding.

Example The compound below is called 5-hexen-1-amine:



The name is deconstructed as follows:

5- position number of the carbon-carbon double bond
hex number of carbons in the parent
en unsaturation marker indicating that there is a carbon-carbon double
 bond in the parent; the unsaturation marker is "en" and not "ene"
 because the priority group ending begins with a vowel
-1- position number of the priority group
amine highest ranking priority group ending

Let's summarize how to name compounds at the amine level and higher. If there are no carbon-carbon double or triple bonds in the parent, the name is arranged as follows:

[stereochemistry]
[substituent list]
[position number(s) of the highest ranking priority group]
[number of carbons in the parent]
[unsaturation marker = "ane" or "an"]
[priority group ending]

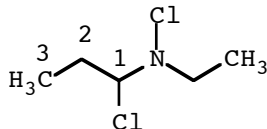
If there are carbon-carbon double or triple bonds in the parent, the name is arranged as follows:

[stereochemistry]
[substituent list]
[position number(s) of the carbon-carbon double or triple bonds]
[number of carbons in the parent]
[unsaturation marker = "ene", "en", "yne", or "yn"]
[position number(s) of the highest ranking priority group]
[priority group ending]

Amines

As a parent

The priority group ending is "amine". A peculiarity of the amine nomenclature is the treatment of substituents that reside on the amine nitrogen. Such substituents are assigned the odd-looking position number *N*. For example, the compound below is called 1,*N*-dichloro-*N*-ethyl-1-propanamine:

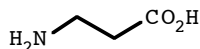


The highest ranking priority group (the amine) is located on C1 of a three-carbon chain. There is a chlorine atom at C1 as well as on the amine nitrogen. Finally, there is an ethyl group on the amine nitrogen. The position number *N*, although it does not look like a number, is treated just like any other position number.

As a substituent

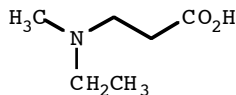
When the -NH_2 group is a substituent, it is called "amino". When an amine is a substituent and the amine nitrogen has substituents of its own, then the amine substituent is treated as a complex substituent: the entire complex amine substituent name is enclosed in parentheses and the name of the complex amine substituent is alphabetized as is, that is, replicating prefixes are not ignored.

Example Consider the following compounds in which the carboxylic acid outranks the amine so the amine must be treated as a substituent. In the first example, the amine nitrogen has no substituents so it is simply called amino:

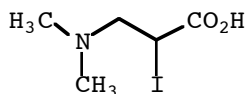


3-amino-1-propanoic acid

In the next two examples, the amine nitrogen has substituents on it and the amine substituent is treated as a complex substituent:



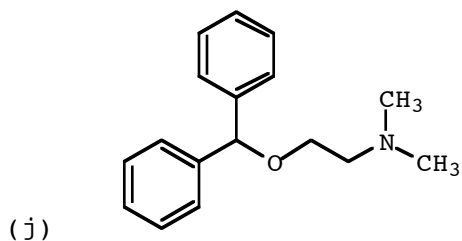
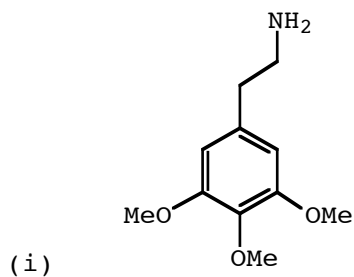
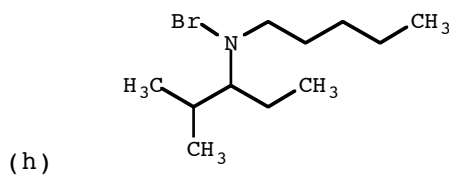
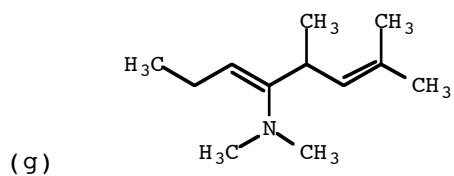
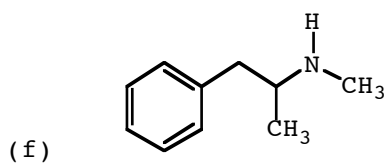
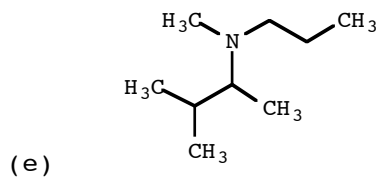
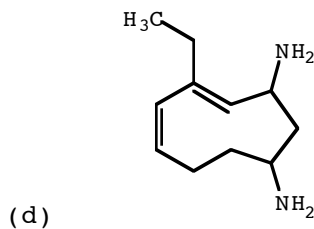
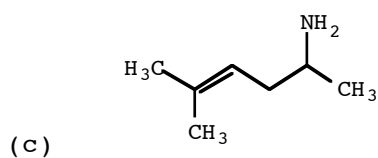
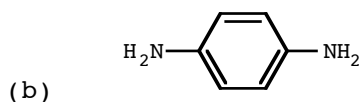
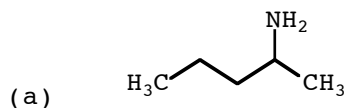
3-(*N*-ethyl-*N*-methylamino)-1-propanoic acid



3-(*N,N*-dimethylamino)-2-iodo-1-propanoic 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) 2-pentanamine (b) 1,4-benzenediamine (c) 5-methyl-4-hexen-2-amine (d) 5-ethyl-4,6-cyclononadiene-1,3-diamine (e) 3,*N*-dimethyl-*N*-propyl-2-butanamine (f) *N*-methyl-1-phenyl-2-propanamine ("crystal meth") (g) 5,7,*N,N*-tetramethyl-3,6-octadien-4-amine (h) *N*-bromo-2-methyl-*N*-pentyl-3-pentanamine (i) 2-(3,4,5-trimethoxyphenyl)-1-ethanamine ("mescaline") (j) 2-(1,1-diphenylmethoxy)-*N,N*-dimethyl-1-ethanamine ("benadryl")

Thiols

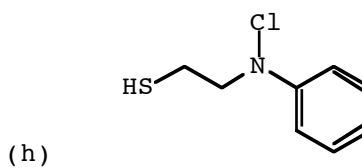
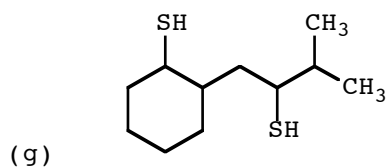
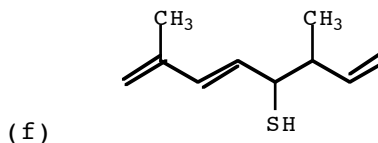
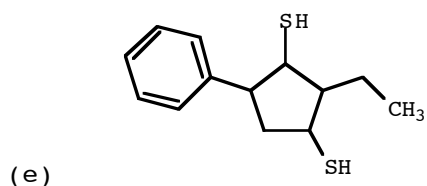
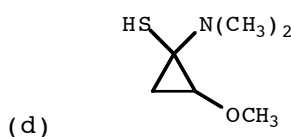
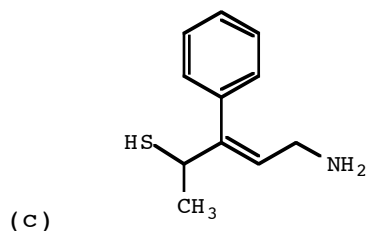
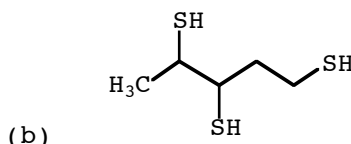
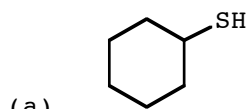
As a parent

The priority group ending is "thiol".

As a substituent

When the -SH group is a substituent, it is called "mercapto".

Problem Write the systematic name of these compounds.



Answer (a) 1-cyclohexanethiol (b) 1,3,4-pentanetrithiol (c) 5-amino-3-phenyl-3-pentene-2-thiol (d) 1-(*N,N*-dimethylamino)-2-methoxy-1-cyclopropanethiol (e) 2-ethyl-4-phenyl-1,3-cyclopentanedithiol (f) 3,7-dimethyl-1,5,7-octatriene-4-thiol (g) 2-(2-mercapto-3-methylbutyl)-1-cyclohexanethiol (h) 2-(*N*-chloro-*N*-phenylamino)-1-ethanethiol

Alcohols

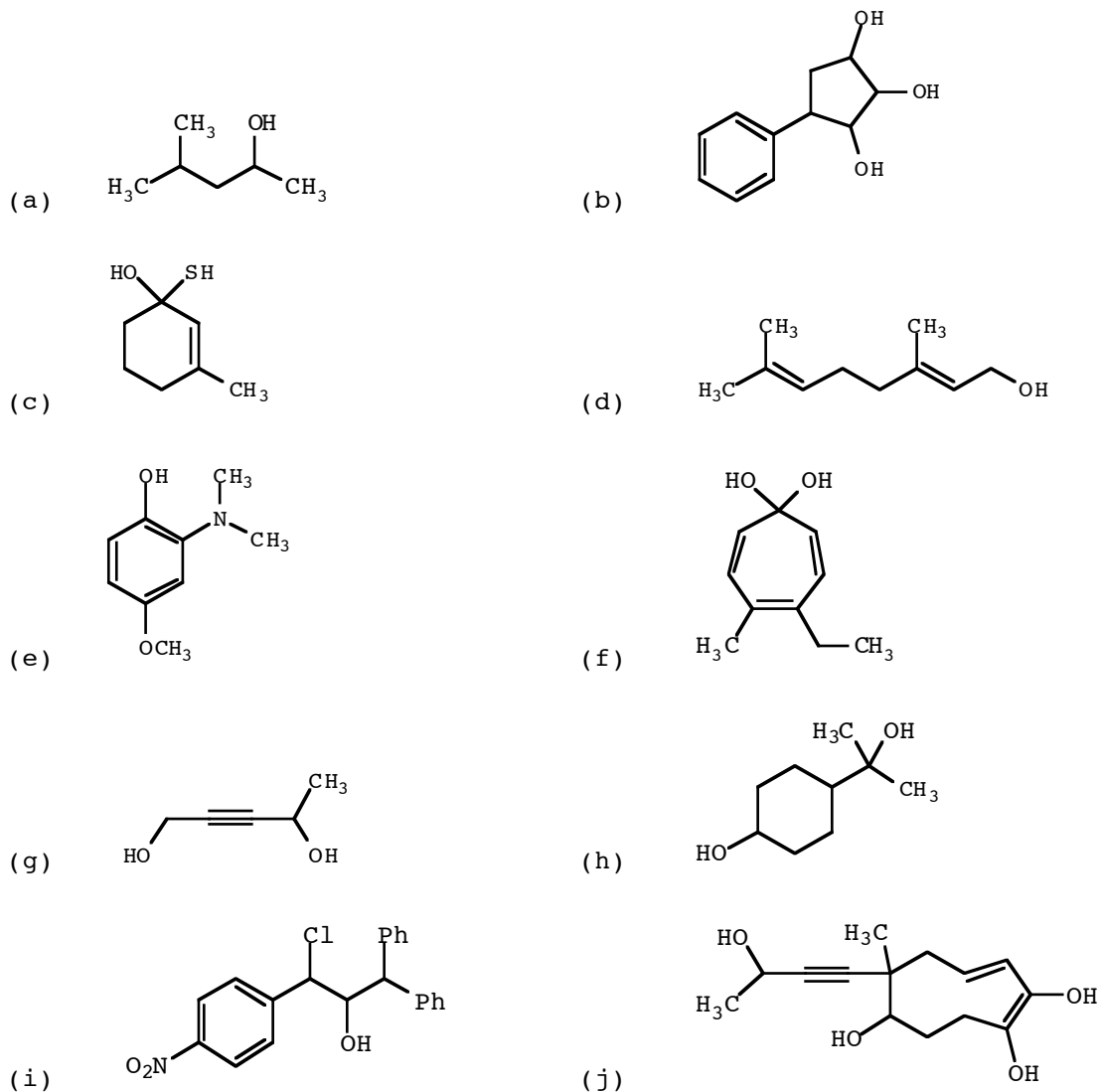
As a parent

The priority group ending is "ol".

As a substituent

When the $-OH$ group is a substituent, it is called "hydroxy".

Problem Write the systematic name of these compounds.



Answer (a) 4-methyl-2-pentanol (b) 4-phenyl-1,2,3-cyclopentanetriol (c) 1-mercapto-3-methyl-2-cyclohexen-1-ol (d) 3,7-dimethyl-2,6-octadien-1-ol (e) 2-(*N,N*-dimethylamino)-4-methoxy-1-benzenol (f) 4-ethyl-5-methyl-2,4,6-cycloheptatriene-1,1-diol (g) 2-pentyne-1,4-diol (h) 4-(1-hydroxy-1-methylethyl)-1-cyclohexanol (i) 1-chloro-1-(4-nitrophenyl)-3,3-diphenyl-2-propanol (j) 6-(3-hydroxy-1-butynyl)-6-methyl-1,8-cyclononadiene-1,2,5-triol

Ketones

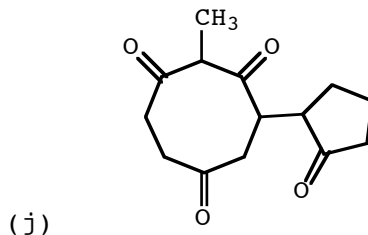
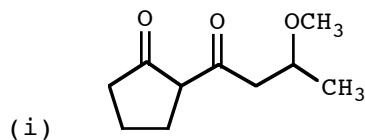
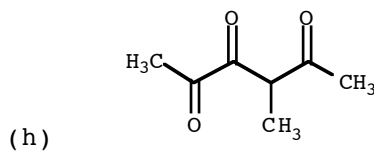
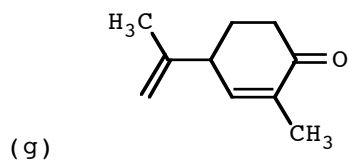
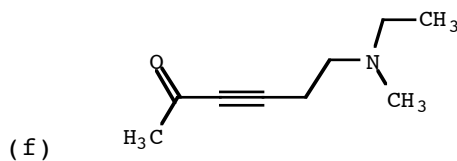
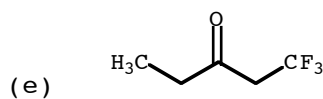
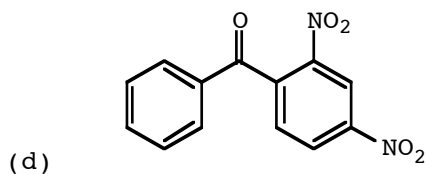
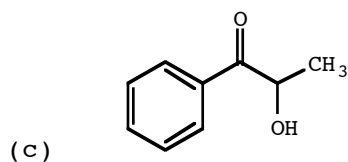
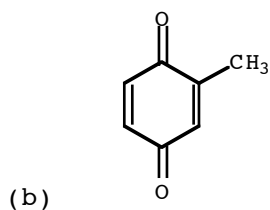
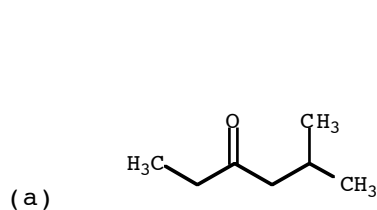
As a parent

The priority group ending is "one".

As a substituent

When the ketone functional group is a substituent, it is called "oxo".

Problem Write the systematic name of these compounds.



Answer (a) 5-methyl-3-hexanone (b) 2-methyl-2,5-cyclohexadiene-1,4-dione
(c) 2-hydroxy-1-phenyl-1-propanone (d) 1-(2,4-dinitrophenyl)-1-phenyl-1-

methanone (e) 1,1,1-trifluoro-3-pentanone (f) 6-(*N*-ethyl-*N*-methylamino)-3-hexyn-2-one (g) 2-methyl-4-(1-methyl-1-ethenyl)-2-cyclohexen-1-one ("carvone") (h) 4-methyl-2,3,5-hexanetrione (i) 2-(3-methoxy-1-oxobutyl)-1-cyclopentanone (j) 2-methyl-4-(2-oxocyclopentyl)-1,3,6-cyclooctanetrione