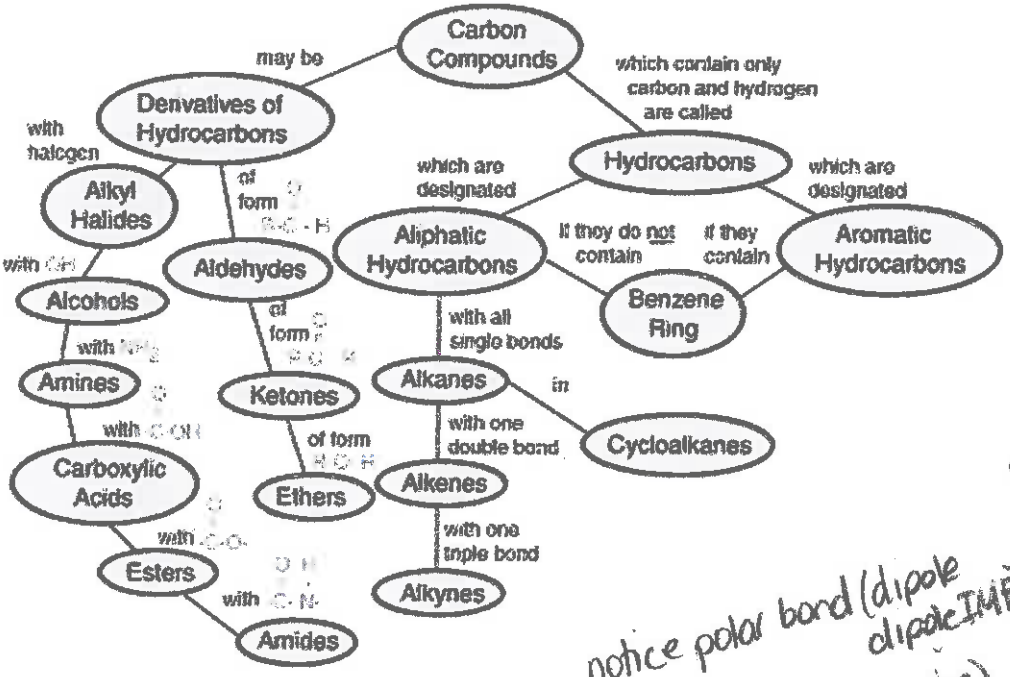
5.0 Alcohols, Ethers, and Thiols

Functional Groups & Hydrocarbon Derivatives



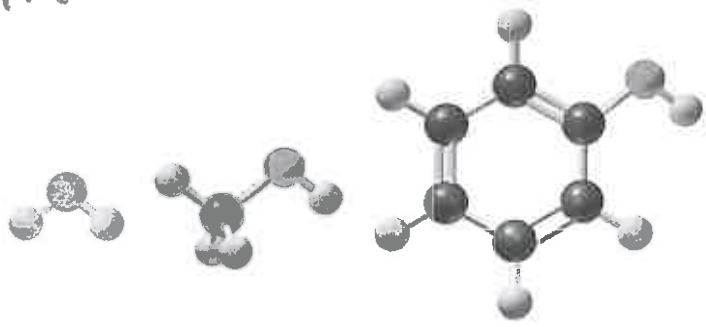
- A functional group is a <u>reactive</u> portion of a molecule (eg. –OH).
- Functional groups are used to identify compounds but also to explain properties like solubility, melting and boiling points.
- Hydrocarbon derivatives are organic compounds that are based on hydrocarbons with the <u>addition</u> of specific functional groups.

notice polar bond (dipole dipole IMF) C-O and OH (H bonding)

Alcohols

An alcohol contains the <u>hydroxyl</u> functional group (—OH) attached to a <u>carbon chain</u>.

A phenol contains a hydroxyl group (—OH) attached to a *benzene ring*.

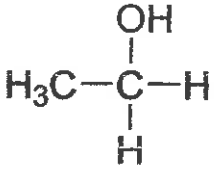


water **alcohol** **phenol**

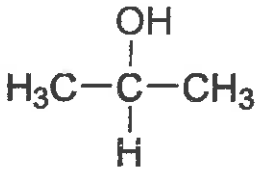
A *primary alcohol* has the hydroxyl group bonded to a <u>terminal</u> carbon atom.

A *secondary alcohol* has the hydroxyl group bonded to a carbon atom with <u>two alkyl</u> groups.

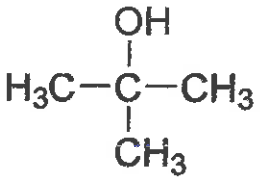
A *tertiary alcohol* has the hydroxyl group bonded to a carbon atom with <u>three alkyl</u> groups.



a primary alcohol



a secondary alcohol

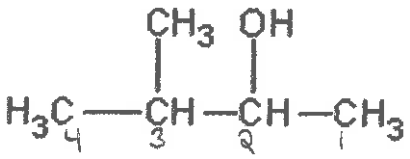


a tertiary alcohol

Naming Alcohols

- Use the suffix *–ol*
- Number the parent chain so that the hydroxyl group has the lowest number possible
- If necessary, include a number before the *–ol* suffix to indicate which carbon the hydroxyl group is attached to.

Example: Name the following and state whether it is primary, secondary or tertiary.

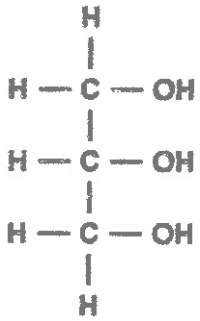


3-methyl-2 butanol

Alcohols containing more than one hydroxyl group are referred to as polyalcohols.

- Use the suffix *–diol* or *–triol* instead of *-ol*.

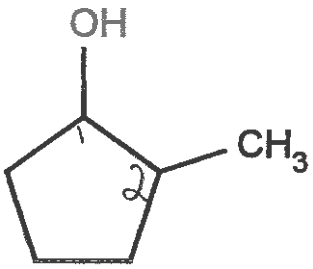
ethane-1,2-diol
(commonly called ethylene glycol)
used as antifreeze



propane-1,2,3-triol
(commonly called glycerol)
used in the pharmaceutical industry

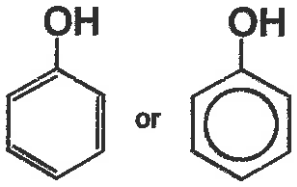
Example: Name the following. $HOCH_2CH_2OH$ 1,2-diethanol

If the hydroxyl group is attached to a cyclic hydrocarbon, remember to number the ring so the hydroxyl group has the lowest number possible, and use the prefix *cyclo-*.

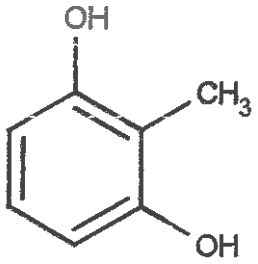


2-methylcyclopentanol

The hydroxyl group can also be attached to an aromatic hydrocarbon, what we now call a phenol.



If the benzene ring has multiple hydroxyl groups benzene is used as the root word.

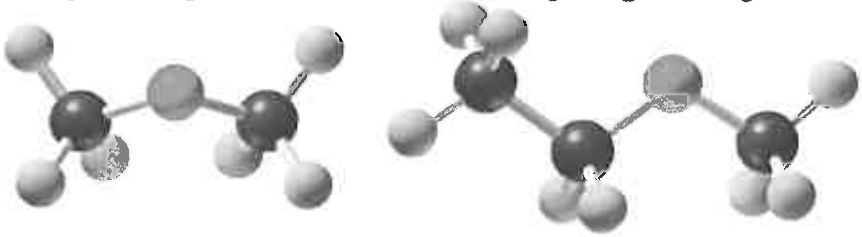


2-methylbenzene-1,3-diol

Ethers

- contain an oxygen atom between two carbon atoms in a chain

$CH_3–O–CH_3$ $CH_3–CH_2–O–CH_3$

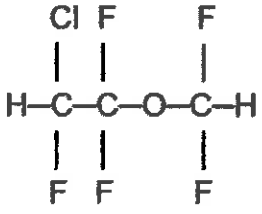


- named by writing the name of the shorter alkyl group, then the suffix oxy, then the name of the longer alkyl group as if it were an alkane

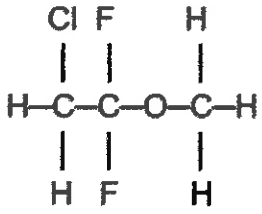
Ethers as Anesthetics

Anesthetics

- inhibit pain signals to the brain.
- like diethyl ether $CH_3–CH_2–O–CH_2–CH_3$ were used for over a century, but caused nausea and were flammable.
- developed by the 1960's were nonflammable.



Ethane(enflurane)



Penthrane

Example: Draw the following.

(a) ethoxyethane

$CH_3-CH_2-O-CH_2-CH_3$

(b) ethoxypropane

$CH_3-CH_2-O-CH_2-CH_2-CH_3$

Thiols

- contain the sulfhydryl (-SH) functional group
- generally have strong odours (i.e. thiols give garlic, skunks, and sewage their distinctive smells)
- named by adding thiol to the alkane name of the longest carbon chain

$CH_3CH_2CH_2CH_2SH$ butanethiol