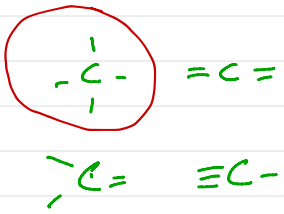
1412 - E3
CH 20 - Organic Chemistry
Notes

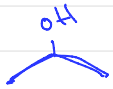
20

CHAPTER 20: ORGANIC CHEMISTRY

Hydrocarbons [20.1]

- Contain only Carbon & Hydrogen.
- Carbon is sp^3 hybridized (4 bp) — simplest form



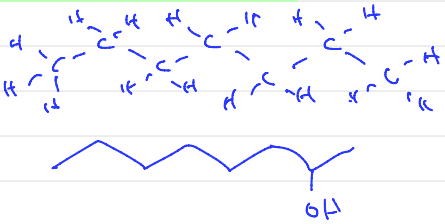


Chapter Topics

- 3 classes of hydrocarbons
- Functional-group variations of hydrocarbons (e.g. alcohol as HC derivative)

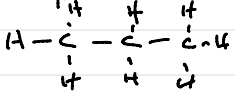
3 Flavors of HC

Alkane — only single bonds
Alkene — has at least 1 double bond
Alkyne — " " " " triple "



Alkanes

- aka "saturated hydrocarbon", one no bond of π orbital
- Three types of formulas:

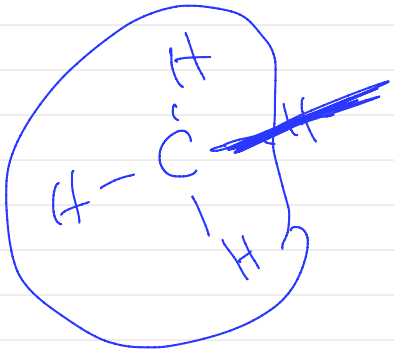


EXPANDED

- $CH_3-CH_2-CH_3$

CONDENSED

SKELETAL



Alkane	Molecular Formula
methane	CH_4
ethane	C_2H_6
propane	C_3H_8
butane	C_4H_{10}
pentane	C_5H_{12}
hexane	C_6H_{14}
heptane	C_7H_{16}
octane	C_8H_{18}
nonane	C_9H_{20}
decane	$C_{10}H_{22}$
tetradecane	$C_{14}H_{30}$
octadecane	$C_{18}H_{38}$

Table 20.1

Properties of Some Alkanes

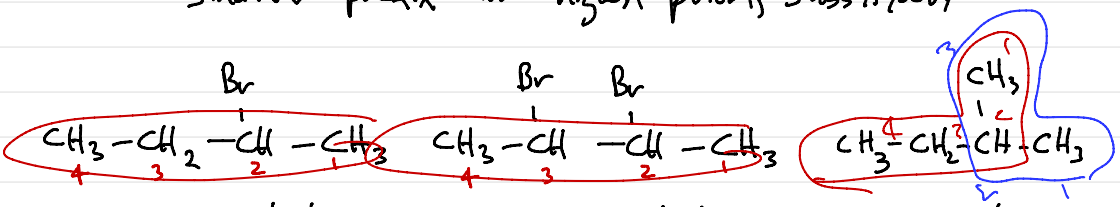
Alkane	Molecular Formula	Melting Point (°C)	Boiling Point (°C)	Phase at STP[4]	Number of Structural Isomers
methane	CH_4	−182.5	−161.5	gas	1
ethane	C_2H_6	−183.3	−88.6	gas	1
propane	C_3H_8	−187.7	−42.1	gas	1
butane	C_4H_{10}	−138.3	−0.5	gas	2
pentane	C_5H_{12}	−129.7	36.1	liquid	3
hexane	C_6H_{14}	−95.3	68.7	liquid	5
heptane	C_7H_{16}	−90.6	98.4	liquid	9
octane	C_8H_{18}	−56.8	125.7	liquid	18
nonane	C_9H_{20}	−53.6	150.8	liquid	35
decane	$C_{10}H_{22}$	−29.7	174.0	liquid	75
tetradecane	$C_{14}H_{30}$	5.9	253.5	solid	1858
octadecane	$C_{18}H_{38}$	28.2	316.1	solid	60,523

Table 20.1

Alkane Nomenclature

① Name longest chain

② Add prefix to show position of substituent, using smaller prefix for highest priority substituent



2-bromobutane 2,3-dibromobutane 2-methylbutane

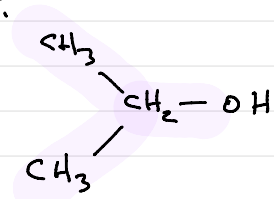
- A group formed by removing 1 hydrogen is an alkyl group

Common Isomer Designations

- n-
- iso
- sec- (secondary)
- tert- (tertiary)

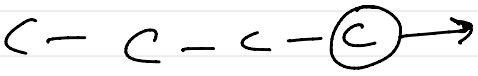
Alkyl Group	Structure
methyl	CH_3-
ethyl	CH_3CH_2-
n-propyl	$CH_3CH_2CH_2-$
isopropyl	CH_3CHCH_3
n-butyl	$CH_3CH_2CH_2CH_2-$
sec-butyl	$CH_3CH_2CHCH_3$
isobutyl	CH_3CHCH_2- CH_3
tert-butyl	CH_3CCH_3 CH_3

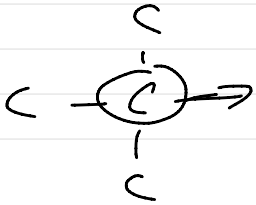
Ex:

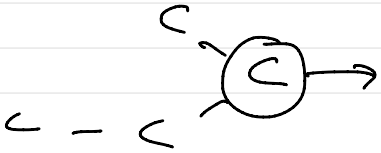


isopropyl alcohol (common)
2-propanol (formal)

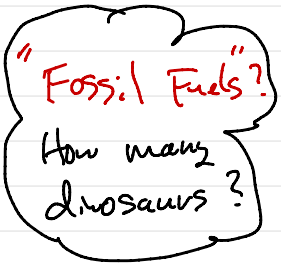
* More on alcohols later

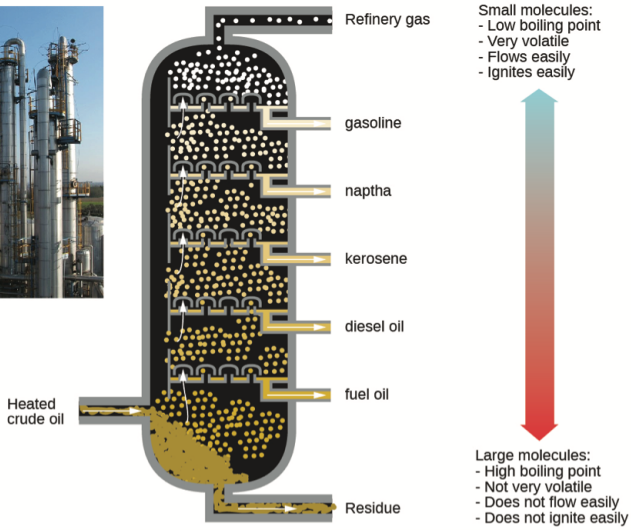






Hydrocarbon Manufacturing





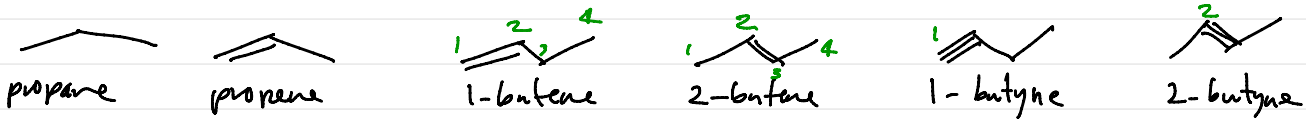
Small molecules:
- Low boiling point
- Very volatile
- Flows easily
- Ignites easily

Large molecules:
- High boiling point
- Not very volatile
- Does not flow easily
- Does not ignite easily

Alkene (dbl bond) and Alkyne (triple bond) Nomenclature

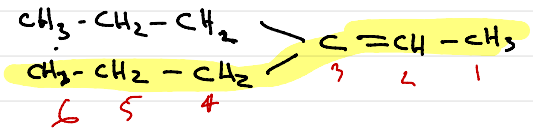
Notables
ethylene
propylene
acetylene

- double bond — "ene" ending
- triple bond — "yne" ending



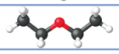
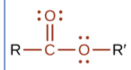
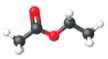
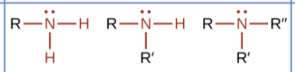
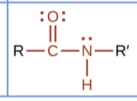
Note: longest chain with multiple bond

(EX) ¿Name the following compound alkene?

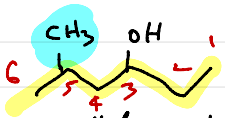


4-ethenyl heptane, or
3-propyl-2-hexene
3-propyl-2 hexene ✓

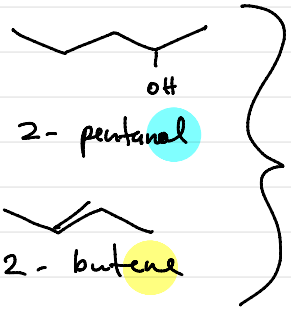
Key Functional Groups in Organic Compounds

Compound Name	Structure of Compound and Functional Group (red)	Example	
		Formula	Name
alkene		C_2H_4 	ethene
alkyne		C_2H_2 	ethyne
alcohol		CH_3CH_2OH 	ethanol
ether		$(C_2H_5)_2O$ 	diethyl ether
aldehyde		CH_3CHO 	ethanal
ketone		$CH_3COCH_2CH_3$ 	methyl ethyl ketone
carboxylic acid		CH_3COOH 	acetic acid
ester		$CH_3CO_2CH_2CH_3$ 	ethyl acetate
amine		$C_2H_5NH_2$ 	ethylamine
amine		CH_3CONH_2 	acetamide

2-propanone

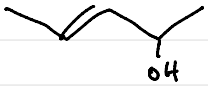


5-methyl-3-hexanol



2-pentanol

2-butene



pent-4-en-2-ol

* Hardest test problem will be a branched single functional group molecule.