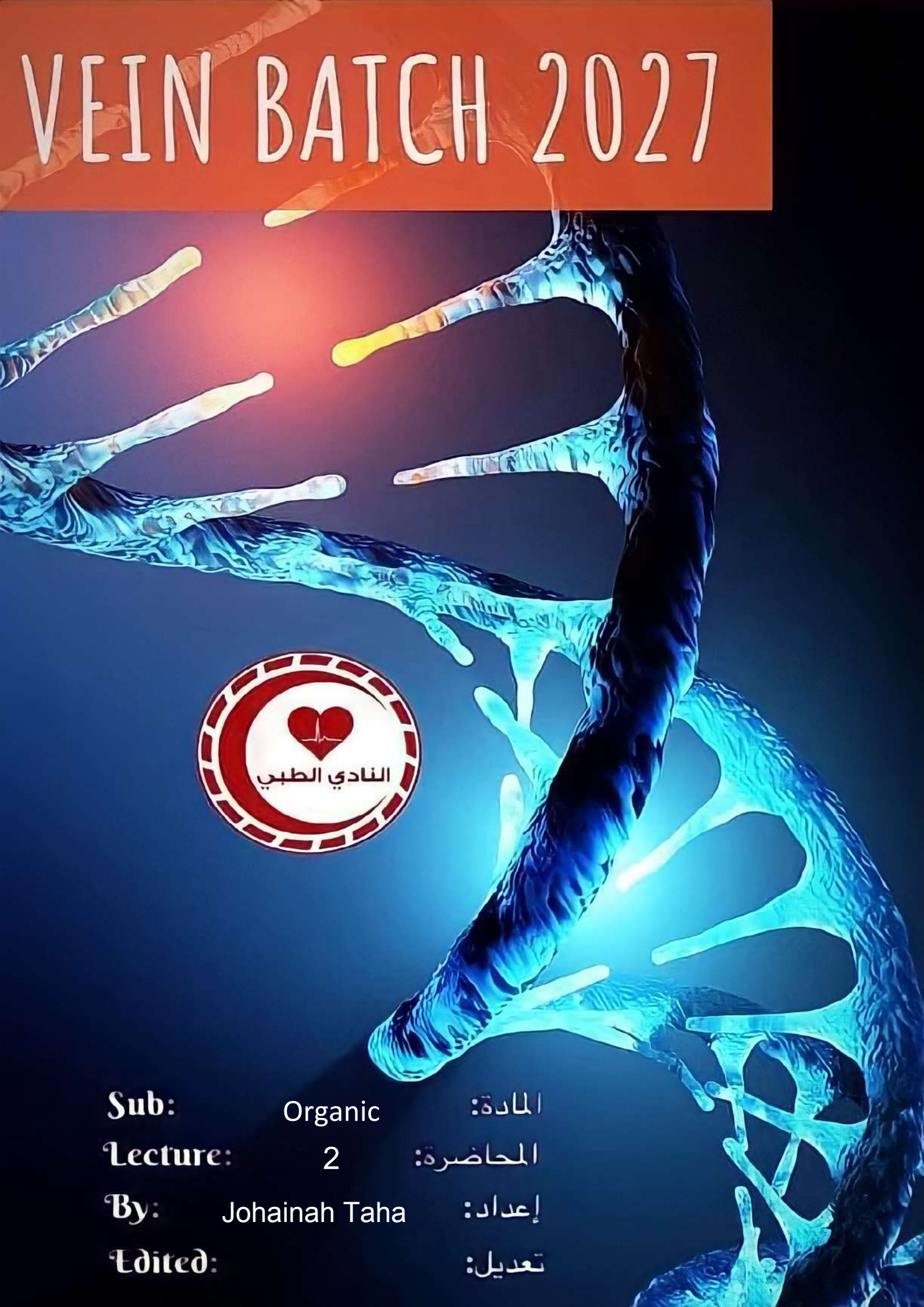
VEIN BATCH 2027



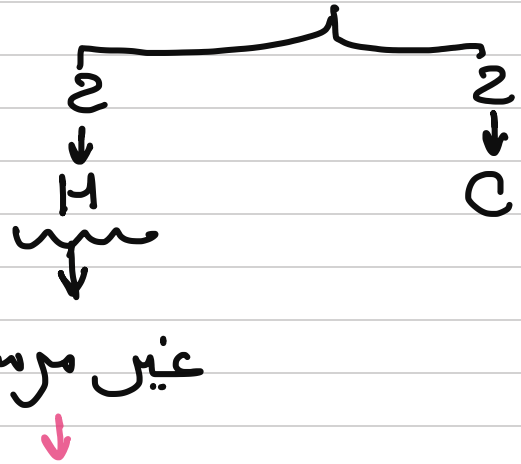
النادي الطبي

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

Lecture 6 :-

* اليوم بدنا نكمل كلامنا عن Cyclohexan ونشوف هل في الـ conformers مثل الـ hexane ؟؟

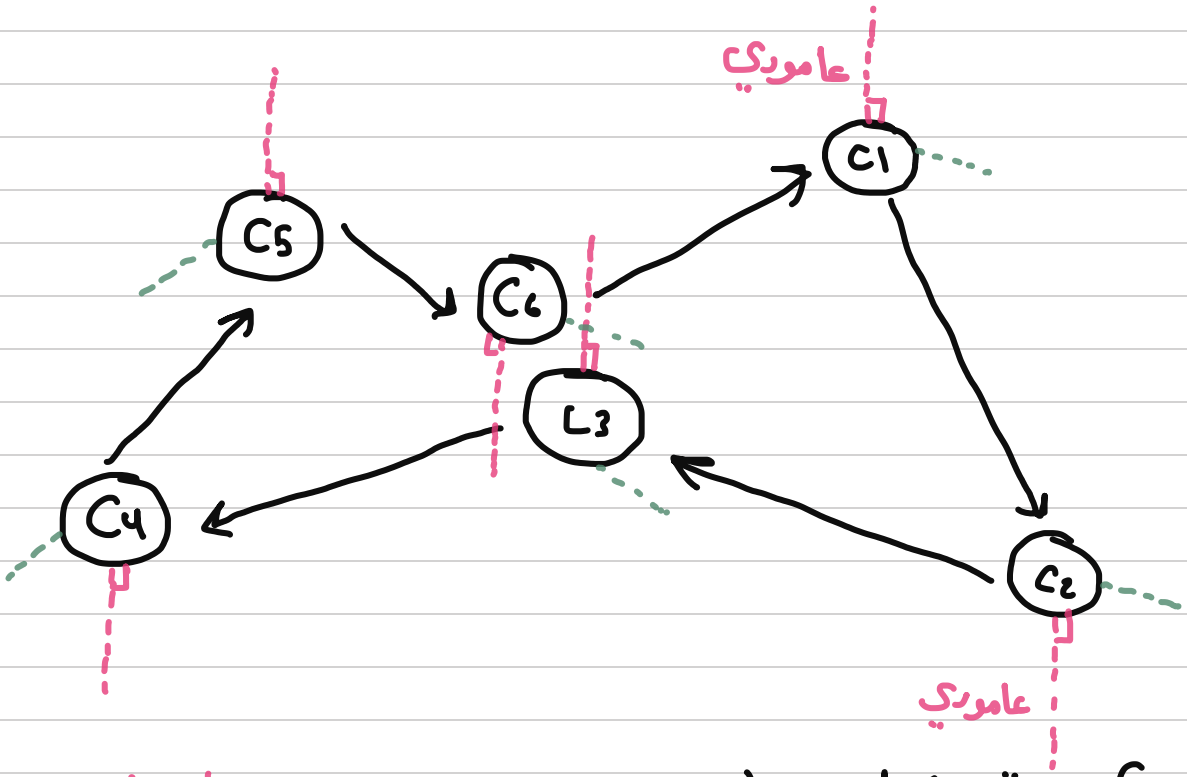
* كل كربونة بالـ Chair مرتبطة بـ 4 روابط



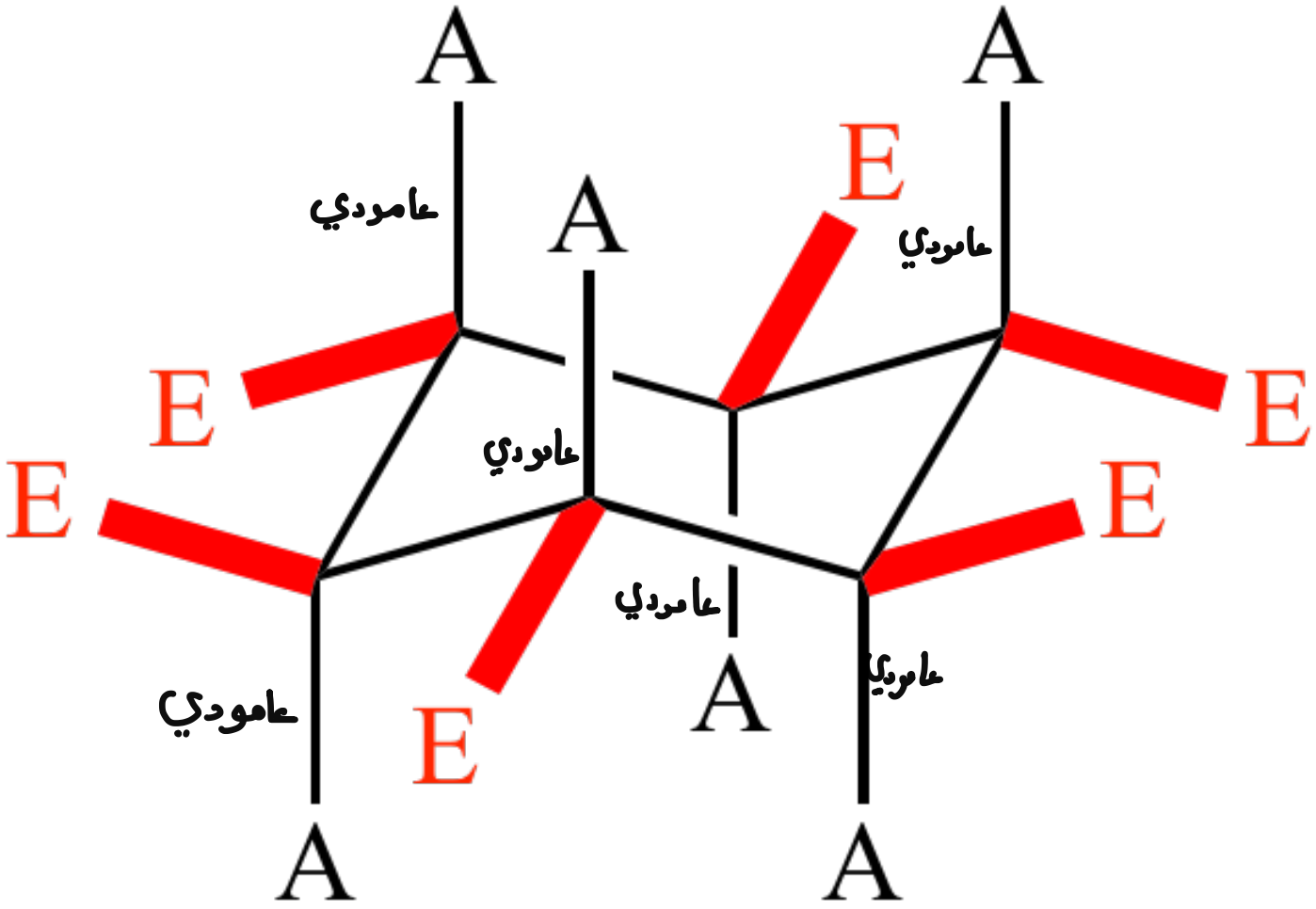
عين مرسومين

↓

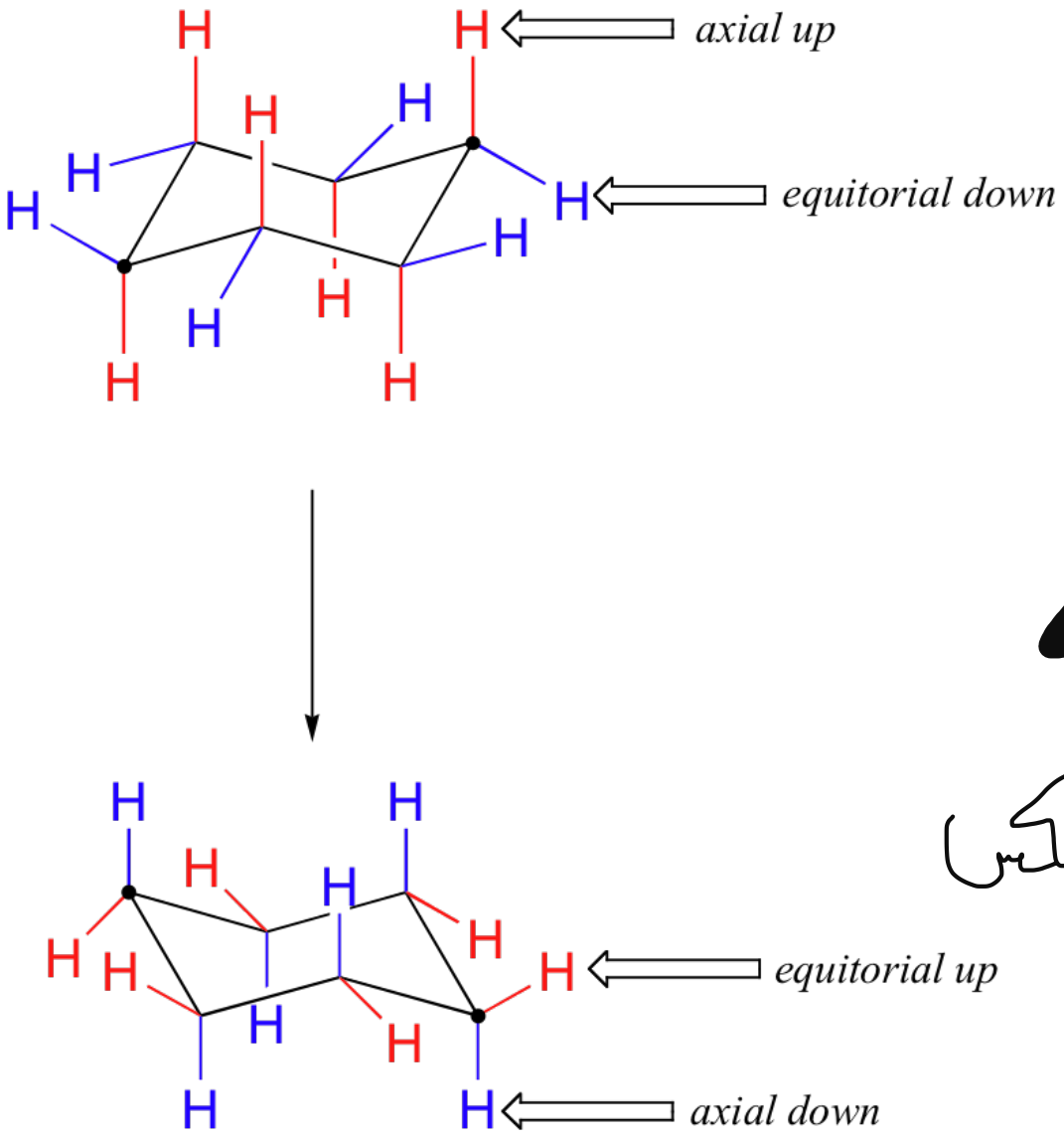
ففي محاضرة اليوم
حنتعلم كيف نرسم
وكيف نستنتج



* الكربونة الأولى فيها هيدروجينة عامودية عليها للأعلى ، وفي هيدروجينة أفقية عليها.
* الكربونة الثانية فيها هيدروجينة عامودية عليها للأسفل وفي هيدروجينة أفقية عليها.
* الهيدروجينة العامودية سواء أكانت في الأعلى أو في الأسفل ← بسميها Axial
* الهيدروجينة الأفقية ← بسميها equatorial
* كل كربونة فيها هيدروجينة axial وكمان هيدروجينة equatorial
* كل cyclohexane = 6 axial + 6 equatorial



* رسمة من النت بتوضح كيف انه كل كربونة بترتبط فيها axial Hydrogen و equatorial (H) . وزي ما اتفقنا صاد الكلام بس بـ cyclohexan .



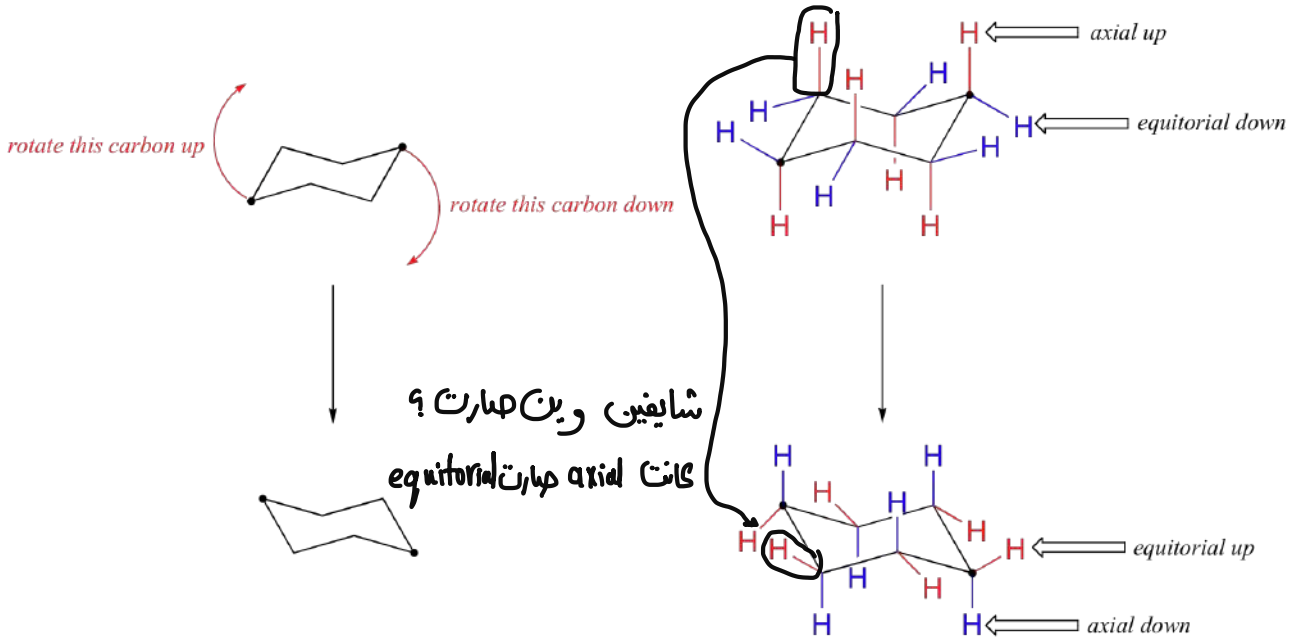
مثل ما انتو ملاحظين بجدول
الصورتين عنا شكلين لـ
cyclohexan

الأول

الثاني

مهم ؟!
طيب كيف بنحول الأول للثاني والعكس
و مين موجود في الطبيعة

next slide



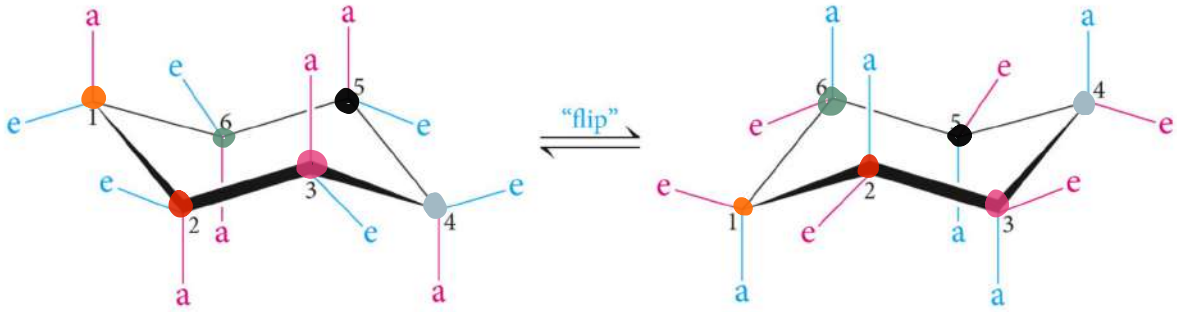
شايفين وين صارت ؟
كانت axial صارت equitorial

* في عنا شي بنسميه Ring Flipping وهي انو ذرة الهيدروجين بتنتقل بين وضع axial لـ equitorial .

طيب كيف ؟؟

كل الي بعمله هو اني بمسك كربونة وبنقلها من مكانها فلو كانت فوق بخليها تحت ولو كانت تحت بخليها فوق

شوفوا هاد الشكل وراقبوا كل لون وين حينتقل :



Axial bonds (red) in the left structure become equatorial bonds (red) in the right structure when the ring "flips."

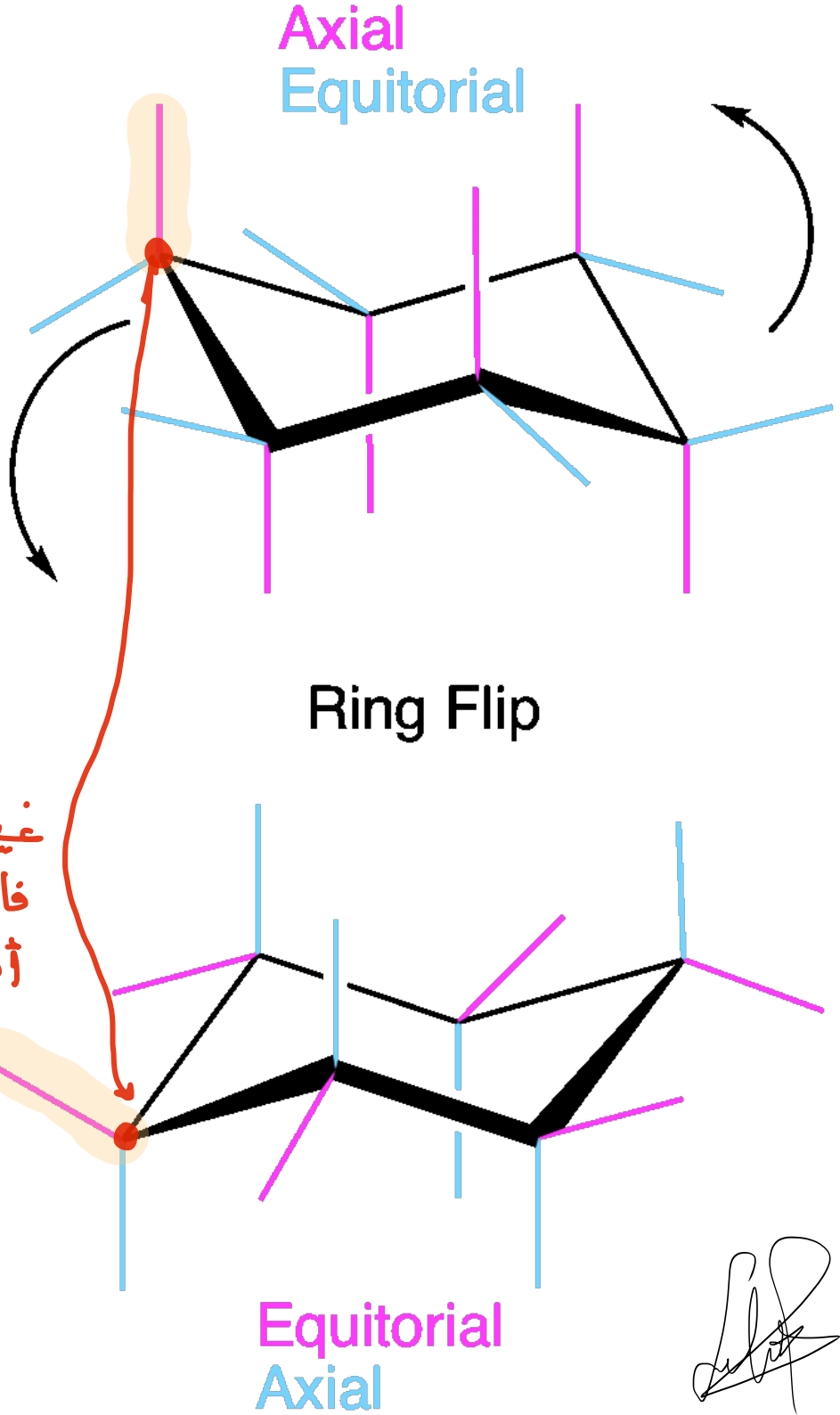
فمجازاً وكأنها عملت إزاحة ن

وصلت ؟؟

هي كمان رسمة لنأكد المعلومة :

* Ring flipping ← عملت ازاحة لمكان كربونة وحدة فبالتالي باقي الكربونات صار الها ازاحة ، وهاد الشي على مين أثر؟؟

يا سلام عليكم أثر على الهيدروجين ، فلو كانت axial بتصير equitorial ولو كانت equitorial بتصير axial



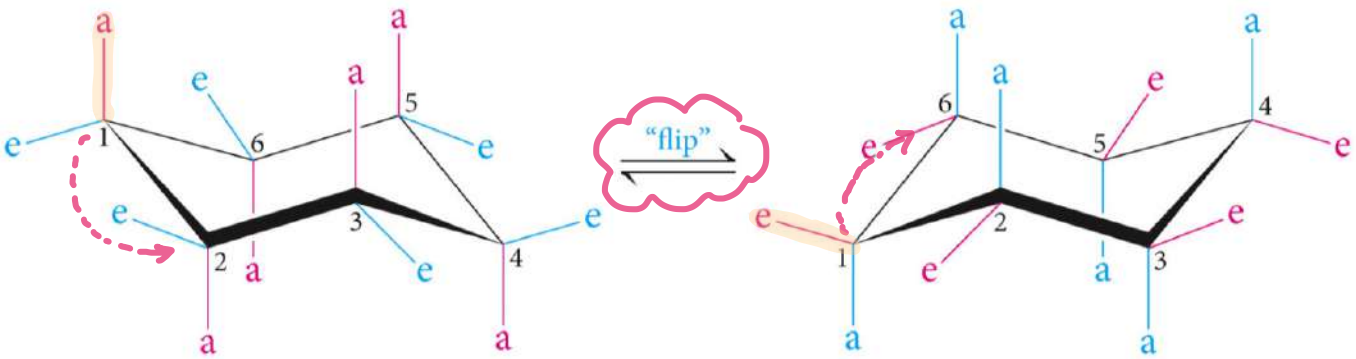
غيرت مكان الكربونة فالهيدروجينة اللي كانت axial عامودية صارت أفقية equitorial

وكمان ملاحظة الشكل الأول احتمالية وجوده هي ٪50 ، والشكل الثاني كمان ٪50

Cyclohexane interconverts between two chair conformers. حكينا عنا شكلين تعالوا نقرأ السلايدات

Cyclohexane cont'd:

Since the C-C bonds are all single (σ) bonds, it is possible to rotate about these bonds. This process in known as **a ring inversion** or a "chair-chair" **flip**. In the process of the inversion **all equatorial H become axial and axial become equatorial.**



Axial bonds (red) in the left structure become equatorial bonds (red) in the right structure when the ring "flips."

٪ 50 ٪ 50

Important information:

- axial planes → less stable + less favorable if we have a big substituent on that end because it puts us in contact with other parts,
- equatorial planes → point away from the structure → will give us more space → so if we have a big structure → it will attach and will be more favorable.

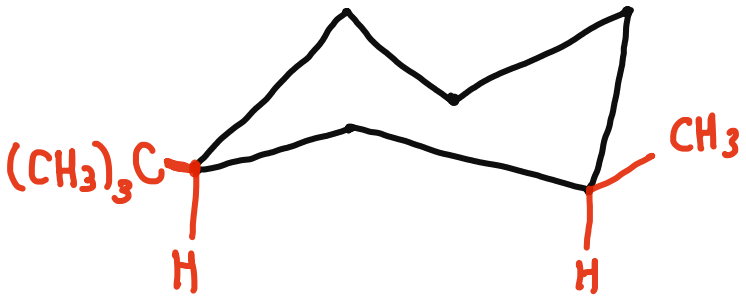
فمثلاً لو عندي مركب كبير مثل tertiary butyl ← حترتبط مع equatorial axis.

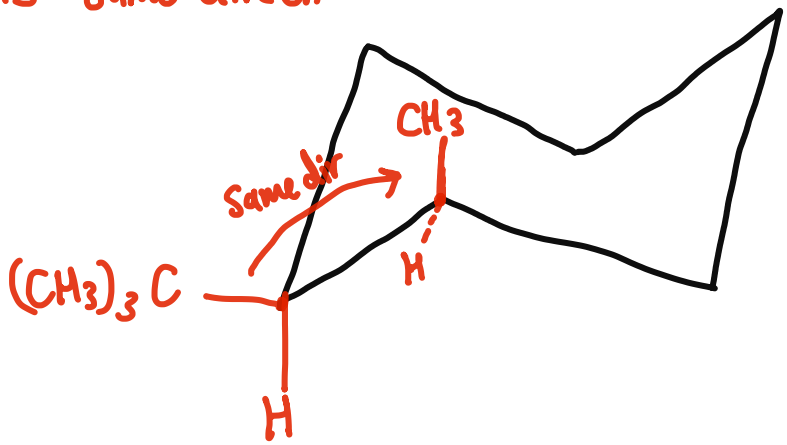
Q: Draw the most stable chair conformation for the following structures:

a) cis-tert-butyl-3-methylcyclohexan b) cis-1-tert-butyl-2-methylcyclohexane.

big small

NOTE cis = same direction



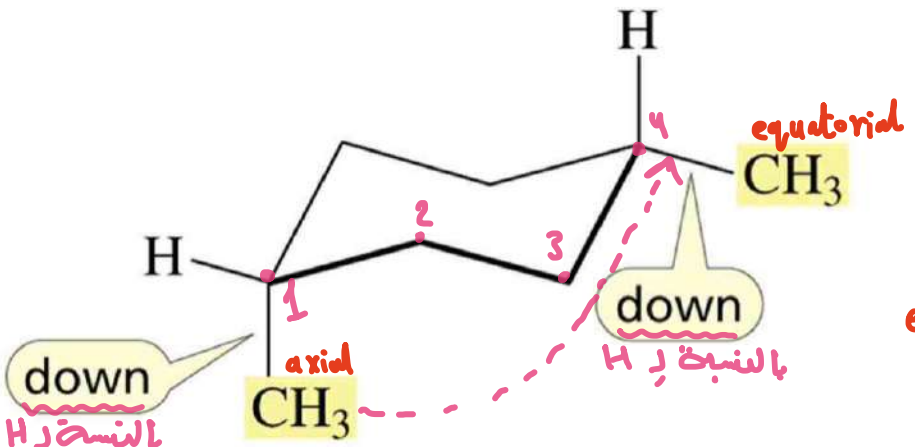


Cis and Trans Isomers

* نسبة الشكل الأول مع الثاني لما عمل RingFlip هي 1 : 1

ممن يمكن الأول ٪99 والثاني ٪1

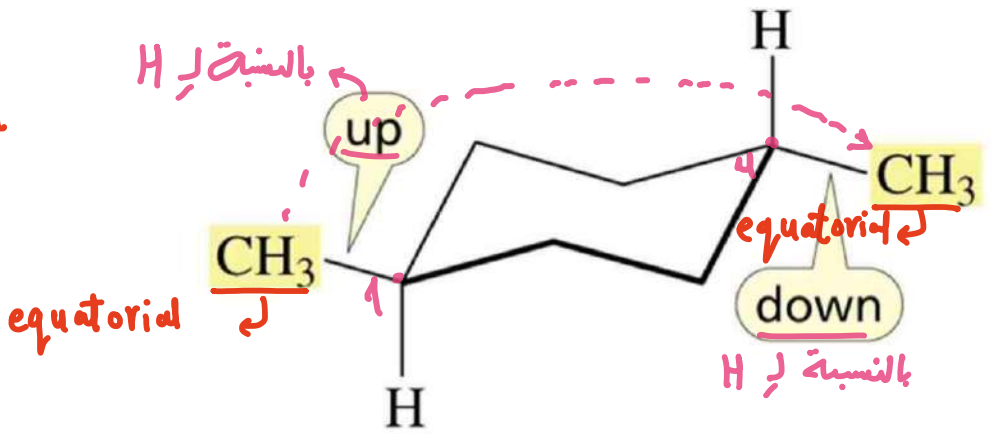
two methyl groups are on the same side of the ring



cis-1,4-dimethylcyclohexane

They have the same orientation

two methyl groups are on opposite sides of the ring

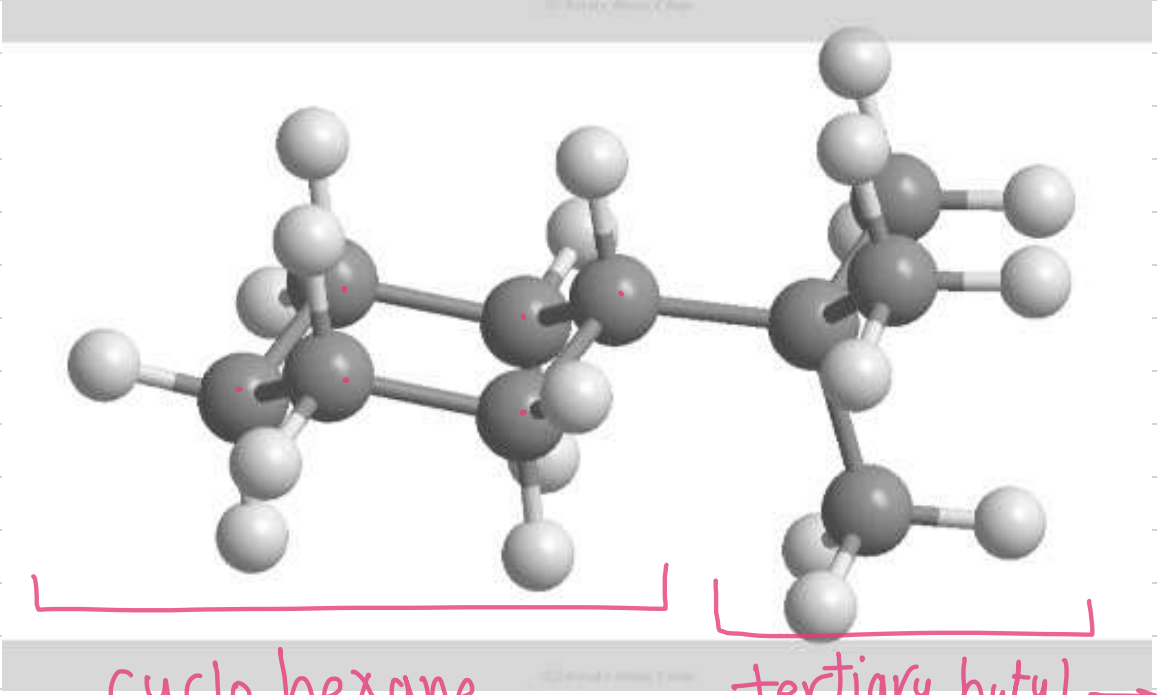


trans-1,4-dimethylcyclohexane

opposite direction

* ملاحظة، لو عملت Ring Flipping فالحصلة حتكون ان 1 ← equatorial و 4 ← axial، ولن تختلف الـ Stability. (مش فارقة ت) وهتي cis

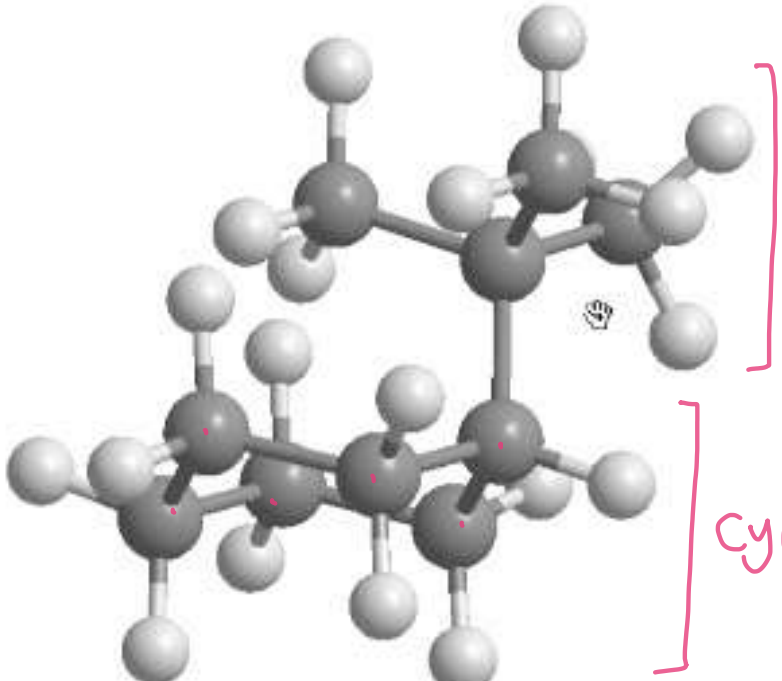
لو عملنا Ring Flipping ← الـ equatorial جيبس axial فحتقل الـ Stability وهاذا الـ trans



cyclo hexane

tertiary butyl → equatorial
- more stable
- no interaction with any CH

مجبب



tertiary butyl → axial

interaction with C3

we called it

[1,3-diaxial interaction]

غير مجبب

non-Faverable

cyclohexan

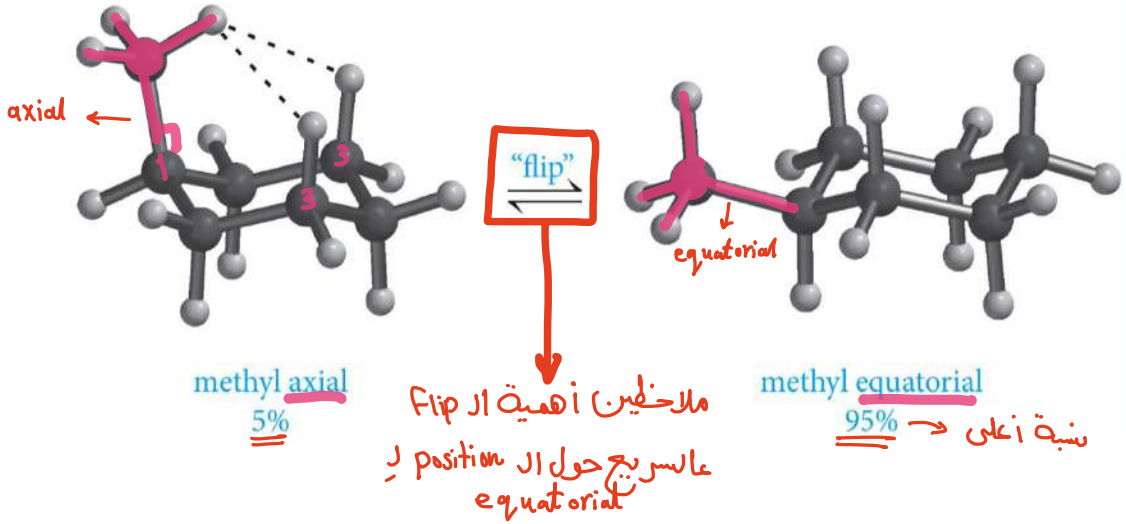
ملخص

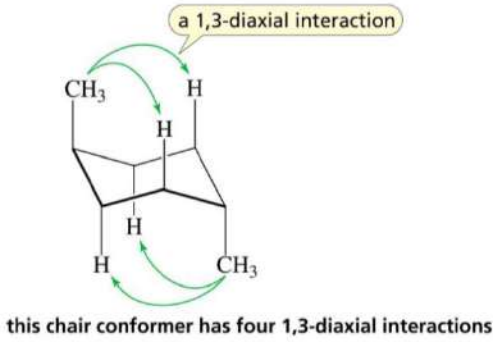
* لوعنا mono-substituent يفضل يكون متخذ أي؟ Position

ال Equatorial ، والسبب لتجنب تفاعلات 1,3 diaxial interaction

- Substituted cyclohexane: (**1,3-Diaxial Interactions**)

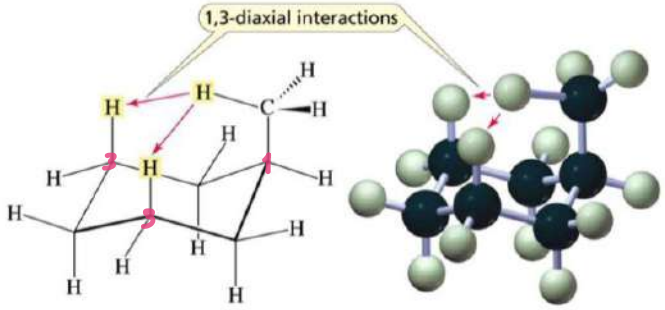
The addition of a methyl group on cyclohexane (methylcyclohexane) can have two conformations, the methyl can be axial or equatorial, i.e.





this chair conformer has four 1,3-diaxial interactions

The equatorial is preferred as there is significantly less steric interactions than when in the axial position. This will be true for any group on a cyclohexane ring and has implications for the chemical reactivity of the compound.



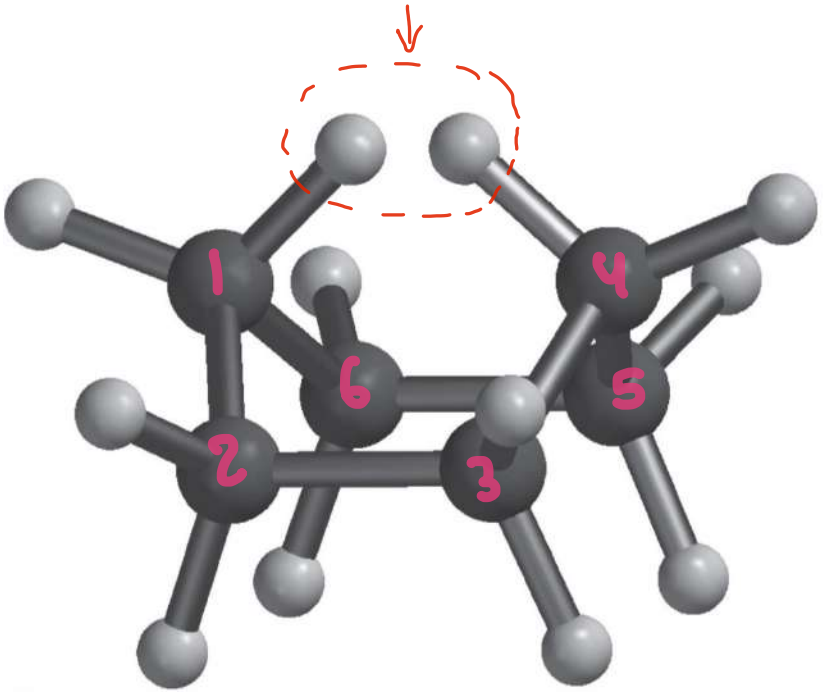
Note: The larger the substituent, the more the equatorial-substituted conformer is favored.

Conformational Isomers (cont'd)

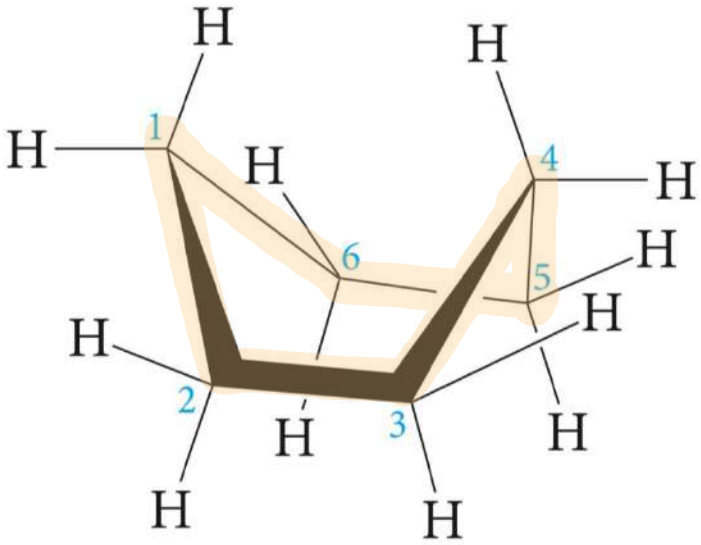
Cyclohexane cont'd:

في عنا أشكال أخرى لـ Cyclohexane ولكن :

Other conformations of cyclohexane are possible but they are higher in energy and less stable, i.e. the "boat" conformation



Eclipsing في



boat cyclohexane

العبرة :- أحسن Conformation ← Chair

حكينا سابقاً ، إنو رابطة سيغما مسموح اد rotation حوليها

وبذلك ما كان في ثبات للمجموعات ، كان في rotation ، conformers

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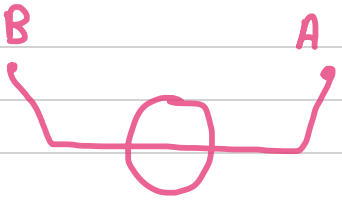
لو جينا هاد الشكل و حكينا إمنع اد rotation حيظهر



عنا شكلين :-

الأول : A و B بنفس الاتجاه

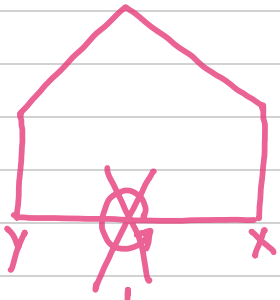
الثاني : A و B عكس الاتجاه

والفرق بينهم هو اد orientation ، يا إما مع بعض أو عكس بعض

Cis ← مع بعض

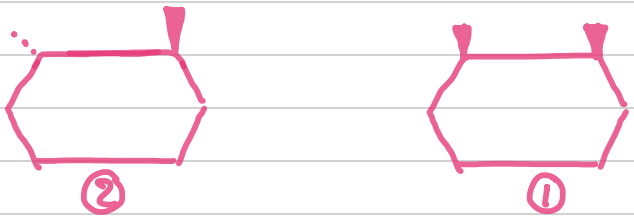
trans ← عكس بعض

: Cycloalkane_



ماني full rotation ← فال x و y بكونوا مع بعض أو عكس بعض

مثال: Cyclohexane



العلاقة بين ① و② هو وجود فرق بال Orientation بينهم ، ف 1 ← cis و 2 ← trans

وانهم geomitric isomers

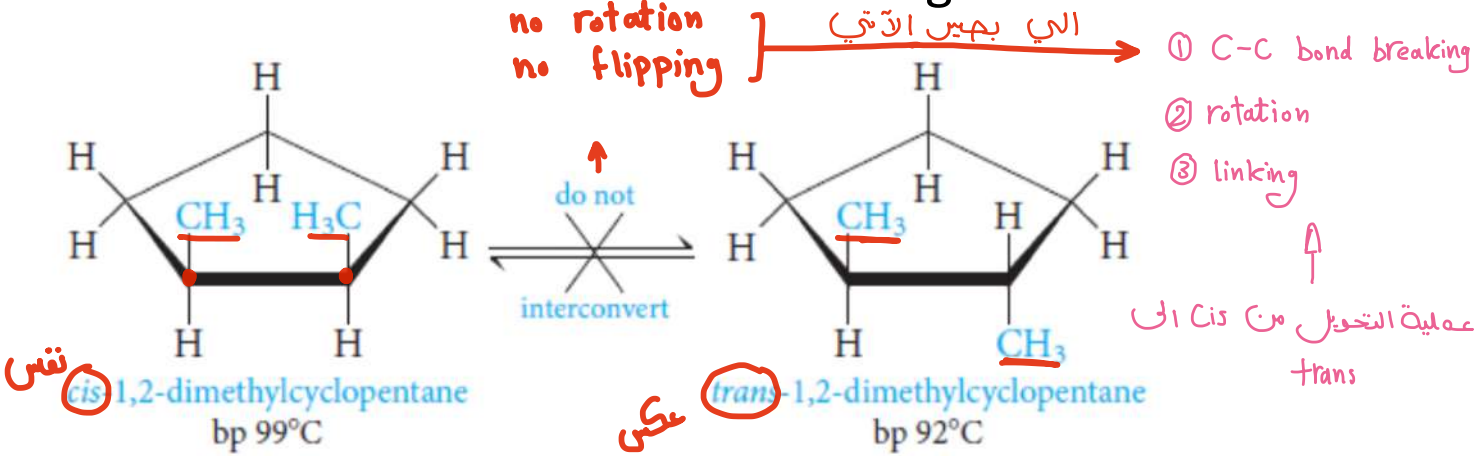
نوع آخر من isomers

Geometric Isomers (**isomerism)**

Geometric isomers (or **configurational** isomers, a subset of stereoisomers) are molecules which have the same chemical formula, the atoms are bonded in the same order, but located in different positions in space. Unlike conformational isomers, where the atoms are located in different location in space due to rotation about C-C single (σ) bonds, geometric isomers are not related by rotation about σ bonds. This situation arises with cyclic structures.

An example of this is 1,2-dimethylcyclopentane

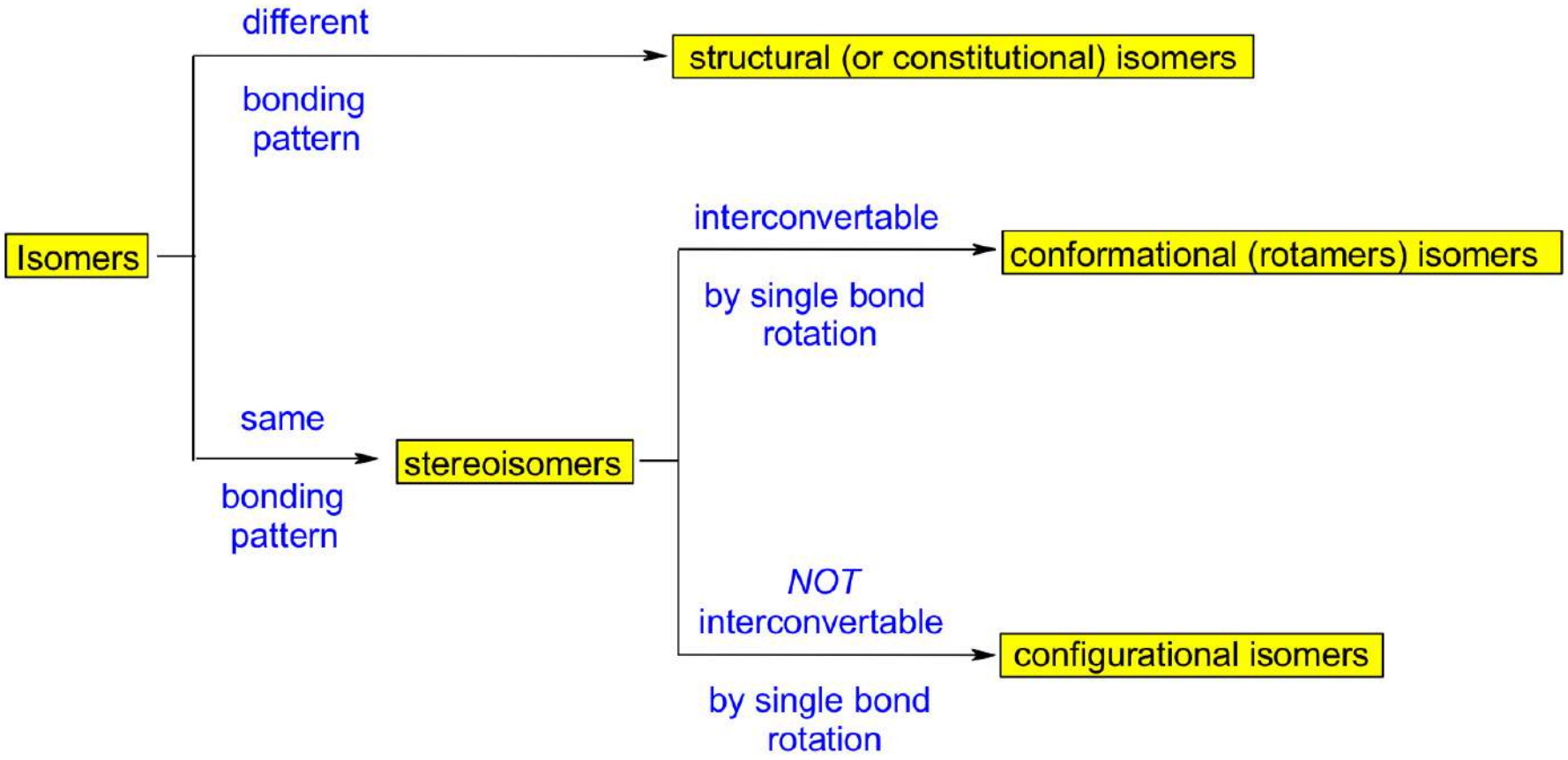
This structures can not interconvert without breaking a C-C bond.



- The two methyl groups may be on the same side of thering plane (*cis*)
- or they may be on the opposite sides (*trans*)

- Cis–trans isomers differ from one another only in the way that the atoms or groups are positioned in space. Yet this difference is sufficient to give them different physical and chemical properties
- *Cis trans* isomers can be separated from each other and kept separate

Summary of Isomers (to date)



Chemical Reactions of Alkanes

In general, because of their strong non-polar covalent bonds alkanes are fairly inert. They do not react with most common acids, bases, oxidizing or reducing reagents. They means they do make good solvents for extraction, recrystallization or as a reaction solvent. They do however have two substances they react with; molecular oxygen and halogens.

خامل

مادة مذيبة

استخراج

to form cryestal again

بتسمية

oxidation reaction

بتسمية

Halogenation

Oxidation Reactions

All chemical processes are redox (oxidation / reduction) reactions. Formally oxidation is the loss of electrons (increase in oxidation sate) and reduction the gain of electrons (decrease in oxidation sate). The two processes are coupled since whatever gains the electrons must gain them from somewhere and whatever loses the electrons must lose them to somewhere.

بما أنو أحنا بكيمياء عضوية فتركيزنا حيكون على Carbon atom

Oxidation Reactions (cont'd)

For the C atom, oxidation involves increasing the number of C-O (or other atoms more EN than C) bonds and/or decreasing the number of C-H bonds.

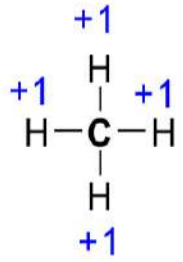
* عملية الارتباط بـ Carbon atom ← تعتبر more EN مثل Oxidation reaction

Reduction will be the opposite, a decrease in the number of C-O bonds or increase in the number of C-H bonds.

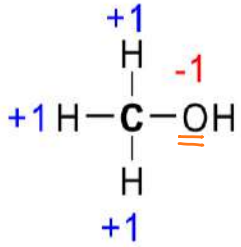
Oxidation Reactions (cont'd)

To determine the oxidation state:

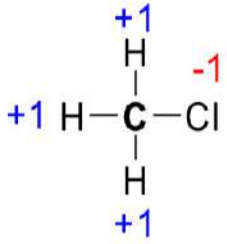
- each bond to a C atom counts: 0
- each bond to a H atom counts +1
- Each (single) bond to a more EN atom count -1, i.e.



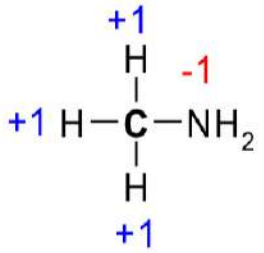
C = -(+1+1+1+1)
= -4



C = -(+1+1+1-1)
= -2



C = -(+1+1+1-1)
= -2

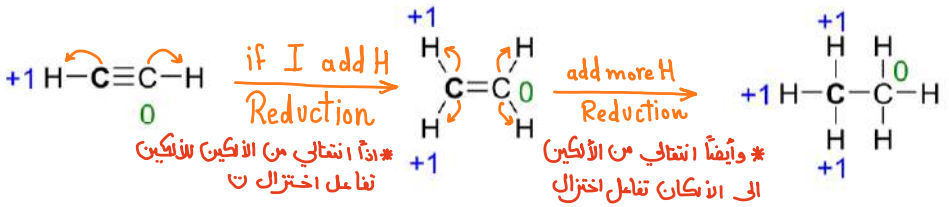


C = -(+1+1+1-1)
= -2

Oxidation Reactions (cont'd)

More examples:

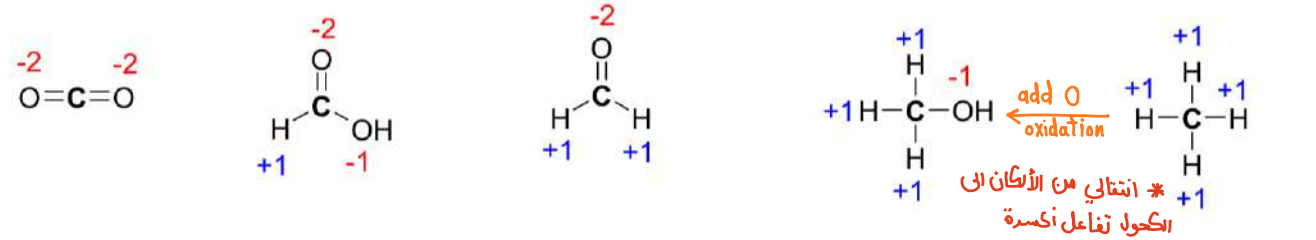
les:



C = -(0+1) = -1

C = -(0+1+1) = -2

C = -(0+1+1+1) = -3



C = -(-2-2) = +4

C = -(-2-1+1) = +2

C = -(-2+1+1) = 0

C = -(+1+1+1-1) = -2

C = -(+1+1+1+1) = -4

Most C-O bonds

Reduction

Oxidation

Most C-H bonds

Oxidation Reactions (cont'd)

(احتراق مركبات الألكين)

الكلام هون مهم

The most import use of alkanes is as a fuel. The light weight ones are gases and intermediate weight liquids which makes them handy for storage and transportation. Natural gas is composed primarily of methane with varying amounts of ethane, propane and butanes. It is commonly used to heat homes. The liquid hydrocarbons are used as gasoline, kerosene and jet fuels.

مفيد

① ②

ألكينات + O_2

$$\underset{\text{methane}}{CH_4} + 2\,O_2 \longrightarrow CO_2 + 2\,H_2O + \text{heat (212.8 kcal/mol)} \qquad (2.3)$$

مهمة لحياتنا اليومية

$$\underset{\text{butane}}{C_4H_{10}} + \tfrac{13}{2}\,O_2 \longrightarrow 4\,CO_2 + 5\,H_2O + \text{heat (688.0 kcal/mol)} \qquad (2.4)$$

Oxidation Reactions (cont'd)

The energy of the hydrocarbon is released when combusted or burned. This is an oxidation process and requires atmospheric oxygen. The final oxidation product (assuming sufficient oxygen) is carbon dioxide. If insufficient oxygen is present then partial oxidation products such as carbon monoxide, formaldehyde or formic acid may be formed.

Halogenation of Alkanes

Besides combustion, the only other useful chemical reaction that alkanes undergo is halogenation.

This is a free radical process in which heat or light is used to break a halide-halide bond forming two halide free radicals.

Halogenation of Alkanes (cont'd)

This type of reaction is a ***substitution reaction*** where a halide atom is substituted for a H atom in the alkane.

استبدال

عامل مساعد

*

* تحويل الألكان الى هاليد

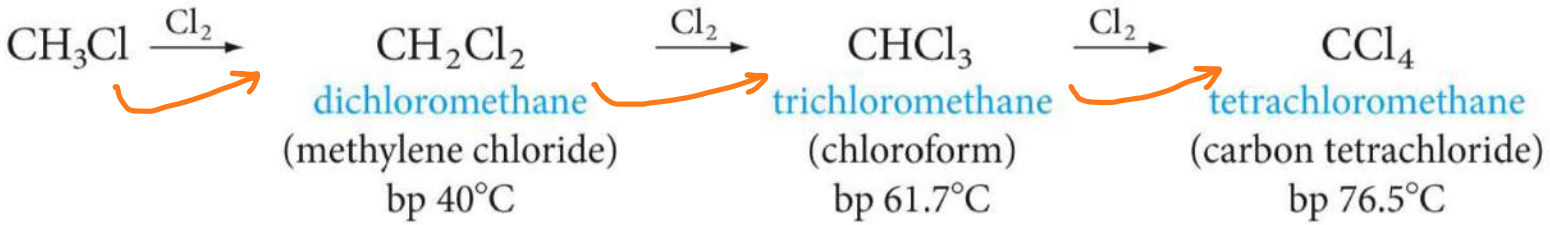
The two common halides used are chlorine and bromine.

Halogenation of Alkanes (cont'd)

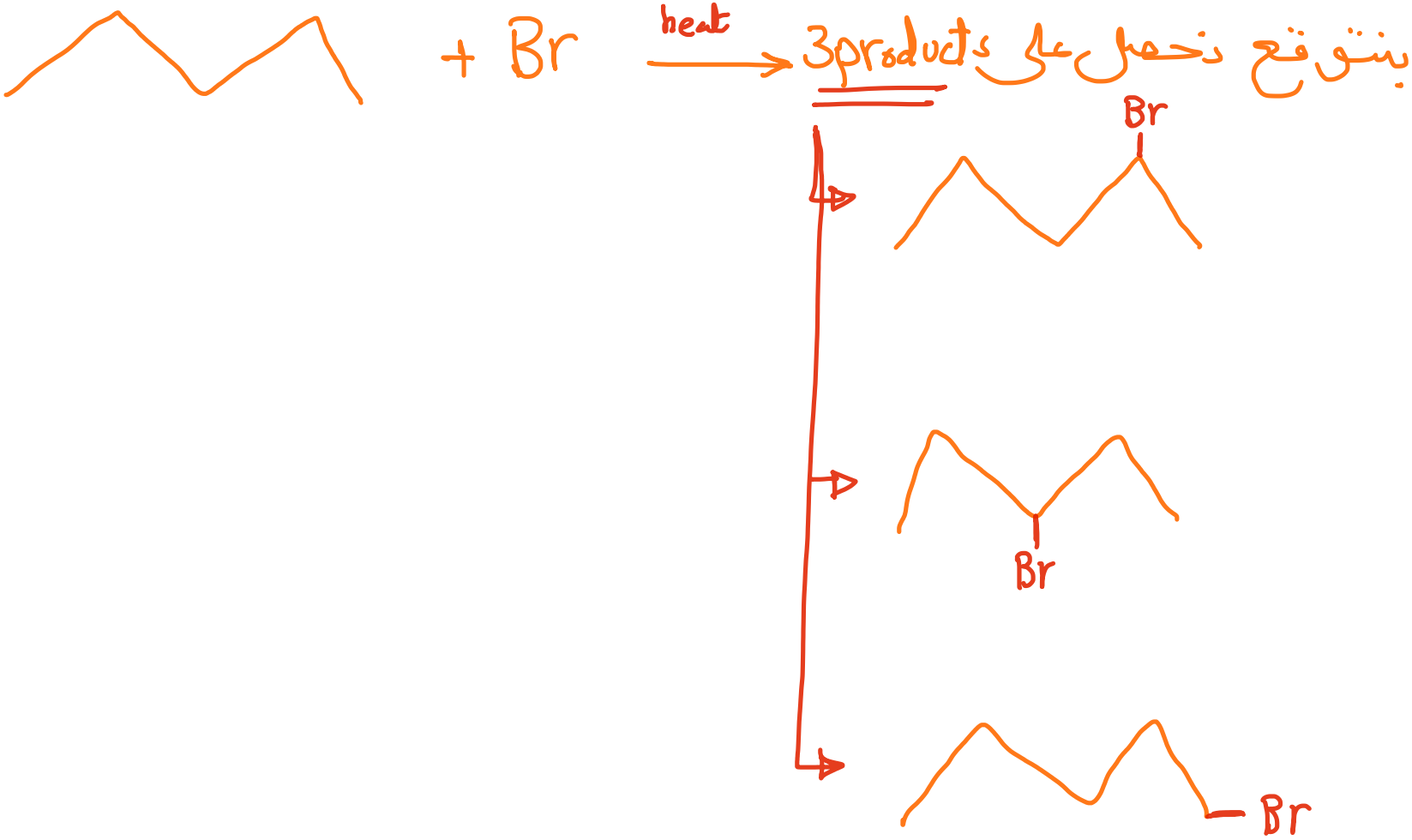
A single alkane molecule can undergo several substitution steps depending on the concentration of the halide radical, i.e.

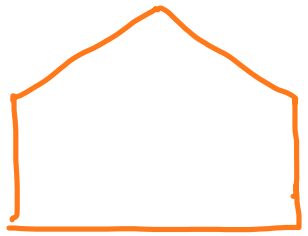
مشكلة ← الحل ← اضافة Cl_2 ← تتفاعل multi halogenation

$CH_4 + Cl \rightarrow CH_3Cl$



As a matter of fact, unless the concentration of chlorine is kept quite low there will be a mixture of these produces.


+ Br
heat
3products يتوقع نحصل على
Br
Br
Br



+ Br $\xrightarrow{\text{heat}}$ 1 product بنتوقع نحصل على

Br

في سلايدات
الكلور حذفنا
فأنا حذفتهم

New terms

Cis : same side

Trans : opposite side

Implication : تبعات

Inert : خامل

Solvent : مادة مذيبة

Extraction : استخلاص و استخراج

Redox : أكسدة و اختزال

Handy : مفيد

Combusted : استهلاك

دعواتكم ♡

Done by : Johainah Taha