Basic IUPAC Nomenclature V

Alcohols and Ethers

Alcohols:

- Alcohols have the general group R-OH. They are polar, moderately water soluble, and moderately acidic. They get higher priority than all hydrocarbons and haloalkanes. Alcohols have lower priority than carbonyl groups.

- IUPAC Nomenclature of alcohols follows these steps:
  1) Find the longest chain of continuous carbons that includes the **carbon** attached to the *alcohol*. This is now the main chain. Name this chain as if it were a straight chain alkane.
     a. Drop the –ne ending and add –ol. This works for –enes and –ynes as well.
  2) Count the carbons in the main chain left to right and right to left. The direction you *first* run into the carbon attached to the *alcohol* is the direction use to number the chain. Other substituents no longer matter only the *alcohol* determines direction.
     a. If the numbers are the same go to the next highest priority functional group or substituent and follow its priority rules.
  3) Give each substituent a number according to which carbon it's attached to. Numbers for alkenes and alkynes correspond to the lower numbered of the two carbons in the bond.
  4) List the substituents in alphabetical order in front of the main chain as you would in an alkane.
     a. Alkenes and alkynes are always listed as –ene or –yne at the end of the name.
  5) Multiple substituents of the same kind are combined and given a prefix to indicate the number. (di-, tri-, tetra-) these prefixes do not count towards alphabetical order unless they are part of a branched substituent.
  6) Indicate stereochemistry using *cis-* or *trans-* prefixes for disubstituted rings or *R,S* labels for multiply substituted rings and straight chains. Stereochemistry is italicized.

Notes:

- Alcohols as substiutents are *hydroxy-* groups.
- The carbon bonded to the alcohol is always C-1 of a ring unless there is a higher priority substituent.

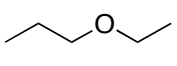
Ethers:

- Ethers have the general group R-O-R'. They are slightly polar and relatively unreactive.

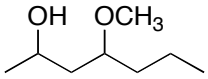
- In IUPAC ethers are named as *alkoxy*- substituents with the smaller side being the substituent and the larger side being the main chain. As substituents they have the same priority as haloalkanes and they do not get a fancy suffix.

- Ether oxygens are NOT generally part of the main chain in linear ethers.

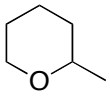
- Cyclic ethers are named as oxacycloalkanes with the oxygen being at position 1 of the chain.



1-ethoxypropane

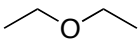


4-methoxy-2-heptanol

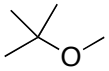


2-methyloxacyclohexane

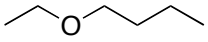
- Simple ethers may be given *common names* as alkyl alkyl ethers where the alkyl groups attached to the oxygen are listed in alphabetical order. This style of naming is not used when one or more of the alkyl groups is complex or has other functional groups.



diethyl ether
AKA
ether

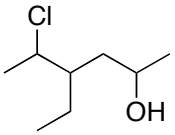


methyl *tert*-butyl ether
AKA
MTBE

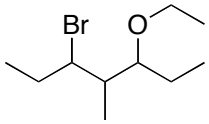


butyl ethyl ether

Examples:

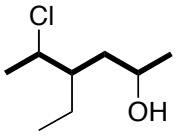


Compound A



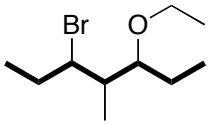
Compound B

1)



a **hexane**

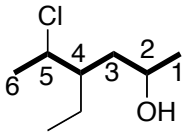
The horizontal chain has 3 substituents including the alcohol, if we used the lower left ethyl as the main chain we'd only have 2 substitutents.



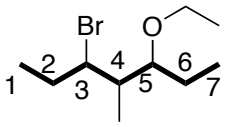
a **heptane**

The longest chain of contiguous carbons is counted as the main chain. The ether oxygen is not a part of the main chain.

2)

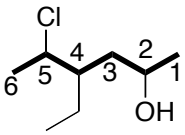


Left to right we get substituents at positions 2,3 and the alcohol at 5.
Right to left we also get substituents at postions 4,5 and the alcohol at 2.
2 < 5 so R-->L is correct.

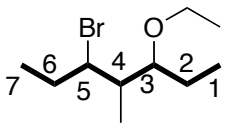


Left to right we get substituents at positions 3, 4, and 5.
Right to left we also get substituents at postions 3, 4, and 5
Bromo comes before **E**thoxy alphabetically so R-->L is correct.

3)



5-chloro
4-ethyl



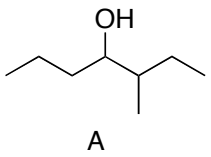
3-bromo
4-methyl
5-ethoxy

4,5)

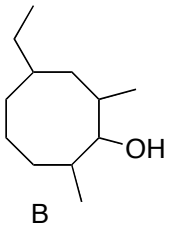
5-chloro-4-ethyl-2-hexanol
or
5-chloro-4-ethylhexan-2-ol

3-bromo-5-ethoxy-4-methylheptane

Practice Alcohol and Ether Nomenclature:



A



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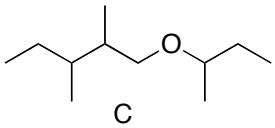

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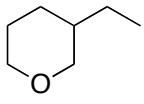

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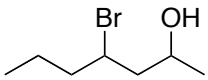

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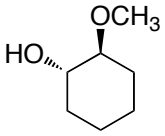

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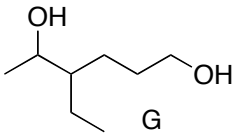

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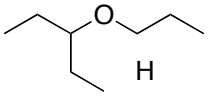

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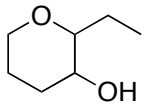

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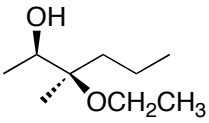

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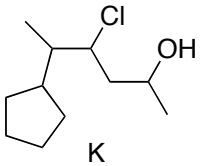

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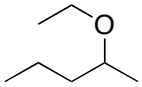

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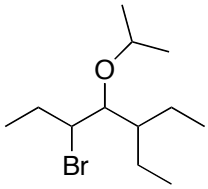

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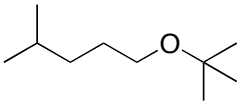

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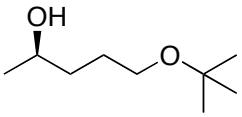

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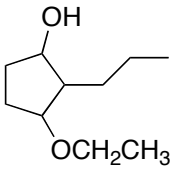

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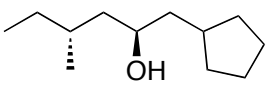

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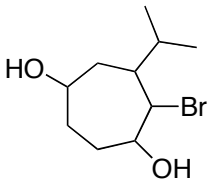

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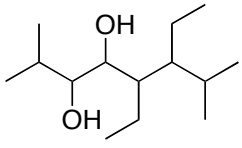

T

Practice Alcohol and Ether Nomenclature Key:

Compound A: 3-methyl-4-heptanol

Compound B: 4-ethyl-2,8-dimethylcyclooctanol

Compound C: 1-*sec*-butoxy-2,3-dimethypentane or
1-(1-methylpropoxy)-2,3-dimethylpentane

Compound D: 3-ethyloxacyclohexane

Compound E: 4-bromoheptan-2-ol or
4-bromo-2-heptan-2-ol

Compound F: *(1S,2S)*-2-methoxycyclohexanol

Compound G: 4-ethyl-1,5-hexanediol or
4-ethylhexane-1,5-diol

Compound H: 3-(1-propoxy)pentane

Compound I: 2-ethyl-3-oxacyclohexanol or 2-ethyloxacyclohexan-3-ol

Compound J: *(2R,3R)*-3-ethoxy-3-methyl-2-hexanol or
(2R,3R)-3-ethoxy-3-methylhexan-2-ol or

Compound K: 4-chloro-5-cyclopentyl-2-hexanol or
4-chloro-5-cyclopentylhexan-2-ol

Compound L: 2-ethoxypentane

Compound M: 2-bromo-4-ethyl-3-isopropoxyhexane or
2-bromo-4-ethyl-3-(1-methylethoxy)hexane

Compound N: 1-*tert*-butoxy-4-methylpentane or
1-(1,1-dimethylethoxy)-4-methylpentane

Compound O: *(2R)*-5-*tert*-butoxy-2-pentanol or
(2R)-5-(1,1-dimethylethoxy)-2-pentanol

Compound P: *(2S,3S)*-2,3-dimethyloxacyclopropane

Compound Q: 3-ethoxy-2-propylcyclopentanol

Compound R: *(2S,4R)*-1-cyclopentyl-4-methyl-2-hexanol

Compound S: 5-bromo-6-isopropyl-1,4-cycloheptanediol or
5-bromo-6-(1-methylethyl)cycloheptane-1,4-diol

Compound T: 5,6-diethyl-2,7-dimethyloctane-3,4-diol