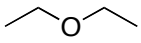
Ethers

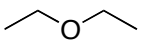
An ether is a substance that has two organic groups bonded to the same oxygen atom, R-O-R', where R and R' can be the same or different, but cannot be carbonyl (C=O), or H directly attached. The organic groups may be alkyl, aryl, or vinylic, and an ether can either be an open chain or a ring. Perhaps the most well known ether is diethyl ether, a familiar substance that has been used medically as an anesthetic, and is used industrially as a solvent.



diethyl ether

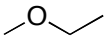
Naming Ethers

Two systems for naming ethers are allowed by IUPAC rules. Simple ethers with no functional groups are named by identifying the two organic substituents and adding the word *ether* as in the below examples.

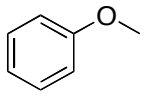


diethyl ether
or ethyl ether
or ether

dimethyl ether
or methyl ether



ethyl methyl ether

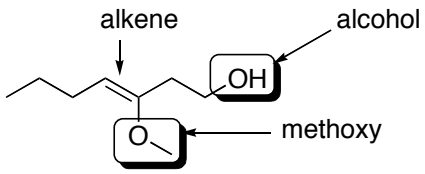


anisole
methyl phenyl ether

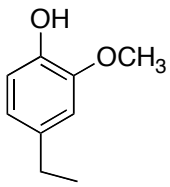
Naming Rule
Drop ane add oxy: e.g. methyl to metghoxy

If other functional groups are present, the ether part is considered to be an alkoxy substituent (-OR).

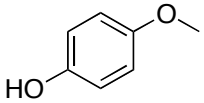
For example, the parent name for the below structure is an alcohol.



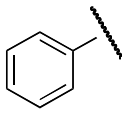
(*Z*)-3-methoxyhept-3-en-1-ol
(*Z*)-3-methoxy-3-hepten-1-ol



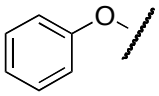
Cockroach sex pheromone
2-methoxy-4-ethylphenol
4-ethyl-2-methoxyphenol



4-methoxyphenol
methyl *p*-hydroxyphenyl ether

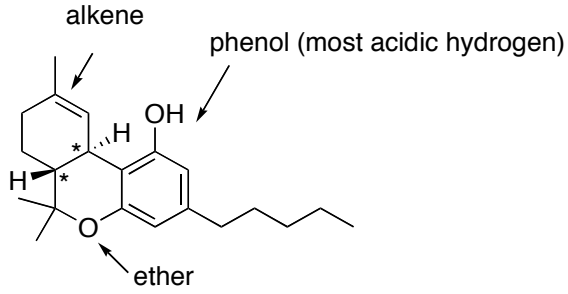


phenyl group



phenoxy group

Example: THC



Tetrahydrocannabinol
(THC)

You should be able to identify different functional groups in a large molecule like THC, and be able to find stereogenic centers and identify the configurations. If treated with Br_2, which double bond will react? *Answer:* Top one (The non-aromatic alkene).

Ethers: Properties

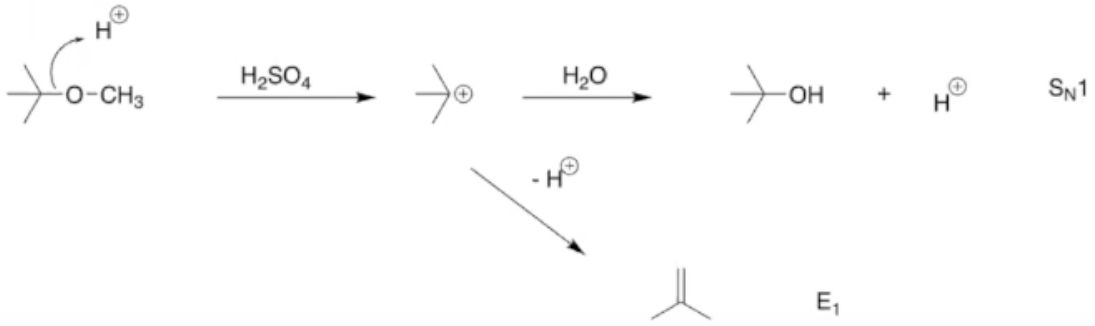
1. Intermediate polarity - usually have dipoles & can accept hydrogen bonds
2. Not miscible with water - very slight solubility
3. Good solvents for many organic compounds
4. Less dense than water ρ <1.0 - floats on water
5. Usually chemically unreactive - inert to base or weak acid - can react with very strong acid

Elimination to alkenes

Reverse of Addition Reaction Requires Strong Acid

Ethers are essentially inert except in the case of reacting with a strong acid

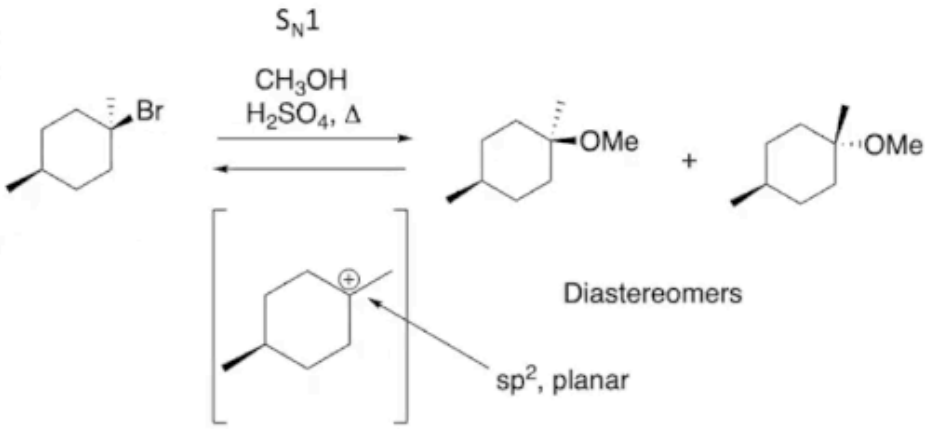
Example:



Substitution to alcohols or alkyl halides

Substitution reversible – reverse of synthesis of ethers –

Strong Acid



S_N2 Reaction to Convert Alkyl Halide to Ethers – NOT reversible without strong acid