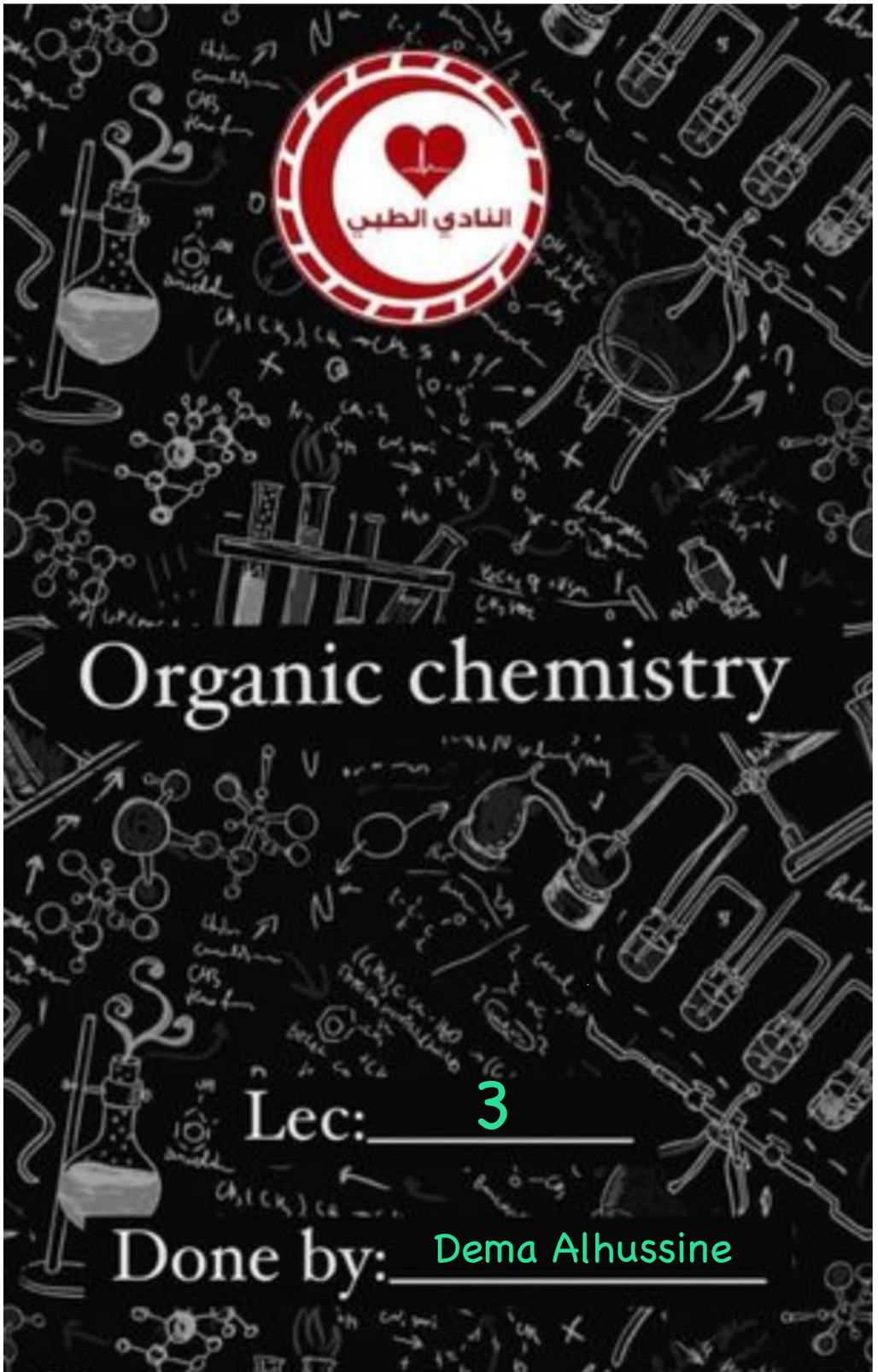
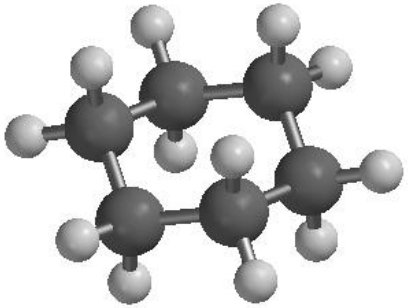
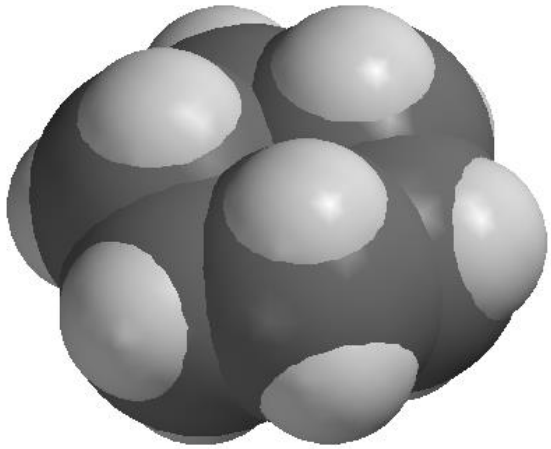
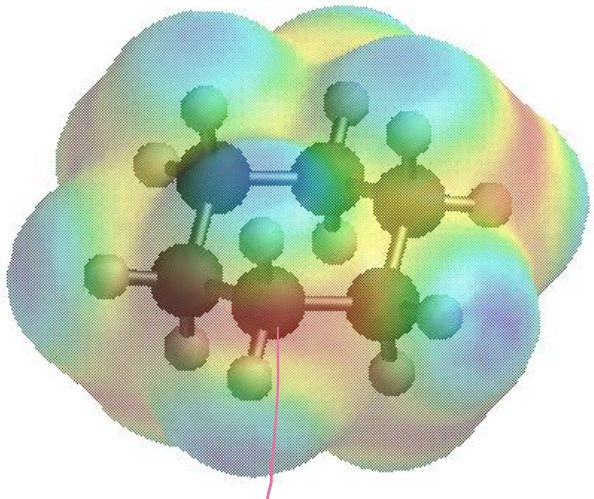

النادي الطبي
Organic chemistry
Lec: 3
Done by: Dema Alhussine



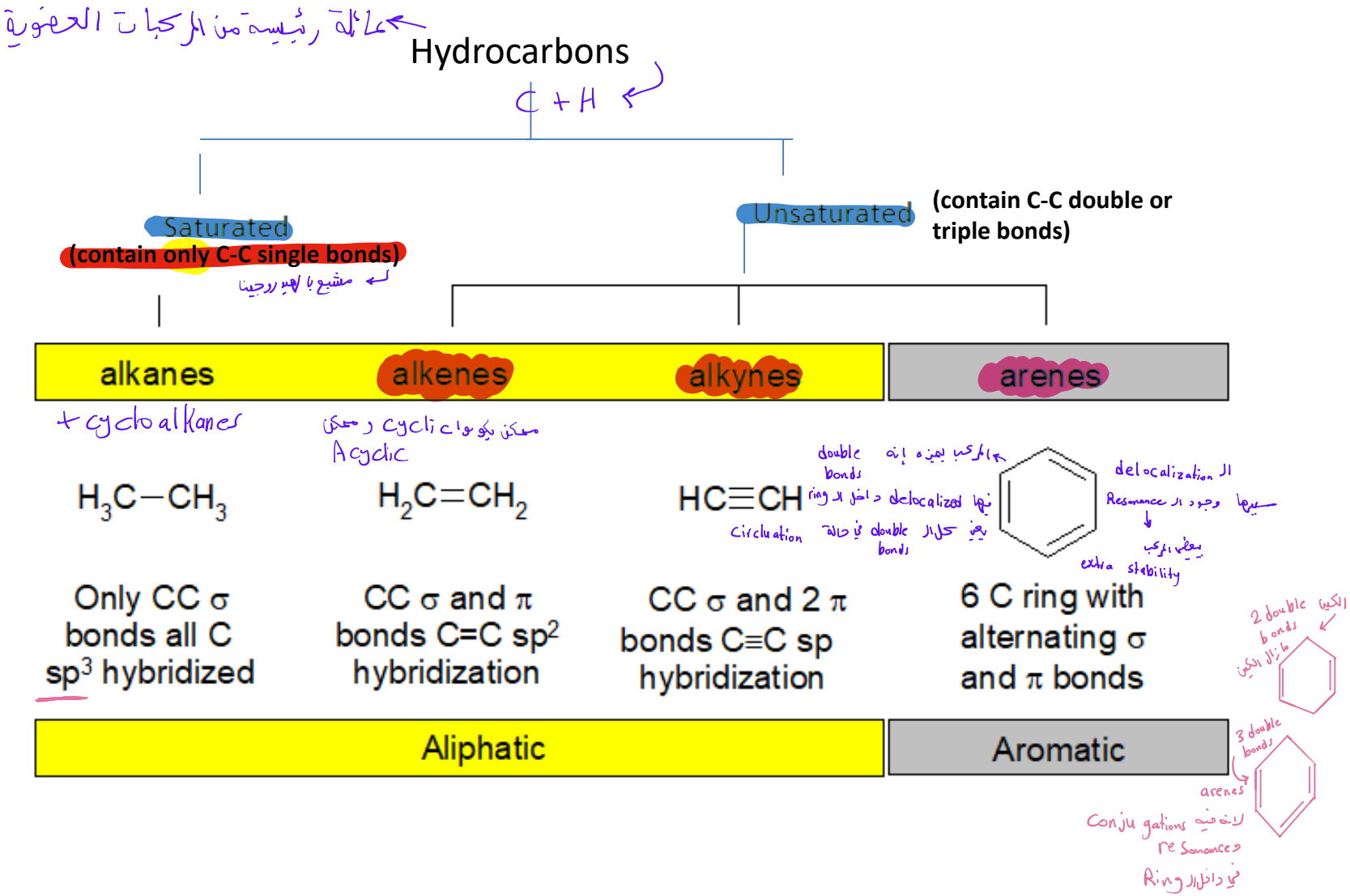


# *Chapter 2: Alkanes and Cycloalkanes: Conformational and Geometric Isomers*



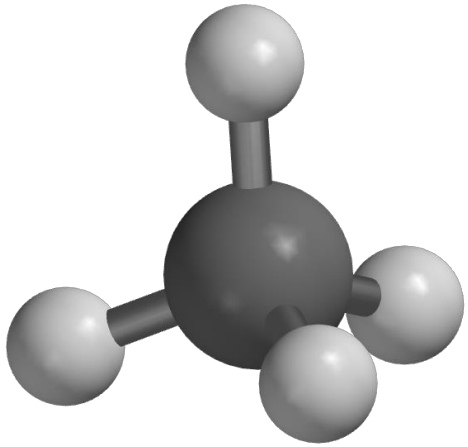
# Types of Hydrocarbons

Hydrocarbons are compounds that only contain C and H atoms.



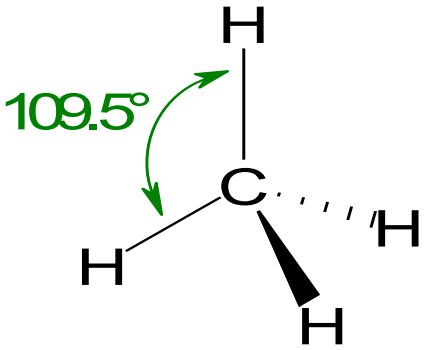
# Structure of Alkanes

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



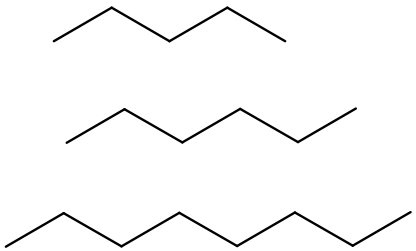
The generic formula for an alkane is:
$C_nH_{2n+2}$

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

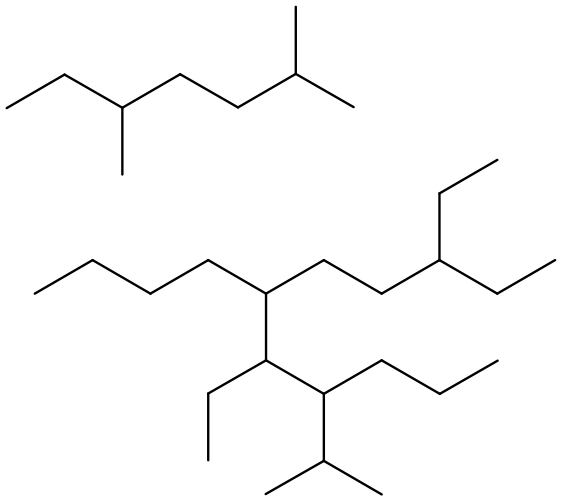


# Structure of Alkanes (cont'd)

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

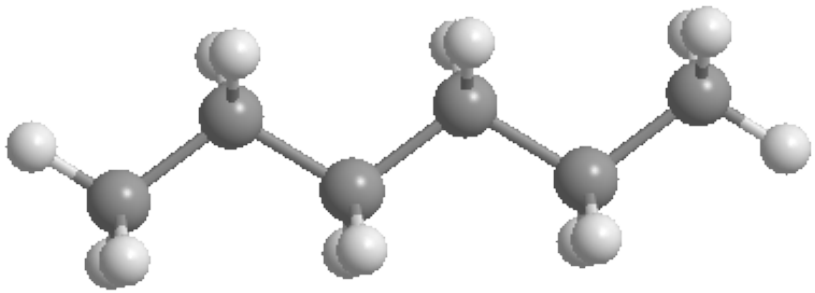


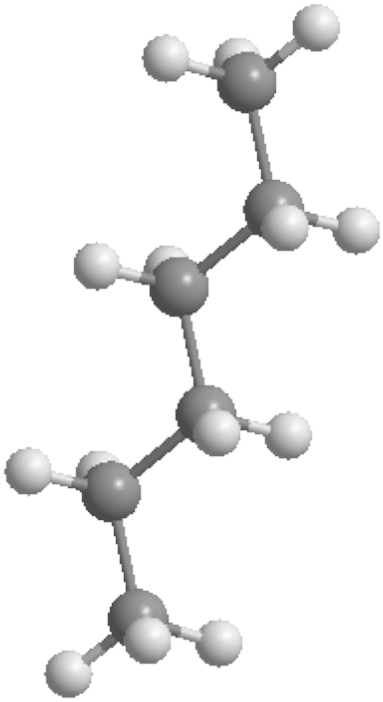
Normal, unbranched (or linear)



branched

# Structure of Alkanes (cont'd)





# Nomenclature of Organic Compounds

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

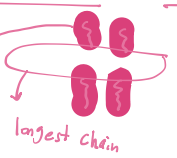
التسمية حسب مصدرها، مين حضرها، طريقة تحضيرها، functional group، عائلة معينة (طريقة عشوائية)

**B. IUPAC** : → (Rules)

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

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

3- **Prefix** :What and where substituents. → بدي أحكي مين هم وعين موجودين




1- **Parent** (Root) : longest chain → أطول سلسلة تمثل الاسم الأساسي

2- **Suffix** : functional group. → في نهاية الاسم في حرفين أو ثلاث بدلوا على الـ functional group

## Table 2.1 Names and Formulas of the First Ten Unbranched Alkanes

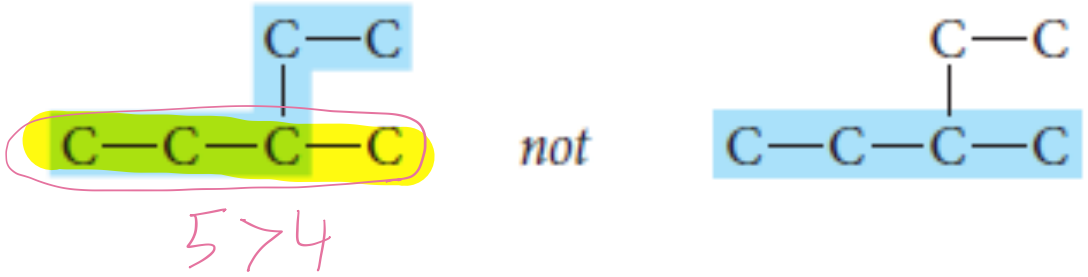
| Name | Number of carbons | Molecular formula | Structural formula | Number of structural isomers |
|---|---|---|---|---|
| methane | 1 | $CH_4$ | $CH_4$ | 1 |
| ethane | 2 | $C_2H_6$ | $CH_3CH_3$ | 1 |
| propane | 3 | $C_3H_8$ | $CH_3CH_2CH_3$ | 1 |
| butane | 4 | $C_4H_{10}$ | $CH_3CH_2CH_2CH_3$ | 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 |

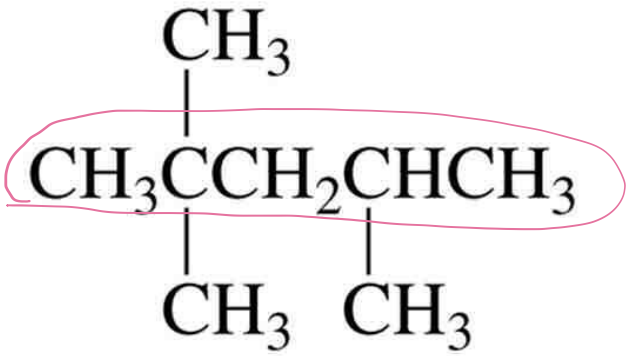
Note: The repeating group is (-CH2-) is Methylene group

# IUPAC Rules for Naming Alkanes

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

لـــ شرط تكون ملستمرة



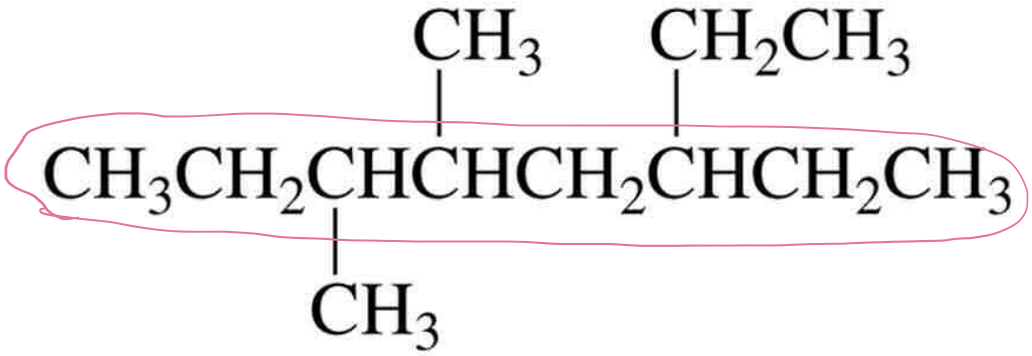



**2,2,4-trimethylpentane**

**not**

**2,4,4-trimethylpentane**

because 2 < 4



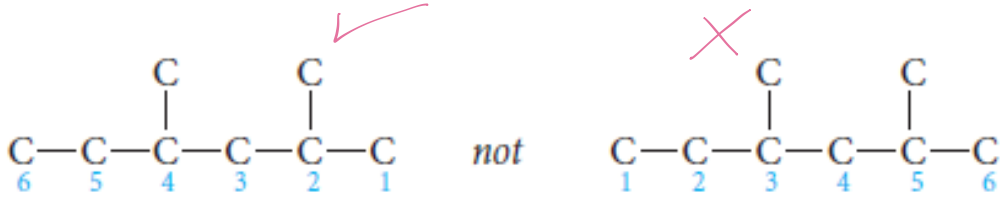
**6-ethyl-3,4-dimethyloctane**

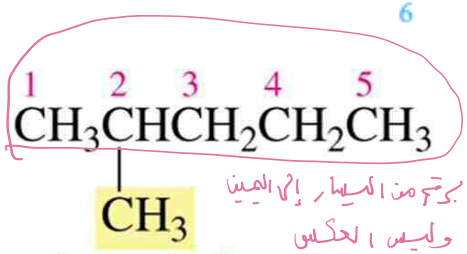
**not**

**3-ethyl-5,6-dimethyloctane**

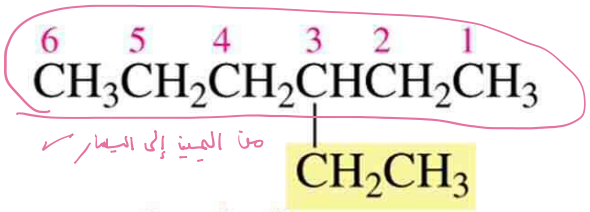
because 4 < 5

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

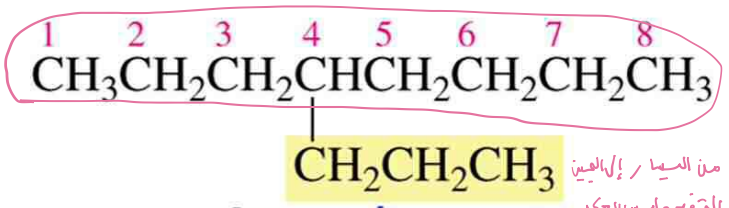



2-methylpentane
not
4-methylpentane

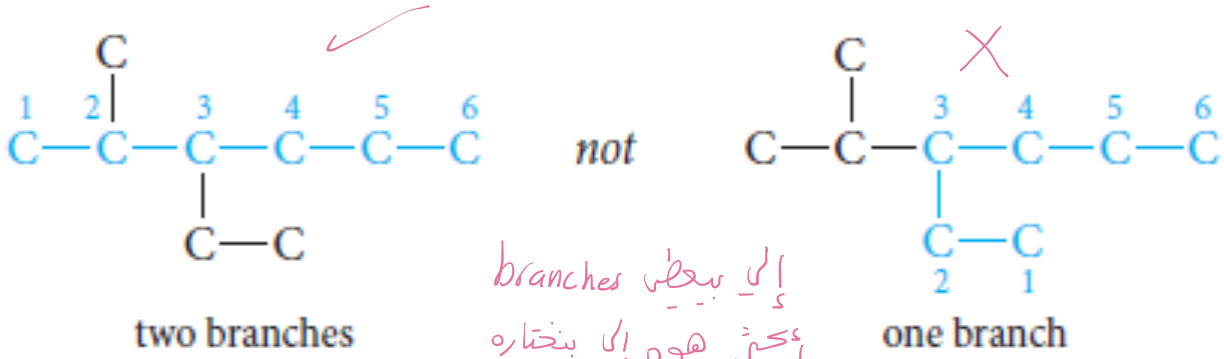



3-ethylhexane
not
4-ethylhexane




4-propyloctane
not
5-propyloctane

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

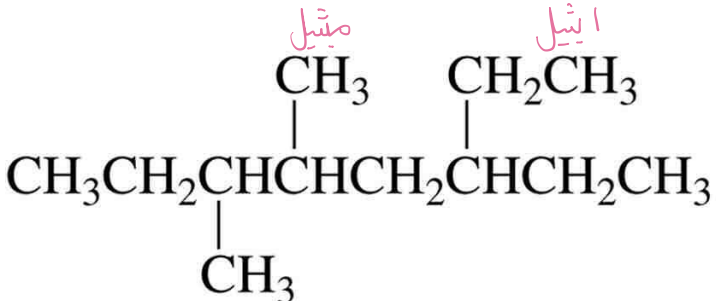



two branches

one branch

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.**

$CH_4$ → Methane

$CH_4 - H$ → $CH_3$ → Methyl Group (alkyl)

$CH_3-$ **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

3C فما أكثر يصير في structural isomers عندي

مطلوب حفظ الأشكال و ال isomers as Alkyl

a secondary carbon

a primary carbon

$CH_3CH_2CH_3$

propane

remove a hydrogen

$CH_3CH_2CH_2-$

propyl group

-Pr

$CH_3CHCH_3$

isopropyl group

عشان أميزهم عن بعض بحط كلمة هكذا

Propyl مختلفين عن بعض

*i*-Pr-

أسهل من الطرف

## -There are Four Butyl Groups

primary carbon

$CH_3CH_2CH_2CH_2-$

butyl group

primary carbon

$CH_3CHCH_2-$

$CH_3$

isobutyl group

بدي احفظا شكلها

secondary carbon

$CH_3CH_2CH-$

$CH_3$

*sec*-butyl group

tertiary carbon

$CH_3$

$CH_3C-$

$CH_3$

*tert*-butyl group

وراح يسموها nbutyl

Secondary

* Connection بس بفرق لمكان ال butyl مهم

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

Wednesday 6-3-2024