

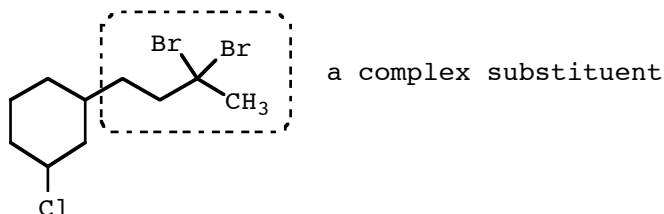
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**O R G A N I C C H E M I S T R Y I**


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## Naming complex substituents

A complex substituent is a substituent that has substituents and normally requires its own numbering system different from that of the parent numbering system. An example of such a substituent is present in the molecule below:



The molecule has no priority group so the parent is the longest chain or the biggest ring; in this case, the parent is the six-carbon ring. The substituent chain bonded to the ring is not just a simple four-carbon chain and, hence, cannot be called just "butyl". Instead, it's a butyl substituent that has two bromo substituents: it is a substituent that has substituents, that is, a complex substituent that needs its own numbering system because we need to specify the location of its two bromine atoms.

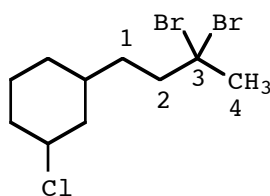
Naming complex substituents is handled by the following rules:

- Award the carbon in the complex substituent closest to the parent the "1" position and number out to the end of the longest chain having the most substituents of which that carbon atom is a part.
- We pointed out in a previous lecture that replicating prefixes are normally ignored when alphabetizing, but replicating prefixes are NOT ignored when they are part of a complex substituent's name.
- The name of the complex substituent is written in parentheses. The parentheses serve to alert the reader that any position numbers they enclose do not refer to the carbon atoms of the parent.
- A complex substituent's name follows a modified five-part plan:

[stereochemistry] [substituent list]  
 [number of carbons in the complex substituent's main chain]  
 [unsaturation marker] [substituent ending]

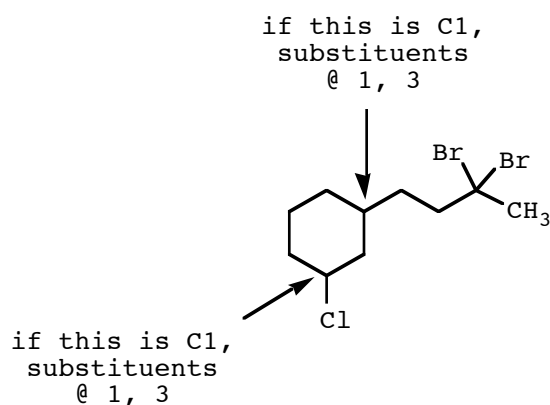
In this respect, a complex substituent's name is laid out in a manner similar to the systematic name as a whole. Because we are just starting to name complex substituents, we will delay discussing stereochemistry and unsaturation markers until later.

Example The carbon atoms of the complex substituent of the molecule below are numbered as follows:



We award the atom closest to the parent the "1" position and number out to the end of the four-carbon chain. There are two bromo substituents at the 3 position in the complex substituent. Thus, the name of the complex substituent is 3,3-dibromobutyl.

We now turn to numbering the carbon atoms of the parent six-carbon ring. As is always the case when no priority group is present, we choose the numbering system that gives the lowest number to a substituent at the first point of difference in the numbering systems. There are two possibilities:



We have a tie in the substituent numbering. To break the tie, we give the lowest number to the substituent that is first alphabetically, that is, we

compare "chloro" to "dibromobutyl". Note that we do NOT ignore replicating prefixes when alphabetizing complex substituents. Thus, the name of the compound is 1-chloro-3-(3,3-dibromobutyl)cyclohexane. Note that there is a "3" outside the parentheses (this refers to C3 of the parent) and two "3"s inside the parentheses (these refer to C3 of the complex substituent). Also note that the order in which the various parts of the complex substituent's name are written conforms to the five-part plan referred to earlier:

[stereochemistry] = missing

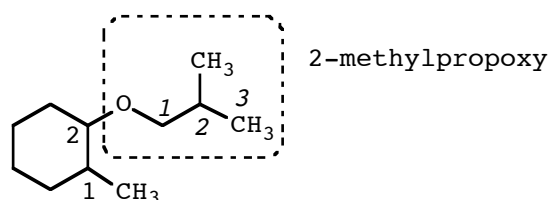
[substituent list] = 3,3-dibromo

[number of carbons in the substituent's main chain] = but

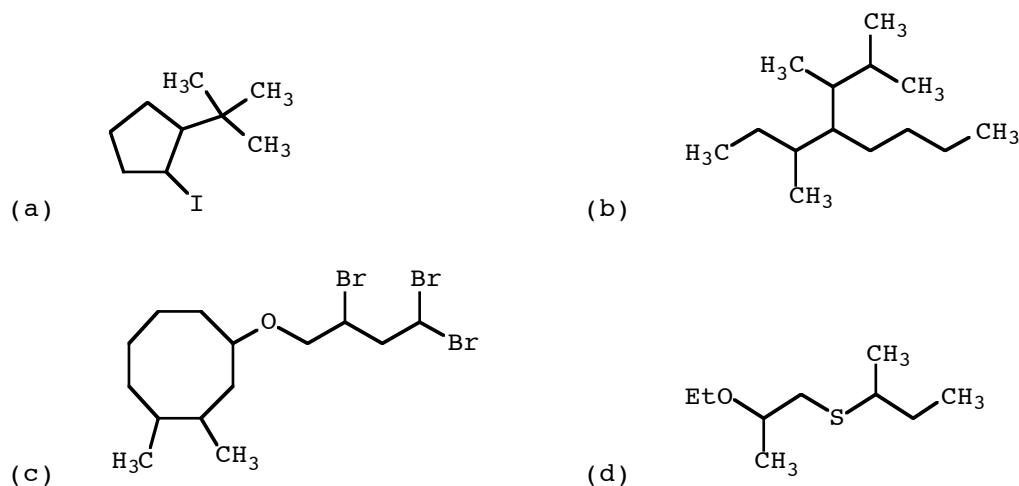
[unsaturation marker] = missing

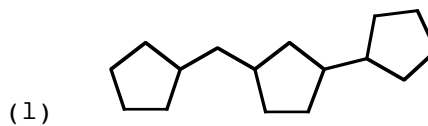
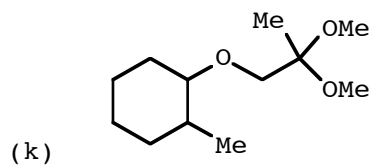
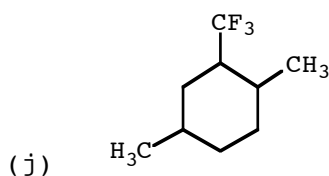
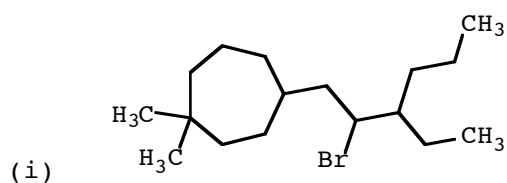
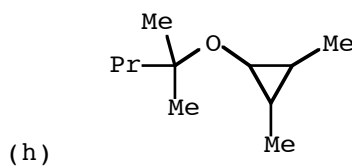
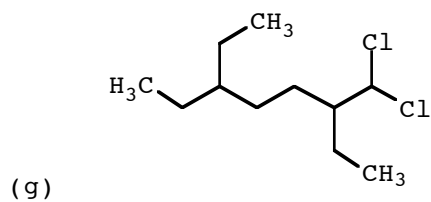
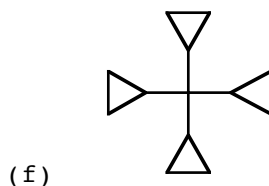
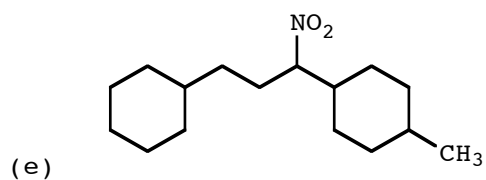
[substituent ending] = yl

Example In the molecule below, the parent is the cyclohexane ring. The ether substituent is not just propoxy: it's a propoxy with a methyl substituent. The carbon closest to the parent is awarded the "1" position and we number out to the end of the chain. The compound is called 1-methyl-2-(2-methylpropoxy)cyclohexane.



Problem Write the systematic name of these compounds, all of which have complex substituents.





Answer (a) 1-(1,1-dimethylethyl)-2-iodocyclopentane (b) 2,3-dimethyl-4-(1-methylpropyl)octane (c) 1,2-dimethyl-4-(2,4,4-tribromobutoxy)cyclooctane (d) 2-(2-ethoxypropylthio)butane (e) 1-(3-cyclohexyl-1-nitropropyl)-4-methylcyclohexane (f) 1-(1,1,1-tricyclopropylmethyl)cyclopropane (g) 3-(1,1-dichloromethyl)-6-ethyloctane (h) 2-(2,3-dimethylcyclopropoxy)-2-methylpentane (i) 4-(2-bromo-3-ethylhexyl)-1,1-dimethylcycloheptane (j) 1,4-dimethyl-2-(1,1,1-trifluoromethyl)cyclohexane (k) 1-(2,2-dimethoxypropoxy)-2-methylcyclohexane (l) 1-cyclopentyl-3-(1-cyclopentylmethyl)cyclopentane