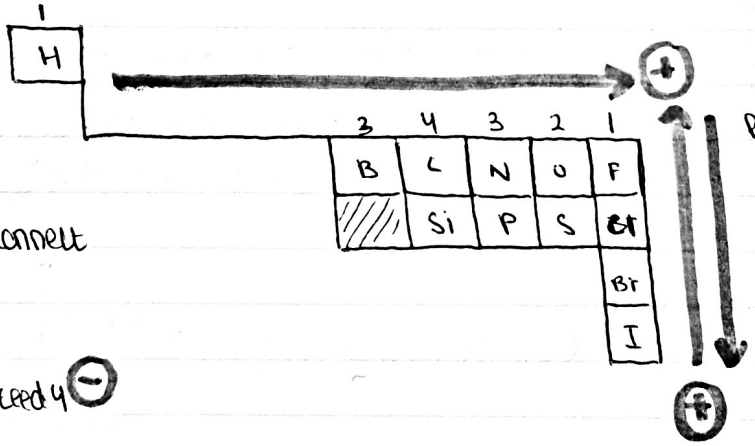
Lecture 1 - Jan 10th

Organic Chemistry: study of reactivity of carbon

Chemistry of Carbon

- is unique ; no other element can do what it does
- bonds to itself in complex ways to make:
  - rings + chains
- element of life
- all organics contain (C) and (H)
- most also contain heteroatoms
  - ↳ element ≠ (C) or (H)

★ Memorize Organic Periodic Table



#s at top indicate Normal # of bonds

Use normal # bonds to connect to other structures

First Row: max 4 bond

Lower Row: possible to exceed 4

Need to know:

- Position of elements relative to each other

Periodic Trends

- Electronegativity
- Atomic Size

Molecular formulas — almost never use

— gives no information on structure of compound (organic chem is all about structure)

Ex ⇒ $C_6H_{12}O_2$

list 1st — 2nd — list others in alphabetical order

Lecture 1 - Jan 10TH

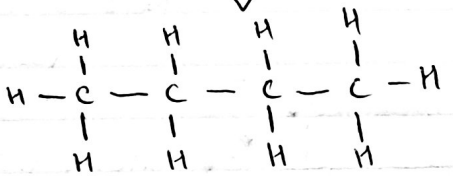
Condensed Formulas

- gives info about connections between atoms
- atoms which connect to other atoms are listed immediately after to max valence of first
- presented in a list

Ex ⇒ ① $CH_3CH_2CH_2CH_3$

① 3 (H)s connected to leading carbon (assumed)
Carbon generally forms (4) bonds
does not have max valence - indicates next carbon is connected to the leading (C)

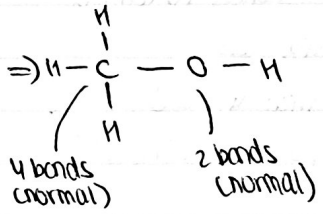
$CH_3CH_2CH_2CH_3$ - 4th bond assumed to connect to (C) since they are adjacent / listed directly after



⇒ $CH_3-CH_2-CH_2-CH_3$

* demonstrates connections between carbons
** connection between heavy atom (not (H))

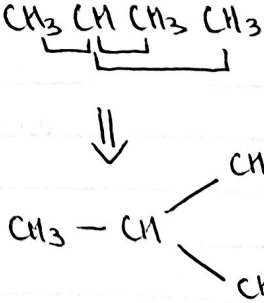
Ex2 ⇒ condensed formula
CH_3OH ⇒ CH_3-OH (connection between heavy atoms)



ooo Parentheses are used to shorten structures

Ex $CH_3CH\,CH_3\,CH_3$

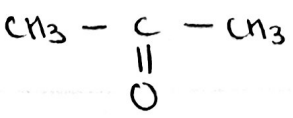
* last (L) cannot connect to previous (C) since (C) has a max of 4 bonds ⇒



Final Answer:
⇒ $CH_3CH(CH_3)_2$

Ex2 $CH_3C(O)CH_3$

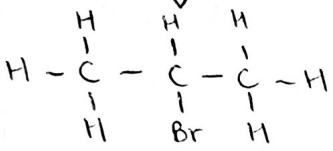
* oxygen normally has 2 bonds - parentheses indicate that both are attached to (C)



Lecture 1 — Jan 10th

∞ Parentheses are used to shorten structures

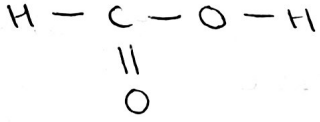
$CH_3CHBrCH_3$ ⇓



* Br normally has 1 bond ∴ only connected to the preceding (C) and NOT the one after too / instead
* indicates that CH and CH_3 are connected

Subscripts — indicates all connected to preceding atom

Ex HCO_2H ⇒



* How the presence of the double bond was determined

(H) forms 1 bond

(O_2) = 2 oxygens both bonded to (C)

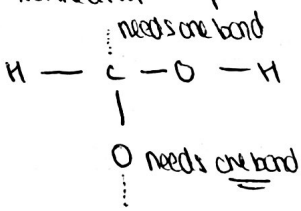
Normal # of bonds

C → 4

H → 1

O → 2

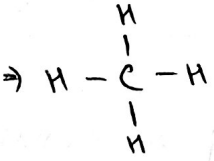
Intermediate step:



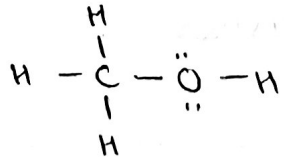
Lewis Structure Method — for when you're stuck
— works w almost anything

Bonds —
Electrons •] must show

Ex CH_4 ⇒



Ex 2 CH_3OH ⇒



* must include electrons to be correct

Lecture 1 - January 10th

Formal Charge Method

* useful for functional groups that are unfamiliar

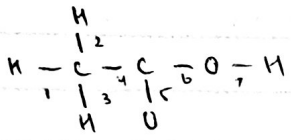
— 1) Count all valence e^-

— 2) Draw connections using single bonds

Ex CH_3CO_2H ① valence $\bar{e}$ count $[H\times4]+[C\times4\times2]+[O\times6\times2] = 24e^-$

② Draw ⇓

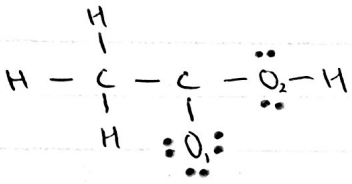
* only w/ single bonds



— 3) Count $\bar{e}$ in bonds (2 each) $24e^-$

7 bonds $\times 2 = 14e^-$ $-14e^-$

leftover $10e^-$



— 4) Add remaining $\bar{e}$ to the structure

— most electronegative atoms first

— 5) Calculate formal charge

* skip carbons w/ 4 bonds and (H)

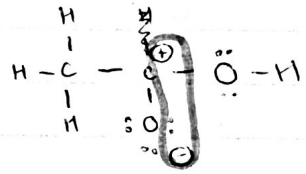
$FC = [\text{Group \#}] - (\#\text{ bonds}) - (\#\bar{e})$ non-bonded

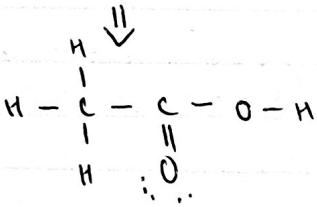
* takes care of all leftover $\bar{e}$

FC = C = Group 4 - 3 bond - $0e^-$
(before) = +1

= O_1 = Group 6 - 1 bond - $6e^-$
= -1

= O_2 = Group 6 - 2 bonds - $4e^-$
= 0

⇒ 



✓

FC = C = Group 4 - 4 bond - $0e^-$
(after) = 0

O_1 = Group 6 - 2 bonds - $4e^-$
= 0

] NO formal charges