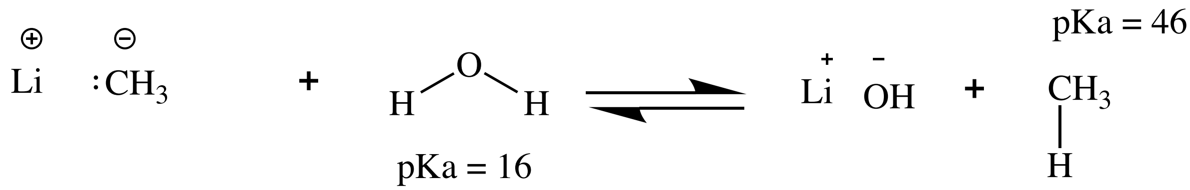
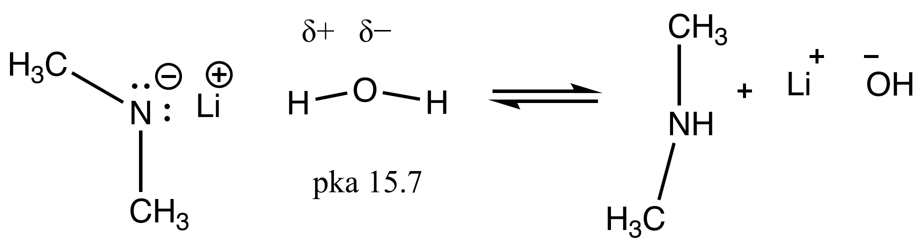
Ex #4)



Stronger base   Stronger acid ⇨ Weaker base   Weaker acid

Ex #5)



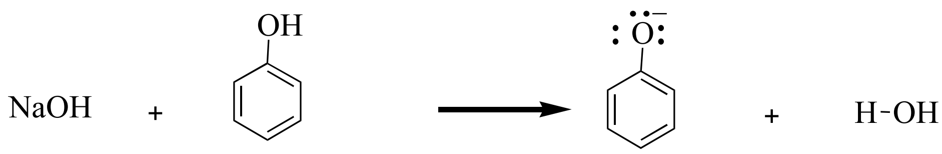
Stronger base   Stronger acid ⇨ Weaker base   Weaker acid

Gas		Solid		
HCl	+	NaOH	→	$\overset{+}{Na}\overset{-}{Cl}$ + H—OH
Strong Acid				Weak Acid
pKa = -7				pKa =15.7

Strong Acid

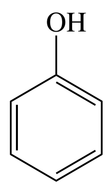
pKa = -7

pKa = -1.74



Strong Base | Strong Acid | Weak Base | Weak Acid

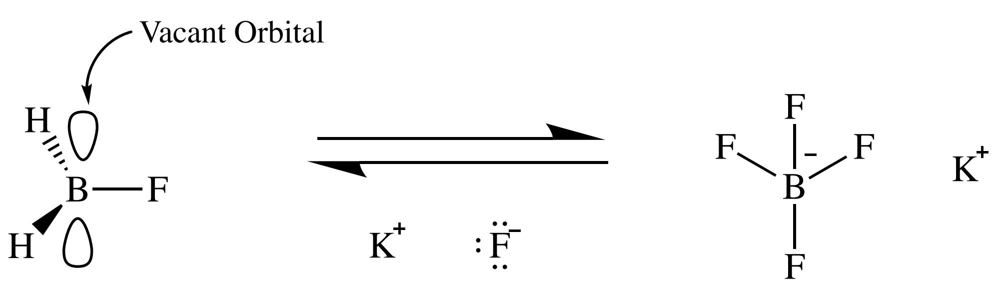
NB: Oxygen is more electron withdrawing than Carbon and can stabilize negative charge so removing a proton from the oxygen is preferable than from the Carbon on the phenol compound



Phenol pKa = 10

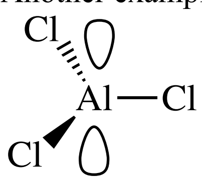
Phenol

These Lewis acids are not Bronsted-Lowry acids: Note BF_4^- is not a Lewis acid, although BF_3 is



BF_3 has a planar structure, hence hybridization is sp2, it is not isoelectronic with an inner gas

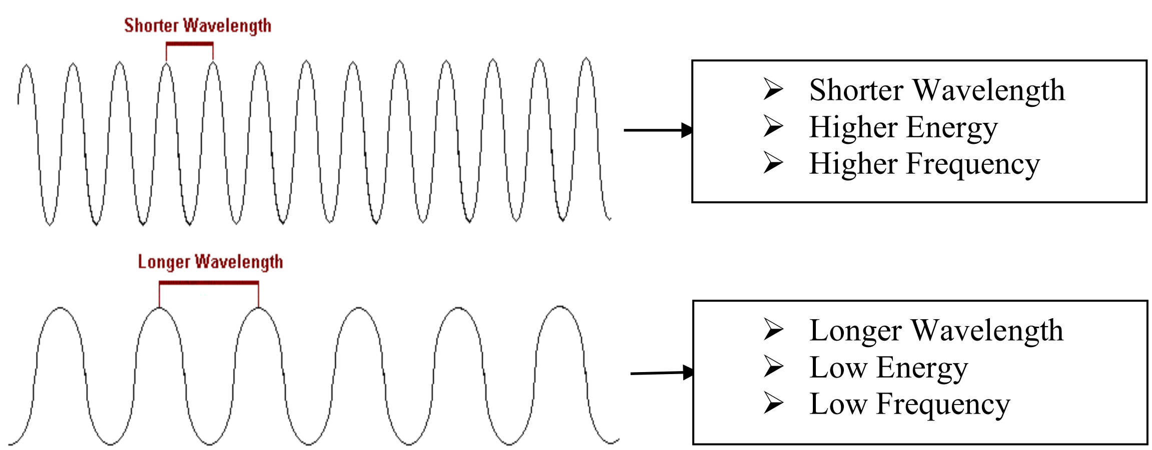
Another example, $AlCl_3$



<u>Infrared (IR) Spectroscopy – Background only</u>

E = hc/λ = hν , energy is quantized

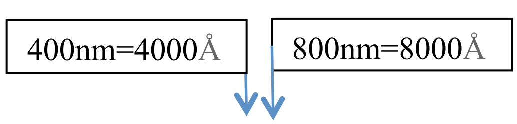
E = Energy
h = Planck's Constant= 6.6 x 10^{-34} joules/sec
ν = Frequency
λ = Wavelength
c = Speed of light = 3.0 X 10^{10} cm/sec

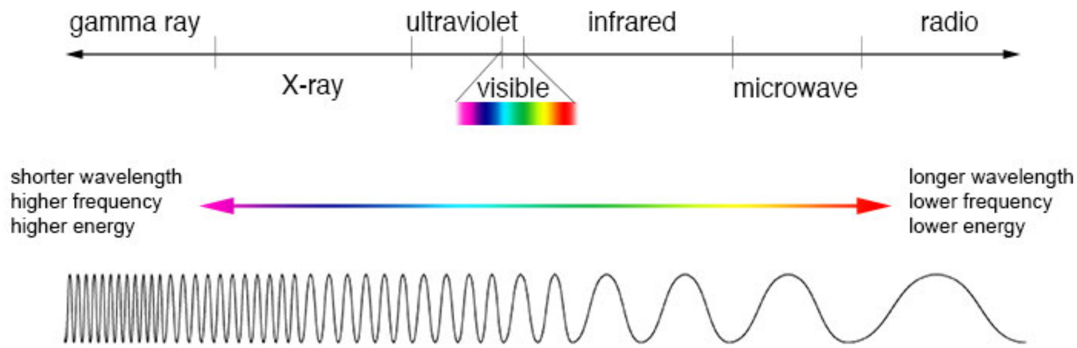


NB: There is an inverse relationship between wavelength and frequency.

Electromagnetic Spectrum:

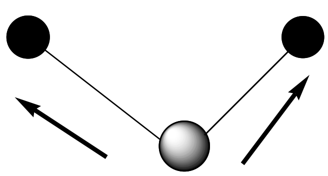
NB: 1λ = 10 angstrom



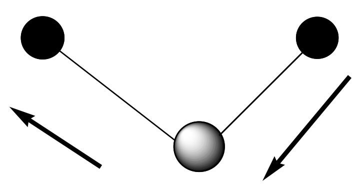


uv and visible light: conjugated double bond systems

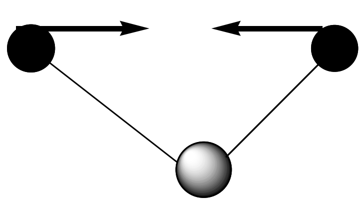
infrared radiation: bond stretching and bending



SYMMETRIC STRETCHING

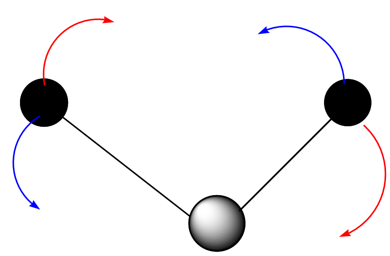


ASYMMETRIC STRETCHING



IN PLANE BENDING

(SCISSORING)



OUT OF PLANE BENDING

(TWISTING)

NEXT SECTION: Lecture Outline 2: ALKANES

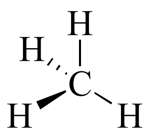
<u>Hydrocarbons</u> – Compounds that contain only C and H

- Alkanes contain only single bonds (C-H, C-C)
- Alkenes = Olefins (C=C)
- Alkynes =Acetylenes (C≡C)

Alkanes

- All carbons are sp^3 hybridized (optimal bond angle of 109^o)
- Single bonds (σ bonds).
- Tetrahedral geometry at every carbon
- Held together by London (dispersion) forces

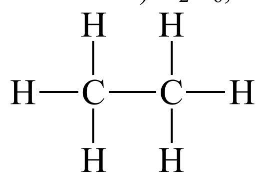
Ex #1) CH_4, methane



Bp = -161^oC

CH_4 H_4C CH_3-H

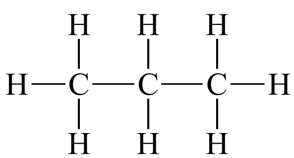
Ex #2) C_2H_6, ethane



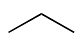
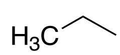
Bp = -88^oC

C_2H_6 CH_3-CH_3 H_3C-CH_3

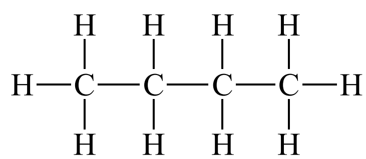
Ex #3) C_3H_8, propane



Bp = -42^oC

C_3H_8 $CH_3CH_2CH_3$  

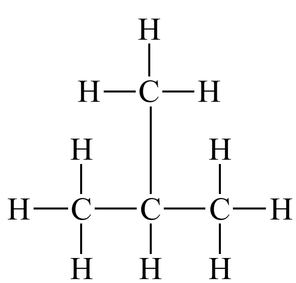
Ex #4) C_4H_{10}, butane



C_4H_{10}, $CH_3CH_2CH_2CH_3$

n-Butane: normal straight chain butane

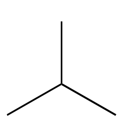
Ex #5) C_4H_{10} , isobutene or i-Butane



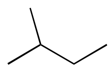
- Isomers are different compounds that have the same molecular formula and different structure. They have different physical properties (e.g. mp, bp, odour, biological effects)

-	iso	-	meros
	same	-	parts

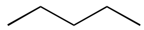
one type: structural (same as constitutional)



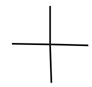
structural isomer = constitutional isomer



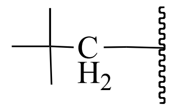
isopentane



n - pentane



Neopentane

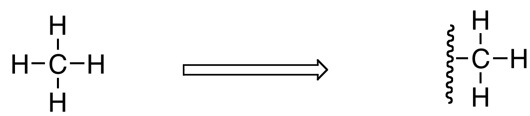


Neo Group

<u>Groups</u> <u>(part of an alkane structure)</u>

- In naming the particular group, drop the "ane" part and add "yl" to the name
- For example, meth<u>ane</u> → meth<u>yl</u>

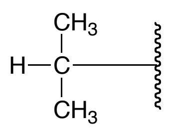
(i) Methane – CH_4



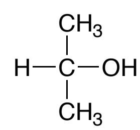
methane methyl group

(ii) Ethyl group $-CH_2CH_3$

(iii)

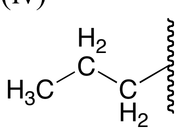


iso-propyl group

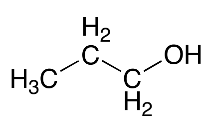


iso-propyl alcohol

(iv)



n-propyl chain

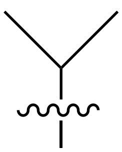


n-propyl alcohol

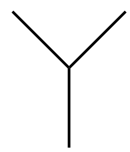
<u>Systematic Nomenclature</u>

RULES:

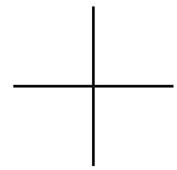
1. Find the longest chain
2. Number from end of the chain, so that the 1st branch point has the lowest number
3. Name the chain, then add prefixes (for the groups attached) with number and name the groups attached
4. Separate numbers and names by dash



isopropyl



isobutane
2-methylpropane

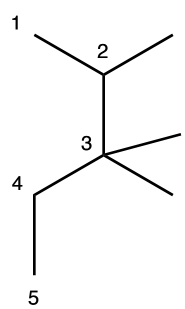


neopentane
2,2-dimethylpropane

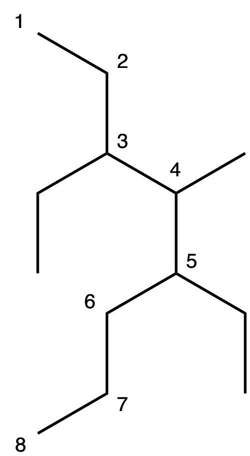
Note: iso = second-to-last carbon of the chain is disubstituted (2 methyl groups)
neo = second-to-last carbon of the chain is trisubstituted (3 methyl groups)

Recall: CH_2 – methylene group, CH_3 – methyl group

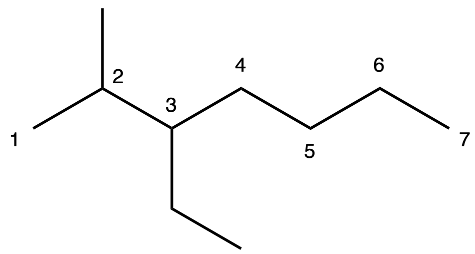
Examples



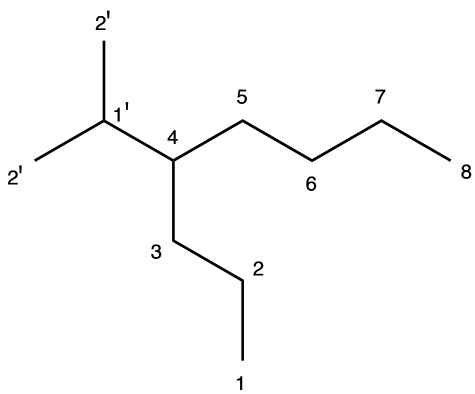
2,3,3-trimethylpentane



3,5-diethyl-4-methyloctane



3-ethyl-2-methylheptane



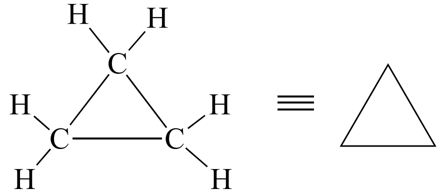
4-(1-methylethyl)octane

Note: Ring Structure Naming

- Prefix with "cyclo"
- Start with numbering at point of maximum branching/most important functional group
- Number so as to give next branch/functional group lowest number

<u>Cycloalkanes</u>

Cyclopropane, C_3H_6



- One degree of unsaturation (n-propane is C_3H_8)
- C-C-C bond angle (60^{o})
- Highly reactive due to ring strain

Cyclobutane, C_4H_8