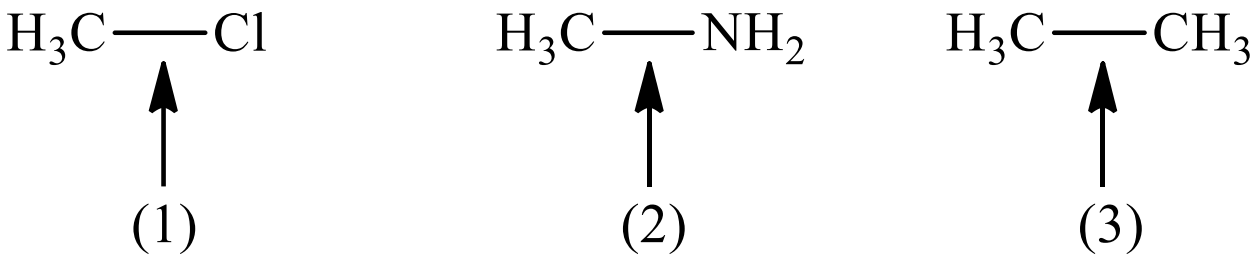
1. Sắp xếp các liên kết được chỉ ra sau đây theo thứ tự giảm dần độ phân cực:



A. (1) = (2) > (3)

B. (3) > (2) > (1)

C. (2) > (3) > (1)

D. (2) > (1) > (3)

2. Thứ tự giảm dần hiệu ứng –I trong dãy -OH, $-NH_2$, -F, $-CH_3$ là:

A. $-OH > -NH_2 > -CH_3 > -F$

B. $-F > -OH > -NH_2 > -CH_3$

C. $–NH_2 > -OH > -F > -CH_3$

D. $-F > -NH_2 > -OH > -CH_3$

3. Sắp xếp các axit sau theo thứ tự tăng dần tính axit

(1) CH_3COOH; (2) C_2H_5COOH; (3) $ClCH_2COOH$

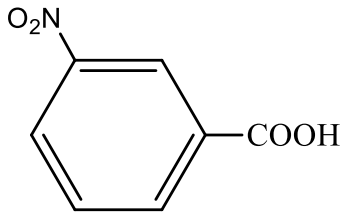
A. 1 < 2 < 3

B. 2 < 1 < 3

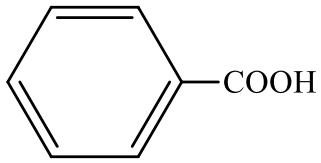
C. 2< 3 < 1

D. 1 < 3 < 2

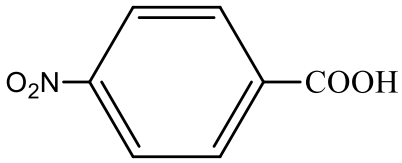
4. Sắp xếp các axit sau theo thứ tự giảm dần tính axit



(1)



(2)



(3)

A. 1 > 2 > 3

B. 3 > 2 > 1

C. 1 > 3 > 2

D. 3 > 1 > 2

5: So sánh tính bazơ của các chất sau:

(1) NH_3; (2) $(CH_3)_2NH$; (3) CH_3NH_2

Chọn đáp án đúng

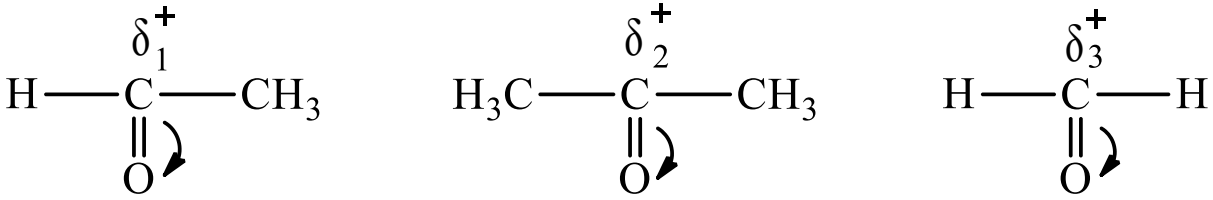
A. 1 > 2 > 3

B. 2 > 3 > 1

C. 2 > 1 > 3

D. 3 > 2 > 1

6: Cho các chất sau:



So sánh nào sau đây đúng?

A. $\delta_3^+ > \delta_1^+ > \delta_2^+$

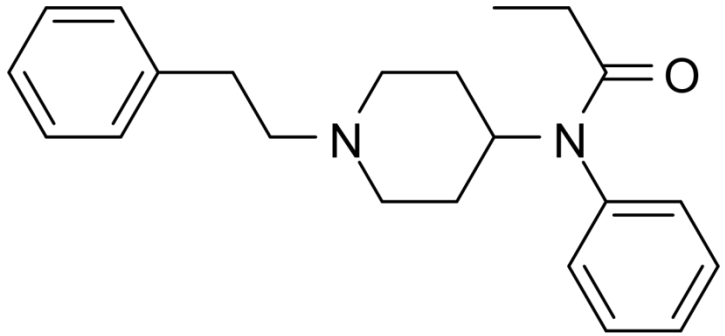
B. $\delta_2^+ > \delta_3^+ > \delta_1^+$

C. $\delta_1^+ > \delta_3^+ > \delta_2^+$

D. $\delta_3^+ > \delta_2^+ > \delta_1^+$

Fentanyl

a strong opioid to help patients manage chronic pain. 80 times as powerful as morphine and hundreds of times more powerful than heroin.



first made in 1960
by Paul Janssen

2012: the most widely used synthetic opioid in medicine.
2013: 1700 kilograms were used globally.

is also used as a recreational drug, and has led to **thousands of overdose deaths** each year (2000-2015)

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B.C. declares public health emergency after fentanyl overdoses kill 200 people in three months

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Fentanyl deaths are a Canada-wide 'disaster'

Mysterious narcotic is hundreds of times more powerful than heroin

By Aleksandra Sagan, CBC News Posted: Aug 10, 2015 5:00 AM ET | Last Updated: Aug 10, 2015 4:36 PM ET

A KILLER HIGH

THE GLOBE AND MAIL

How Canada got addicted to fentanyl

Manufactured in China, it easily crosses our porous borders, triggering a heroin-like bliss in users – and, all too often, death. The Globe investigates the rise of a fatal opioid

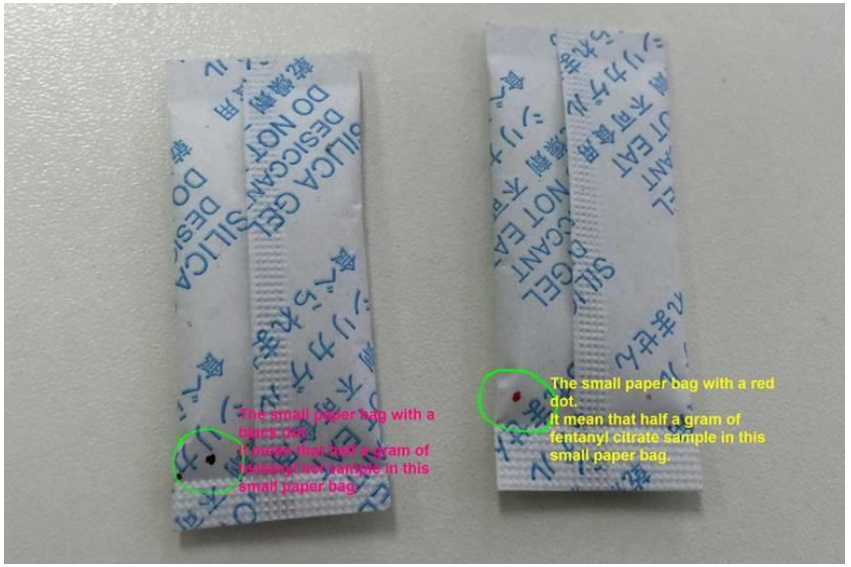
KAREN HOWLETT, JUSTIN GIOVANNETTI, NATHAN VANDERKLIPPE AND LES PERREAUX
TORONTO, EDMONTON, BEIJING AND MONTREAL
GLOBE AND MAIL UPDATE – INCLUDES CORRECTION
LAST UPDATED: THURSDAY, JAN. 05, 2017 3:27PM EST

died at 25 year old

Fentanyl's deadly path

How the powerful drug gets through Canada's border and into the hands of users

Suppliers in China hide fentanyl in decoy packages before shipping the drug to Canada. Sometimes they conceal the drug alongside urine test strips



Fentanyl from China is sometimes hidden in silica desiccant packages.

THE GLOBE AND MAIL

Fentanyl pills are made to look similar to OxyContin pills
(a moderately potent opioid analgesic, generally indicated for relief of moderate to severe pain).

A photo of a lab that a Chinese drug vendor sent to Rodney Bridge

THE BLOG

‘Not for Human Consumption’ — The Glut of Synthetic Psychoactive Drugs on the Horizon

04/06/2016 11:01 am ET | **Updated** Apr 06, 2016

Legal highs
(legal intoxicant)

European Contraband

http://www.huffingtonpost.com/

How Addiction Hijacks the Brain?

Organic Chemistry

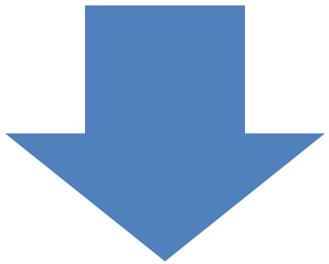
CHE 203

Lecture 3: Alkanes

Le Quoc Chon – Duy Tan University

50 million compounds

- Physical properties
- Chemical reactivities



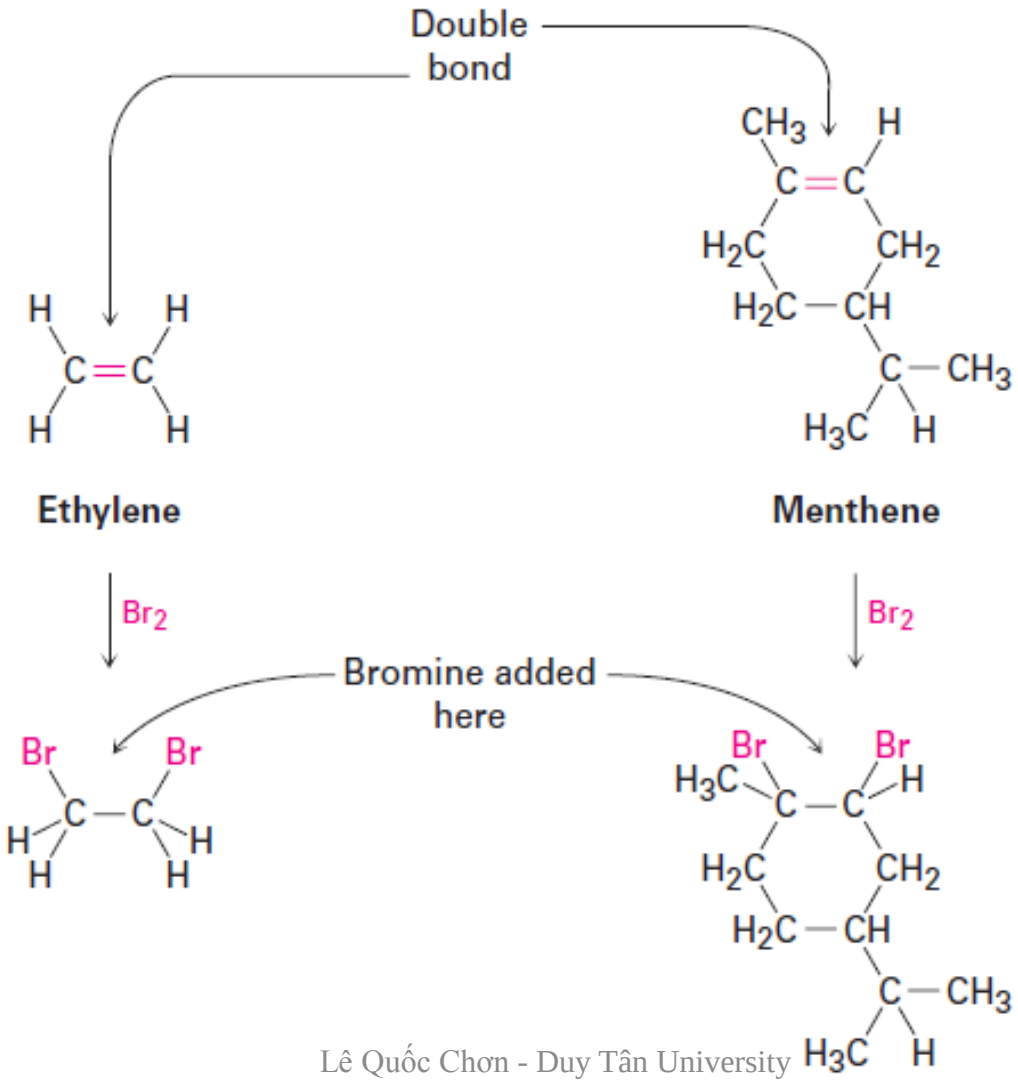
Có rất nhiều chất nên cần phân loại, sắp xếp lại theo các nhóm chất.

Classification

& simplest family: alkanes

Functional groups (nhóm chức)

a plant hormone that cause fruit to ripen



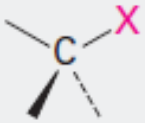
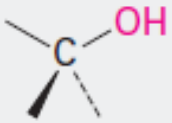
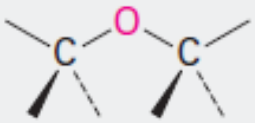
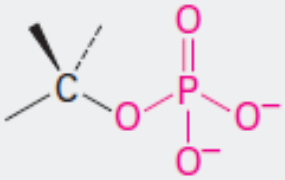
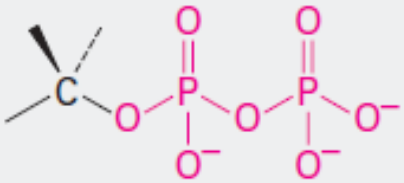
in peppermint oil

Functional groups (nhóm chức)

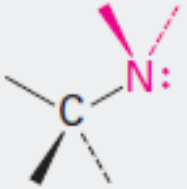
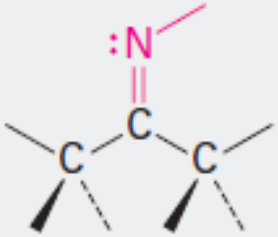
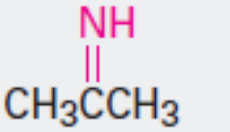
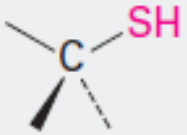
TABLE 3-1 Structures of Some Common Functional Groups

Name	Structure*	Name ending	Example
Alkene (double bond)		*-ene*	$H_2C{=}CH_2$ Ethene
Alkyne (triple bond)	—C≡C—	*-yne*	HC≡CH Ethyne
Arene (aromatic ring)		None	 Benzene

Functional groups

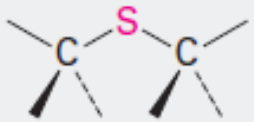
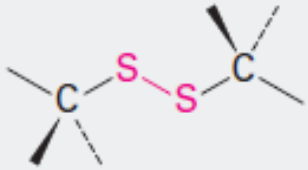
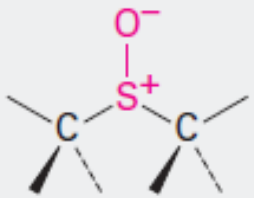
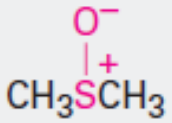
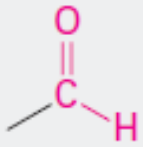
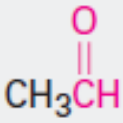
Halide	 (X = F, Cl, Br, I)	None	CH_3Cl Chloromethane
Alcohol		*-ol*	CH_3OH Methanol
Ether		*ether*	CH_3OCH_3 Dimethyl ether
Monophosphate		*phosphate*	$CH_3OPO_3^{2-}$ Methyl phosphate
Diphosphate		*diphosphate*	$CH_3OP_2O_6^{3-}$ Methyl diphosphate

Functional groups

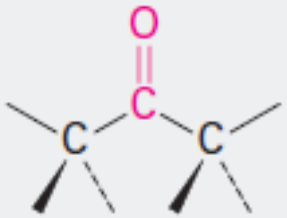
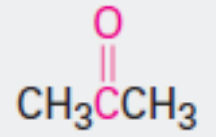
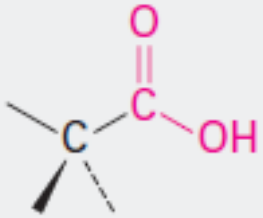
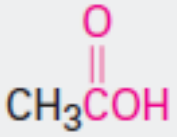
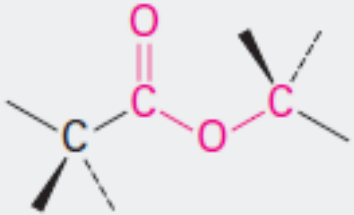
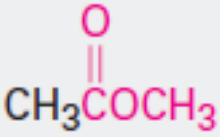
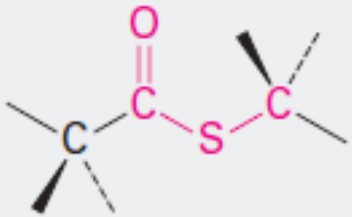
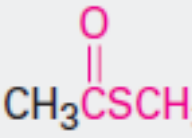
Amine		*-amine*	CH_3NH_2 Methylamine
Imine (Schiff base)		None	 Acetone imine
Nitrile		*-nitrile*	$CH_3C{\equiv}N$ Ethanenitrile
Thiol		*-thiol*	CH_3SH Methanethiol

Functional groups

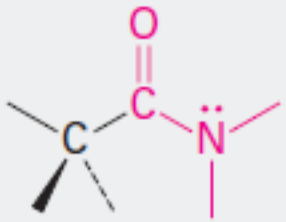
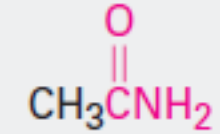
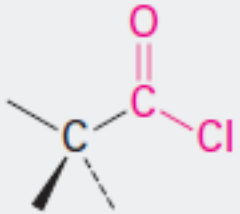
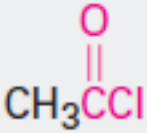
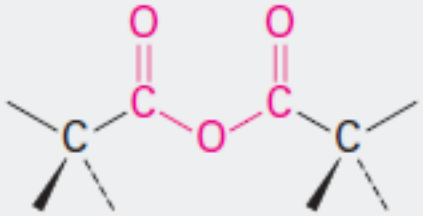
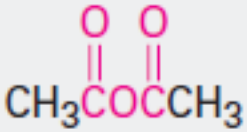
TABLE 3-1 Structures of Some Common Functional Groups *(continued)*

Name	Structure*	Name ending	Example
Sulfide		*sulfide*	CH_3SCH_3 Dimethyl sulfide
Disulfide		*disulfide*	CH_3SSCH_3 Dimethyl disulfide
Sulfoxide		*sulfoxide*	 Dimethyl sulfoxide
Aldehyde		*-al*	 Ethanal

Functional groups

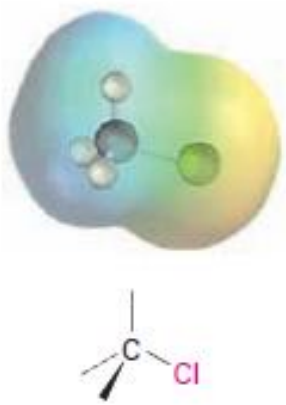
Ketone		*-one*	 Propanone
Carboxylic acid		*-oic acid*	 Ethanoic acid
Ester		*-oate*	 Methyl ethanoate
Thioester		*-thioate*	 Methyl ethanethioate

Functional groups

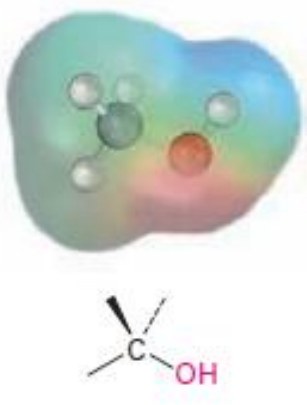
Amide		*-amide*	 Ethanamide
Acid chloride		*-oyl chloride*	 Ethanoyl chloride
Carboxylic acid anhydride		*-oic anhydride*	 Ethanoic anhydride

C singly bonded to EN atom

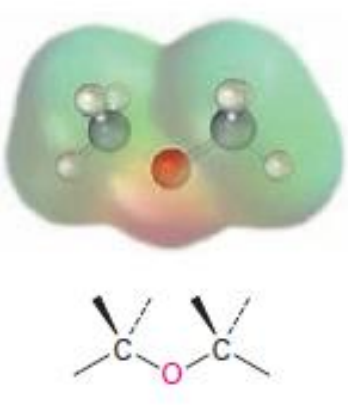
(nguyên tử C liên kết đơn với nguyên tử có độ âm điện lớn)



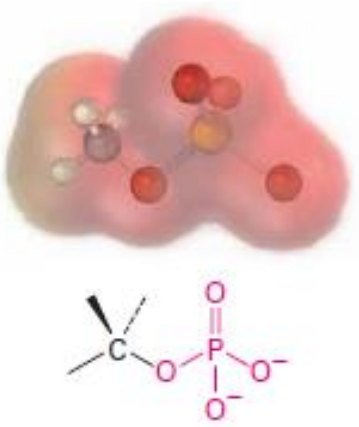
Alkyl halide
(haloalkane)



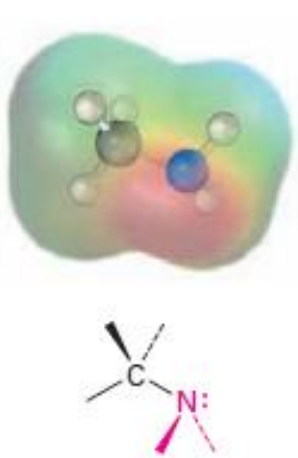
Alcohol



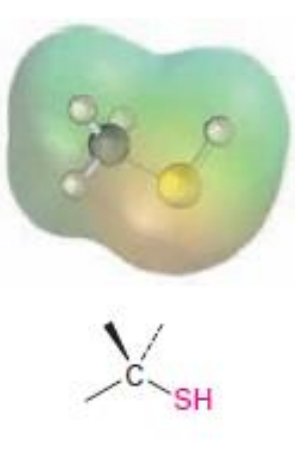
Ether



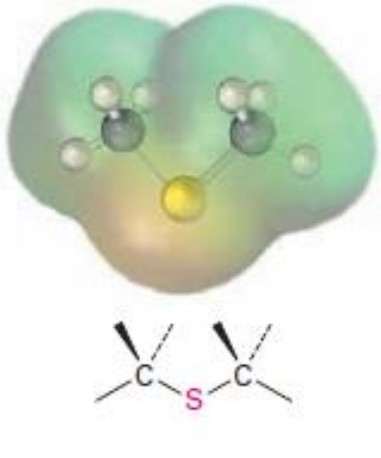
Phosphate



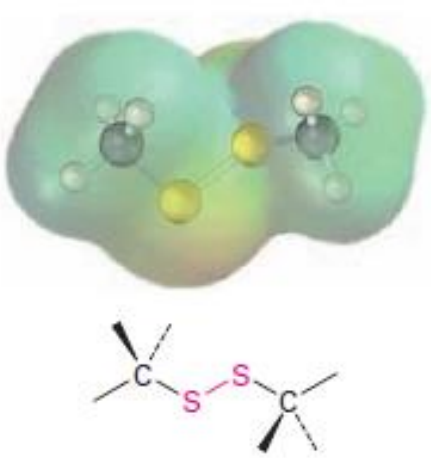
Amine



Thiol

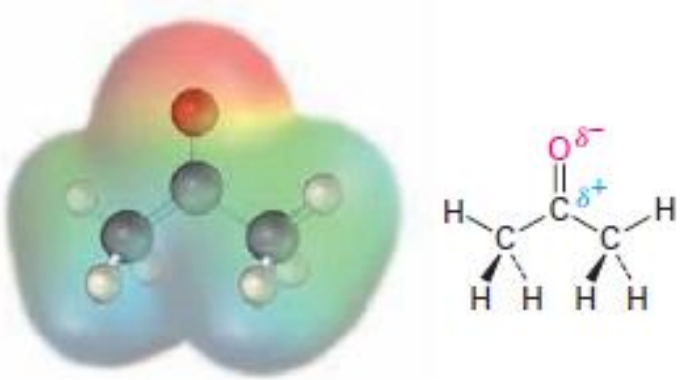


Sulfide

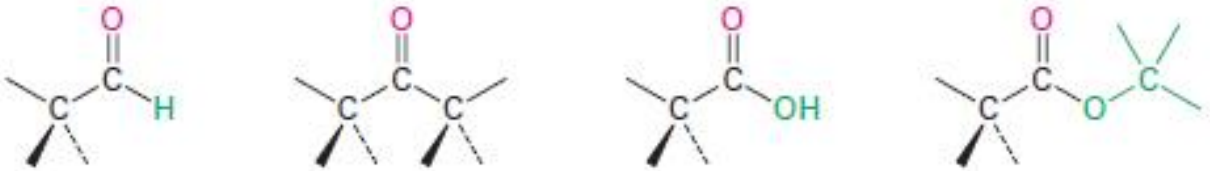


Disulfide

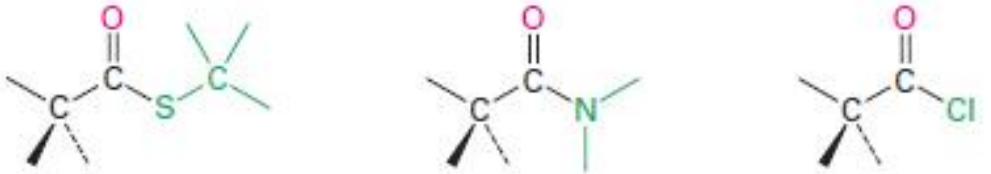
Carbonyl group



Acetone — a typical carbonyl compound



Aldehyde | Ketone | Carboxylic acid | Ester



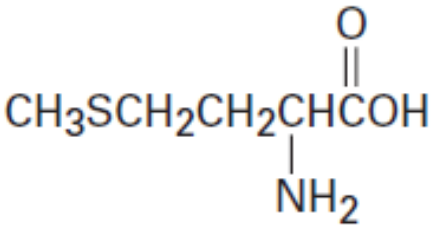
Thioester | Amide | Acid chloride

Problem

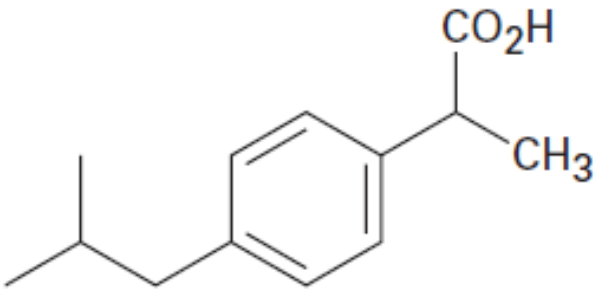
PROBLEM 3-1 Xác định nhóm chức có trong các chất sau:

Identify the functional groups in each of the following molecules:

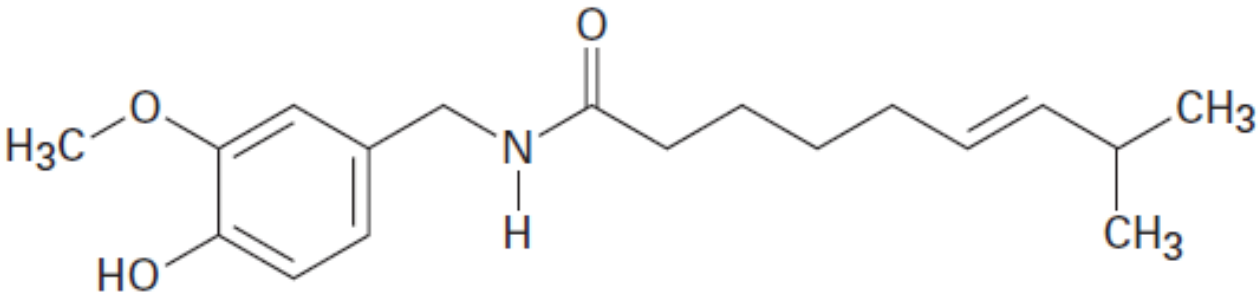
(a) Methionine, an amino acid:



(b) Ibuprofen, a pain reliever:



(c) Capsaicin, the pungent substance in chili peppers:

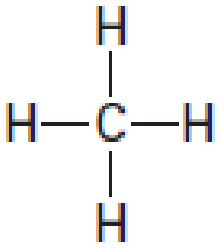


Problem

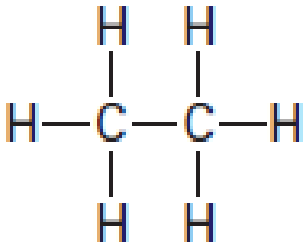
PROBLEM 3-3 Xác định nhóm chức có trong chất sau:

Identify the functional groups in the following model of arecoline, a veterinary drug used to control worms in animals. Convert the drawing into a line-bond structure and a molecular formula (red = O, blue = N).

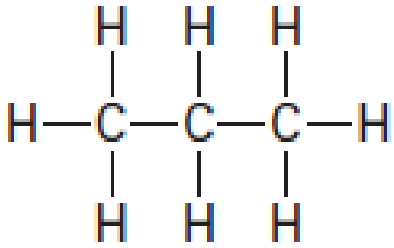
Alkane



Methane



Ethane

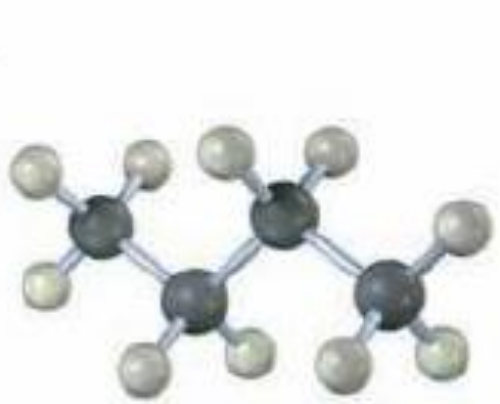


Propane

and so on

Alkane and its isomers

(alkane và đồng phân)



$CH_3CH_2CH_2CH_3$

Butane, C_4H_{10}

CH_3CHCH_3 (with CH_3 branch)

Isobutane, C_4H_{10}
(2-methylpropane)

Alkane and its isomers

$CH_3CH_2CH_2CH_2CH_3$

Pentane, C_5H_{12}

$CH_3CH_2\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_3$

2-Methylbutane, C_5H_{12}

$CH_3\underset{\displaystyle CH_3}{\underset{|}{C}}CH_3$
$\underset{\displaystyle CH_3}{\underset{|}{}}$

2,2-Dimethylpropane, C_5H_{12}

Alkane and its isomers

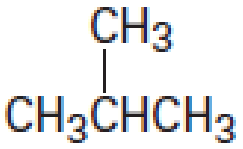
TABLE 3-2 Number of Alkane Isomers

Formula	Number of isomers
C_6H_{14}	5
C_7H_{16}	9
C_8H_{18}	18
C_9H_{20}	35
$C_{10}H_{22}$	75
$C_{15}H_{32}$	4347
$C_{20}H_{42}$	366,319
$C_{30}H_{62}$	4,111,846,763

Số đồng phân tăng khi số C tăng

Constitutional isomerism
(syn: structural isomer = đồng phân cấu tạo)

Different carbon skeletons
C_4H_{10}



2-Methylpropane (isobutane)

and

$CH_3CH_2CH_2CH_3$

Butane

Different functional groups
C_2H_6O

CH_3CH_2OH

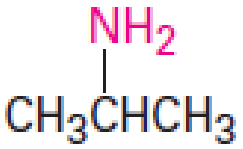
Ethanol

and

CH_3OCH_3

Dimethyl ether

Different position of functional groups
C_3H_9N



Isopropylamine

and

$CH_3CH_2CH_2NH_2$

Propylamine

Alkane chains (chuỗi alkane)

TABLE 3-3 Names of Straight-Chain Alkanes

Number of carbons (n)	Name	Formula (C_nH_{2n+2})	Number of carbons (n)	Name	Formula (C_nH_{2n+2})
1	Methane	CH_4	9	Nonane	C_9H_{20}
2	Ethane	C_2H_6	10	Decane	$C_{10}H_{22}$
3	Propane	C_3H_8	11	Undecane	$C_{11}H_{24}$
4	Butane	C_4H_{10}	12	Dodecane	$C_{12}H_{26}$
5	Pentane	C_5H_{12}	13	Tridecane	$C_{13}H_{28}$
6	Hexane	C_6H_{14}	20	Icosane	$C_{20}H_{42}$
7	Heptane	C_7H_{16}	30	Triacontane	$C_{30}H_{62}$
8	Octane	C_8H_{18}			

Problem

PROBLEM 3-4

Vẽ 5 đồng phân của C_6H_{14}

Draw structures of the five isomers of C_6H_{14}.

PROBLEM 3-5

Vẽ công thức cấu tạo cho: (a) có hai đồng phân ester, (b) có hai đồng phân nitrile, (c) có hai đồng phân disulfide

Propose structures that meet the following descriptions:

(a) Two isomeric esters with the formula $C_5H_{10}O_2$

(b) Two isomeric nitriles with the formula C_4H_7N

(c) Two isomeric disulfides with the formula $C_4H_{10}S_2$

Problem

Các công thức sau có bao nhiêu đồng phân
(a) rượu, (b) bromoalkane, (c) thioester

PROBLEM 3-6

How many isomers are there with the following descriptions?

(a) Alcohols with the formula C_3H_8O

(b) Bromoalkanes with the formula C_4H_9Br

(c) Thioesters with the formula C_4H_8OS

Alkyl groups

Methane

A methyl group

Methyl alcohol
(methanol)

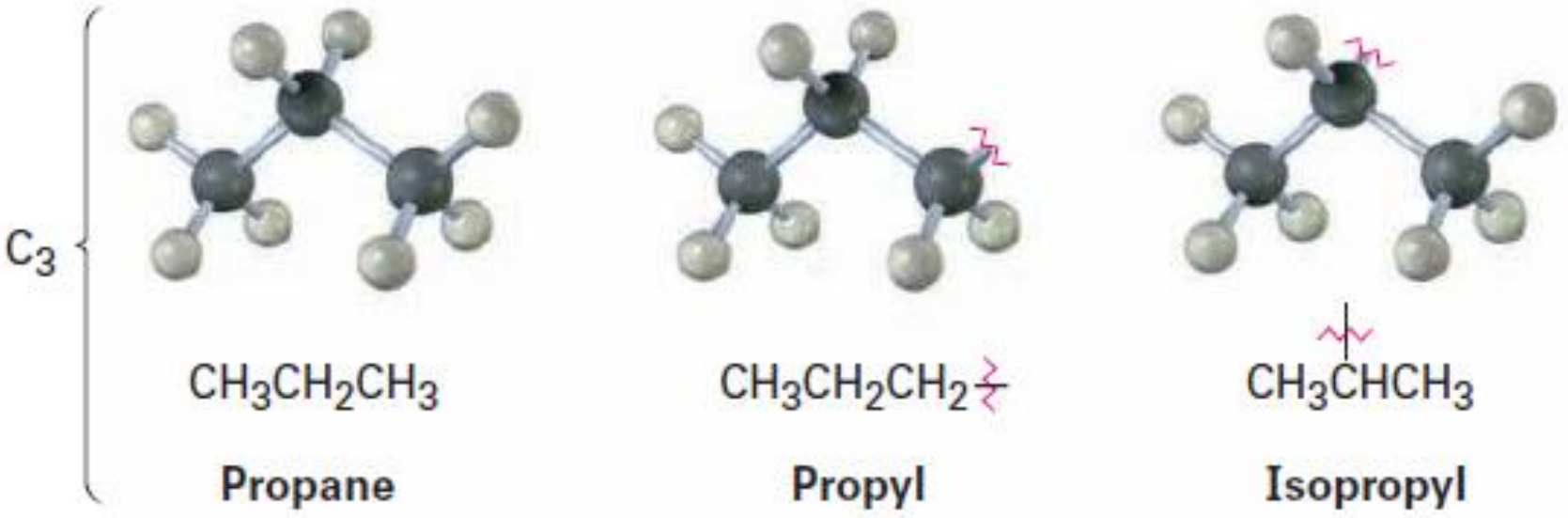
Methylamine

Alkyl groups

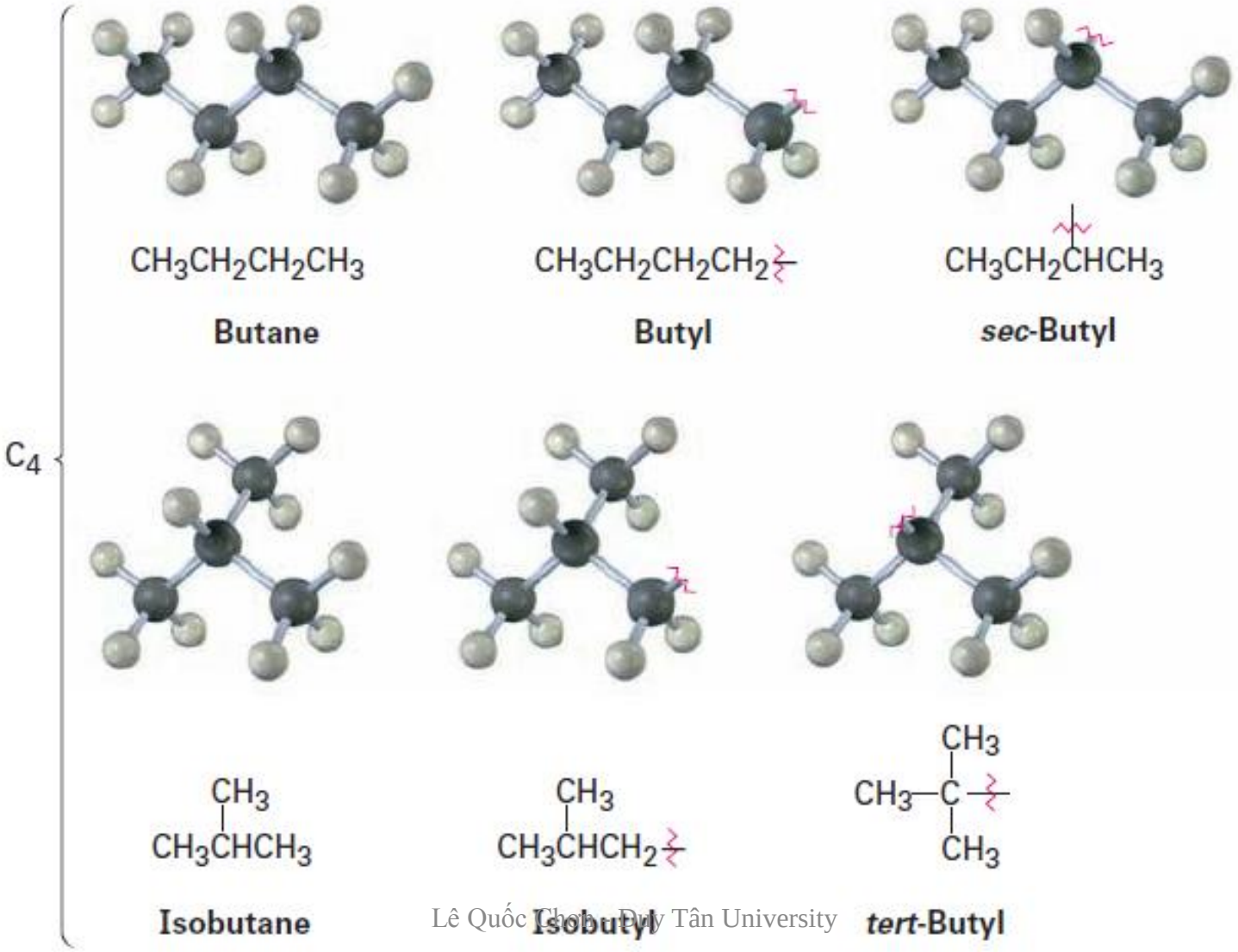
TABLE 3-4 Some Straight-Chain Alkyl Groups

Alkane	Name	Alkyl group	Name (abbreviation)
CH_4	Methane	$-CH_3$	Methyl (Me)
CH_3CH_3	Ethane	$-CH_2CH_3$	Ethyl (Et)
$CH_3CH_2CH_3$	Propane	$-CH_2CH_2CH_3$	Propyl (Pr)
$CH_3CH_2CH_2CH_3$	Butane	$-CH_2CH_2CH_2CH_3$	Butyl (Bu)
$CH_3CH_2CH_2CH_2CH_3$	Pentane	$-CH_2CH_2CH_2CH_2CH_3$	Pentyl, or amyl

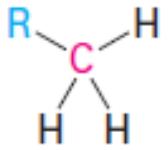
Alkyl groups



Alkyl groups



Alkyl groups

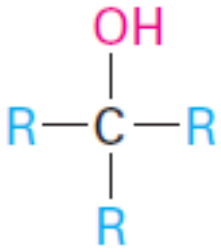


Primary **carbon (1°) is bonded to one other carbon.**

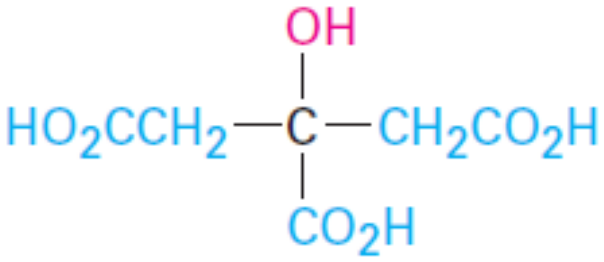
Secondary **carbon (2°) is bonded to two other carbons.**

Tertiary **carbon (3°) is bonded to three other carbons.**

Quaternary **carbon (4°) is bonded to four other carbons.**



General class of tertiary alcohols, R_3COH



Citric acid—a specific tertiary alcohol

Alkyl groups

(H bậc 1)

Primary hydrogens (CH_3)

$CH_3CH_2CHCH_3$

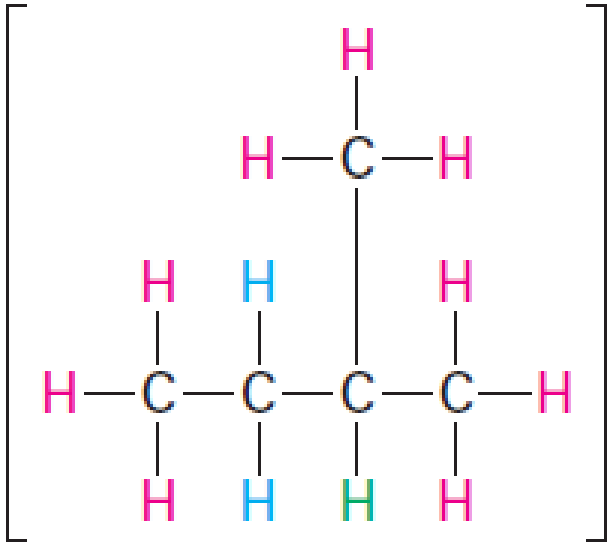
(H bậc 2)

Secondary hydrogens (CH_2)

A tertiary hydrogen (CH)

(H bậc 3)

=



Problems

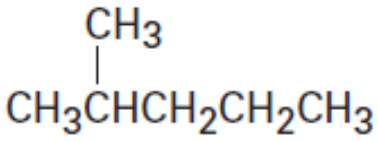
PROBLEM 3-7

Draw the eight 5-carbon alkyl groups (pentyl isomers).

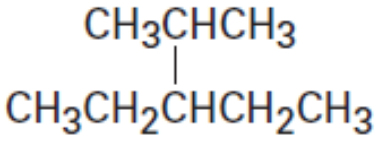
PROBLEM 3-8

Identify the carbon atoms in the following molecules as primary, secondary, tertiary, or quaternary:

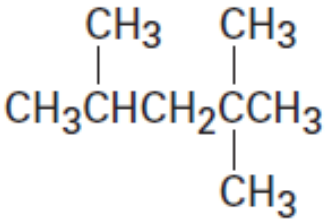
(a)



(b)



(c)



Problem

PROBLEM 3-10

Draw structures of alkanes that meet the following descriptions:

(a) An alkane with two tertiary carbons

(b) An alkane that contains an isopropyl group

(c) An alkane that has one quaternary and one secondary carbon

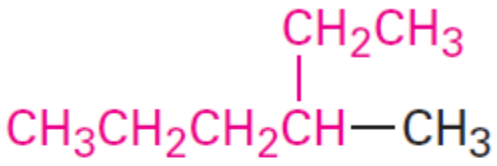
Naming alkanes

(đọc tên alkane)

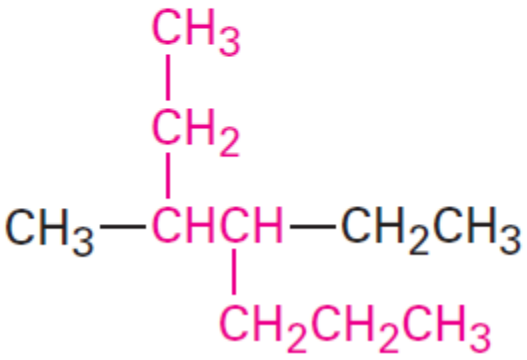
Naming alkanes

Step 1: find the parent chain (tìm mạch chính)

the longest chain that contains more branches

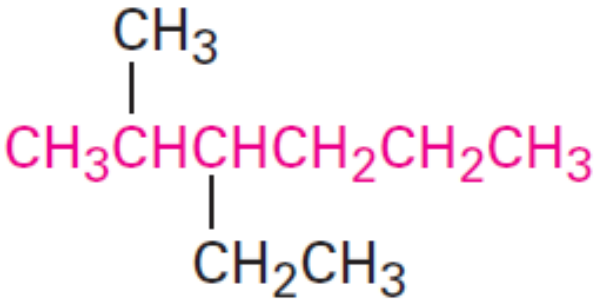


Named as a substituted hexane



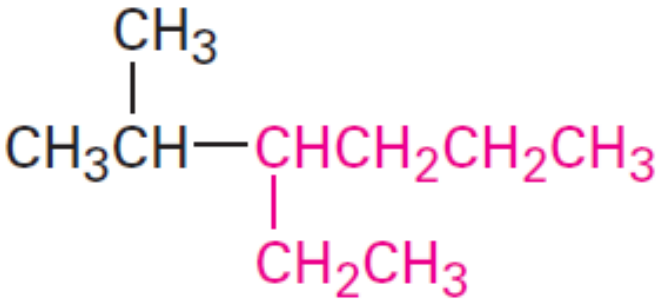
Named as a substituted heptane

Naming alkanes



Named as a hexane with *two* substituents

NOT

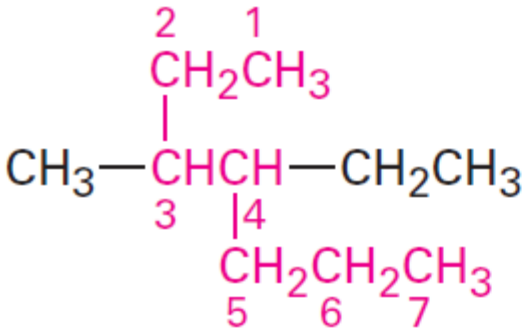


as a hexane with *one* substituent

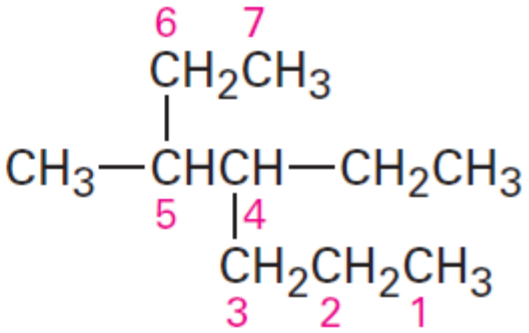
Naming alkanes

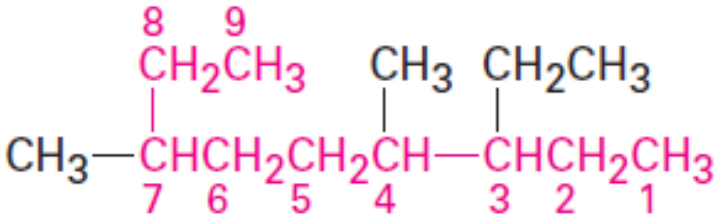
Step 2: number the C in parent chain

begin at the end nearer to branches

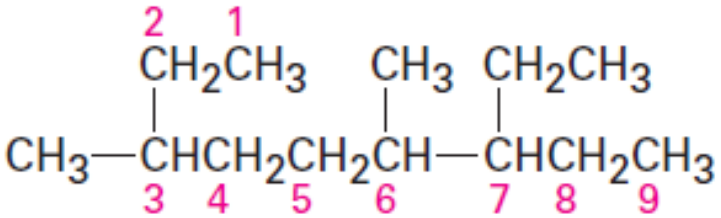


NOT



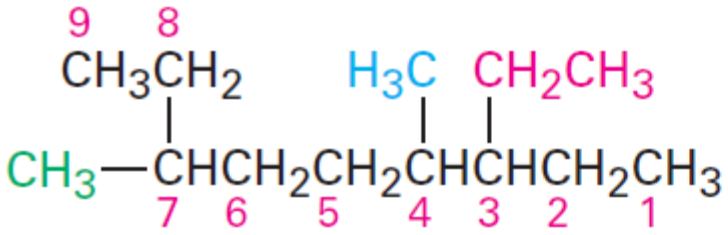


NOT



Naming alkanes

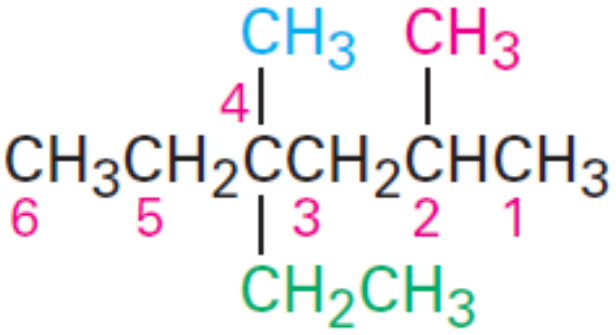
Step 3: identify and number the substituents begin at the end nearer to branches



Named as a nonane

Substituents:	On C3, CH_2CH_3	(3-ethyl)
	On C4, CH_3	(4-methyl)
	On C7, CH_3	(7-methyl)

Naming alkanes



Named as a hexane

Substituents: On C2, CH_3 (2-methyl)
On C4, CH_3 (4-methyl)
On C4, CH_2CH_3 (4-ethyl)

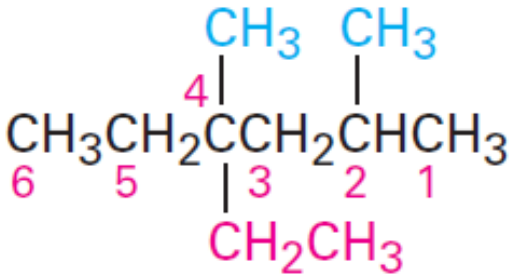
Naming alkanes

Step 4: write the name as single word

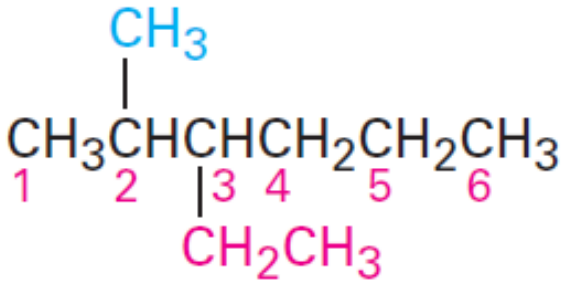
use hyphen to separate prefixes

use comma to separate number

cite in alphabetical order



4-Ethyl-2,4-dimethylhexane



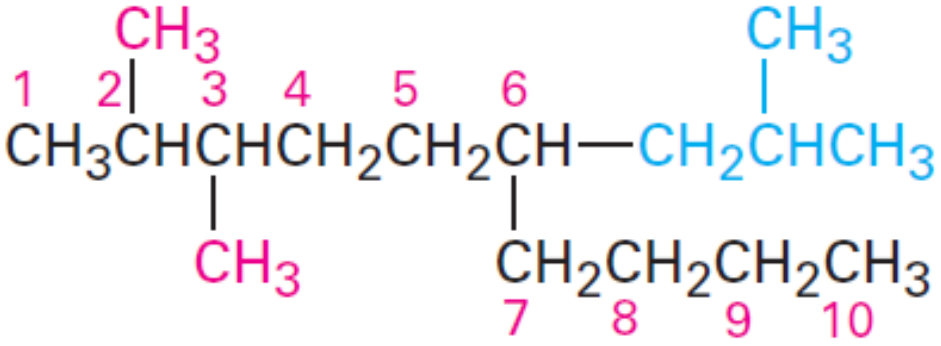
3-Ethyl-2-methylhexane

Naming alkanes

Step 4: name the branches such as it were a compound

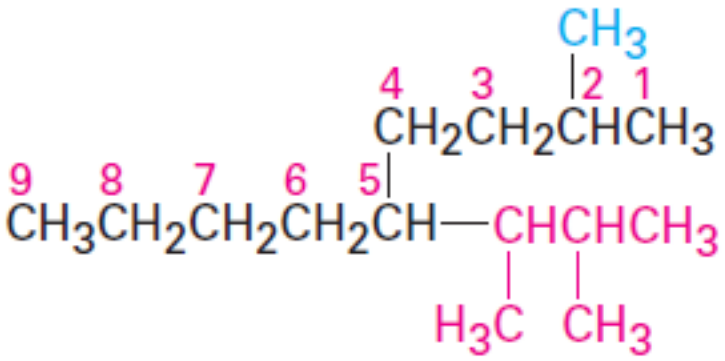
begin at the point of attachment

set off in parentheses

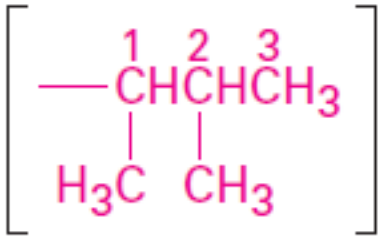


2,3-Dimethyl-6-(2-methylpropyl)decane

Naming alkanes



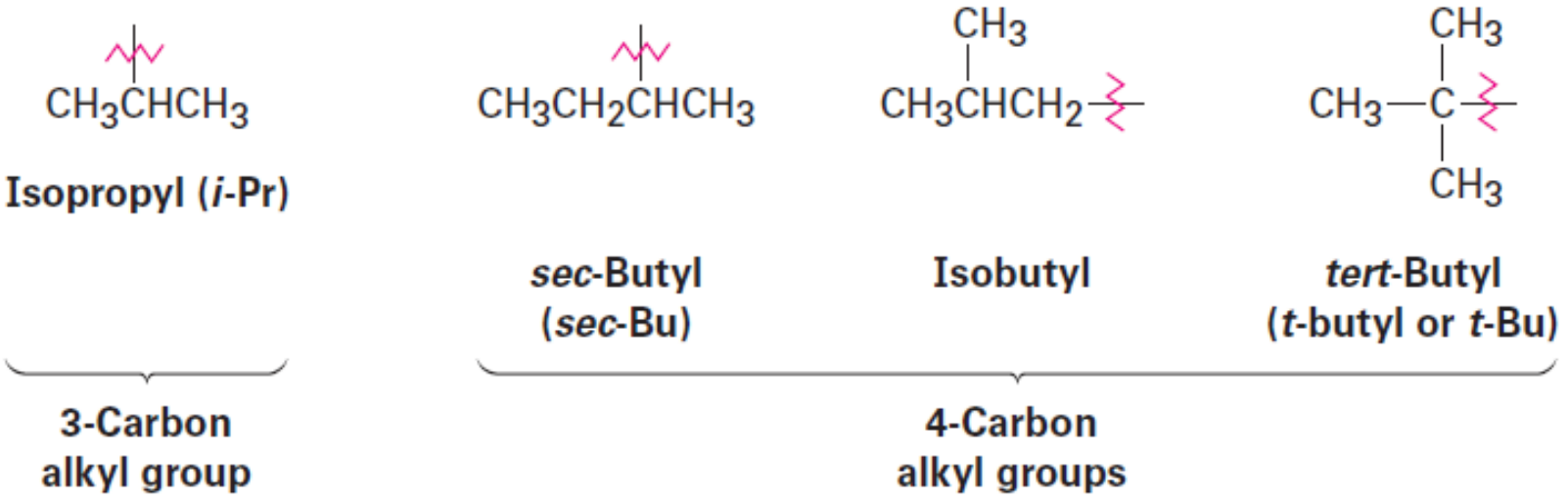
5-(1,2-Dimethylpropyl)-2-methylnonane

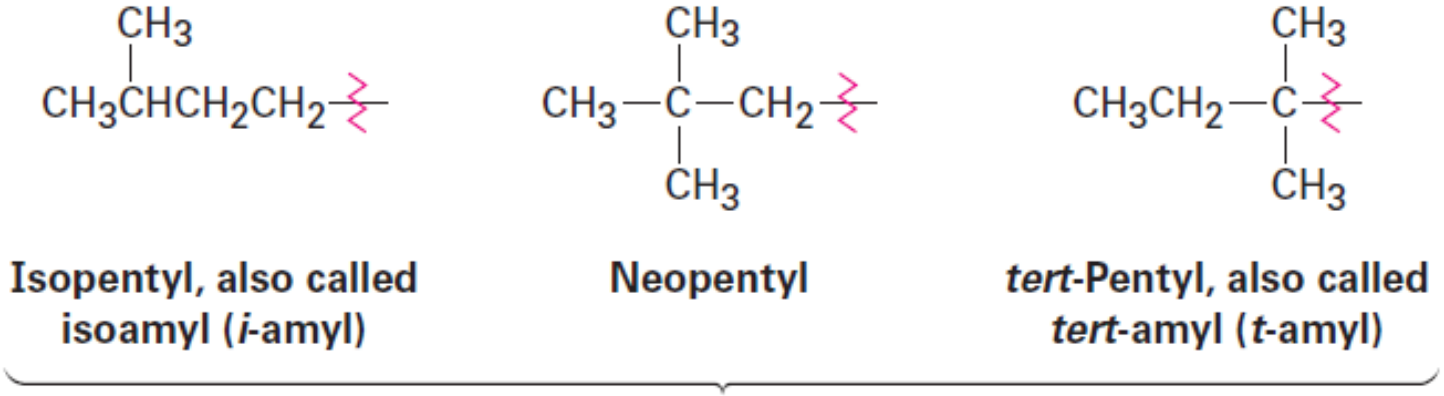


A 1,2-dimethylpropyl group

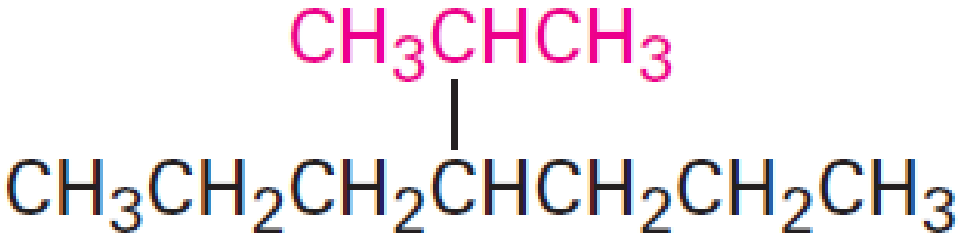
(tên thông thường)

Naming alkanes: common names





Naming alkanes



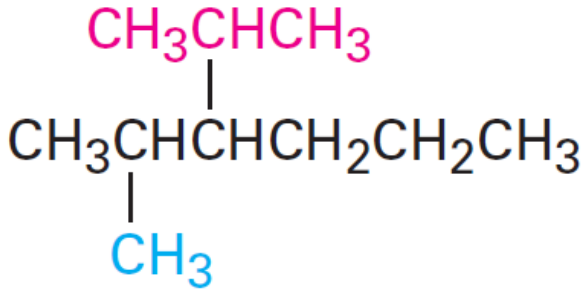
4-(1-Methylethyl)heptane or 4-Isopropylheptane

iso- is a part of alkyl-group: alphabetical order under i.

e.g. isopropyl-, isobutyl-

sec- and *tert*- are not.

e.g. *sec*-butyl-, *tert*-butyl-



3-Isopropyl-2-methylhexane

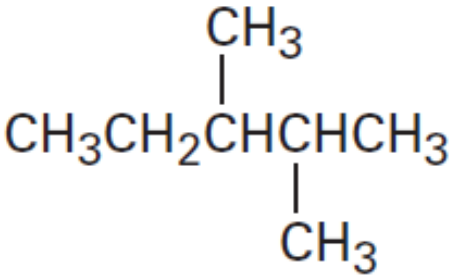
Problem

PROBLEM 3-11 (đọc tên IUPAC = tên quốc tế)

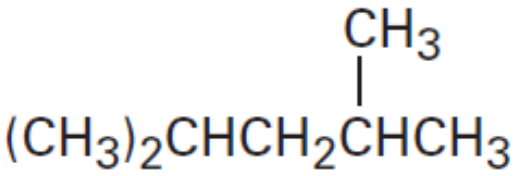
Give IUPAC names for the following compounds:

(a) The three isomers of C_5H_{12}

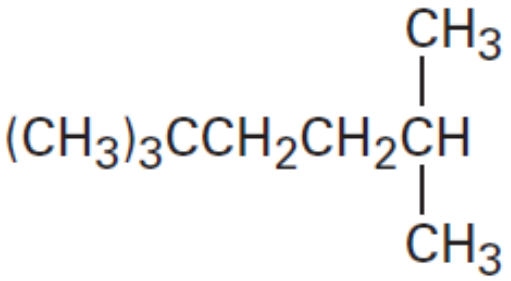
(b)



(c)



(d)



Problem

(vẽ công thức cấu tạo tương ứng với tên IUPAC sau)

PROBLEM 3-12

Draw structures corresponding to the following IUPAC names:

(a) 3,4-Dimethylnonane **(b)** 3-Ethyl-4,4-dimethylheptane

(c) 2,2-Dimethyl-4-propyloctane **(d)** 2,2,4-Trimethylpentane

Problem

(đọc tên IUPAC chất sau và vẽ lại chất này dưới dạng liên kết gạch thẳng trên mặt phẳng)

PROBLEM 3-14

Give the IUPAC name for the following hydrocarbon, and convert the drawing into a skeletal structure.

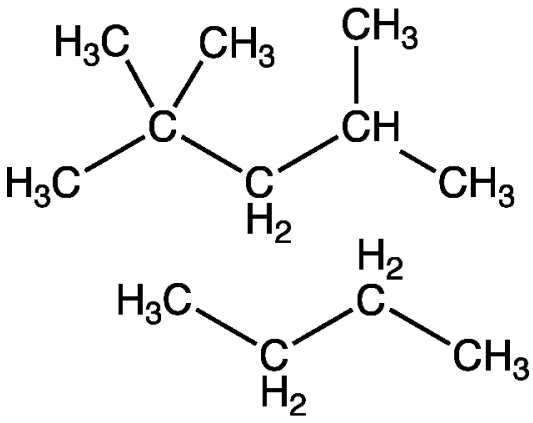
(những tính chất của alkane)

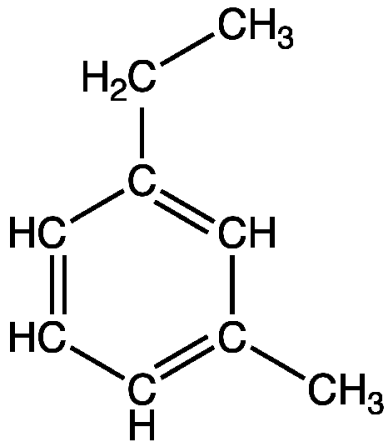
Properties of alkanes

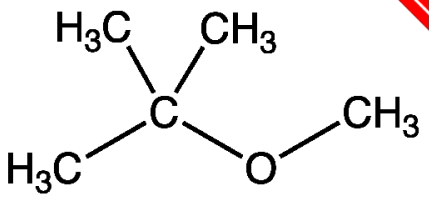
Paraffins – *parum affinis* – little affinity - quite inert

Have reaction with oxygen, halogens and few others

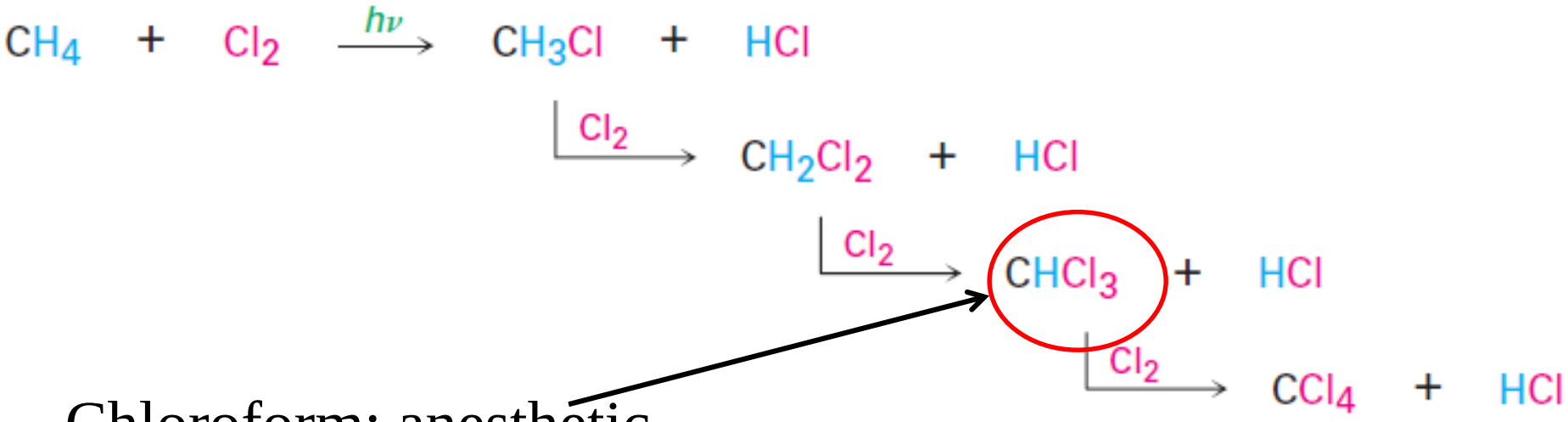
$$CH_4 + 2\,O_2 \rightarrow CO_2 + 2\,H_2O + 890\ kJ/mol\ (213\ kcal/mol)$$







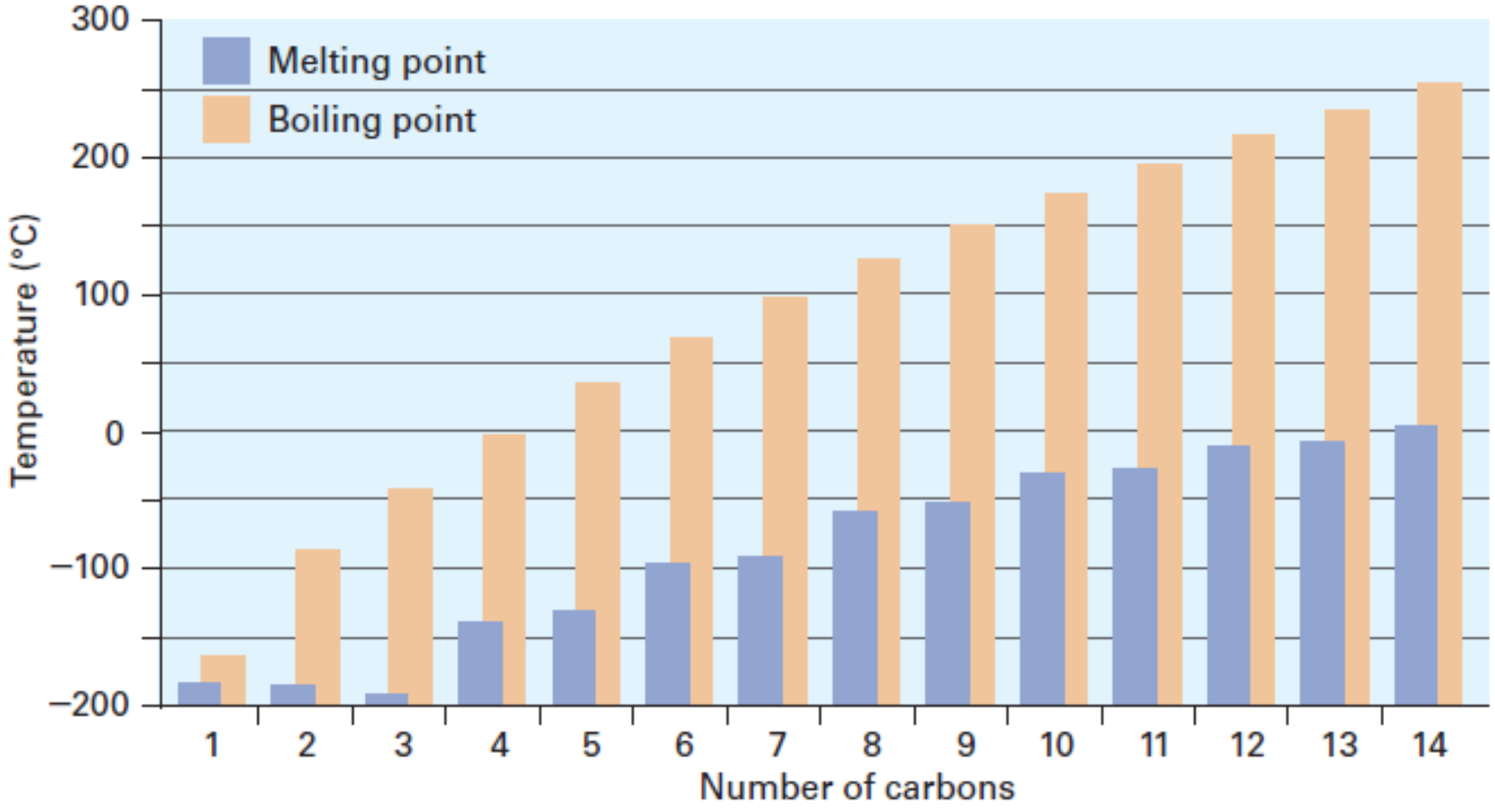
Properties of alkanes



Chloroform: anesthetic
First used 1847
Since 1934, decline because of toxicity

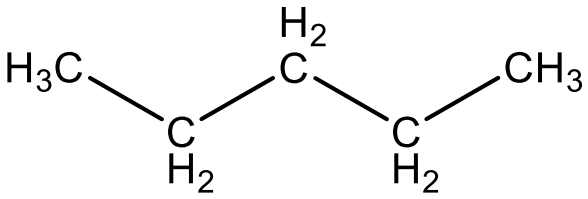
Why it is toxic? Can you prepare a presentation 15 min for our class

Properties of alkanes

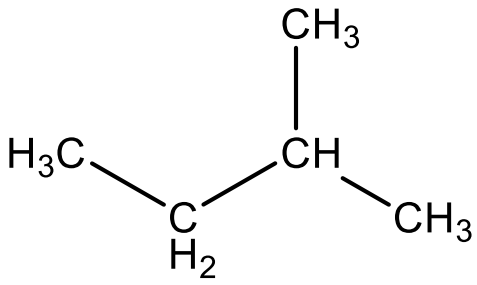


Dispersion forces & effect of branches

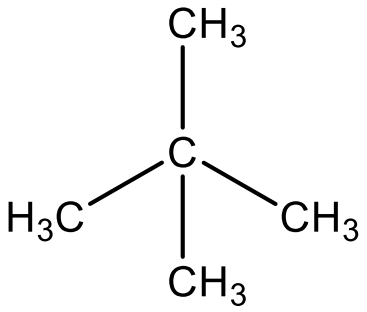
Dispersion forces



n-pentane



isopentane
(2-methylbutane)



neopentane
(2,2-dimethylpropane)

BP	36.1 °C	27.85 °C	9.5 °C

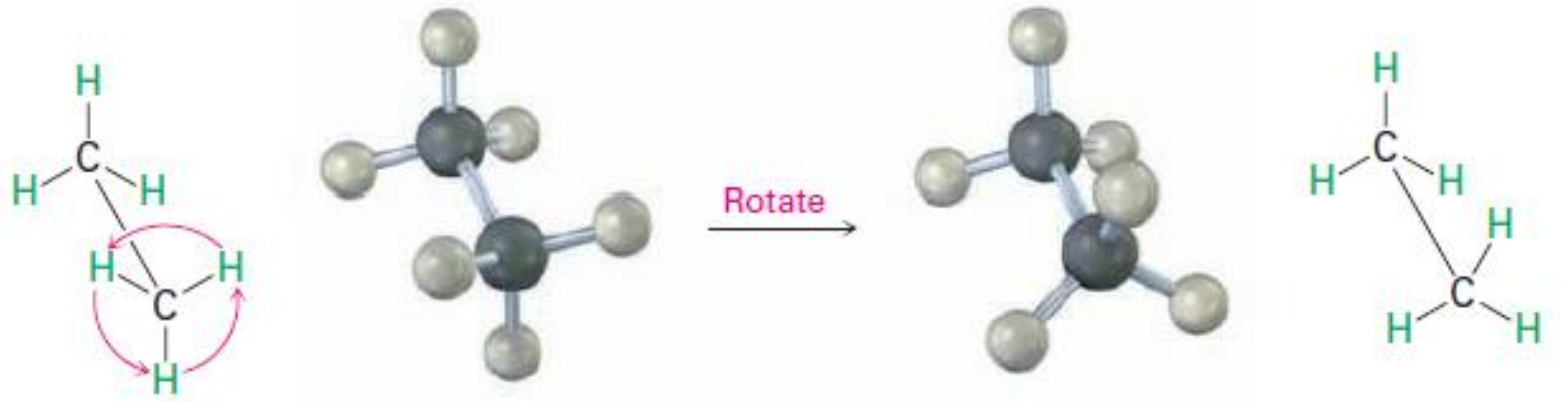
Why?

Conformation of ethane

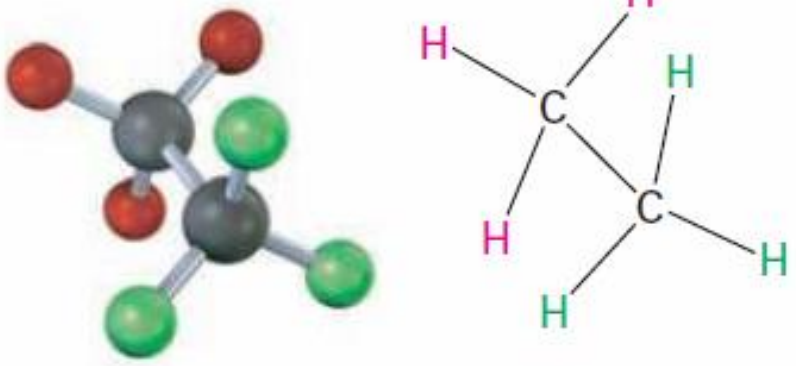
Stereochemistry: 3D aspect of molecules

Conformational isomer: bond rotation

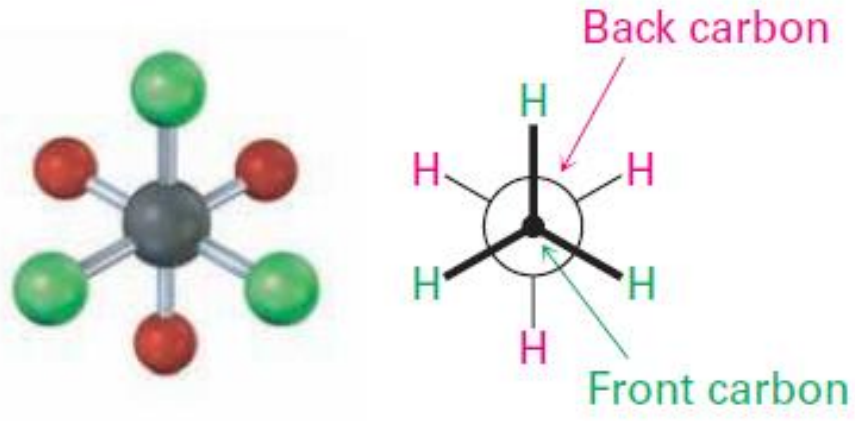
Constitutional isomer



Conformational isomers: 2 ways to present



Sawhorse representation

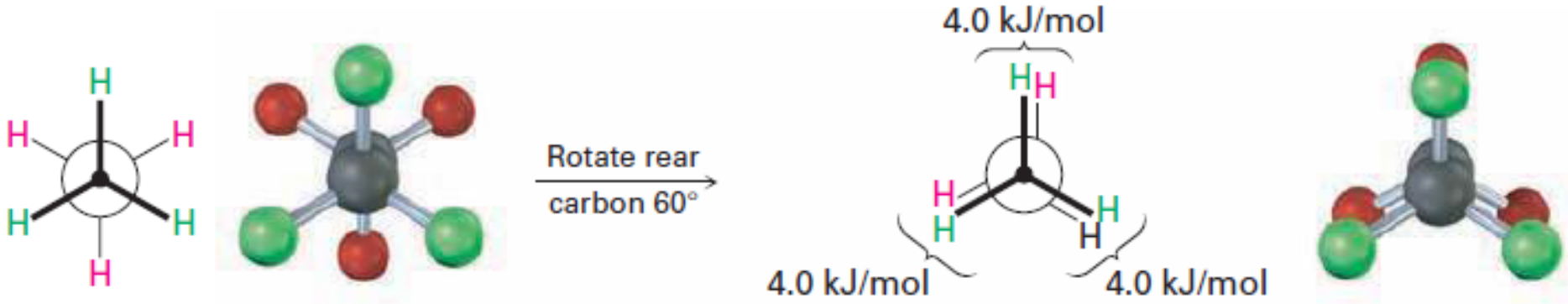


Newman projection

Stability of conformers

Barrier to rotation: 12 kJ/mol

One may be more stable than other



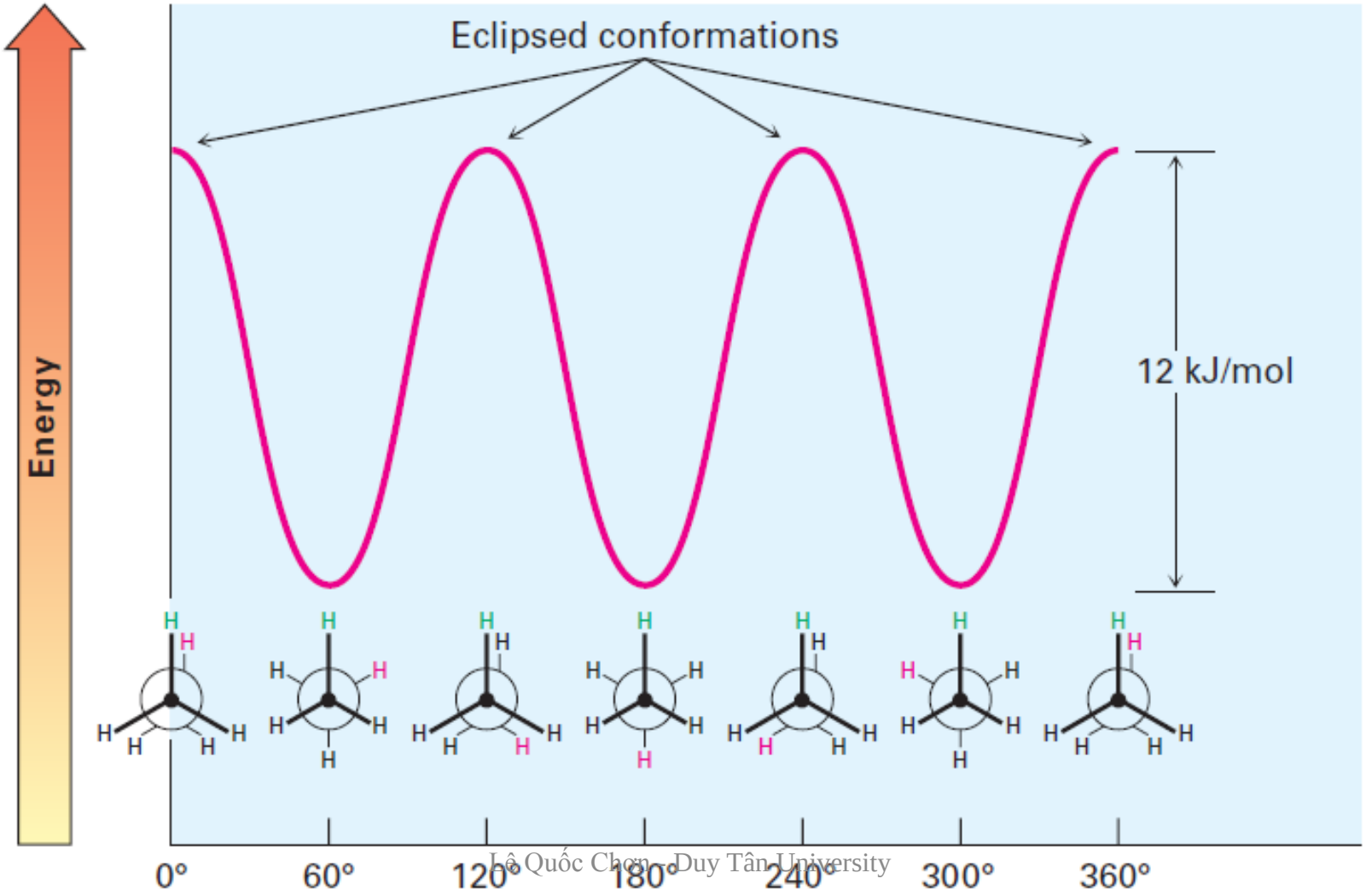
Ethane—staggered conformation Cấu hình xen kẽ

99 %

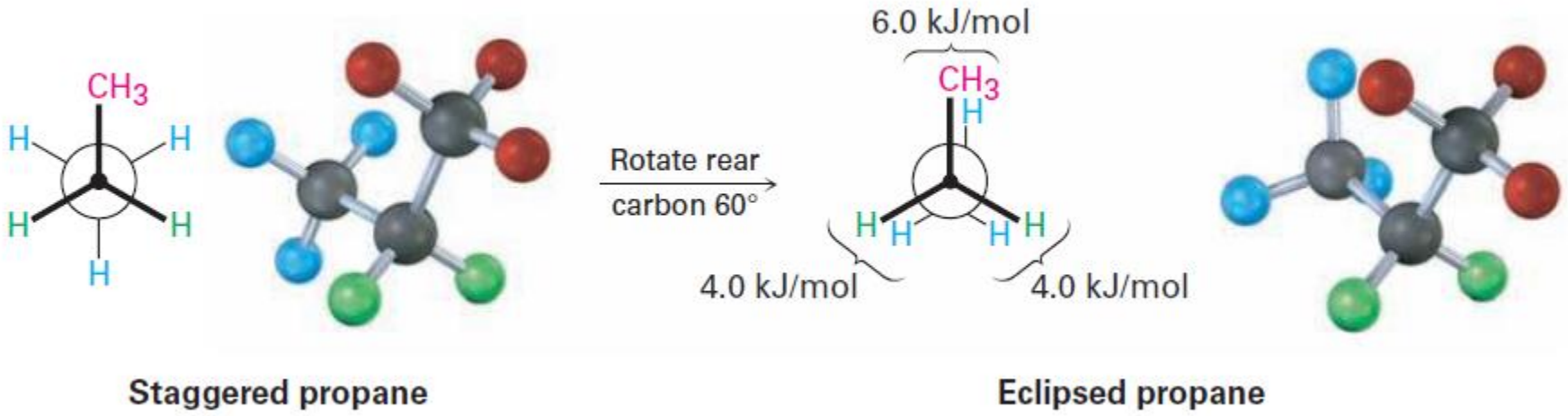
Ethane—eclipsed conformation Cấu hình che khuất

1 %

Conformer stability: potential energy

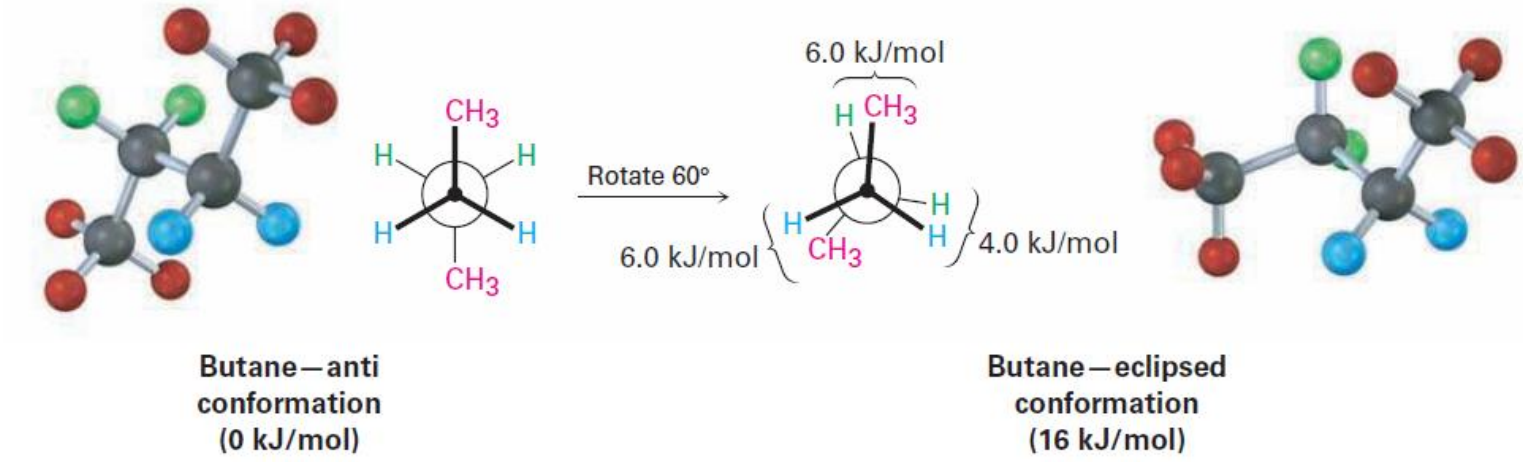


Stability of conformers



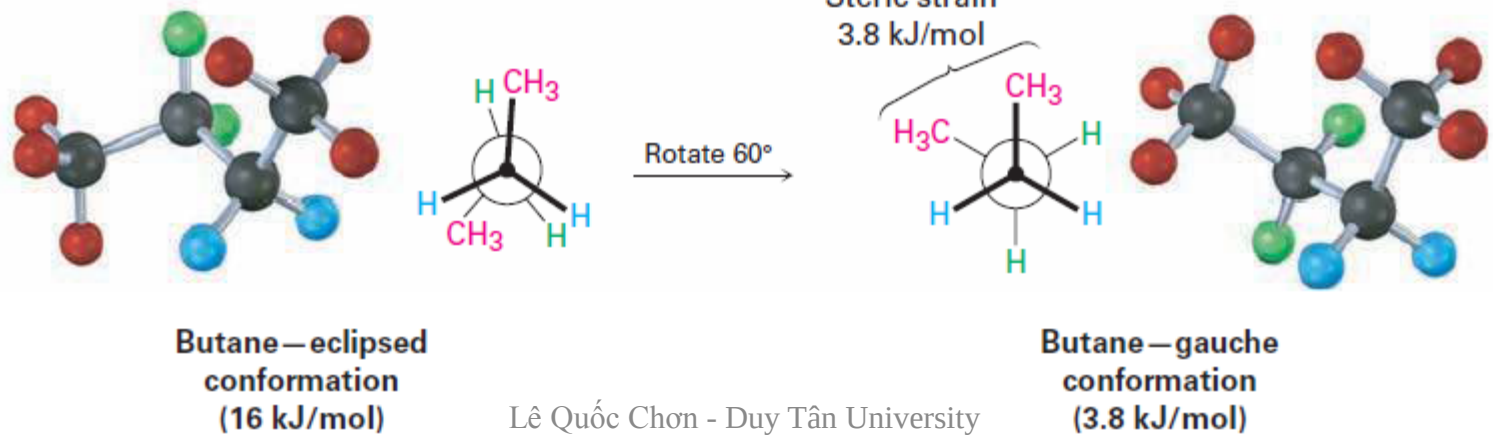
Staggered propane **Eclipsed propane**

Stability of conformer: butane

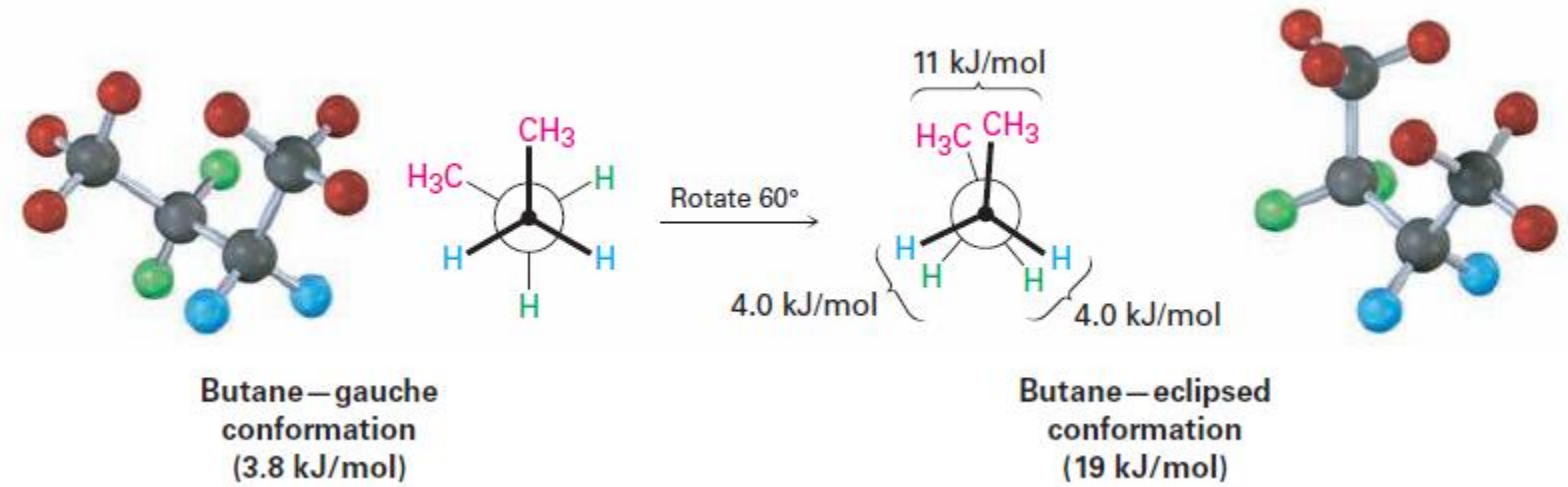


lowest-energy arrangement

60 °



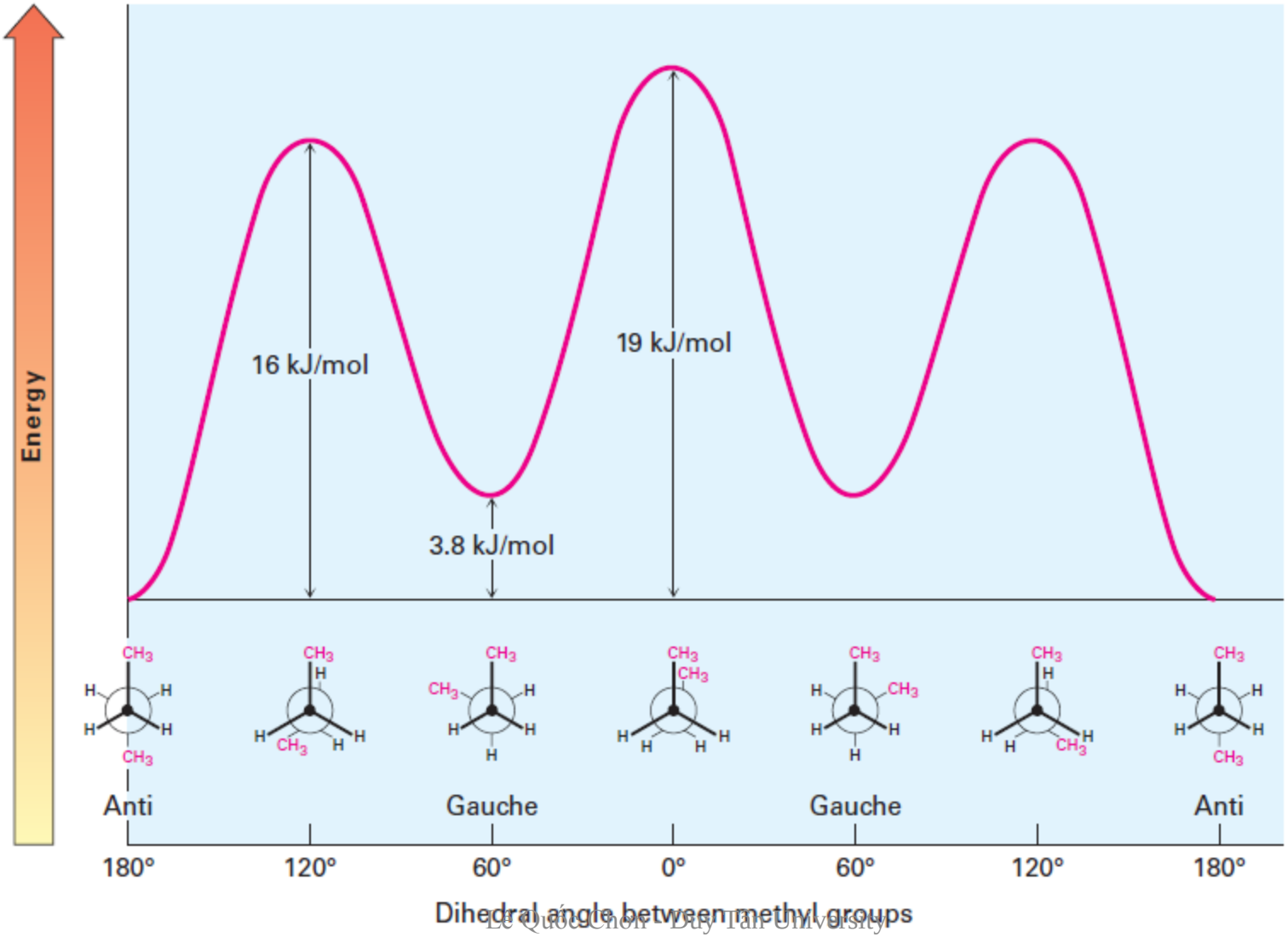
Stability of conformer: butane



Butane—gauche conformation (3.8 kJ/mol)

Butane—eclipsed conformation (19 kJ/mol)

Stability of conformer: butane



Stability of conformer: energy cost

TABLE 3-5 Energy Costs for Interactions in Alkane Conformers

Interaction	Cause	Energy cost (kJ/mol)	Energy cost (kcal/mol)
H⟷H eclipsed	Torsional strain	4.0	1.0
H⟷CH_3 eclipsed	Mostly torsional strain	6.0	1.4
CH_3⟷CH_3 eclipsed	Torsional and steric strain	11.0	2.6
CH_3⟷CH_3 gauche	Steric strain	3.8	0.9

Problem

Sight along the C1–C2 bond of 1-chloropropane, and draw Newman projections of the most stable and least stable conformations.