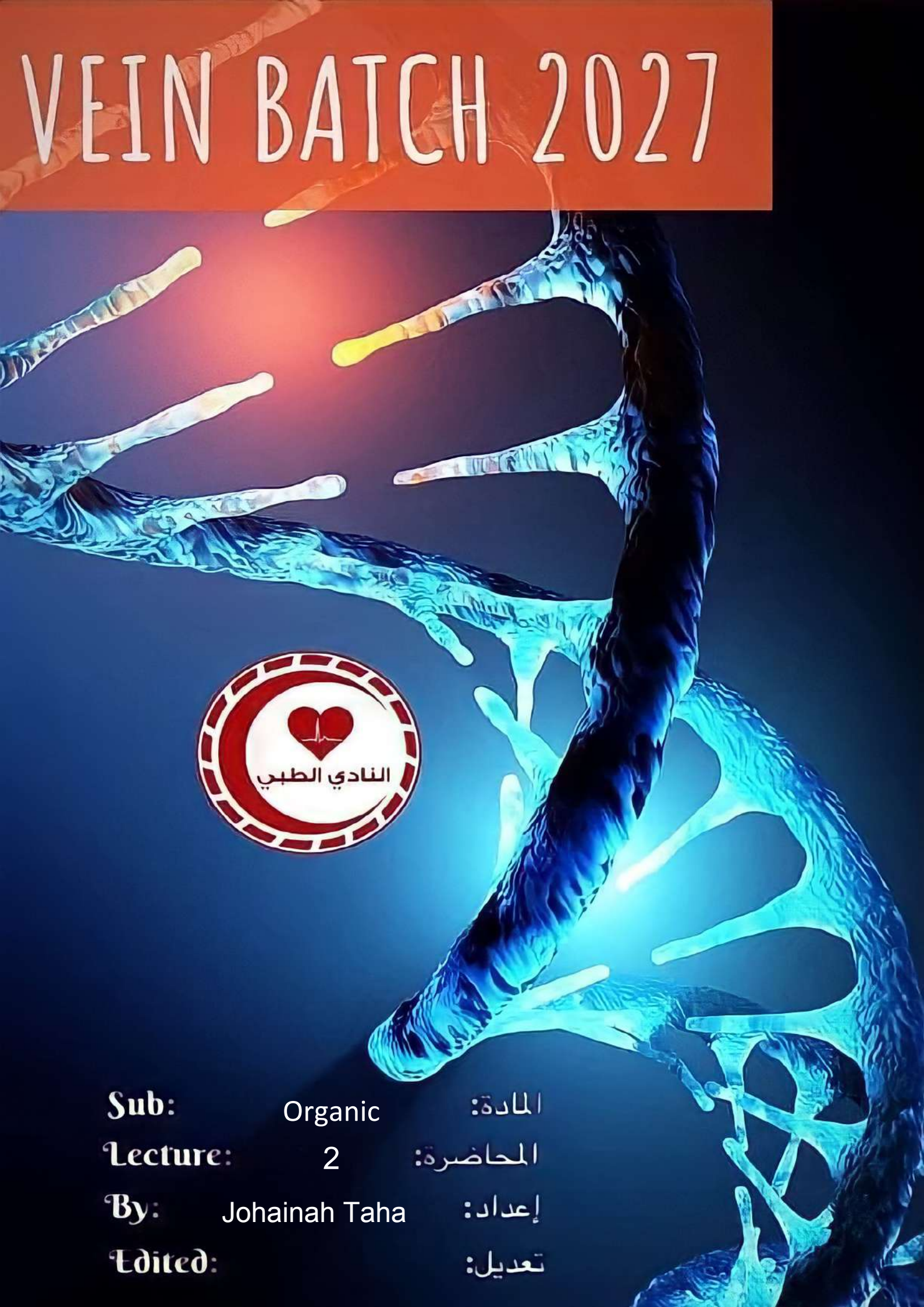
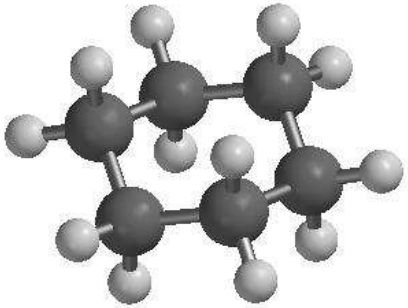
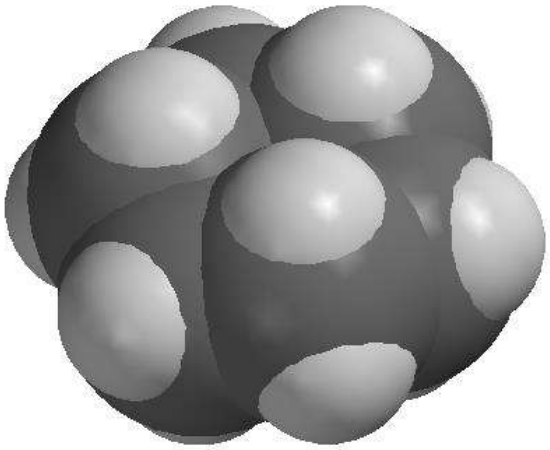
VEIN BATCH 2027



النادي الطبي

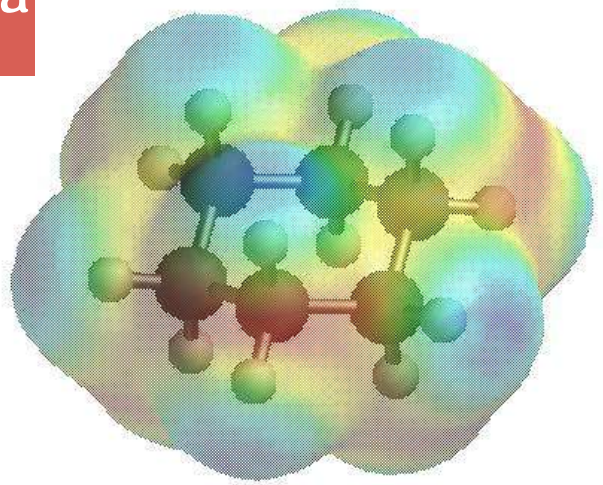
Sub:	Organic	المادة:
Lecture:	2	المحاضرة:
By:	Johainah Taha	إعداد:
Edited:		تعديل:





Chapter 2: Alkanes and Cycloalkanes: Conformational and Geometric Isomers

Done by : Johainah Taha

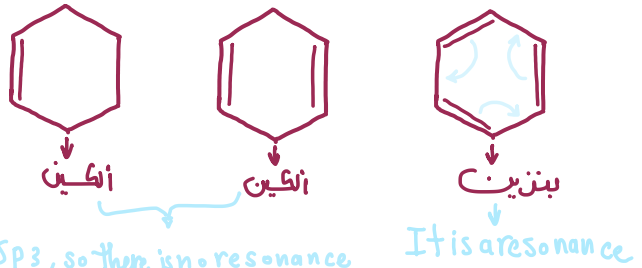


Record 3 → 44 : 25

Types of Hydrocarbons

Hydrocarbons are compounds that only contain C and H atoms.

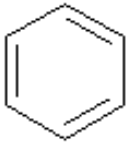
سؤال ؟ شو الفرق بين البنزين والألكين ؟؟



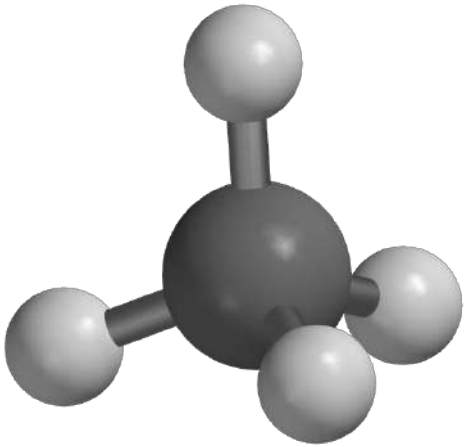
Hydrocarbons

مشبع Saturated
(contain only C-C single bonds)

غير مشبع Unsaturated
(contain C-C double or triple bonds)

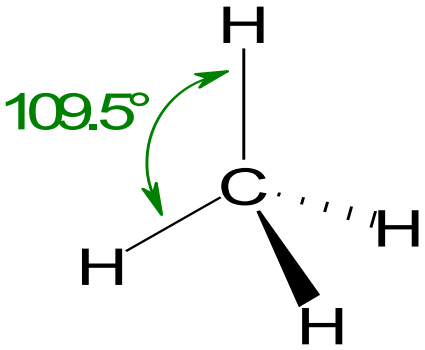
① alkanes ② cycloalkanes	① alkenes (double bond)	alkynes (triple bond)	arenes
H_3C-CH_3	$H_2C=CH_2$	$HC\equiv CH$	
Only CC σ bonds all C sp^3 hybridized	CC σ and π bonds C=C sp^2 hybridization	CC σ and 2 π bonds C≡C sp hybridization	6 C ring with alternating σ and π bonds
Aliphatic (إليفاتية)			Aromatic (أروماتية)

Structure of Alkanes



Alkanes are saturated hydrocarbons, that is they contain the maximum number of H atoms possible for the number of C atoms present.

The generic (عام) formula (صيغة) for an alkane is:
C_nH_{2n+2} Ex: CH_4 - C_3H_8

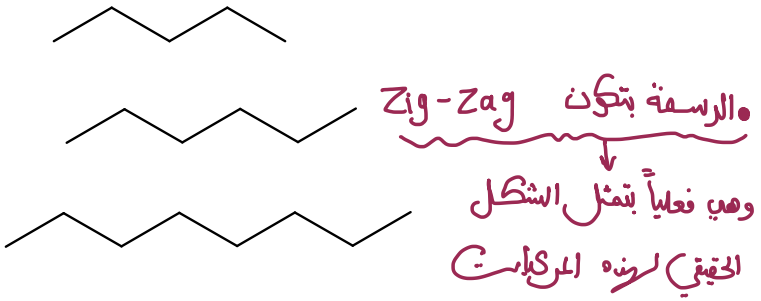


This means every C atom is sp^3 hybridized with bond angles of ~109.5°

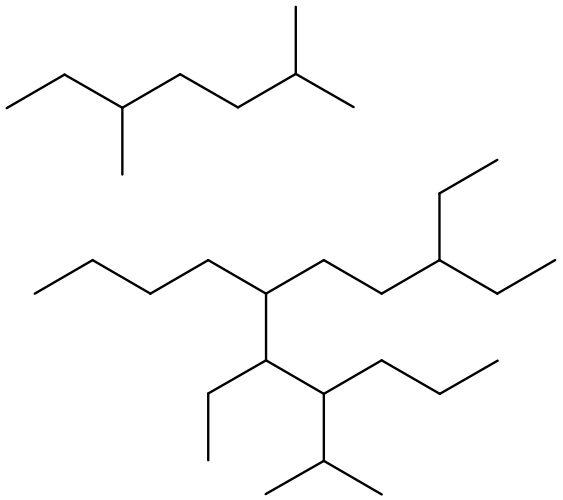
*Tetrahedral molecular geometry.

Structure of Alkanes (cont'd)

Alkanes can come in two forms, normal (or linear) and branched. Branched alkanes can have branched branches. Therefore the number of isomers possible growths quickly

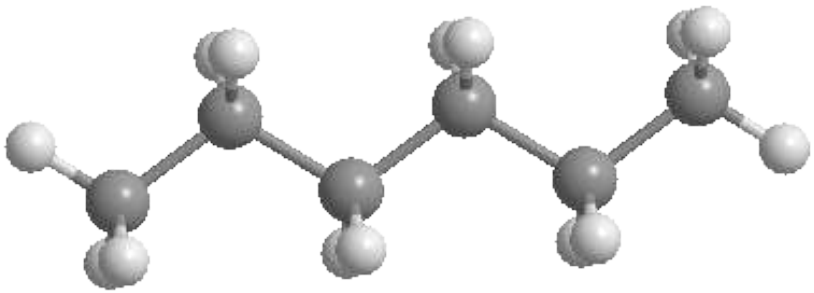


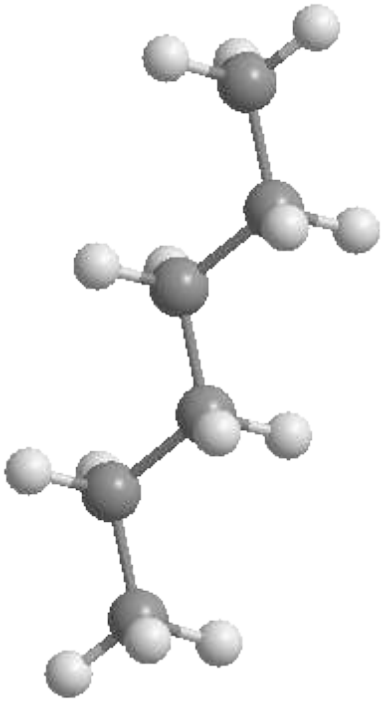
Normal, unbranched (or linear)



branched

Structure of Alkanes (cont'd)





Nomenclature of Organic Compounds (التسمية)

A. Common names In the early days of organic chemistry, each new compound was given a name that was usually based on its source (1) or use (2).

B. IUPAC

The IUPAC name of any compound contains **3 parts :**

IUPAC name= Prefix (3) + parent (1) + suffix (2)

Prefix :What and where substituents (التفرعات). → third step.

Parent (Root) : longest chain → first step

Suffix : functional group. , whether it is alcohol, or alkel .... etc. → Second name

Table 2.1 Names and Formulas of the First Ten Unbranched Alkanes

Name	Number of carbons	Molecular formula	Structural formula	Number of structural isomers
methane	1	CH_4	CH_4	1
ethane	2	C_2H_6	CH_3CH_3	1
propane	3	C_3H_8	$CH_3CH_2CH_3$	1
butane	4	C_4H_{10}	$CH_3CH_2CH_2CH_3$	2
pentane	5	C_5H_{12}	$CH_3(CH_2)_3CH_3$	3
hexane	6	C_6H_{14}	$CH_3(CH_2)_4CH_3$	5
heptane	7	C_7H_{16}	$CH_3(CH_2)_5CH_3$	9
octane	8	C_8H_{18}	$CH_3(CH_2)_6CH_3$	18
nonane	9	C_9H_{20}	$CH_3(CH_2)_7CH_3$	35
decane	10	$C_{10}H_{22}$	$CH_3(CH_2)_8CH_3$	75

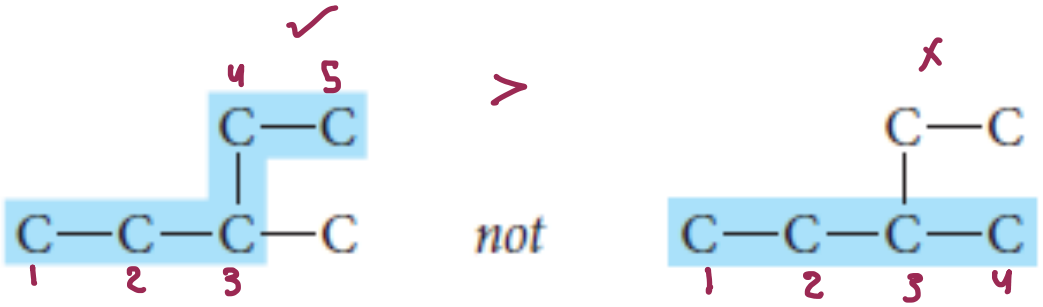
Note: The repeating group is (-CH2-) is Methylene group

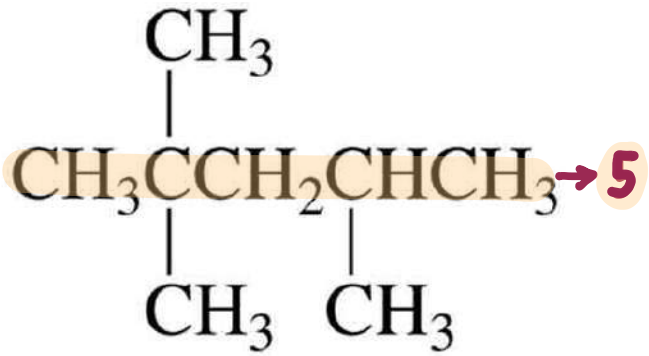
طريقة سهلة لحفظهم كنت أتبعها بالمدرسة 😂

ميشان و إيثان بنات العم ، تزوجوا بروبان وسكنهم في بيوتان ، وأنجبتا بنتان ، الأولى اسمها هكسان والثانية هبتان ، ولما كبروا تزوجتا أوكتان و نونان ، ومعهم كان ديكان

IUPAC Rules for Naming Alkanes

1. First identify the longest continuous chain (parent name)



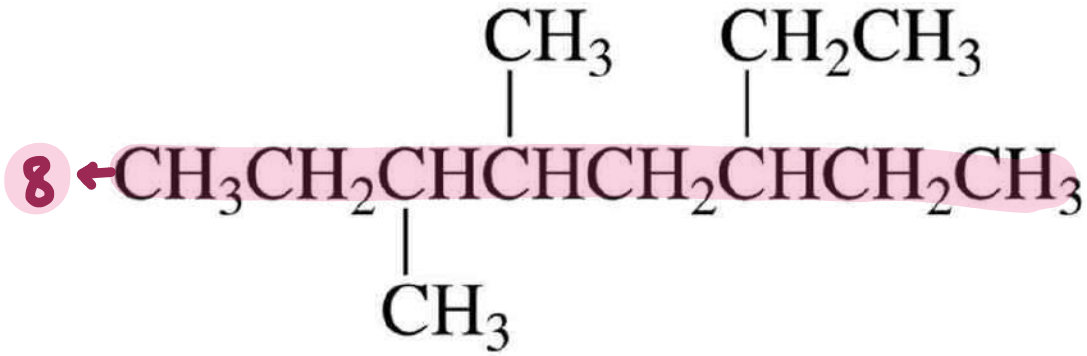


2,2,4-trimethylpentane

not

2,4,4-trimethylpentane

because 2 < 4



6-ethyl-3,4-dimethyloctane

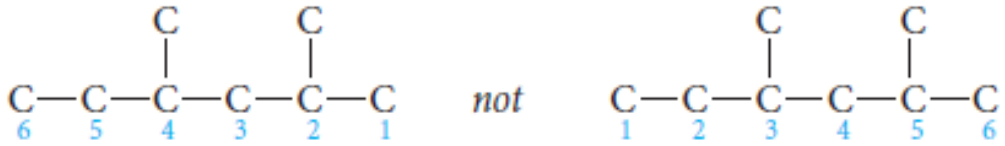
not

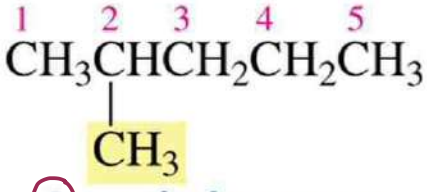
3-ethyl-5,6-dimethyloctane

because 4 < 5

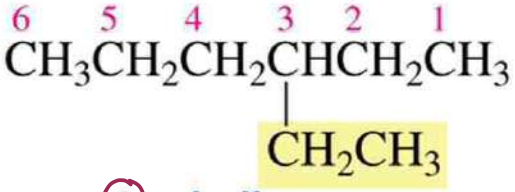
2. Number the chain in the direction that gives the substituent as low a number as possible

نختار الأترب الى التفرع

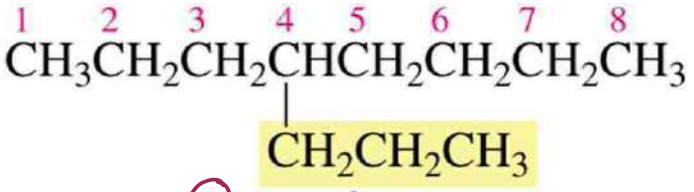




2-methylpentane
not
4-methylpentane

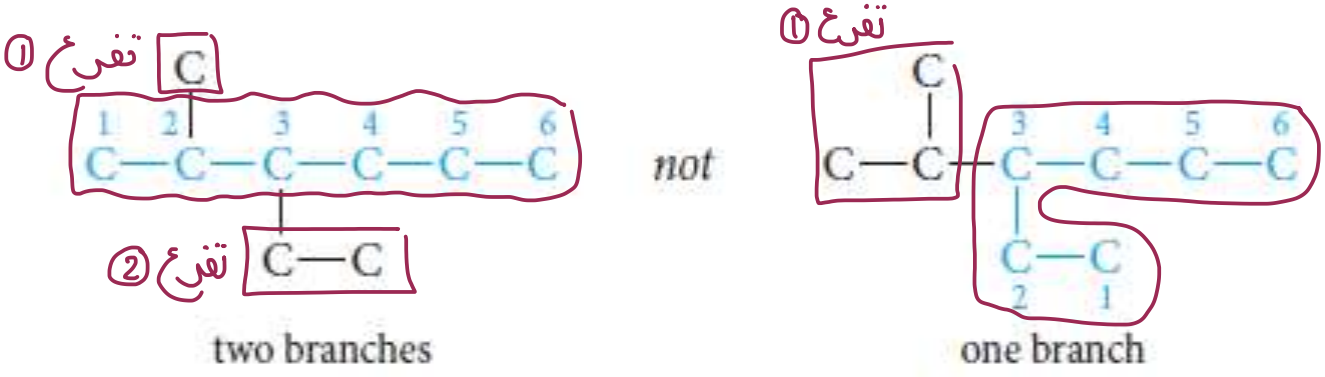


3-ethylhexane
not
4-ethylhexane



4-propyloctane
not
5-propyloctane

Note: If there are two equally long continuous chains, select the one with the most branches. For example:



two branches

one branch

* CH_4 ⟶ methan

  CH_3 ⟶ methyl

* C_2H_6 ⟶ Ethan

  C_2H_5 ⟶ Ethyl

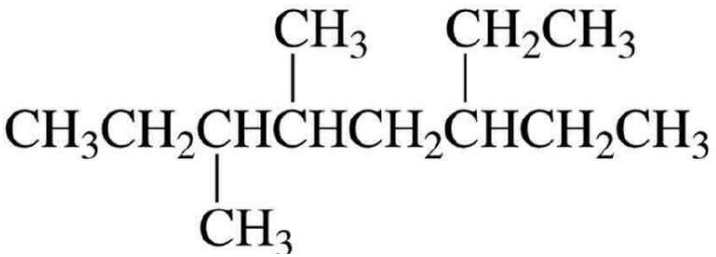
* C_3H_8 ⟶ propan

  C_3H_7 ⟶ propyl

etc ...

If there is a branch equidistant from each end of the longest chain, begin numbering nearest to a third branch

- **How to name a substituent?**
- **It can be a branch In the chain**
- **A branch (alkyl substituent): is (Alkane – H)**



Replace "ane" of alkane with "yl.

CH_3- **methyl group**

CH_3CH_2- **ethyl group**

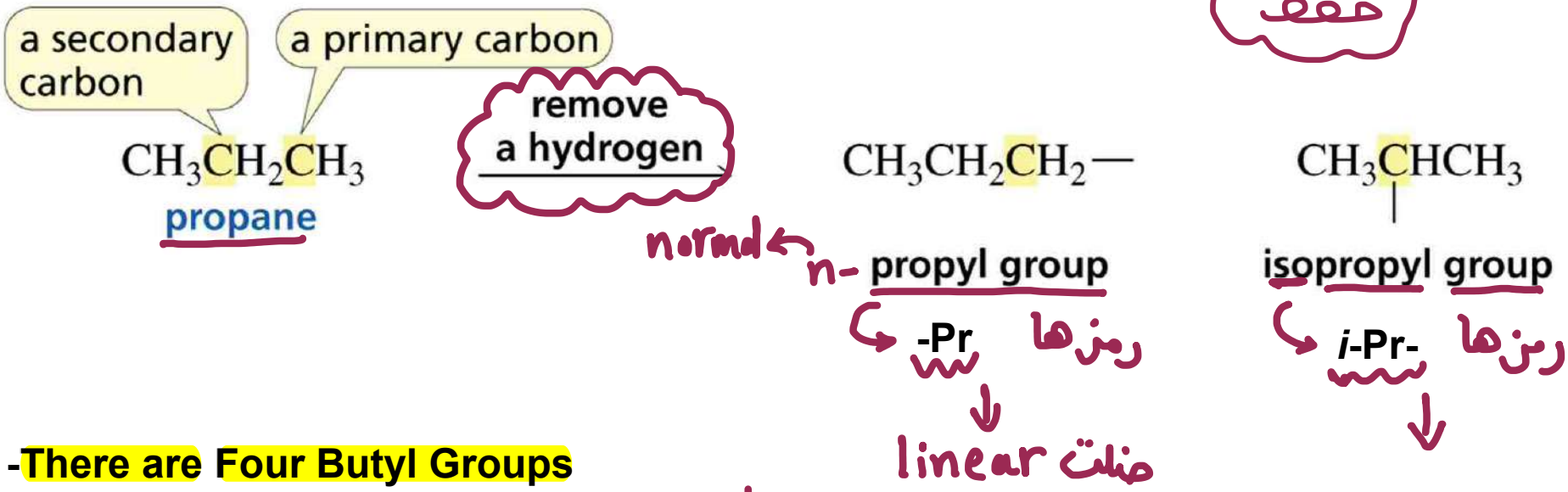
$CH_3CH_2CH_2-$ **propyl group**

$CH_3CH_2CH_2CH_2-$ **butyl group**

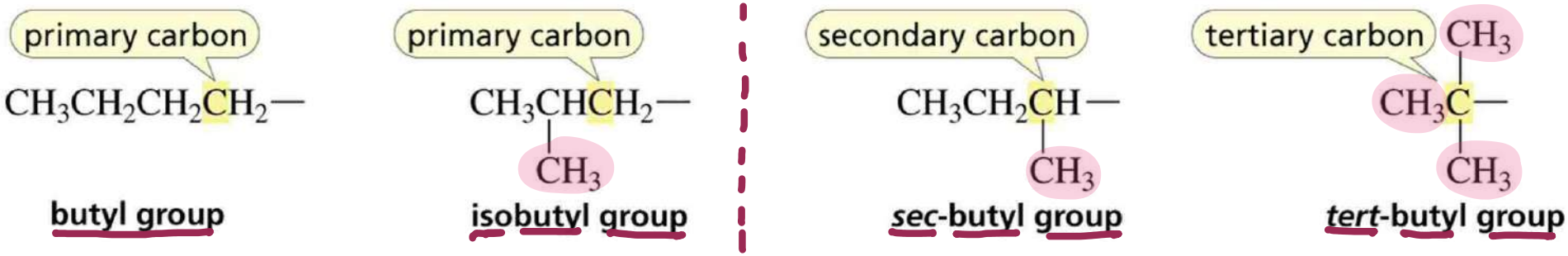
$CH_3CH_2CH_2CH_2CH_2-$ **pentyl group**

$R-$ **any alkyl group**

-There are two propyl Groups



-There are Four Butyl Groups



Note: These names for the alkyl groups with up to four carbon atoms are very commonly used, so you should memorize them.

شرح مني ت: مثل ماحكينا البروبيل هو C_3H_7 يعني ٣ كربونات، والبروبيل اله 2Shapes :-

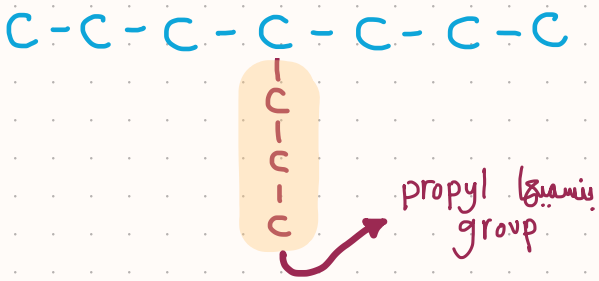
الشكل الأول

مكان ارتباطه بالمركب مهما كان سواء أكان هكسان، أوكتان ...الخ

اسمه :- propyl group

رمزها : -pr

مثال :-



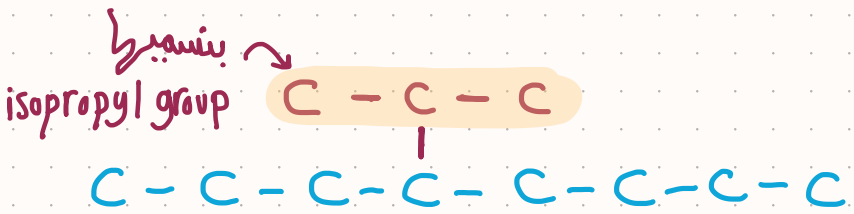
الشكل الثاني

مكان الارتباط بالمركب

اسمه : isopropyl group

رمزها :- i-pr

مثال :-



الملخص

أشكال البروبيل

- iso propyl ↓

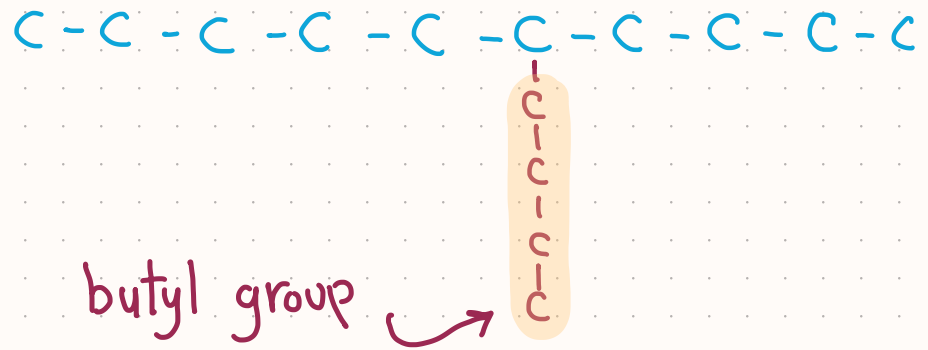
ارتباط من هون

- normal propyl ↓

ارتباط من هون

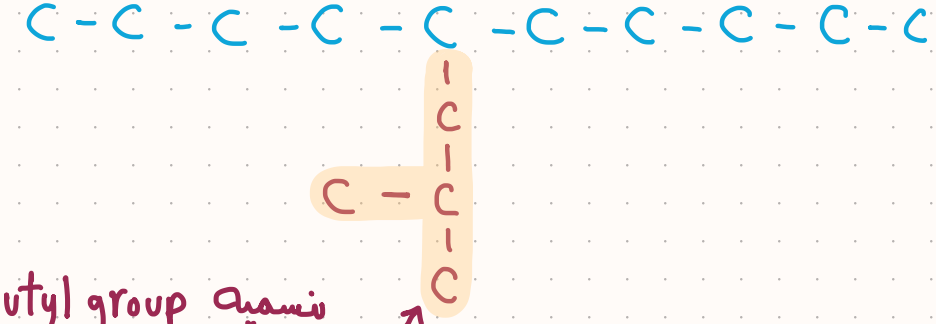
أما بالنسبة لِـ البيوتال فهو C_4H_9 ، وفي الـ 4 Shapes :

الشكل الأول



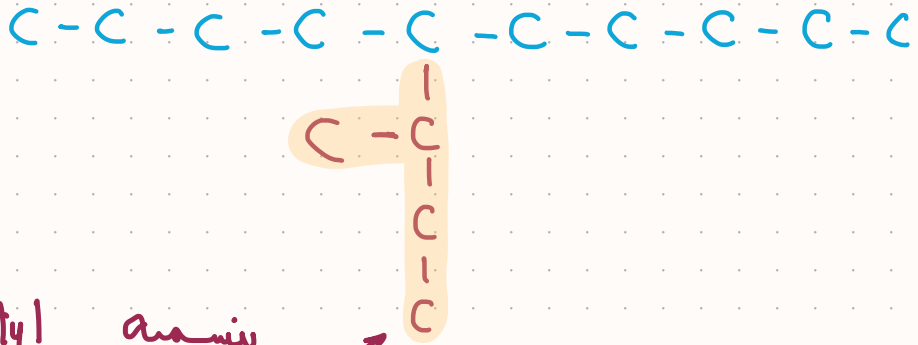
butyl group بتسميه ←

الشكل الثاني



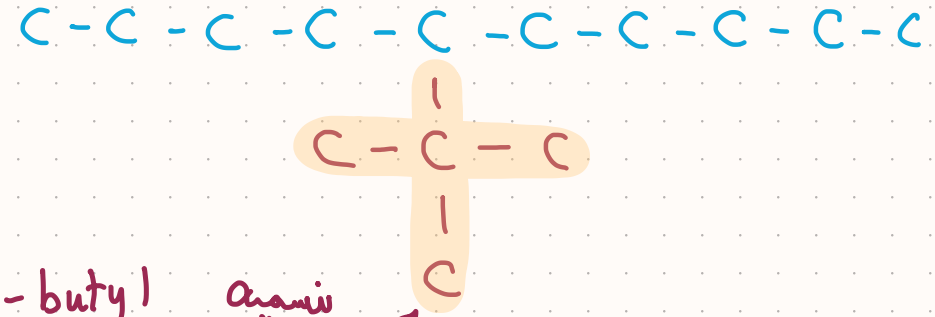
isobutyl group بتسميه ←

الشكل الثالث



sec-butyl group بتسميه ←

الشكل الرابع

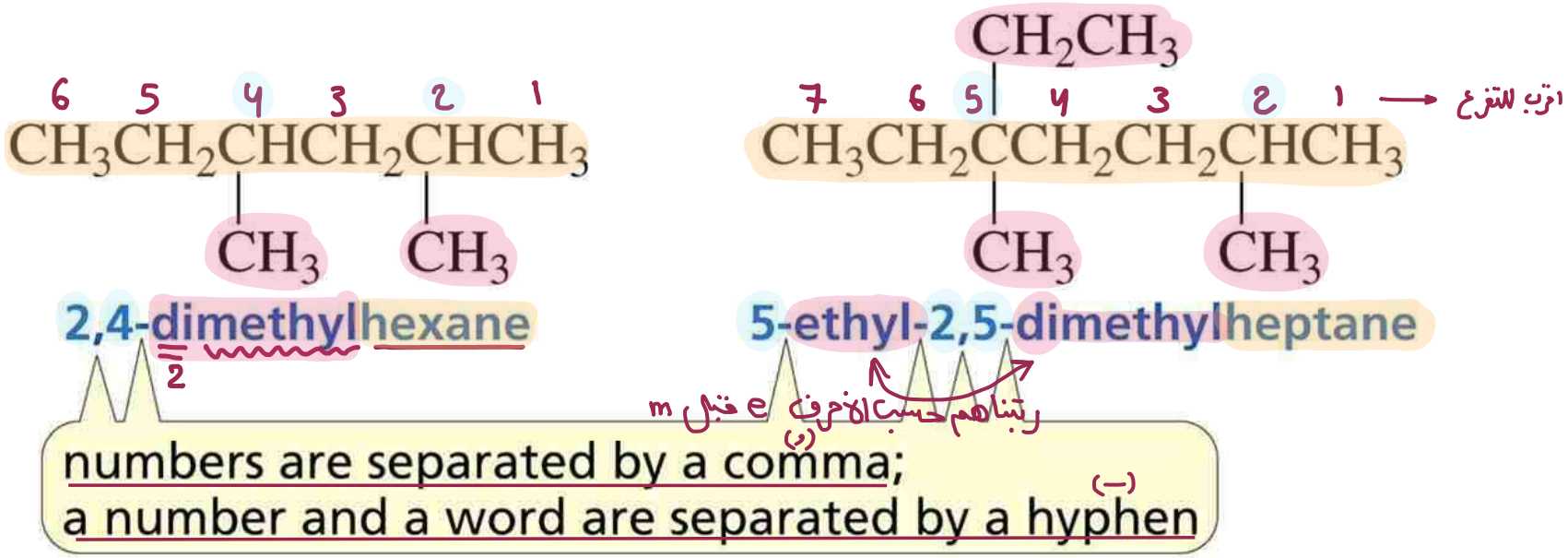


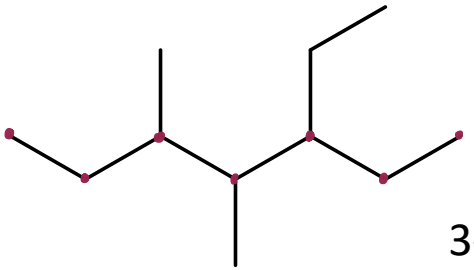
tert-butyl group بتسميه ←

Examples:

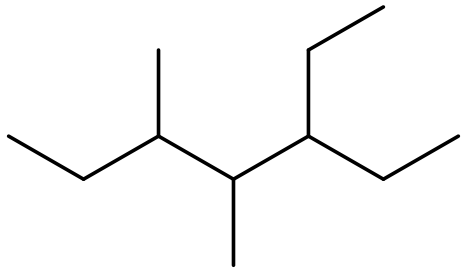
Note 1: *di*-, *tri*-, and *tetra*- are used for the same **Multiple** Substituents

Note 2: Substituents are listed in alphabetical order.
(di, tri, tetra, *sec*, *tert* are not alphabetized)

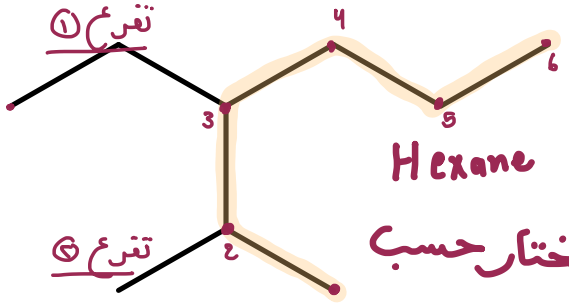




3-ethyl-4,5-dimethylheptane

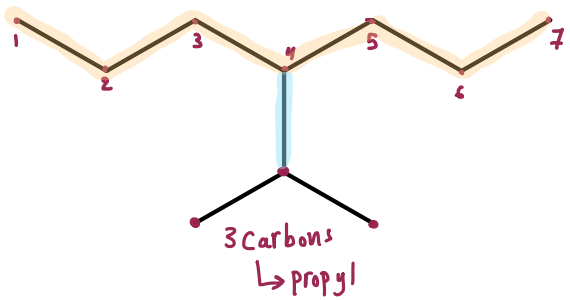


Examples



هون حنختار حسب التفرع الأكثر

3-ethyl-2-methylhexane



4-isopropylheptane

اذا كان عندك أكثر من خيار بيعطوا الـ longest chain ، فلازم نختار الخيار الأكثر تفرع

اذاً الأولويات
① الأطول
② الأكثر تفرع

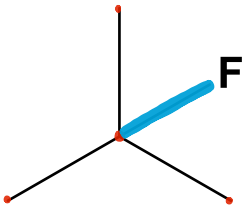
2.4: Alkyl and Halogen Substituents (R-X)

هالوجينات ← ألكيل ← Alkyl Halide يكونوا

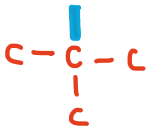
Common name : Alkyl halide

eg. CH_3CH_2Br **Ethyl bromide**

Alkyl halide



***tert*-butyl fluoride**



هاد بنسميه ال Common name

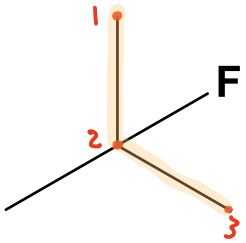
in simple Compounds

note اختر الفرق بين Common - IUPAC

IUPAC:

Halogen substituents are named by changing the *-ine* ending of the element to *-o*.

F: fluoro Cl: chloro Br: bromo I: iodo- على وزن هالو

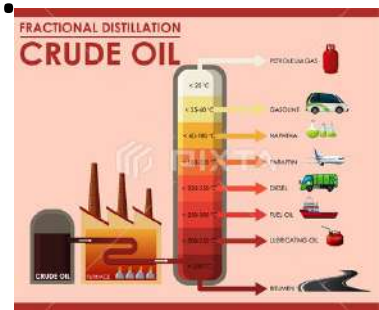


longest chain

2-fluoro-2-methylpropane ← هاد بنسميه ال IUPAC name

Sources of Hydrocarbons

Hydrocarbons are found in crude oil and natural gas. Both are mixtures of different hydrocarbons and they are separated by "fractional distillation" a process where the different compounds are separated in a long distilling column based on their boiling points. Heavy fractions can be "cracked" into small lighter, hydrocarbons using heat and/or catalysts.



2.7: Physical Properties of Alkanes and Nonbonding Intermolecular Interactions

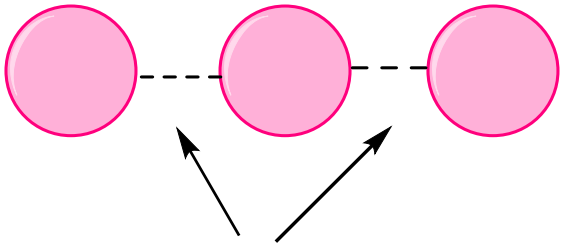
A physical property is any property of matter or energy that can be measured.
When it changes, the chemical composition of the object does not change

***Alkanes** are insoluble in water*. This is because water molecules are *polar*, whereas alkanes are *nonpolar* (Like dissolves like: Polar/ionic solvents **dissolve** polar/ionic solutes and non-polar solvents **dissolve** non-polar solutes)

***Alkanes** have lower boiling points for a given molecular weight than most other organic compounds*. This is because they are nonpolar molecules.

The physical properties of molecules are in part dependent on the type's of intermolecular forces (IMF) present.

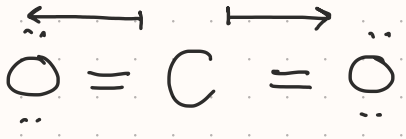
Alkan properties:
1- insoluble in water
2- non polar
3- lower boiling point



NOTE للفائدة ، مين قطبي ومين لا ؟؟

O_3 ← 

خطي ، لهم نفس الكهروسلبية ← غير قطبي

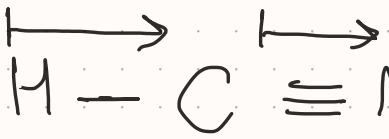
CO_2 ← 

كهروسلبية مختلفة ، الجزيء كامل غير قطبي

لأنه قوة الجذب بتلغي بعض ولكن

بين C و O ذريتين لوحدهم يوجد

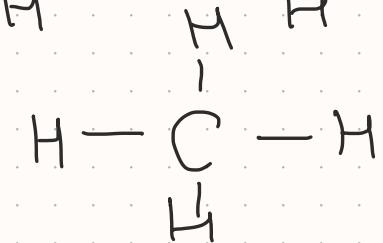
فرق بالكهروسلبية ولهذا بينهم قطبي

HCN ← 

المركب قطبي

H_2O ← 

المركب قطبي

CH_4 ← 

غير قطبي ، القوى يتلغي بعض

Intermolecular Forces

The physical properties of molecules are in part dependent on the type's of intermolecular forces (IMF) present.

Boiling points (BP) are also dependent on the **mass of the molecule.**

الذوبان

Solubility, the ability to dissolve into a solvent is dependent on IMFs.

The strength of the interaction between molecules is also dependent on the **overall shape** of the molecule.

Intermolecular Forces

There are 3 types of IMFs, by decreasing strength they are:

1) Hydrogen bonding الأقوى
2) Dipole-dipole
3) Van der Waals or London Dispersion الأضعف

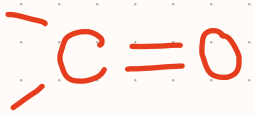
المركبات ال nonpolar زي الألكان

Dipole-dipole

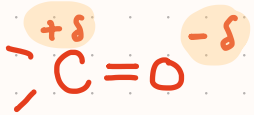
Dipole-dipole forces arise from the attraction of oppositely charged atoms (other than H) in molecules. These molecules may have a **permanent** dipole moment. Generally in organic molecules they results from the presence of C-X bonds where X is more electronegative that C.

These are generally weaker than H-bonding, ranging from about 5-10 kJ/mol.

شرح dipole - dipole



- what is the type of the bond?
  covalent bond.
- Is it polar or nonpolar ?
  polar.
- where is the direction of polarization? ?
  toward oxygen.
- charges ?



* these are dipole (ثابتين)

لهم قيمة ثابتة ومحددة

other molecule مع فعلا تقترم

بتكون في نفس الترتيب

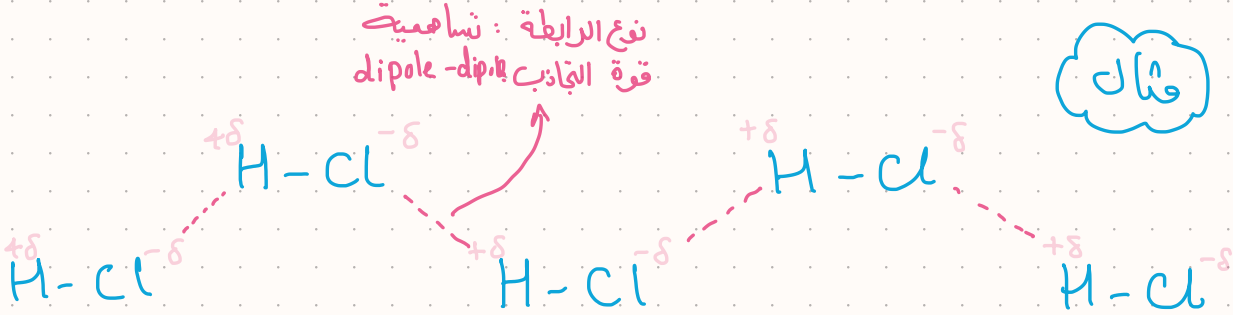
interaction

ناشئ من dipole-dipole

ويعتبر strong

اذاً هي رابطة بتحبس بين المركبات القطبية حيث كل مركب فيه عدد من الذرات كل ذرة لها شحنة ثابتة وخصائص ثابتة من الغير ممكن إنها تتغير.

مثال

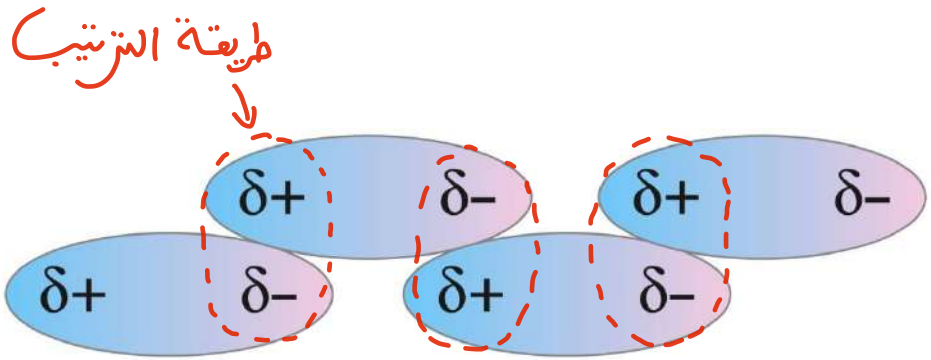


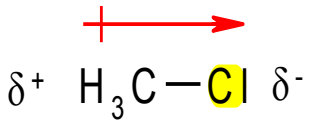
مثل ما انتو ملاحظين المركب قطبي لأنو Cl أعلى كهروسلبية ولهذا :-

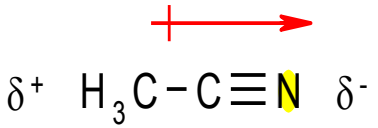
Cl ← شحنة جزيئية سالبة H ← شحنة جزيئية موجبة

فبنشأ قوة تجاذب بين كل ذرتين شحناتهم متعاكسة

Dipole-dipole





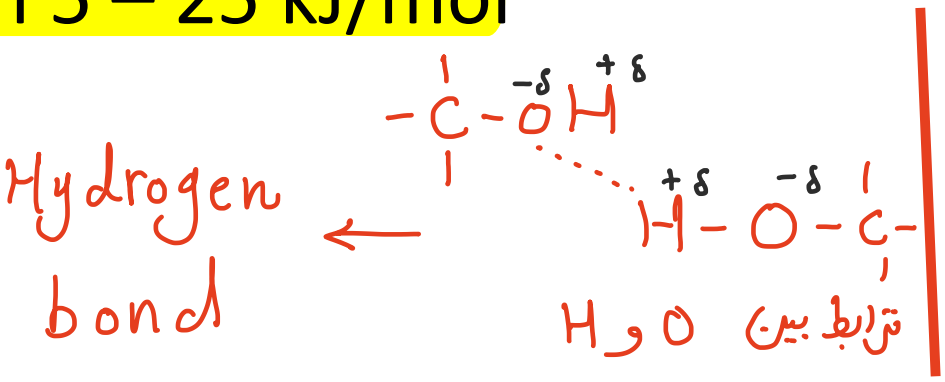


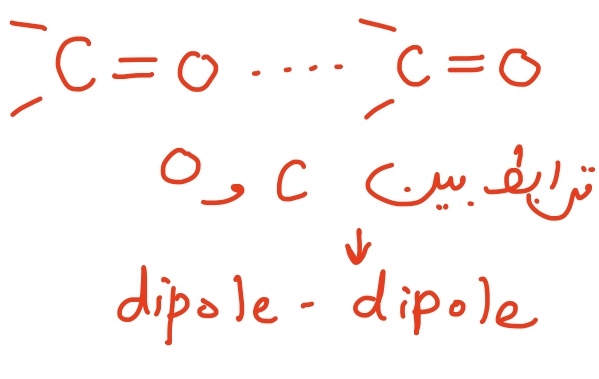
Hydrogen Bonding

N, O or F with H

Hydrogen bonding is a complex interaction that includes dipole-dipole, as well as orbital interactions and the transfer of electron density (انتقال) between molecules.

These are the strongest of the IMFs and range from 5 – 25 kJ/mol





Hydrogen Bonding

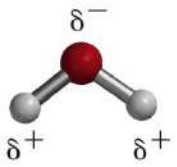
NOF
نوف

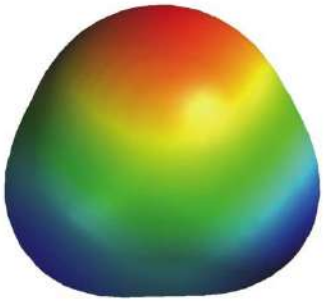
علاقة طردية بين EN و strong

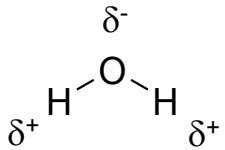
Occur primarily between OH, NH and FH. The more EN the atom the stronger the interaction. (The atom H is attached to usually has a lone pair of e^-)

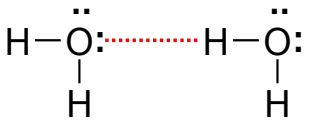
وهاد هوسبب انو الهيدروجين أقوى وحدة

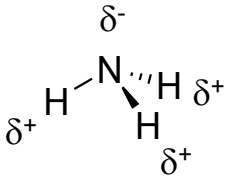
Geometry: X-H ----:X-

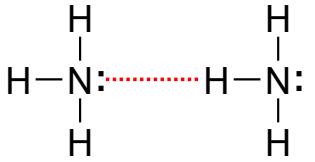


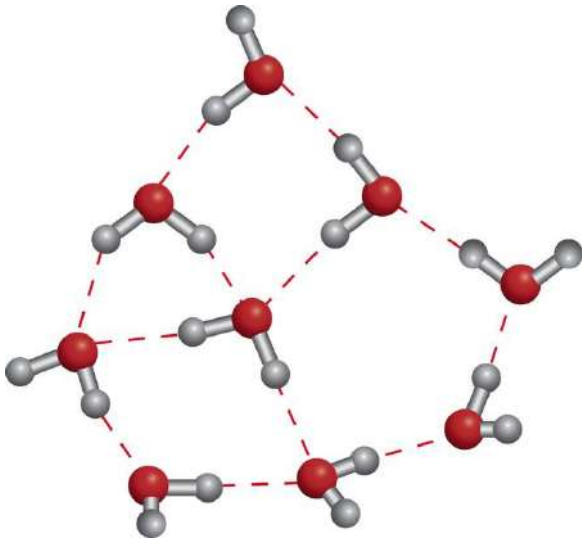










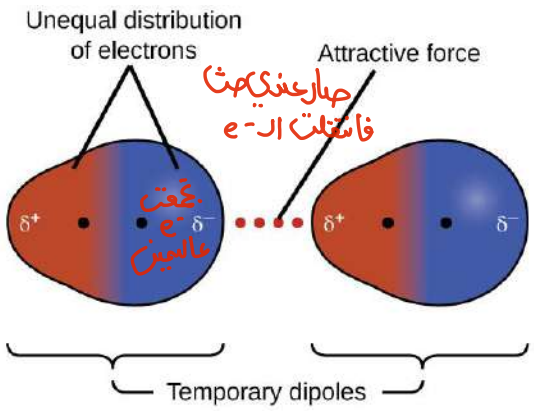


Van der Waals (dispersion) → * موجودة في جميع المركبات العضوية

Van der Waals or (London) *dispersion* forces arise from the movement of electrons within a molecule. This natural motion can produce an uneven distribution of the electrons (polarization of the distribution) resulting in a **temporary dipole moment** in the molecule. This will induce the movement of electrons in adjacent molecules producing a dipole moment in them. These "induced" dipole moments are very brief as they disappear when the electrons move to new locations within the molecule, so they forces are very brief and weak, only 2-5 kJ/mol.

مؤقت — حدث — مختصر

* نلاحظ انو لندن والهيدروجينية بصير الهم انتقال في e⁻.



Very Weak attraction

London dispersion, < dipole-dipole, < Hydrogen bonding

London force

* تتمثل أهميتها في non-polar مثل Alkane .

dipole عليها ↑

الالكترونات هنا ليست بحالة ثبات
انما حالة حركة

لوحدث عنا ازاحة رح تولد dipole

وحتكون قيمته صغيرة

temporary dipole

other molecole لِـ induce حيعمل ← فبيتزتبوا بشكل انه اد opposite مع بعض

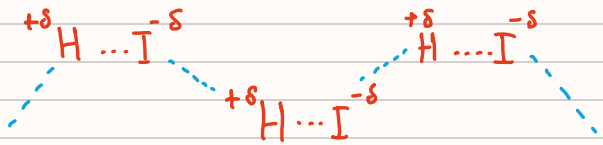
* هاد شرح الدكتور، كمان شوي شرحته انكم بطريقة مفهومة أكتر

اقرأوه كيش بفيدكم

مقارنة سريعة بين intermolecular forces

Dipole-Dipole ثنائية القطب

تحدث في الجزيئات القطبية .



اي بيحدث كالتالي ، الموجب والسالب بيجذبوا بعض برابطة بنسميها ثنائية القطب .

فبصير ترابط بين الجزيئات .

* ملاحظة *

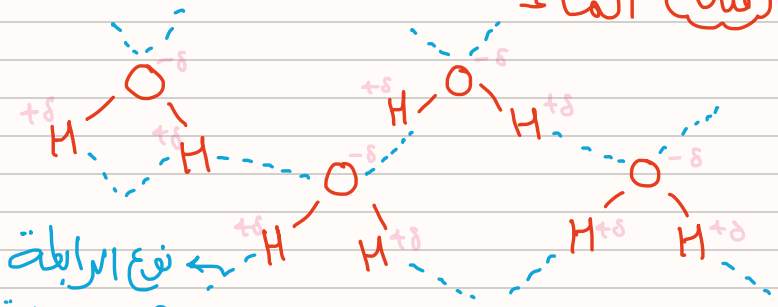
الفرق بينها وبين لندن انه هاي قطبية ولندن غير قطبية وأيضاً بالـ dipole δ+ و δ- ثابتين مابتغير مكانهم مثل لندن

بالمركبات العضوية بنلاقيها بين C مع X و X بتكون أكثر كهروسلبية لازم من المجموعة السابعة

Hydrogen bond

بتصير بمركبات قطبية بين عنصر الهيدروجين و نوف (N,O,F) ، اي الكهروسلبيتهم عالية

مثال الماء



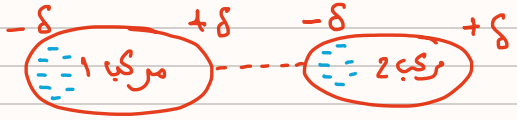
نوع الرابطة هيدروجينية

وبسبب الكهروسلبية العالية ، الالكترونات حتنسحب باتجاه الأكسجين ، وحتكون بينهم رابطة قوية بسبب الكهروسلبية العالية وكمان بسبب انتقال الالكترونات في ذرة حتكسب δ+ وذرة δ-

LONDON

قوة تجاذب وترابط بين الجزيئات غير القطبية ، وبكون فيها فرق الكهروسلبية يسادي صفر .

وبتكون تساهمية .



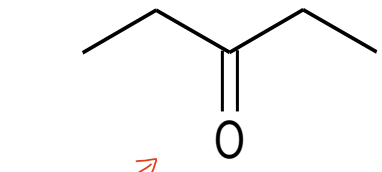
فبصير بينهم حث ، فبيعاد تنظيم الشحنات السالب بينتقل لجهة والموجب بينتقل لجهة .

↓

الانتقال حسب حركة الانتقال e^-

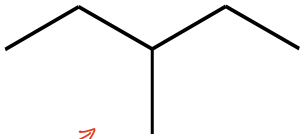
Effects on Physical Properties (cont'd)

Dipole forces: much strong IMFs so the BP is higher when dipole-dipole interactions are present, i.e.



Polar

mass = 86 amu
BP = 101.7 °C



non polar

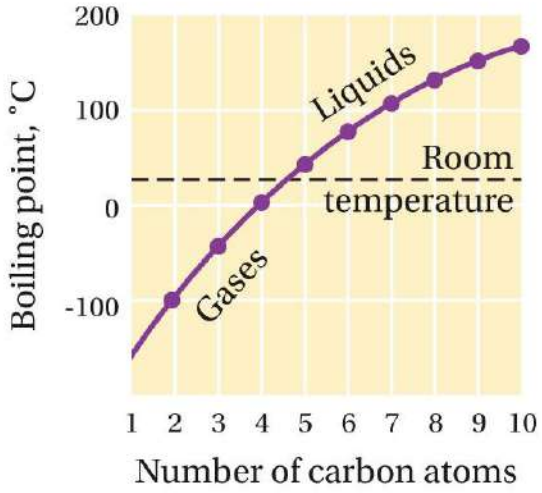
mass = 86 amu
BP = 63.3 °C

سبب الاختلاف انه الي عالشمال dipole dipole
واي عاليمين London .

كلما كانت الرابطة اقوى كلما زادت درجة الغليان
و dipole dipole اقوى من London

Alkanes: no H-bonding or dipole moment (C & H have nearly the same EN ∴ not polar).

Main force → London



Name	Formula	Boiling point, °C
pentane	$CH_3CH_2CH_2CH_2CH_3$ (no branch)	36
2-methylbutane (isopentane)	$CH_3CH(CH_3)CH_2CH_3$ (1 branch)	28
2,2-dimethyl-propane (neopentane)	$C(CH_3)_4$ (4 branch)	10

↑ mass → ↑ attraction → ↑ Boiling point

- Boiling point for alkanes increases with increasing size (mass)
- Boiling point for alkanes decreases with increasing branching

Example:

$CH_3CH_2CH_2CH_3$

n-butane, 0° C

$CH_3CH(CH_3)CH_3$

Isobutane , -12° C

↑ branching → ↓ surface area → ↓ interaction → ↓ boiling

$CH_3CH_2CH_2CH_2CH_3$

n-pentane, 36°C

$CH_3CH(CH_3)CH_2CH_3$

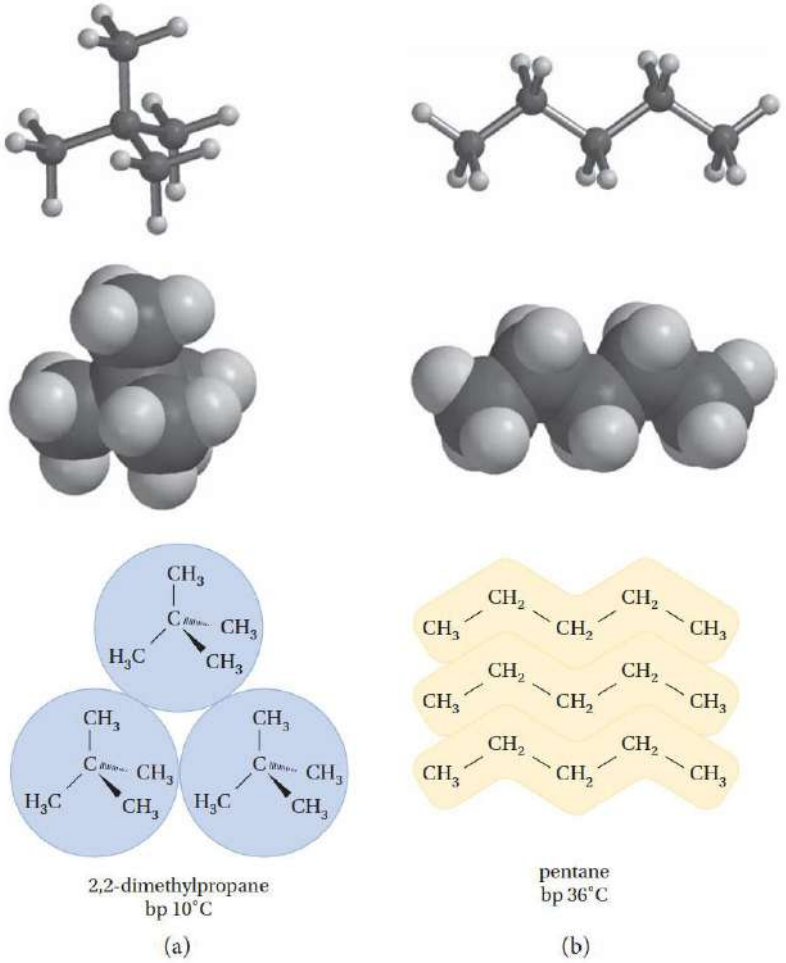
Isopentane, 28°C

$C(CH_3)_4$

Neopentane,9.5°C

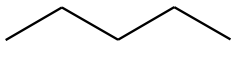
Structural Effects on IMFs

The strength of the IMFs depend on the amount of contact between the molecules, especially for dispersion forces. Hence the shape of the molecule can affect the **surface area of contact,** long thin molecules have more surface in contact than spherical molecules.

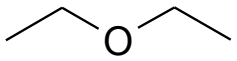


Effects on Physical Properties (cont'd)

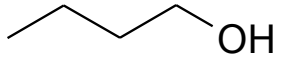
Hydrogen bonding: strongest intermolecular forces so BP are very high for equivalent MW compounds, i.e.



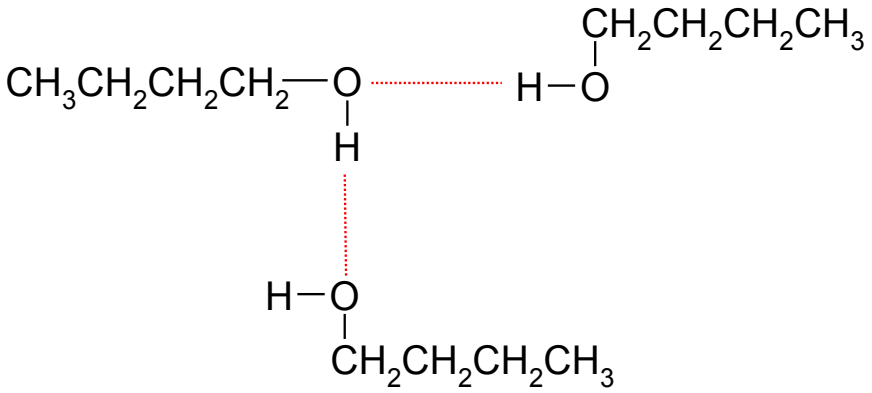
mass = 72 amu
BP = 36.1 °C

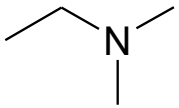


mass = 74 amu
BP = 35 °C

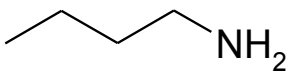


mass = 74 amu
BP = 117 °C





mass = 73 amu
BP = 36 °C



mass = 73 amu
BP = 78 °C

New terms

- saturated: مشبع
- unsaturated: غير مشبع
- generic formula: الصيغة العامة
- substituent: التفرعات
- crude oil: النفط الخام
- fractional distillation: التقطير الجزئي
- insoluble: غير قابل للذوبان
- solvent: مذيب
- dissolve: يذيب
- permanent: دائم و ثابت
- temporary: مؤقت
- Induce: الحث

Remember…
It’s ok to have a bad day
It’s ok to make mistakes
Set back is not failure
It’s ok to take a break
Nothing is perfect
You are stronger than you think you are
Asking for help is a strength
Small steps are also progress

Good luck