Alkanes (p1) Linear

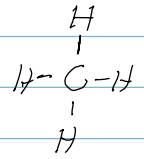
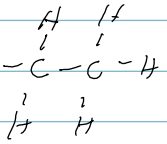
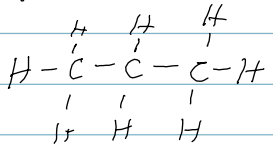
Hydrocarbon - contains only C & H

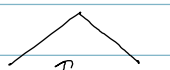
→ Alkane - only single bonds

→ Linear: all C-C bonds in single chain

→ Branched (p2)

→ Cyclic (p3)

b.p.			
-164°C	Methane	CH_4	
-89°C	Ethane	C_2H_6	
-42°C	Propane	C_3H_8	
-0.5°C	Butane	C_4H_{10}	
+36°C	Pentane	C_5H_{12}	
	Hexane	C_6H_{14}	
	Heptane	C_7H_{16}	
126°C	Octane		
	Nonane		
174°C	Decane		
	Undecane		
	Dodecane		



natural gas

liquified fuels (under pressure)

C_nH_{2n+2}

non-polar

$\Delta EN = 0.3$

$C = 2.5$ $H = 2.2$

liquids → dispersion forces

low boiling points

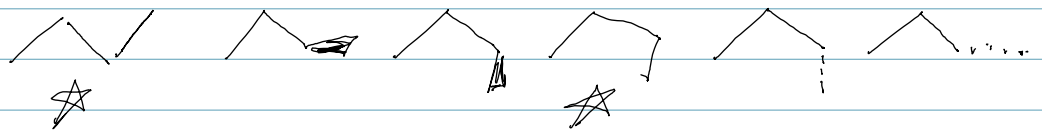
gasoline: C_5H_{12} to $C_{12}H_{26}$

heating oil > $C_{12}H_{26}$

Conformational Flexibility

rotation in ~ 1 ps

Butane:



Decane:

Alkanes — p ≤) Branched also non-polar

$C_n H_{2n+2}$

Isobutane

C_4H_{10}

n-butane

Pentane Neopentane

C_5H_{12}

n-pentane

Decane

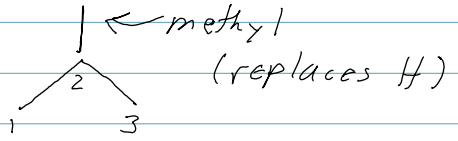
$C_{10}H_{22}$

75 const. isomers

Constitutional Isomers: same chem. formula
different patterns of bonding

Systematic Nomenclature: 1) Longest C chain ⇒ base name
2) Number C's as 1, 2, ...
3) Substituent side chains named with -yl replacing -ane

Ex) Isobutane = 2-methylpropane



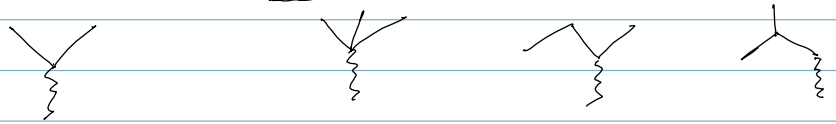
Isopentane = 2-methylbutane

Neopentane = 2,2-dimethylpropane

di = 2
tri = 3
tetra = 4
penta = 5
hexa = 6

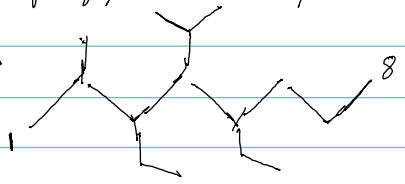
Special substituents (branched)

isopropyl tert-butyl sec-butyl isobutyl

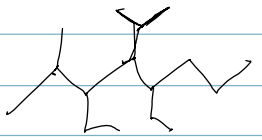


Ex) 3,5-diethyl-4-isopropyl-2-methyloctane

wierd Pencast drawing →

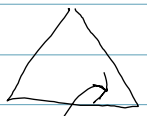


regular drawing



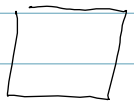
Alkanes - b) Cyclic (Cycloalkanes)

Cyclopropane



60°

Cyclobutane



90°

Strained angles (less stable)

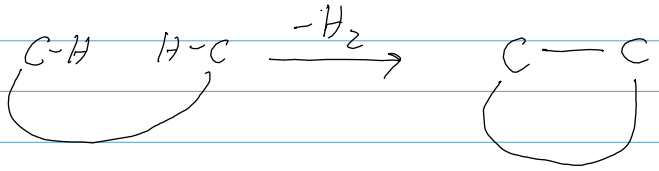
Cyclopentane

108°
(cf 109.5° - sp^3)

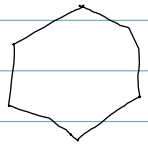
Acyclic alkanes: $C_n H_{2n+2}$

Cycloalkanes: $C_N H_{2n}$ (one ring) $C_N H_{2N-2}$ (2 rings)

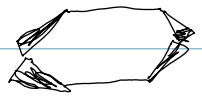
ring forming



Cyclohexane ← non-planar



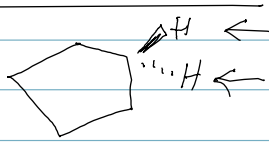
120°?
No!



boat

chair
(most stable)

conformers of each other (cyclohexane)

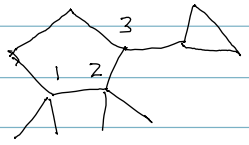


2 substituents: top + top = cis
top + bottom = trans

trans-4-(tert butyl)-3-ethyl-1,1-dimethylcyclohexane

$C_{14} H_{28}$

3-cyclopropyl-1,1,2,2-tetramethyl-cyclopentane



$C_{12} H_{22}$