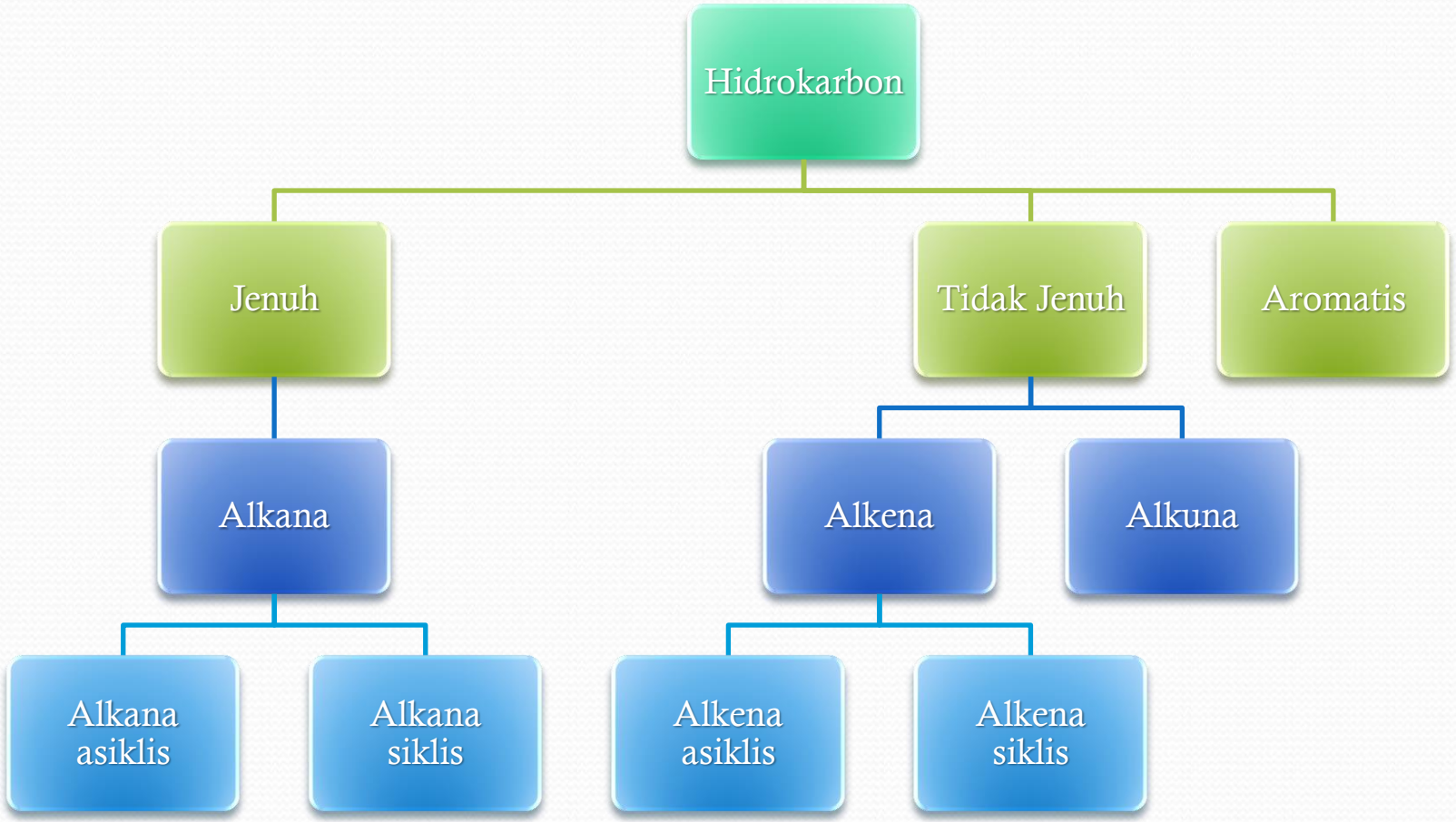
ALKANA & SIKLOALKANA

KLASIFIKASI HIDROKARBON

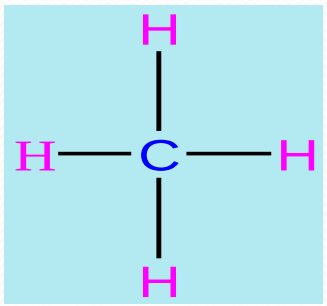


ALKANA

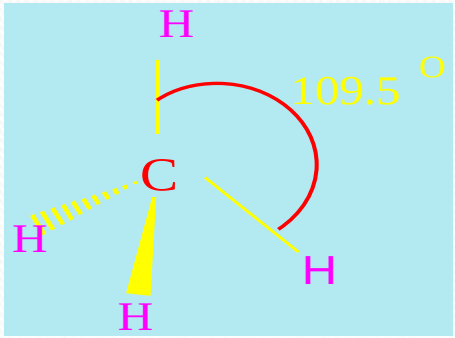
ALKANA

- **Senyawa organik sederhana gol. hidrokarbon jenuh.**
- **Rumus :** C_nH_{2n+2}

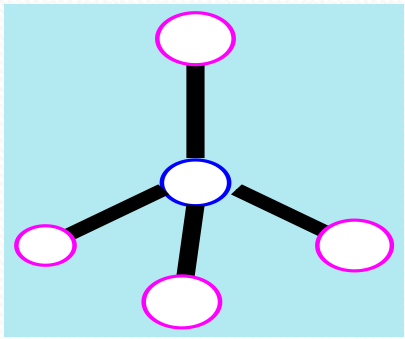
  n = 1, 2, 3,...
- **Struktur**



Metana
Struk. Lewis



Struktur 3D
(tetrahedral)



Model ball dan
Stick

Keadaan dasar

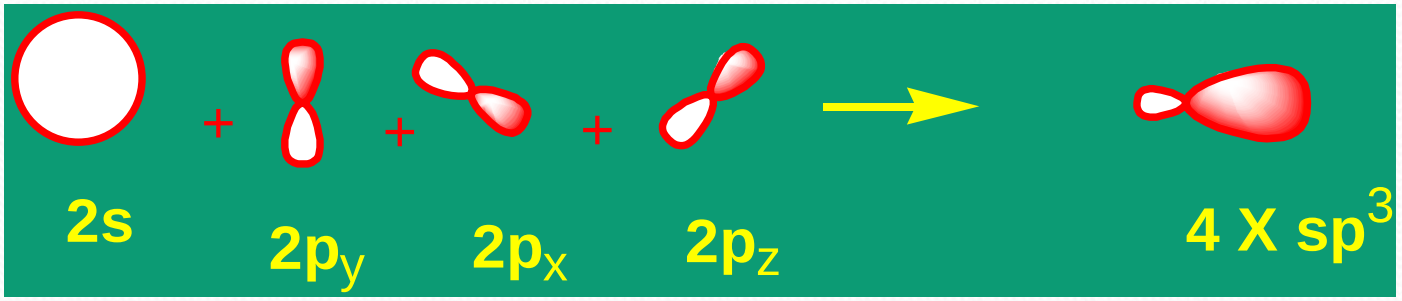
$C(6) - 1s^2, 2s^2, 2p_x^1, 2p_y^1, 2p_z^0$

Keadaan eksitasi

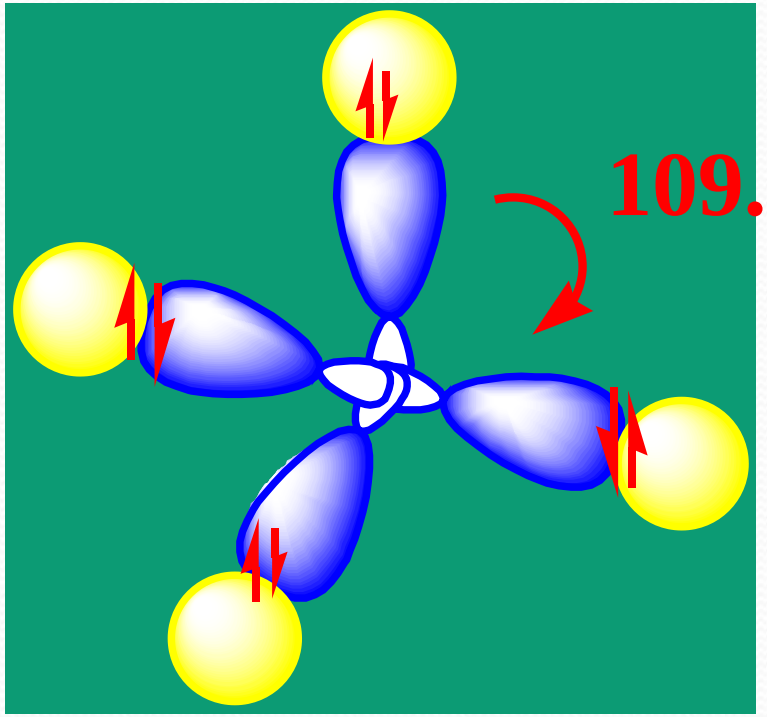
$C(6) - 1s^2, 2s^1, 2p_x^1, 2p_y^1, 2p_z^1$

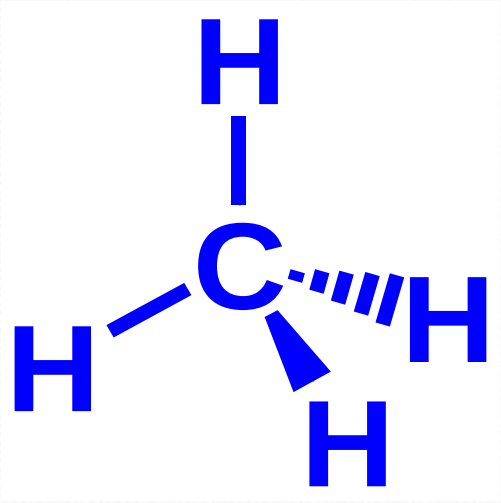
Hibridisasi

4 orbital sp^3



Struktur tetrahedral pada metana





Carbon yang menunjukkan hibridisasi sp3
4 buah ikatan C-H yang ekivalen (ikatan σ)
Semua ikatan tunggal dinamakan ikatan σ

Alkana - C_nH_{2n+2}

metana	CH_4	CH_4
etana	C_2H_6	CH_3CH_3
propana	C_3H_8	$CH_3CH_2CH_3$
butana	C_4H_{10}	$CH_3(CH_2)_2CH_3$
pentana	C_5H_{12}	$CH_3(CH_2)_3CH_3$
heksana	C_6H_{14}	$CH_3(CH_2)_4CH_3$
heptana	C_7H_{16}	$CH_3(CH_2)_5CH_3$
oktana	C_8H_{18}	$CH_3(CH_2)_6CH_3$
nonana	C_9H_{20}	$CH_3(CH_2)_7CH_3$
dekana	$C_{10}H_{22}$	$CH_3(CH_2)_8CH_3$
dodekana	$C_{12}H_{26}$	$CH_3(CH_2)_{10}CH_3$
tetradekana	$C_{14}H_{30}$	$CH_3(CH_2)_{12}CH_3$

Tata Nama

- Rantai utama adalah rantai karbon terpanjang.
- Jika ada substituen atau gugus cabang, beri nomor rantai utama dengan memberi nomor terkecil yang mungkin untuk gugus cabang.
- Gugus cabang diberi nama alkil dengan prioritas penulisan sesuai abjad.
- Jika ada gugus cabang/ substituen yang sama, maka diberi awalan di-, tri-, tetra-, penta- atau hexa- di depan nama substituen.

ALKYL GROUPS

methyl $-CH_3$

ethyl $-CH_2CH_3$

propyl $-CH_2CH_2CH_3$

isopropyl $-CH(CH_3)_2$

butyl $-CH_2CH_2CH_2CH_3$

isobutyl $-CH_2CH(CH_3)_2$

sec -butyl $-CH(CH_3)CH_2CH_3$

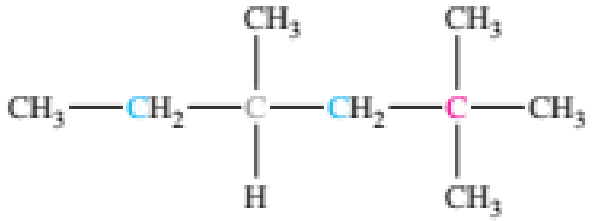
tert -butyl $-C(CH_3)_3$

ALKYL GROUPS

TABLE 26.1 Some Common Alkyl Groups

Common Name	IUPAC Name	Structural Formula
Methyl	Methyl	$-CH_3$
Ethyl	Ethyl	$-CH_2CH_3$
Propyl[a]	Propyl	$-CH_2CH_2CH_3$
Isopropyl	1-Methylethyl	CH_3CHCH_3 (CH$_3$ branch)
Butyl[a]	Butyl	$-CH_2CH_2CH_2CH_3$
Isobutyl	2-Methylpropyl	$-CH_2CHCH_3$ (CH$_3$ branch)
sec-Butyl[b]	1-Methylpropyl	$CH_3CHCH_2CH_3$ (CH$_3$ branch)
tert-Butyl[c]	1,1-Dimethylethyl	CH_3CCH_3 (CH$_3$ branch)

[a]In the past, the prefix *normal* or *n*- was used for a straight-chain alkyl group, such as *n*-propyl or *n*-butyl.
[b]*sec* = secondary
[c]*tert* = tertiary

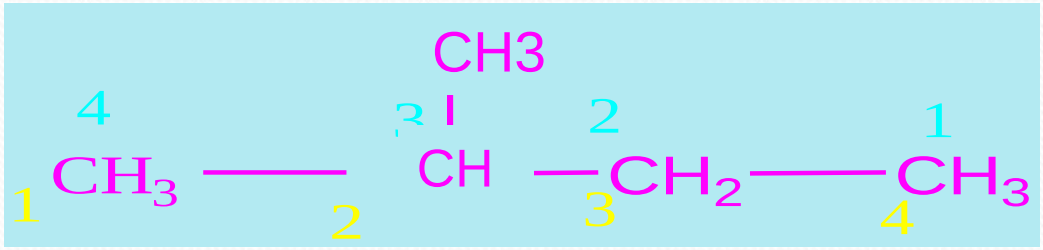


2,2,4-trimethylhexane

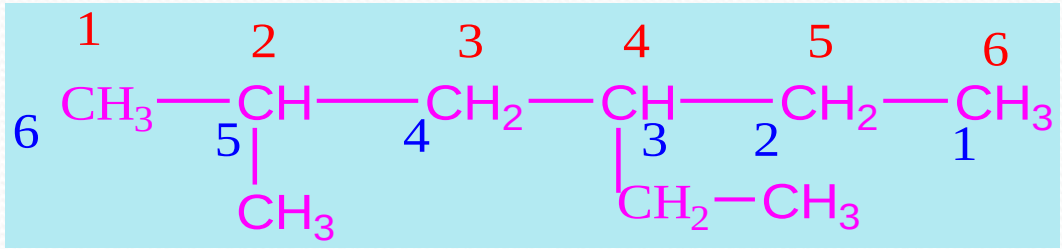
C = primary carbon
C = secondary carbon
C = tertiary carbon
C = quaternary carbon

▲ FIGURE 26-4
Classification of carbon and hydrogen atoms
In 2,2,4-trimethylhexane, there are five primary carbons (shown in black), two secondary carbon atoms (shown in blue), one tertiary carbon atom (shown in gray), and one quaternary carbon atom (shown in red). The hydrogen atoms bonded to a primary carbon atom are called primary hydrogen atoms. Similarly, secondary or tertiary hydrogens are bonded, respectively, to secondary or tertiary carbon atoms.

Contoh :

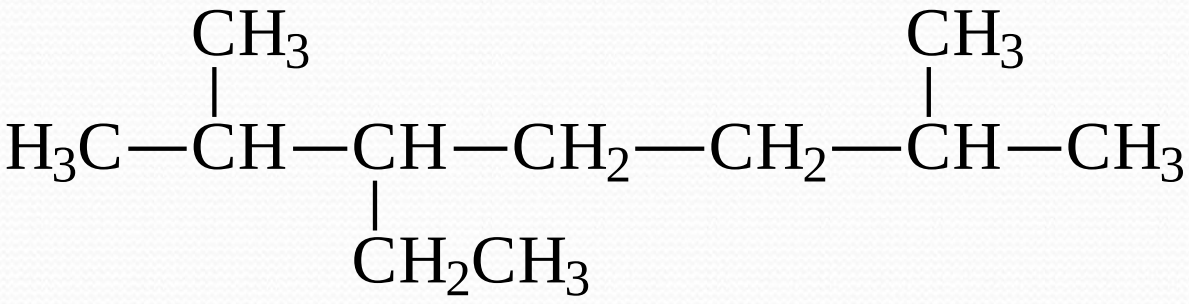


2-metilbutana



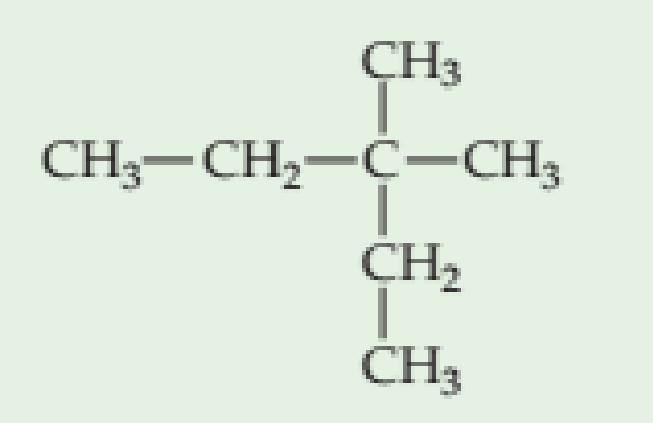
3-etil-5-metilheksana	3 + 5 = 8 ✗
4-etil-2-metilheksana	4 + 2 = 6 ✓

CONTOH :

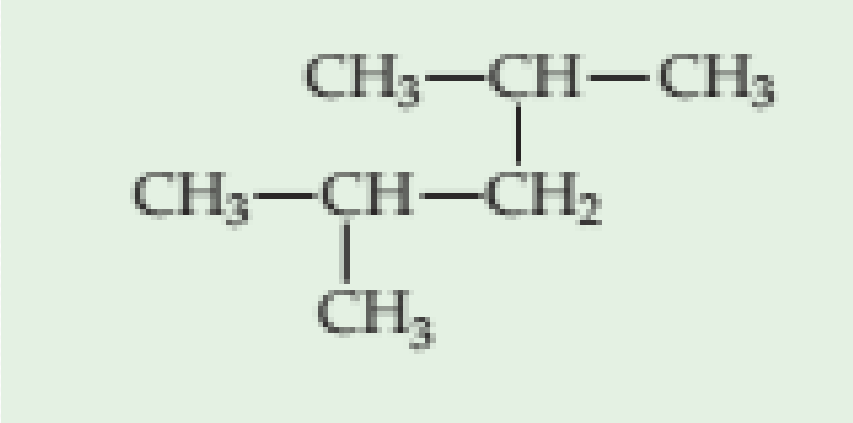


3-ethyl-2,6-dimethylheptane

Beri nama alkana dibawah ini sesuai tata nama !



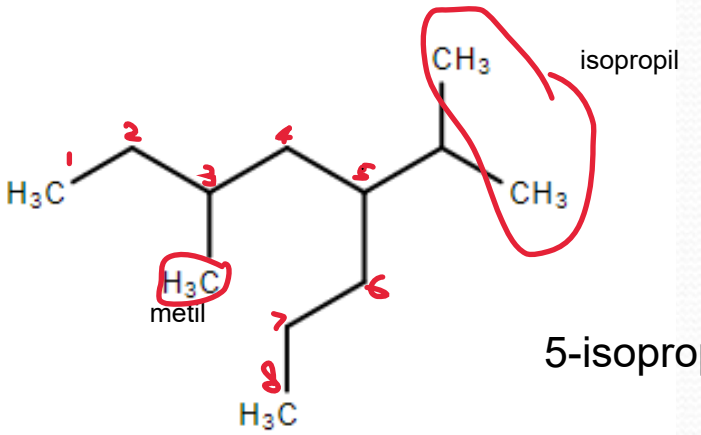
3,3-dimetilpentana



2,4-dimetilpentana

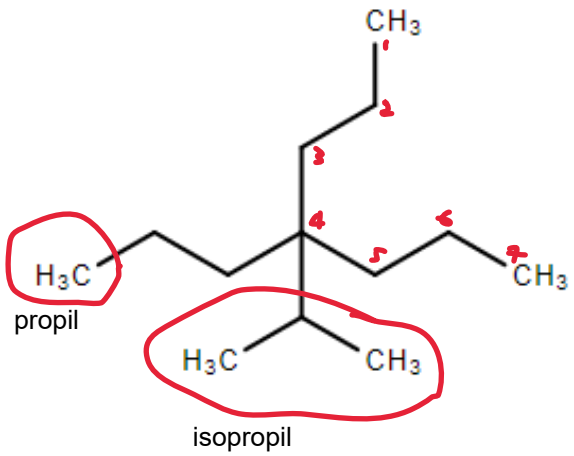
Beri nama alkana di bawah ini sesuai tata nama!

1.



5-isopropil-3-metiloktana

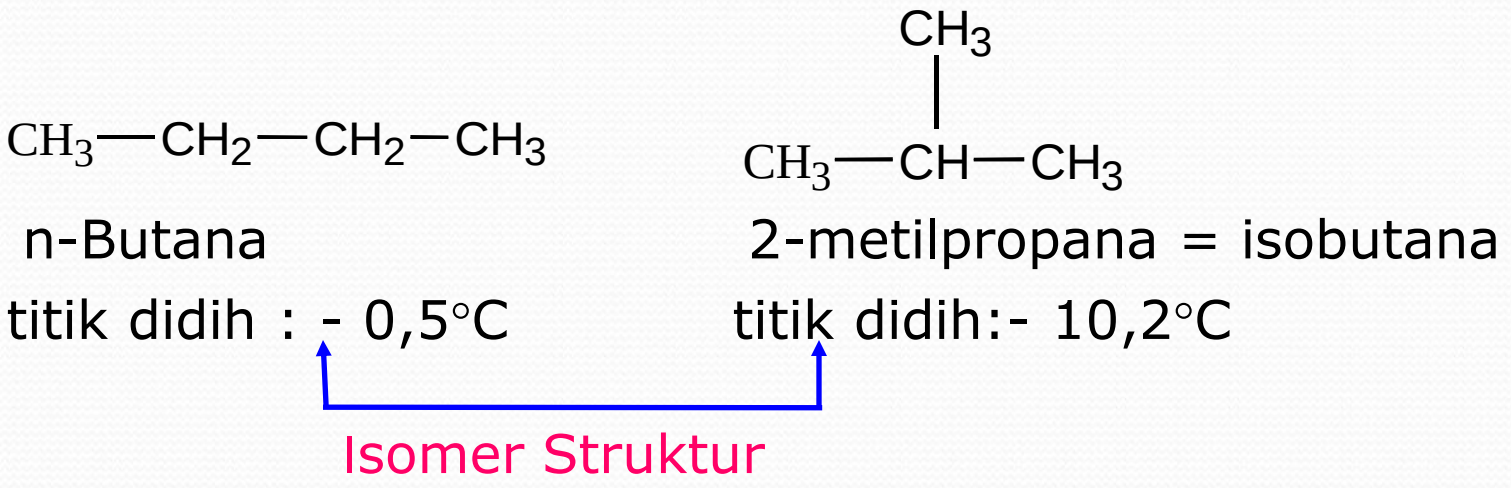
2.

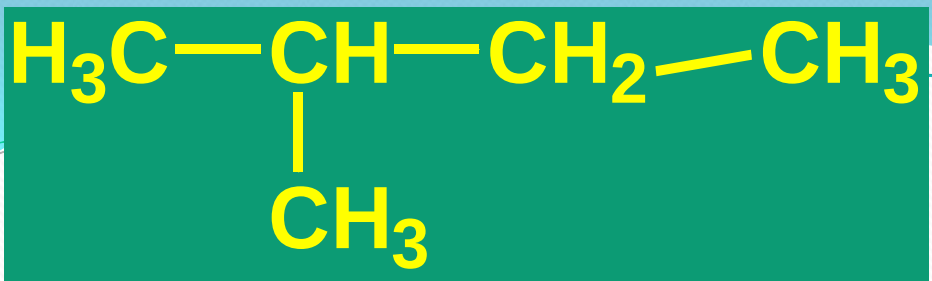


4-isopropil-4propilheptana

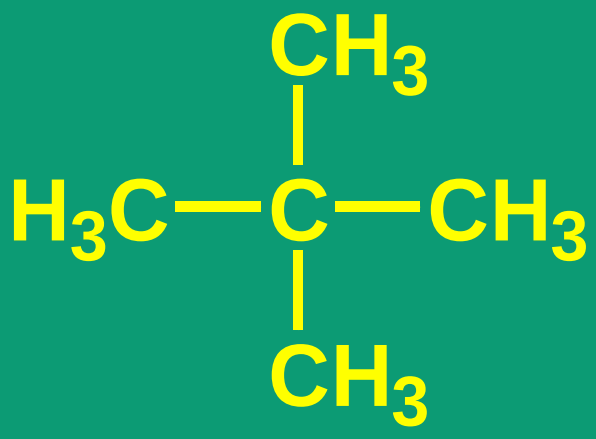
Struktur Isomer Alkana

- Dua atau lebih senyawa yang mempunyai rumus molekul sama tetapi letak atau urutan gugus yang terikat pada atom berbeda disebut **Isomer Struktur**.
- Alkana C = 1 – 3, tidak mempunyai isomer struktur.
- Untuk alkana C = 4 dst mempunyai isomer struktur.





Isopentane (= 2-methylbutane)



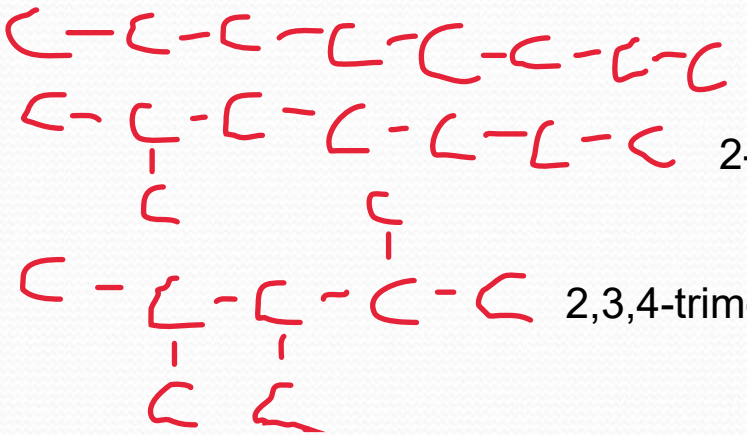
Neopentane (= 2,2-dimethylpropane)

Has the same molecular formula, C_5H_{12}

Sifat-sifat fisika berbeda : titik
lebur (m.p)
titik didih (b.p.)
density

Gambarkan isomer struktur senyawa di bawah ini!

- a. C_8H_{18} b. C_5H_{12} →

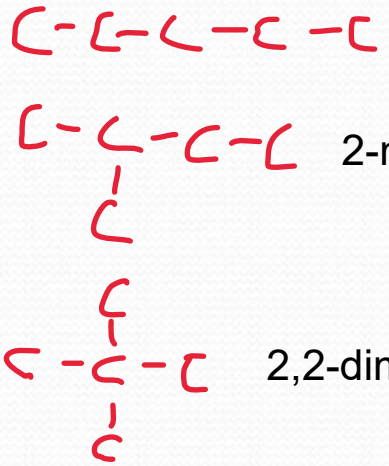


n-oktana

2-metilheptana

2,3,4-trimelpentana

dst...

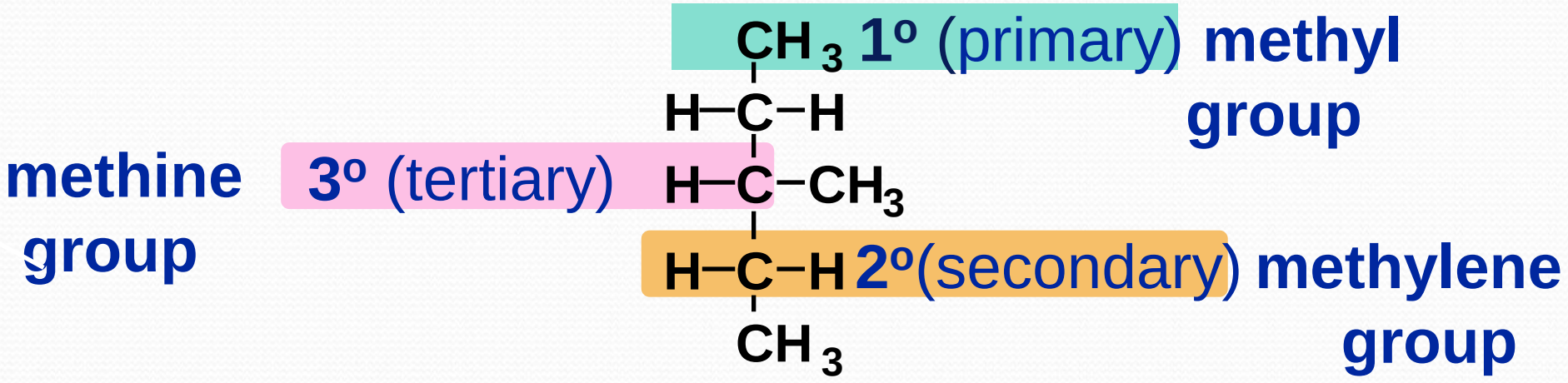


n-pentana

2-metilbutana

2,2-dimetilpropana

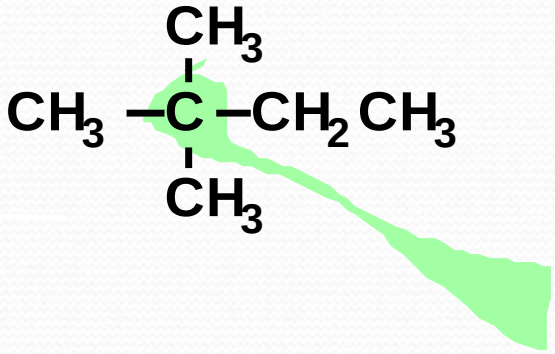
Classification of C & H atoms



H's on 1º C referred to as primary hydrogens

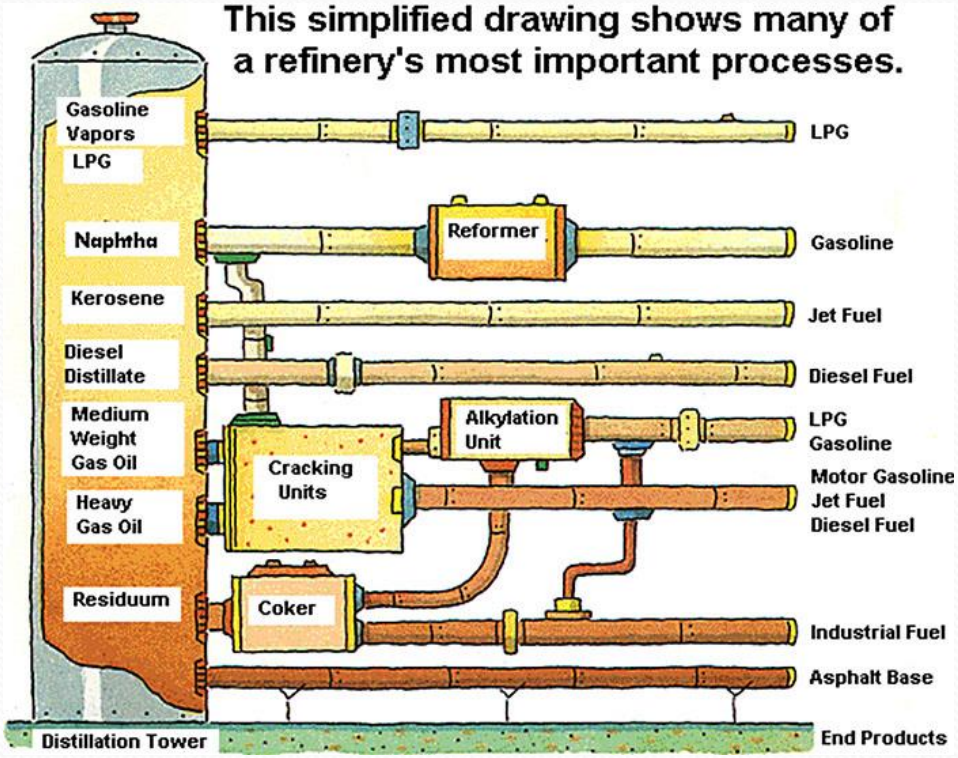
2º - secondary H

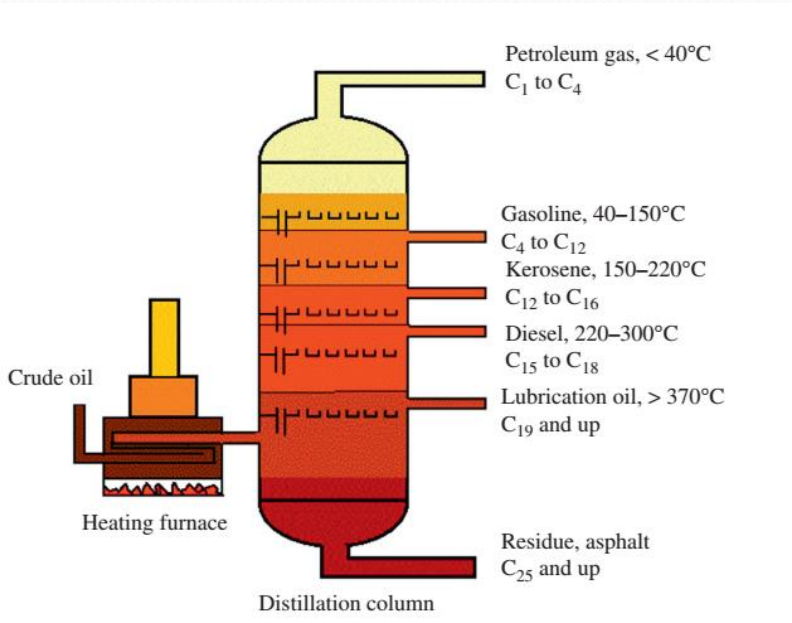
3º - tertiary H



4º quaternary carbon

CONTOH Alkana di alam



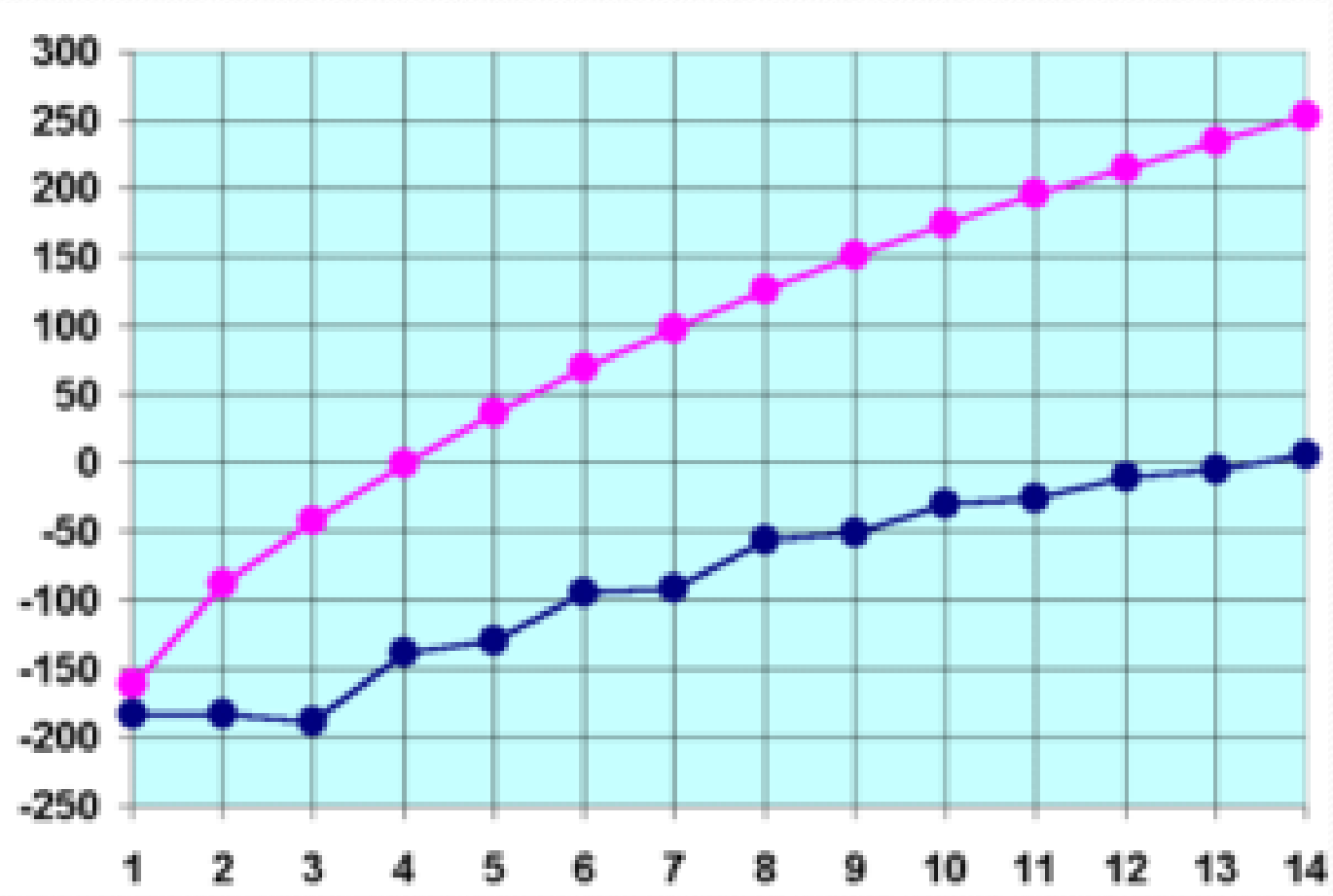


- **C_1-C_2: gases (natural gas)**
- **C_3-C_4: liquified petroleum (LPG)**
- **C_5-C_8: gasoline**
- **C_9-C_{16}: diesel, kerosene, jet fuel**
- **C_{17}-up: lubricating oils, heating oil**

SIFAT FISIKA

- Senyawa non polar, densitas <1, dengan air membentuk dua lapisan
- Larut dalam pelarut organik non polar
- Alkana C ≤ 4, berbentuk gas, Alkana C= 5-8, berbentuk cair, Alkana >C9, berbentuk padat
- Semakin besar jumlah atom C, Mr molekul semakin >, gaya dispersi tiap molekul >, titik didih semakin tinggi
- Alkana bercabang td < alkana rantai lurus padanannya
- Ada pengaruh gaya van der Waals antar molekul
- Ikatan tunggal mampu berotasi bebas

Melting (blue) and boiling (pink) points of the first 14 *n*-alkanes in °C.



Hubungan Mr thd Sifat Fisik

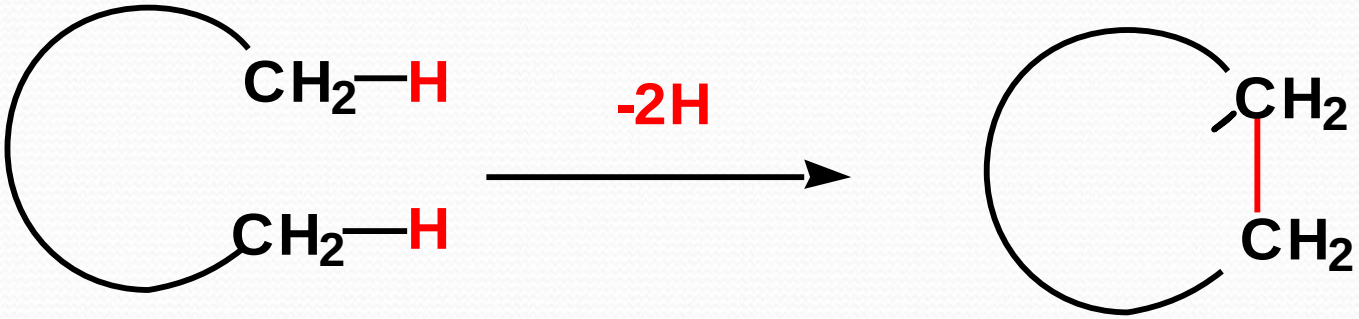
Nama	Rumus Molekul	Titik Lebur	Titik Didih	$\rho_{gr/ml}$
Metana	CH_4	- 182	- 164	gas
Etana	C_2H_6	- 183	- 88	gas
Propana	C_3H_8	- 190	- 42	gas
Butana	C_4H_{10}	- 138	0	gas
Pentana	C_5H_{12}	- 130	36	0,626
Hexana	C_6H_{14}	- 95	69	0,659
Heptana	C_7H_{16}	- 90	98	0,684
Oktana	C_8H_{18}	- 57	126	0,703
Nonana	C_9H_{20}	- 51	151	0,718

SIKLOALKANA

C_nH_{2n}

Sikloalkana

gabungan antar 2 ujung dari alkana jenuh



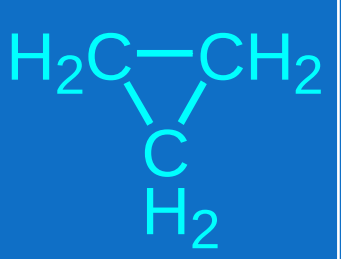
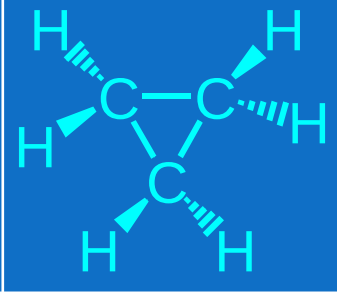
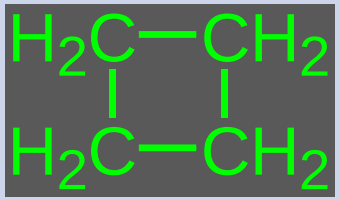
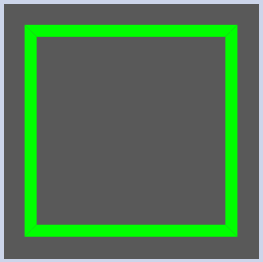
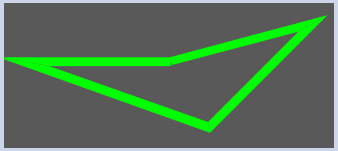
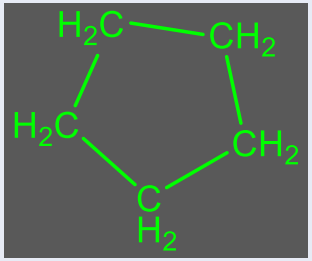
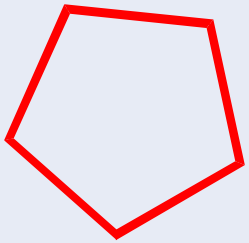
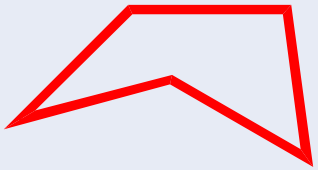
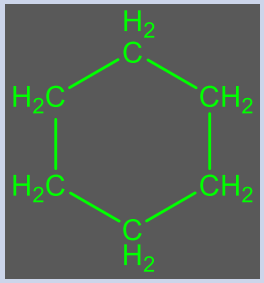
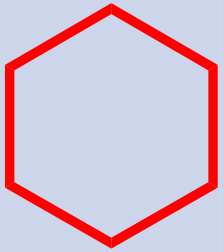
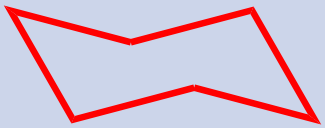
C_nH_{2n+2}

acyclic

$-H_2$

C_nH_{2n}

cyclic

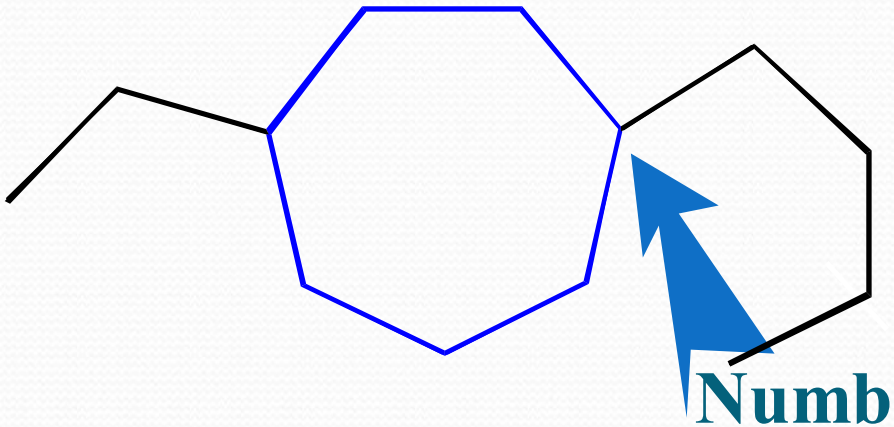
			**Siklopropana**	**Sudut ikatan 60°**
			**Siklobutana**	**Sudut ikatan 88°**
			**Siklopentana**	**Sudut ikatan 108°**
			**Sikloheksana**	**Sudut ikatan 109.5°**

TATA NAMA

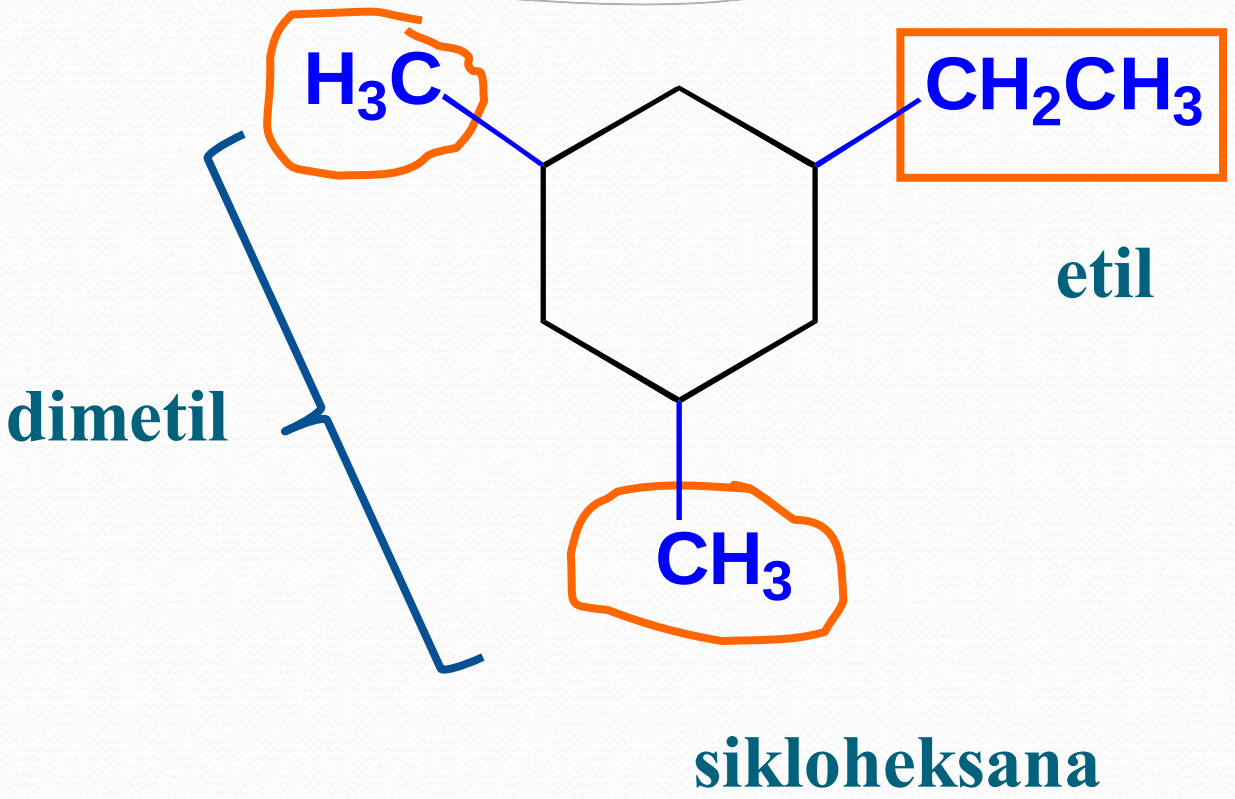
Substituen + sikloalkana

butil + etil + sikloheptana

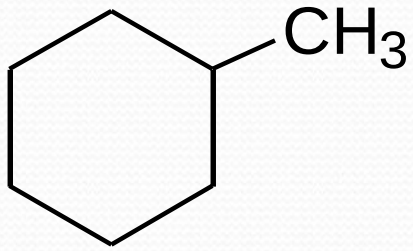
1-butil-4-etilsikloheptana



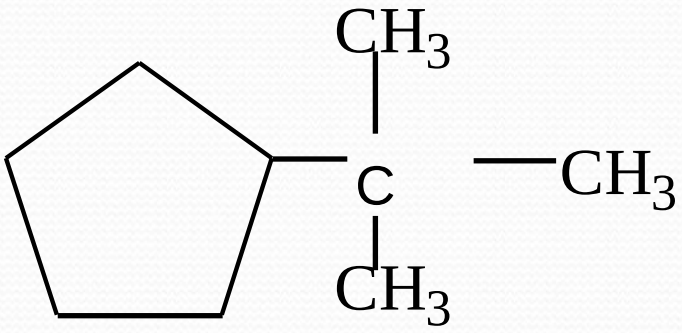
Number from the substituent(s)
the butyl group is at position 1



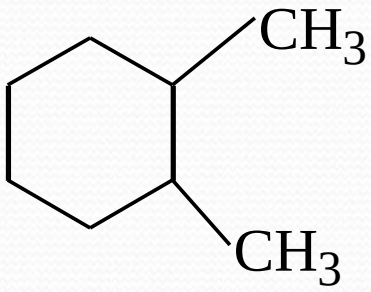
Nama : 1-etil-3,5-dimetilsikloheksana



metilsikloheksana



tert-butilsiklopentana



1,2-dimetilsikloheksana

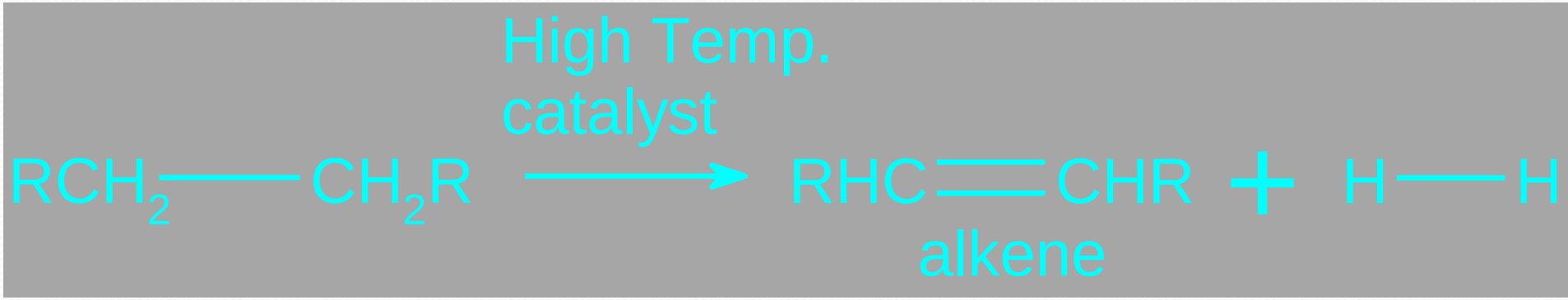
REAKSI ALKANA

1. Oksidasi Alkana

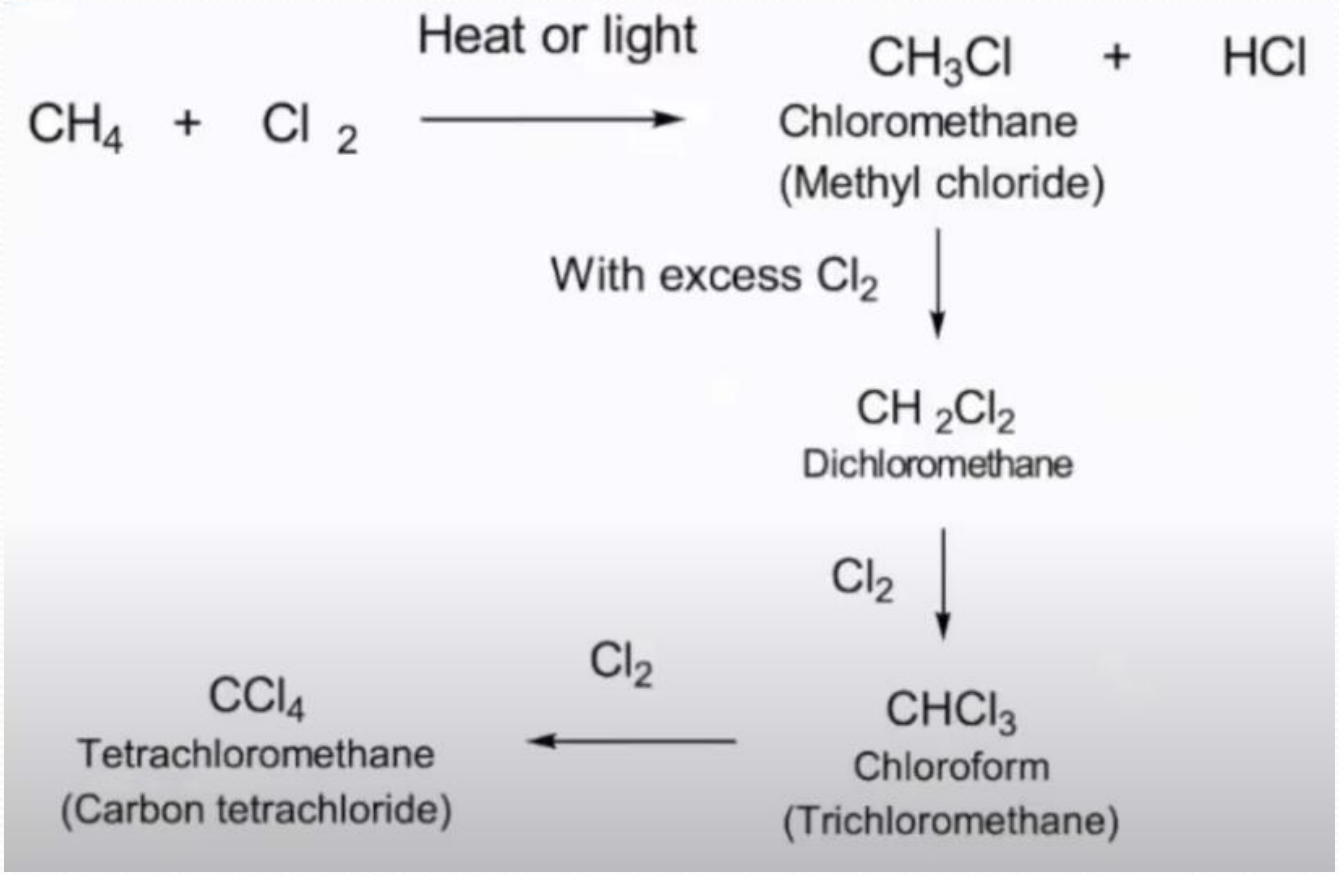
- Reaksi antara alkana (hidrokarbon) dengan O_2 dihasilkan karbondioksida, air dan energi.

$$CH_4 + O_2 \longrightarrow CO_2 + 2\ H_2O \qquad \Delta H = -212 \text{ kkal/mol}$$

2. Dehidrogenasi Alkana



3. Halogenasi Alkana



4. Catalytic Cracking

- Fragmentasi alkana ke dalam molekul yang lebih kecil
- Hasil reaksi campuran hidrokarbon tak jenuh dan gas H_2

Brian van Breehoven/Shutterstock

▲ A catalytic cracking unit (cat cracker) at a petroleum refinery.

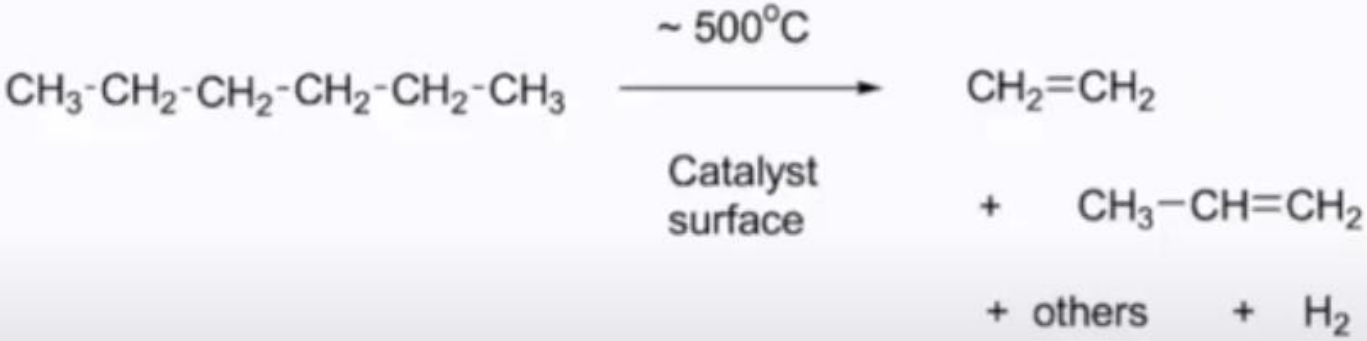
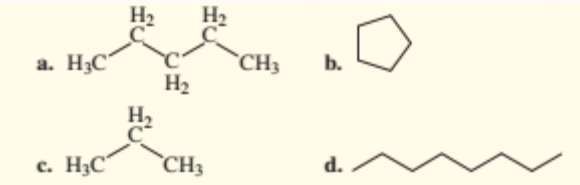


TABLE 26.4 Principal Petroleum Fractions

Boiling Range, °C	Composition	Fraction	Uses
Below 0	C_1 to C_4	Gas	Gaseous fuel
0–50	C_5 to C_7	Petroleum ether	Solvents
50–100	C_6 to C_8	Ligroin	Solvents
70–150	C_6 to C_9	Gasoline	Motor fuel
150–300	C_{10} to C_{16}	Kerosene	Jet fuel, diesel oil
Over 300	C_{16} to C_{18}	Gas–oil	Diesel oil, cracking stock
—	C_{18} to C_{20}	Wax–oil	Lubricating oil, mineral oil, cracking stock
—	C_{21} to C_{40}	Paraffin wax	Candles, wax paper
—	above C_{40}	Residuum	Roofing tar, road materials, waterproofing

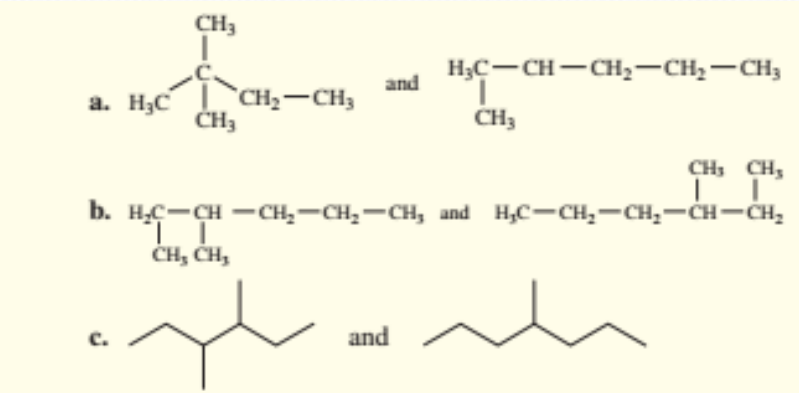
Silakan kerjakan latihan soal di bawah ini!

1. Berikan nama IUPAC untuk senyawa golongan alkana dan sikloalkana berikut!



a. n-pentana
b. n-siklopentana
c. n-propana
d.

2. Identifikasi apakah pasangan senyawa berikut merupakan isomer struktur atau molekul yang sama!



3. Gambarkan struktur senyawa golongan alkana dan sikloalkana berikut!
   a. 3-metilheksana
   b. etilsikloheksana
   c. nonana
   d. 2,3-dimetilbutana
   f. 2,2-dimetilpropana
   g. 4-etil-2,3-dimetilheksana
   h. 4-etil-2,2-dimetiloktana
   i. 3-etil-2-metilheptana
   j. metilsiklopropana

4. Berikan nama IUPAC untuk senyawa golongan alkana dan sikloalkana berikut!