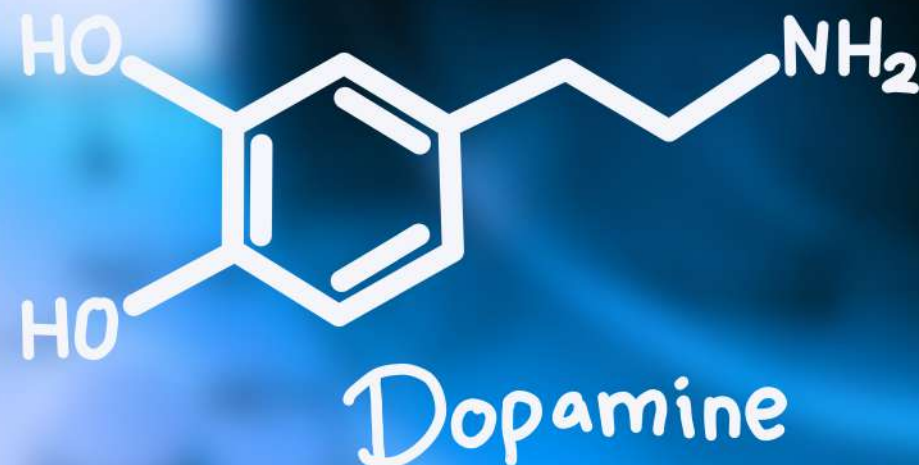


Organic 1



Subject: Lecture 3



Saturated Hydrocarbons

1. Alkanes

Structural Isomerism

→ from 4 carbon and up.

→ من هيدروكربونات لها نفس الصيغة الجزيئية وعدد C لكن تختلف في الترتيب

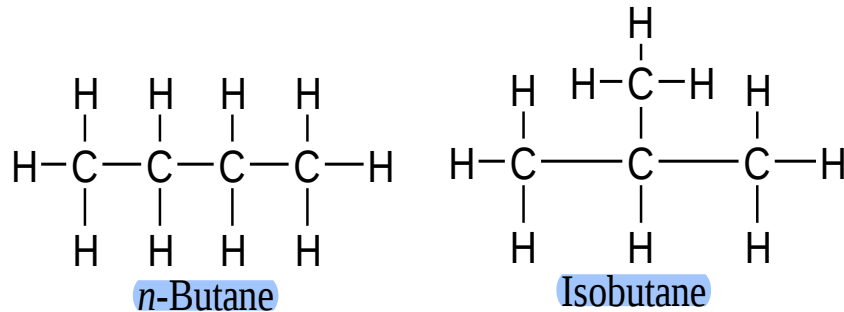
- **Isomers** are different compounds with identical molecular formulas.

The phenomenon is called *isomerism*.

- **Structural** or **constitutional isomers** are isomers which differ in the sequence of atoms bonded to each other.

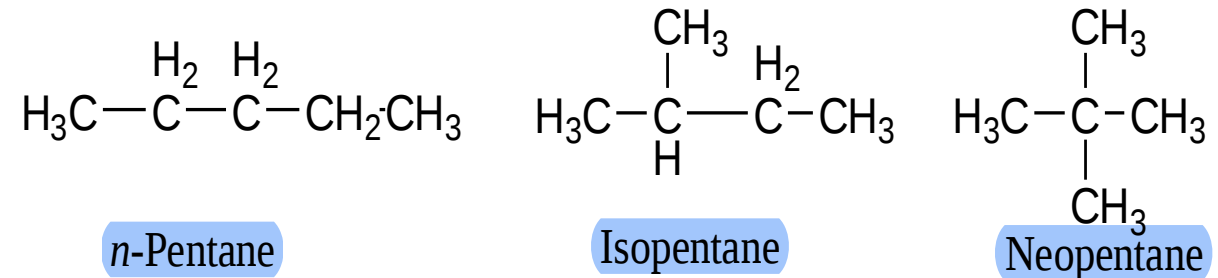
- **Examples:**

➤ Butanes, C_4H_{10} .



↳ don't miss the common names

➤ Pentanes, C_5H_{12} .

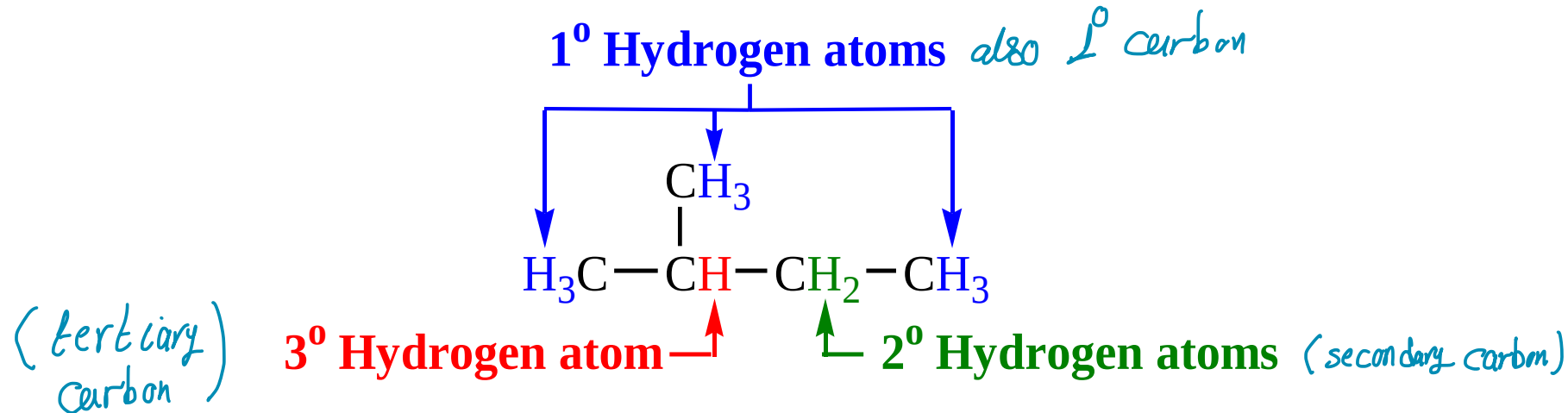


Saturated Hydrocarbons

1. Alkanes

Classes of Carbons and Hydrogen

- **Primary (1°) carbon** is one that is bonded to only **one other carbon**.
- **Secondary (2°) carbon** is one that is bonded to **two other carbons**.
- **Tertiary (3°) carbon** is one that is bonded to **three other carbons**.



- **Hydrogens** are also referred to as 1° , 2° , or 3° according to the type of carbon they are bonded to.

Saturated Hydrocarbons

1. Alkanes

Alkyl Groups

- An **alkyl group** is an alkane from which a hydrogen has been removed.

- General formula C_nH_{2n+1} .

- Alky group** is represented by **R**.

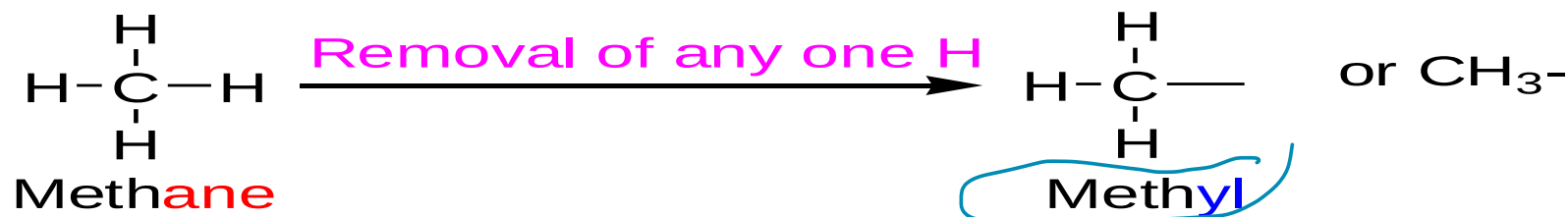
- Nomenclature of alkyl groups by

replacing the suffix **-ane** of the parent alkane by **-yl**.

i.e. $\text{Alkane} - \text{ane} + \text{yl} = \text{Alkyl}$

- Examples:

➤ Methane



$\text{CH}_3- (\text{Methane} - \text{ane} + \text{yl}) = \text{methyl}$

Alkane: C_nH_{2n+2}

alkane - H

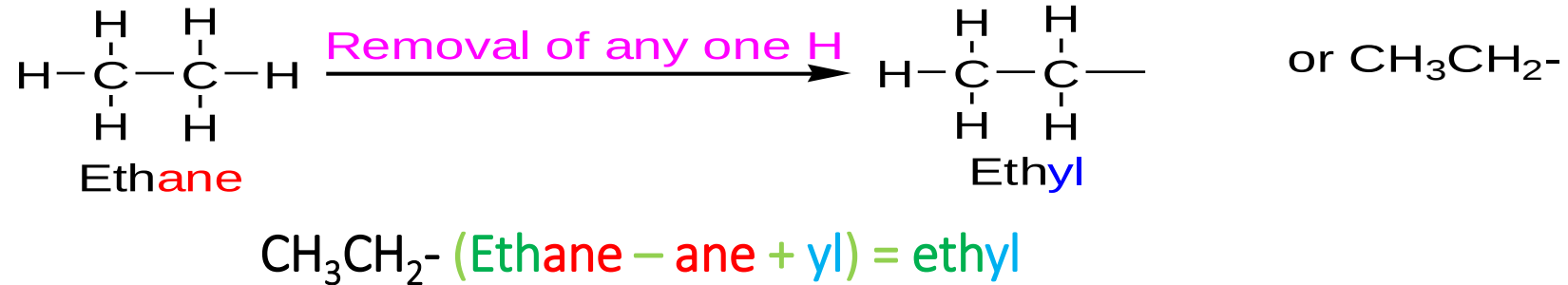
for alkyl

Saturated Hydrocarbons

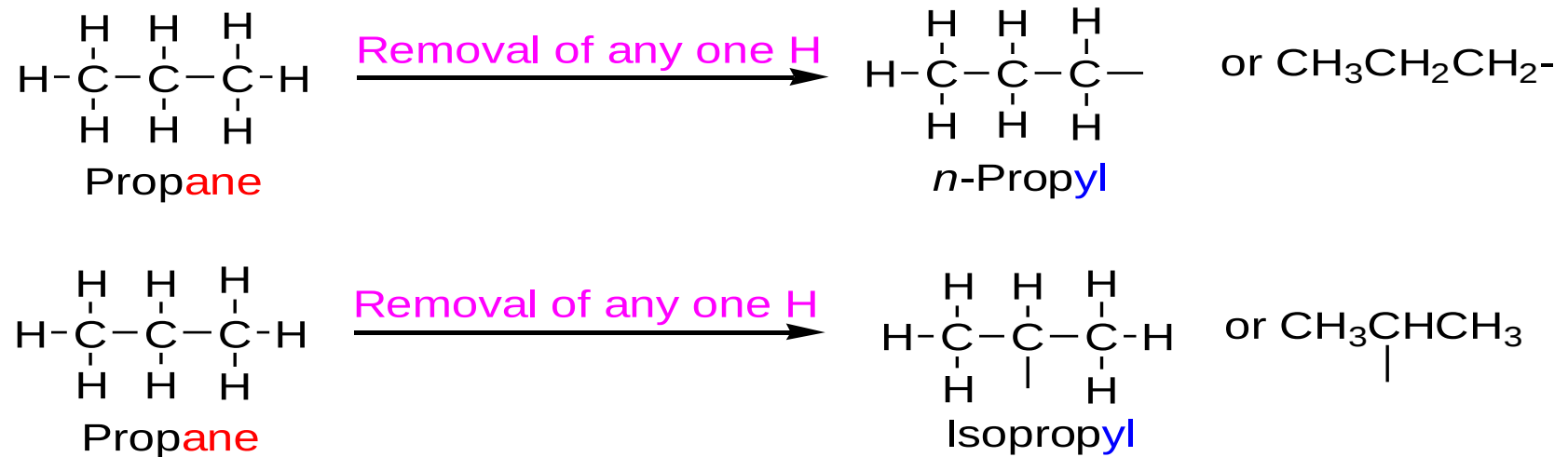
1. Alkanes

Alkyl Groups

➤ Ethane



➤ Propane



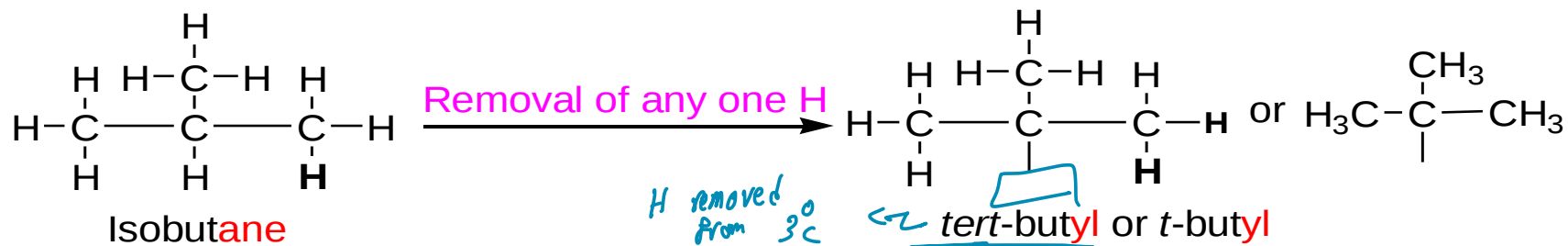
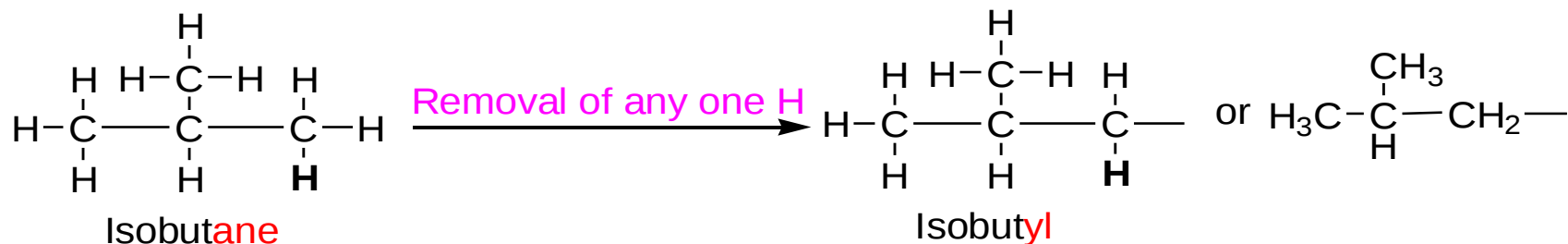
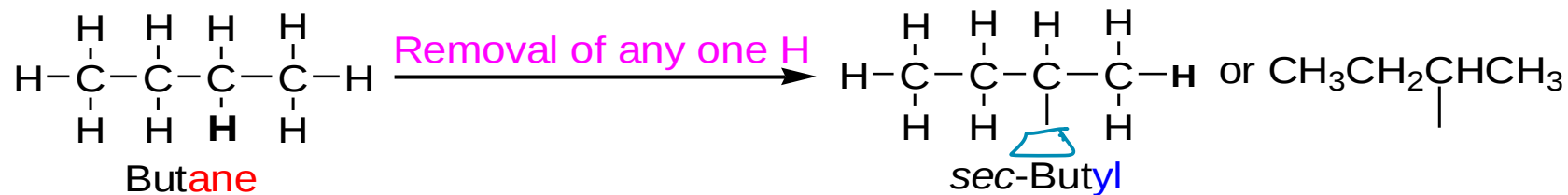
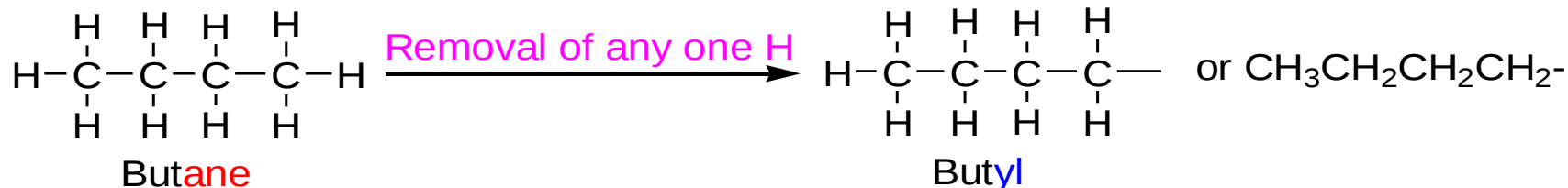
$$\text{Propane} - \text{ane} + \text{yl} = n\text{-propyl or isopropyl}$$

Saturated Hydrocarbons

1. Alkanes

Alkyl Groups

➤ Butane



Saturated Hydrocarbons

1. Alkanes

Alkyl Groups

Alkane		Alkyl Group	Abbreviation
$\text{CH}_3\text{—H}$ Meth ane	becomes	$\text{CH}_3\text{—}$ Methyl	Me—
$\text{CH}_3\text{CH}_2\text{—H}$ Eth ane	becomes	$\text{CH}_3\text{CH}_2\text{—}$ Ethyl	Et—
$\text{CH}_3\text{CH}_2\text{CH}_2\text{—H}$ Prop ane	becomes	$\text{CH}_3\text{CH}_2\text{CH}_2\text{—}$ Propyl	Pr—
$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{—H}$ But ane	becomes	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{—}$ Butyl	Bu—

1. Alkanes

Nomenclature

التسمية

- Most organic compounds are known by two or more names:

- The older **unsystematic** names, (*Common names*). ➤
- The **IUPAC** names.

حفظ حسب
كل مركب

System

International Union of Pure & Appplied Chemistry

استنادا حسب
القوانين للسمية

Saturated Hydrocarbons

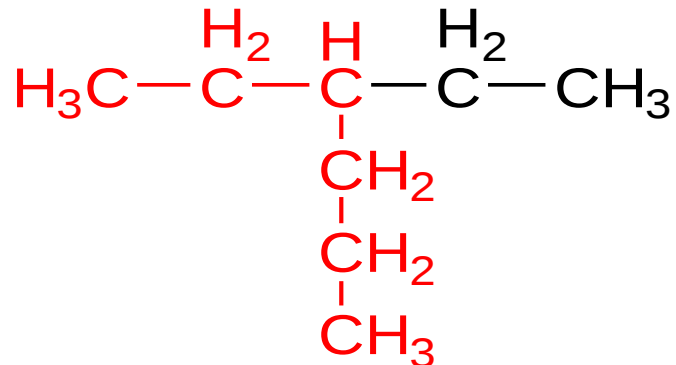
1. Alkanes

Nomenclature

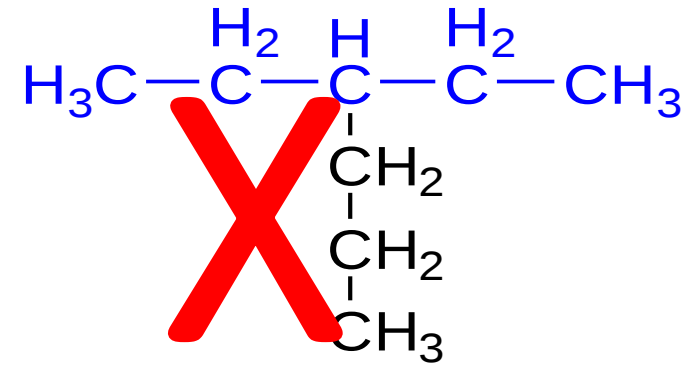
The IUPAC Rules

1) Select the parent structure .

the longest continuous chain



Ethyl hexane



Propyl pentane

not

هو مو فروني ان ا طول سلسلة تكون مستقيمة

The **longest continuous** chain is **not** necessarily **straight**.

الطول سلسلة ه دفن افطاري ه ا كثر عدد فروعها

also called parent chain



Saturated Hydrocarbons

1. Alkanes

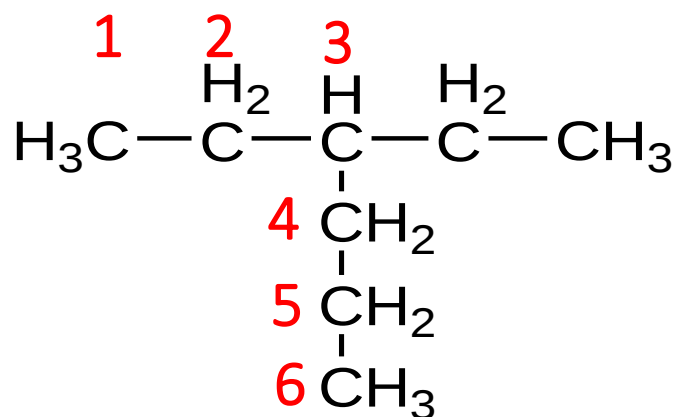
Nomenclature

The IUPAC Rules

2) Number the carbons in the parent chain

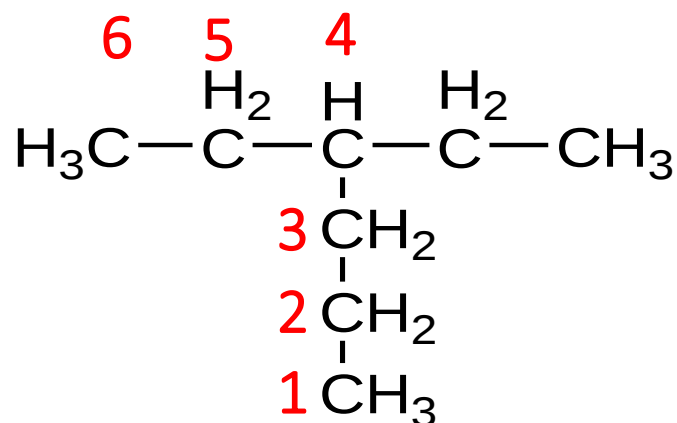
من زبلش ترقيم بحيث يكون التدرج عند الرقم الأقل .

starting from the end which gives the lowest number for the substituent



not

3-Ethyl hexane



4-Ethyl hexane

X

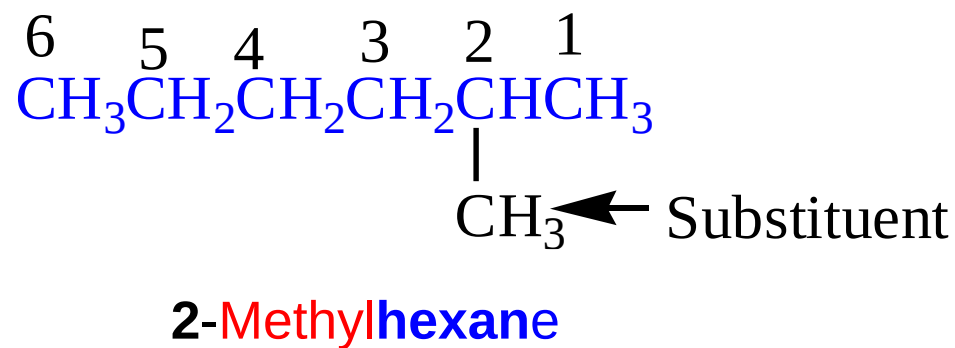
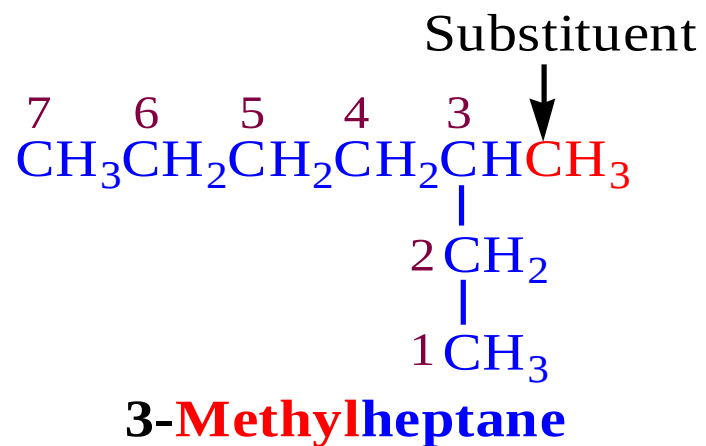
Saturated Hydrocarbons

1. Alkanes

Nomenclature

The IUPAC Rules

2) Number the carbons in the parent chain



1. Alkanes

Nomenclature

The IUPAC Rules

To name the compound;

- 1) The position of the substituent on the parent carbon chain by a number.
- 2) The number is followed by a hyphen (-).
- 3) The combined name of the substituent (ethyl).
- 4) The parent carbon chain (hexane)

3 - Ethyl hexane

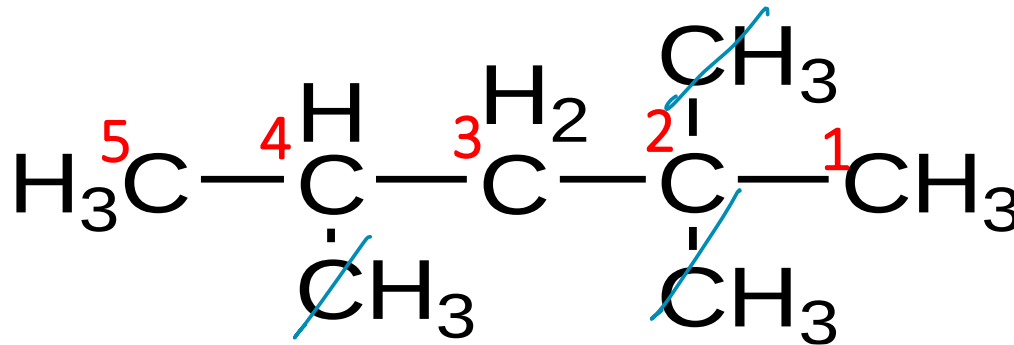
Saturated Hydrocarbons

1. Alkanes

Nomenclature

The IUPAC Rules

- 3) If the **same alkyl substituent** occurs more than once on the parent carbon chain, the prefixes ²di-, ³tri-, ⁴tetra-, ⁵penta-, and so on are used to indicate **two**, **three**, **four**, **five**, and so on.



g: comma
between numbers

dash ~
after num

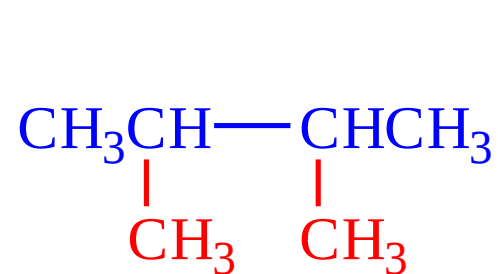
2,2,4- Tri methyl pentane
}

Saturated Hydrocarbons

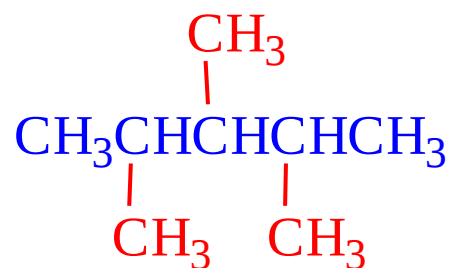
1. Alkanes

Nomenclature

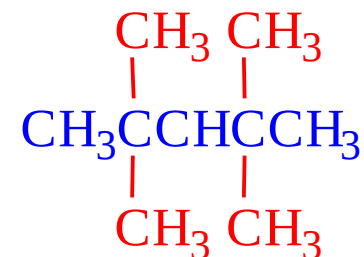
The IUPAC Rules



2,3-**Dimethyl**butane



2,3,4-**Trimethyl**pentane



2,2,4,4-**Tetramethyl**pentane

Saturated Hydrocarbons

1. Alkanes

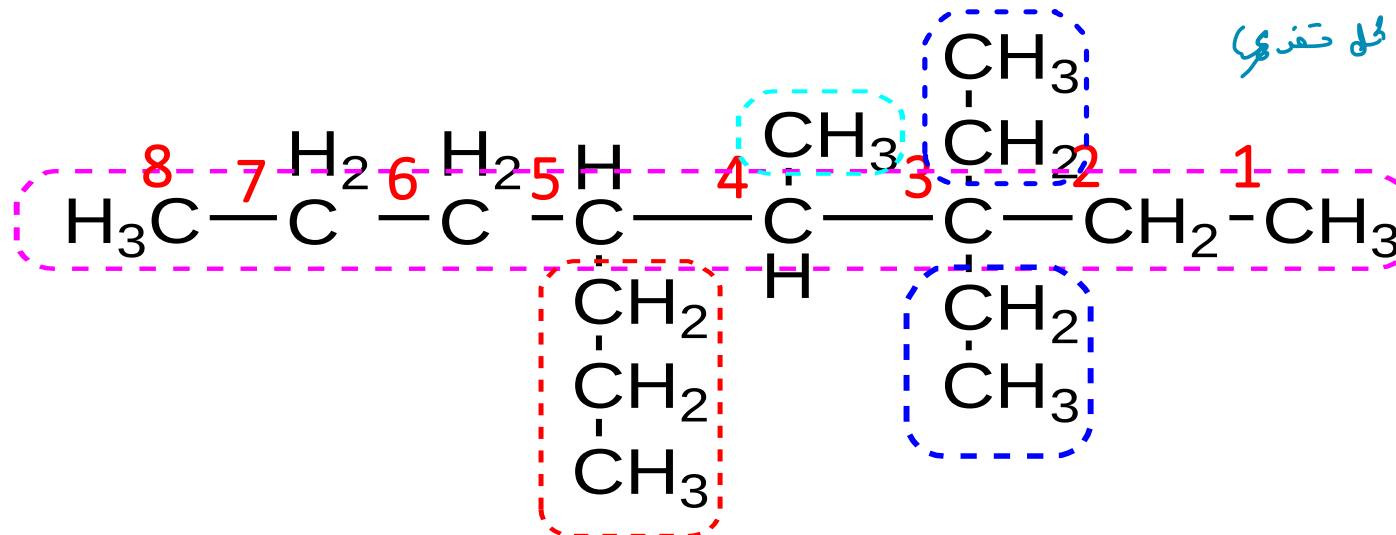
Nomenclature

The IUPAC Rules

4) If **different alkyl substituents** are attached on the parent carbon chain,

they are named in order of **alphabetical order**.

حسب الأجدية
(تدريج الحروف في أولها)



3,3- di ethyl
4- methyl
5- propyl

3,3-Diethyl -4-methyl -5-propyl octane

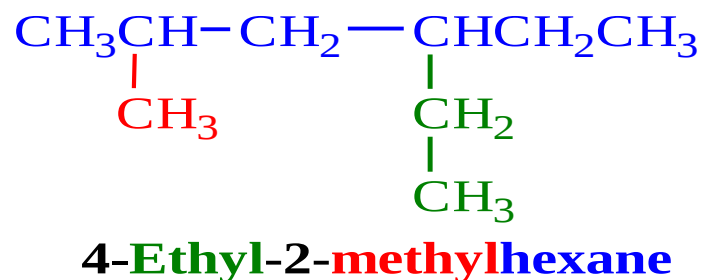
Saturated Hydrocarbons

1. Alkanes

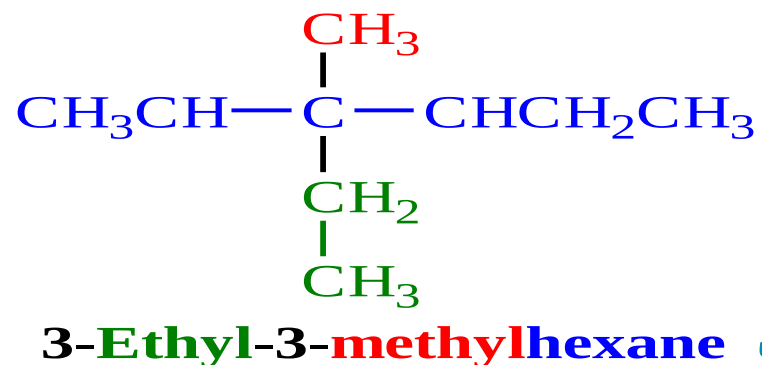
Nomenclature

The IUPAC Rules

Note that each substituent is given a number corresponding to its location on the longest chain. The substituent groups are listed alphabetically.



5) When two substituent are present on the same carbon, use the number twice.



3-E before 4

Saturated Hydrocarbons

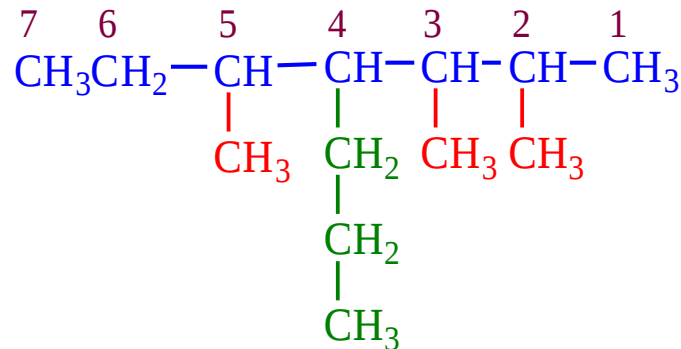
1. Alkanes

Nomenclature

The IUPAC Rules

- 6) When two chains of equal length compete for selection as the parent chain, choose the chain with the greater number of substituents.

اگر بھتر عدد متفرع ہے



2,3,5-Trimethyl-4-n-propylheptane

؟ iso حقیقتاً n پیش
branching لہذا ان
صاف سے الگ
مستند من الہیہ

↓
street not iso

min 24 in the record

Saturated Hydrocarbons

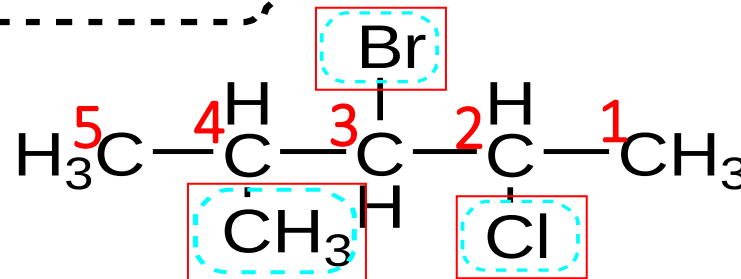
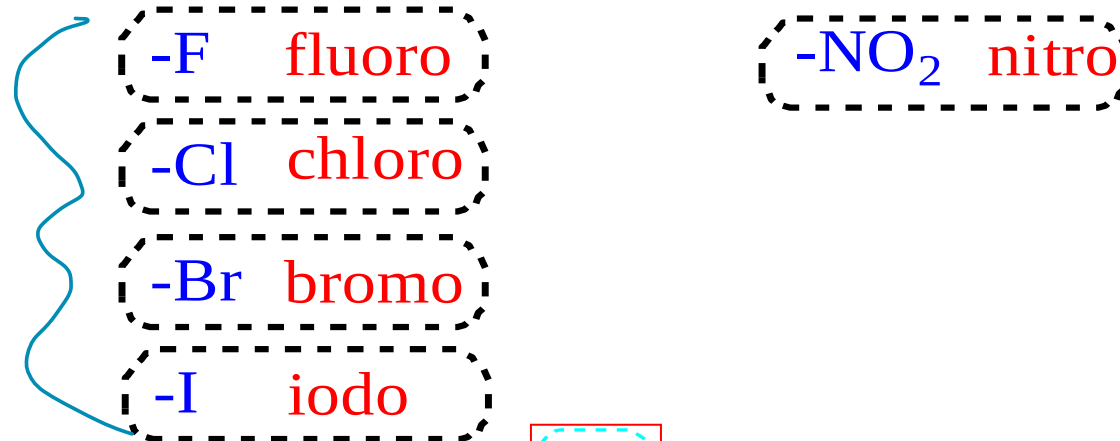
1. Alkanes

Nomenclature

The IUPAC Rules

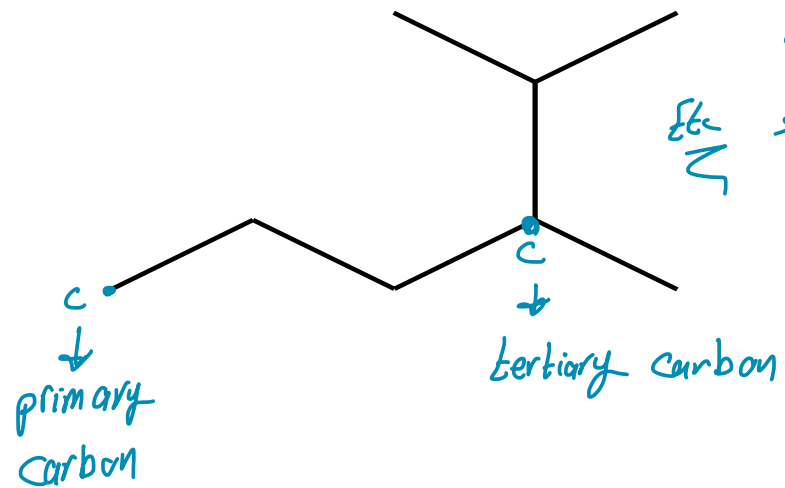
7) If **substituents other than alkyl groups** are also presents on the parent carbon chain; **all substituents are named alphabetically.**

له الترقيم حسب الأجدية
+ الأولوية للمركبات هـ

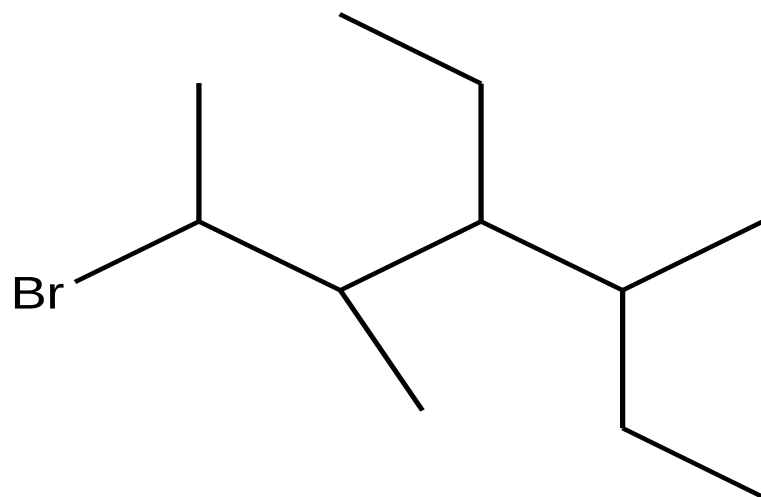
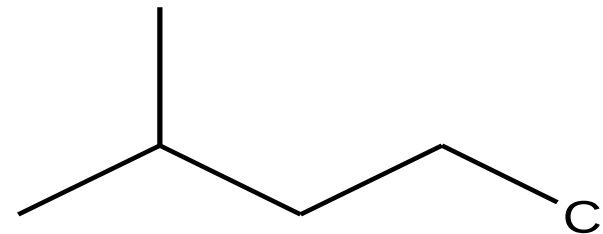


2-chloro
3-bromo
4-methyl

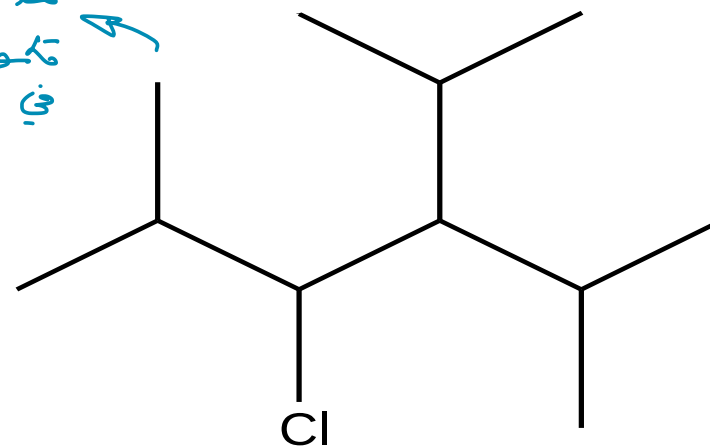
3-bromo -2-chloro -4-methyl pentane

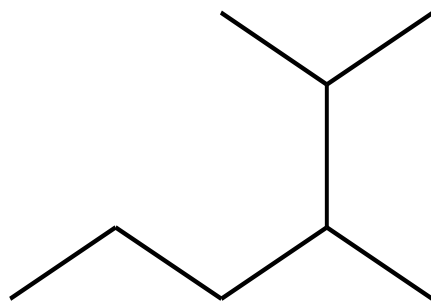


لكه لعل زاوية أو ختاية هي عبارة عن عن
 إذا كانت مستوية زي Cl / Br و عن



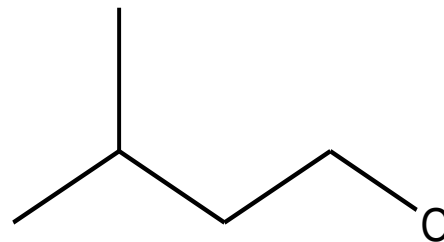
عدلت الدرجة حيث
 تكون مطابقة للإجابة
 في ١٠ مائة إجابي .





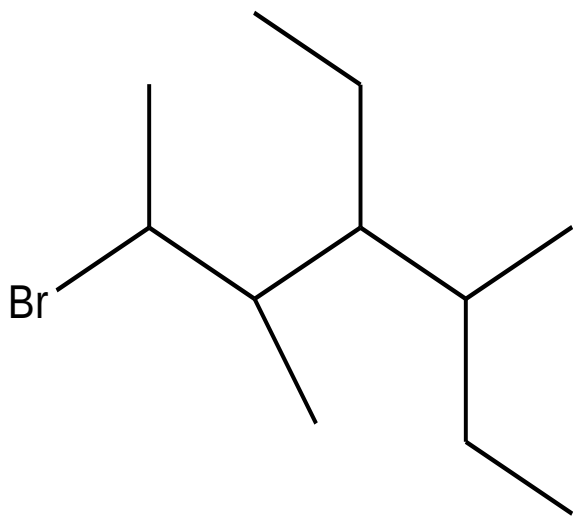
2,3-Dimethyl-hexane

#3: Please note: Alphabetic order of prefixes ignored while selecting parent chain

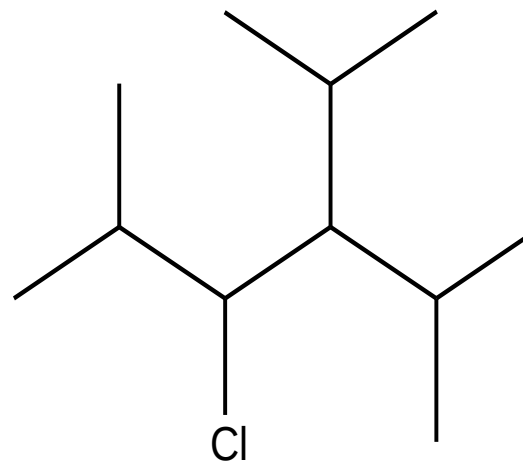


1-Chloro-3-methyl-butane

#3: Please note: Alphabetic order of prefixes ignored while selecting parent chain



2-Bromo-4-ethyl-3,5-dimethyl-heptane



3-Chloro-4-isopropyl-2,5-dimethyl-hexane

#3: Please note: Alphabetic order of prefixes ignored while selecting parent chain

1. Alkanes

Sources of Alkanes

- The two principal sources of alkanes are **petroleum** and **natural gas**.

Petroleum and natural gas constitute the chief sources of المصادر الرئيسية

- Alkanes up to 40 Carbons يصل عدد 40

من عطرية - Aromatic

حلقية (- Alicyclic (Cyclic aliphatic hydrocarbons)

- Heterocyclic خبيث متجانسة

Saturated Hydrocarbons

1. Alkanes

Sources of Alkanes

Petroleum Refining

Some components of refined petroleum

min 40 → in less record

في الأرقام مشي لخفض
فقط استعمالها كمنبي

Fraction	Boiling range (°C)	Carbon content
Gas	Below 20	C1 – C4
Petroleum ether	20 – 60	C5 – C6
Naphtha	60 – 100	C6 – C7
Gasoline	40 – 200	C5 – C10
Kerosine	175 – 325	C11 – C18
Gas oil	300 – 500	C15 – C40
Lubricating oil, asphalt, petroleum coke and paraffins	Above 400	C15 – C40

Saturated Hydrocarbons

1. Alkanes

Physical Properties

Physical Properties of Alkanes, Alkenes and Alkynes

Those properties that can be observed without the compound undergoing a chemical reaction.

A. Physical States

C1 (C2) to C4 are gases, غازات

C5 to C17 are liquids, سوائل

C18 and larger alkanes are wax-like solids.

بين الصلب
واللزج

B. Solubility

الذائبة

- Alkanes, Alkenes and Alkynes are **nonpolar** compounds.
- Their solubility “**Like dissolve like**”
- Alkanes, Alkenes and Alkynes are **soluble** in the **nonpolar solvents**;
carbon tetrachloride, CCl_4 and benzene, فيها في المذيب
- Alkanes, Alkenes and Alkynes are **insoluble** in **polar solvents** like **water**.

تذوب في الغير قطبي
ولا تذوب في القطبي