Organic Chemistry
GV: Lê Quốc Chơn

My background:
Chemical engineer: Da Nang University of Technology (Viet Nam)
Master in Physical Chemistry: Uni Paris Sud – 11 (France)
Ph.D. in Physical Chemistry of Materials: Uni Nantes (France)
Postdoctoral researcher: Uni Laval (Québec – Canada).

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0931.383.074
lequocchon@gmail.com
Đia điểm: Phòng 707, Khoa Tự Nhiên, 03 Quang Trung

Write on your paper and give it to me. NOW

About yourself

1. Your Chemistry grade at high school
2. Điểm thi đại học bao nhiêu?
3. Your career plan?
4. Is Chemistry important to you? Why?
5. What do you want to learn in this course?
6. How do you learn Chemistry?
7. Các khái niệm hóa học khó hiểu/chưa hiểu?

One more slide

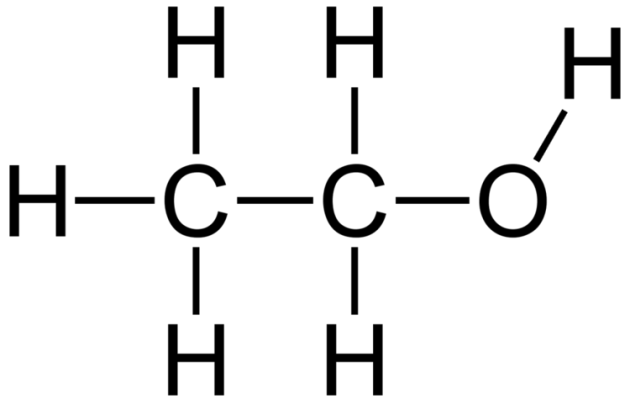
Answer these questions

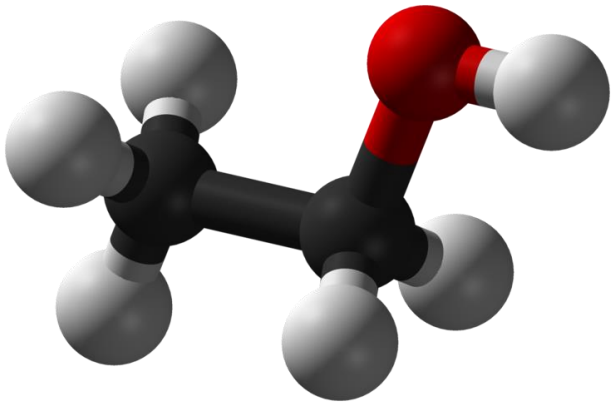
- Draw structure of ethanol, acetic acid, butane and propane.
- Name 5 functional groups that you know.
- Name different chemical bonds that you know.
- Name 5 chemical compounds that you know.

Write on your paper and give it to me!

Background test

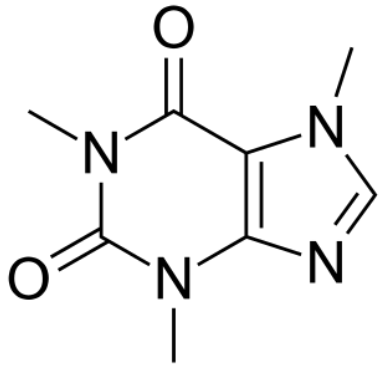
- Ethanol?

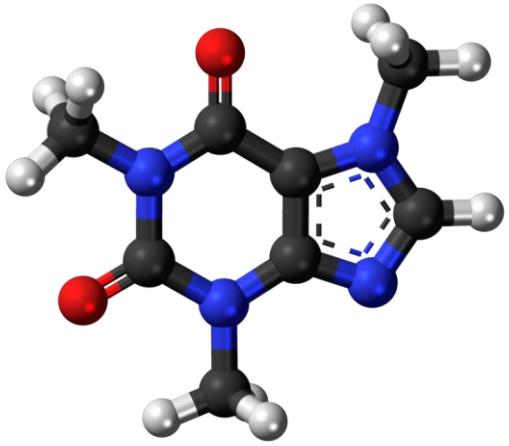




Background test

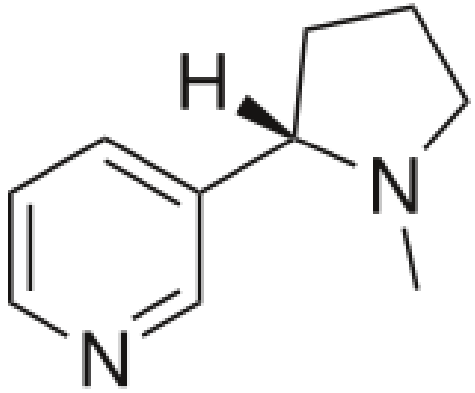
- Caffeine?

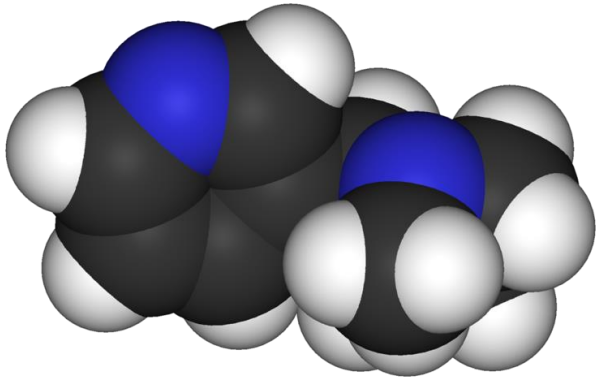




Background test

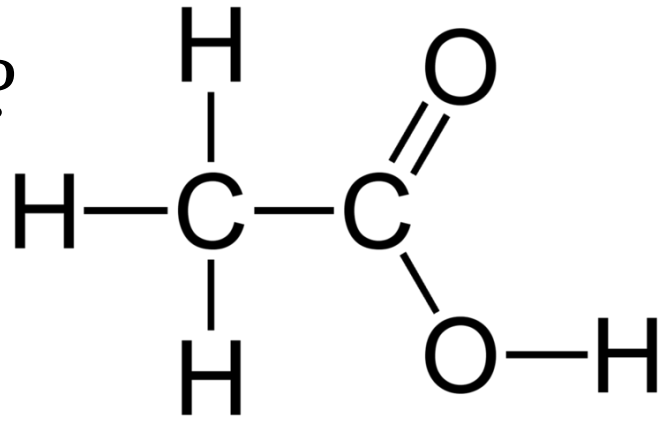
- Nicotine?

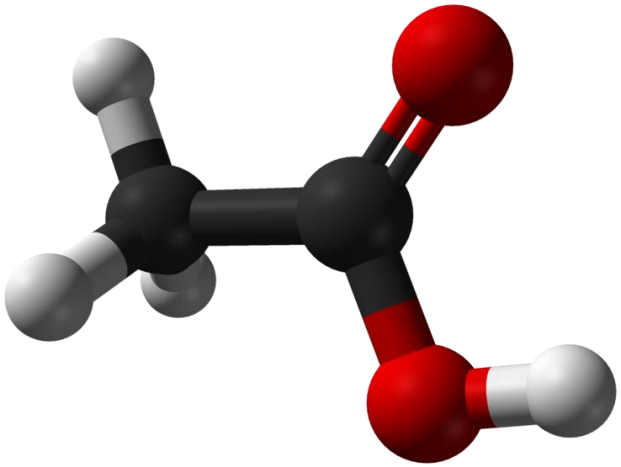




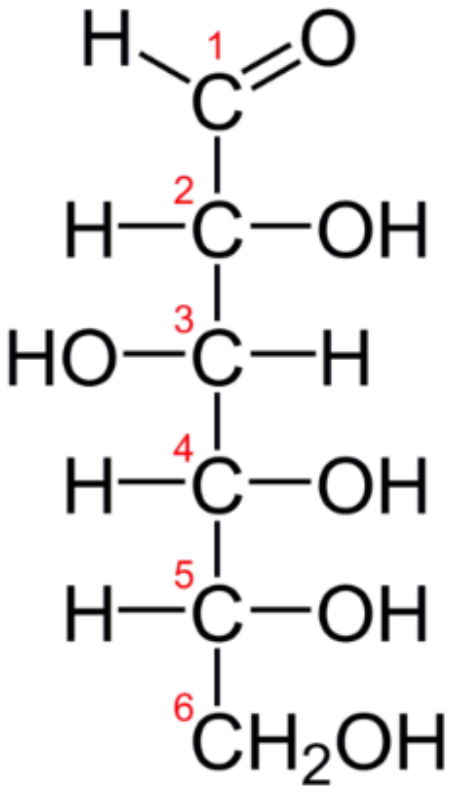
Background test

- Acid in Vinegar?

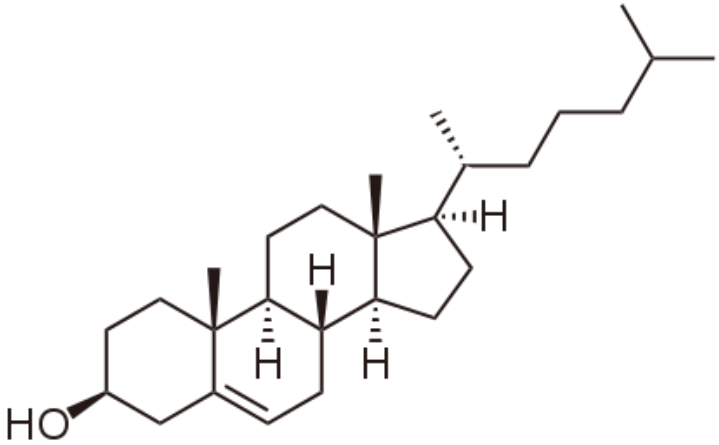


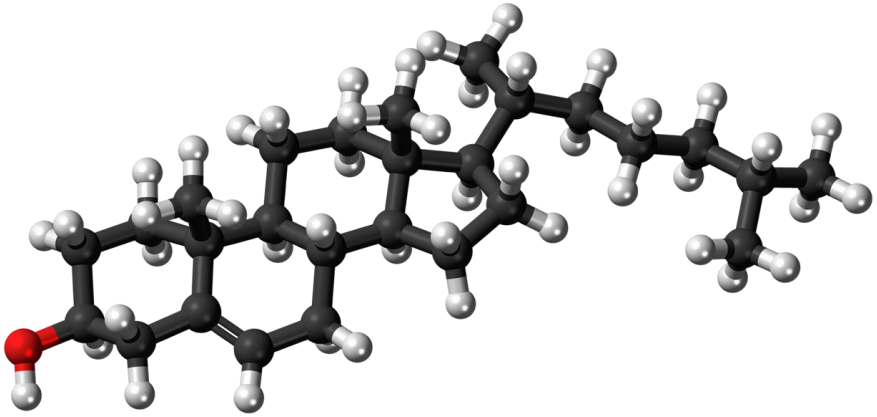


D-Glucose

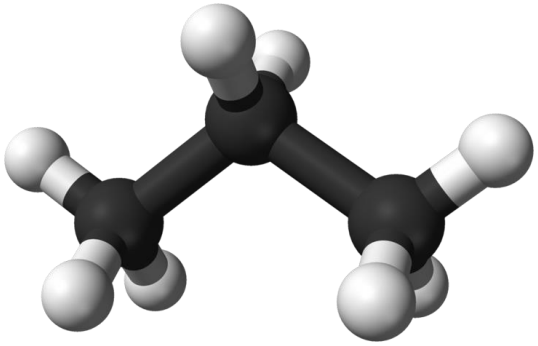


Cholesterol

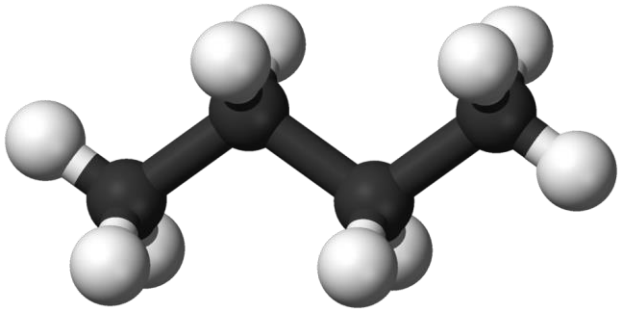




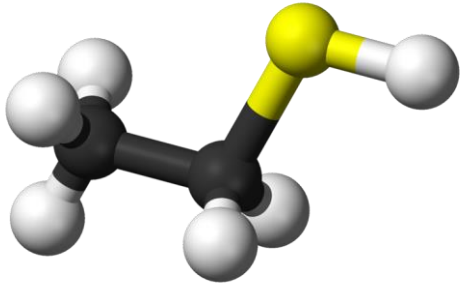
Liquefied petroleum gas (LPG)



propane



butane



(ethanethiol
or methyl captan)

Phân bố điểm

TÊN LỚP: CHE 203 F HÓA HỮU CƠ

Chọn Quy tắc Tính điểm	Quy Tắc Tính Điểm của Đại Học Duy Tân (từ			
Chuyên Cần	10.00	(0.00 - 20.00%)	Còn lại: 10.00%	Cụ thể Bài giao
Phát Biểu & Thảo Luận	5.00	(0.00 - 20.00%)	Còn lại: 5.00%	Cụ thể Bài giao
Kiểm Tra Thường Kỳ	15.00	(0.00 - 30.00%)	Còn lại: 15.00%	Cụ thể Bài giao
Bài Tập Về Nhà	15.00	(0.00 - 30.00%)	Còn lại: 15.00%	Cụ thể Bài giao
Thực Hành & Thực Tế	0.00	(0.00 - 25.00%)	Còn lại: 0.00%	
Kiểm Tra Giữa Kỳ	0.00	(0.00 - 25.00%)	Còn lại: 0.00%	
Đồ Án Cá Nhân	0.00	(0.00 - 15.00%)	Còn lại: 0.00%	
Đồ Án Nhóm	15.00	(0.00 - 25.00%)	Còn lại: 15.00%	Cụ thể Bài giao
Kiểm Tra Cuối Kỳ	40.00	(20.00 - 55.00%)	Còn lại: 40.00%	Cụ thể Bài giao
TỔNG	100.00	(100%)		

Điều kiện Tổng theo Cụm:

0.00% ≤ Chuyên Cần + Phát Biểu & Thảo Luận ≤ 20.00%

0.00% ≤ Kiểm Tra Thường Kỳ + Bài Tập Về Nhà ≤ 30.00%

Đồ Án Cá Nhân + Đồ Án Nhóm + Kiểm Tra Cuối Kỳ = 55.00%

Kiểm tra cuối kỳ: Trắc nghiệm trên PC

Textbooks

- McMurry, Organic Chemistry 9th - Brook Cole 2015
- Daniel P. Weeks-Pushing Electrons-Cengage Learning 2013
- Graham Solomons, Organic Chemistry, 11ed, Wiley 2014
- Giáo trình Hóa Hữu Cơ – (GV. Nguyễn Văn Tiến) - DTU

Software

Avogadro (free) and Gaussian 09 (commercial)

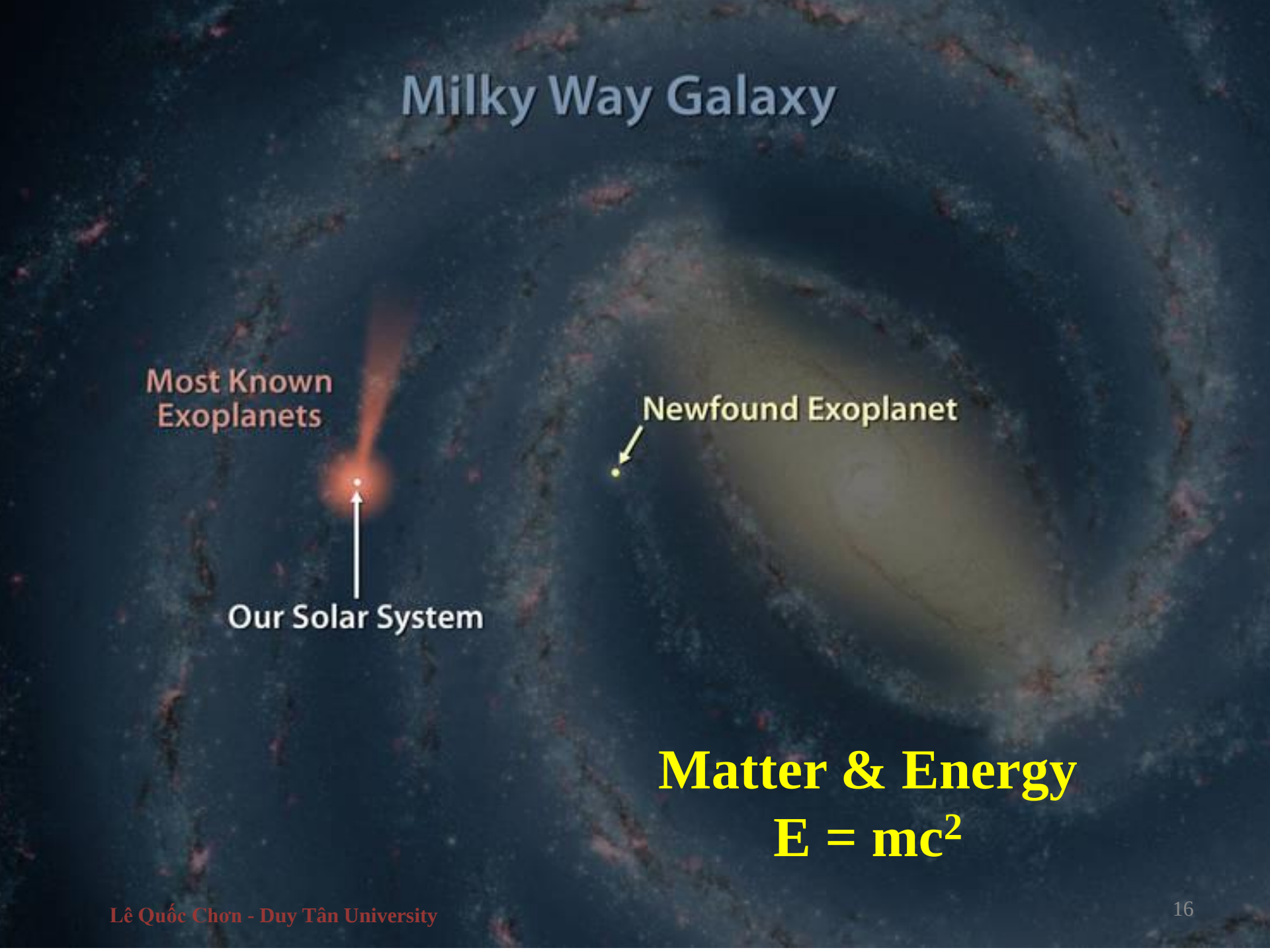
Viết email ra sao?

lequocchon@gmail.com

http://lequocchon.blogspot.com/

Lecture 1: Structure and bonding

Cấu trúc và liên kết



Matter & Energy

$$E = mc^2$$

Curiosity about Nature!

Physics – **Chemistry** - Biology

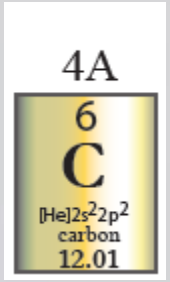
Chemistry

Organic Inorganic

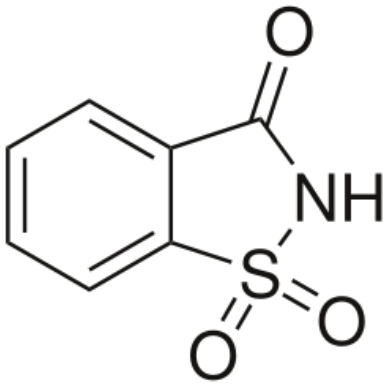
A pallasite: stony-iron meteorite

Scientifically, no barrier!

Carbon



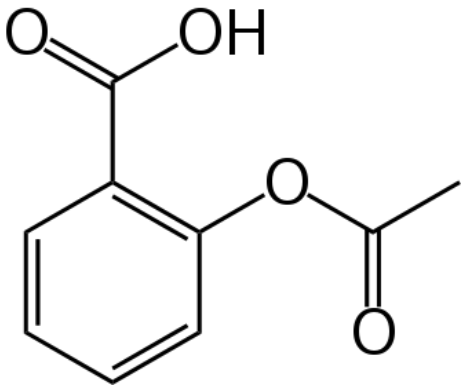
Organic chemistry: applications



Saccharin

artificial sweetener

synthesized 1879

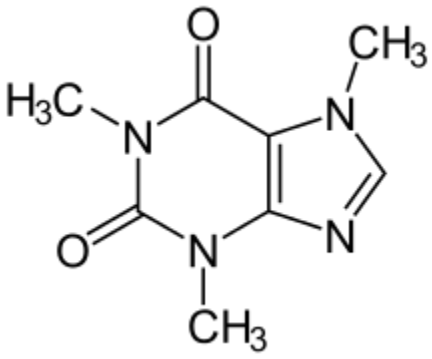


Aspirin

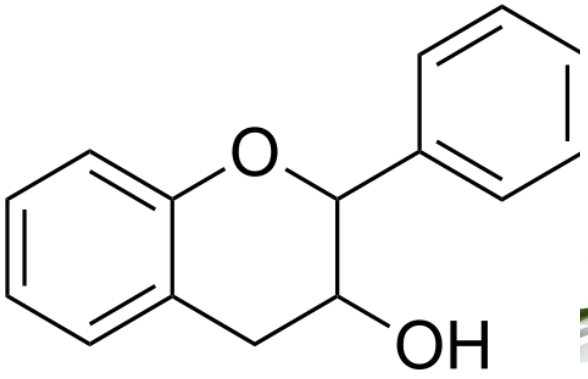
1853 by Charles Frédéric Gerhardt

• • •

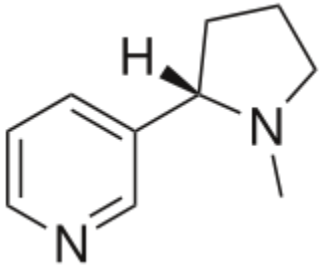
Today: > 50 millions compounds



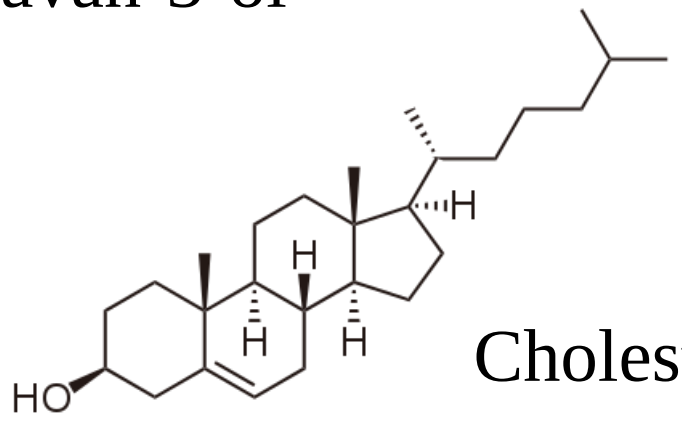
Caffeine



Flavan-3-ol



Nicotine

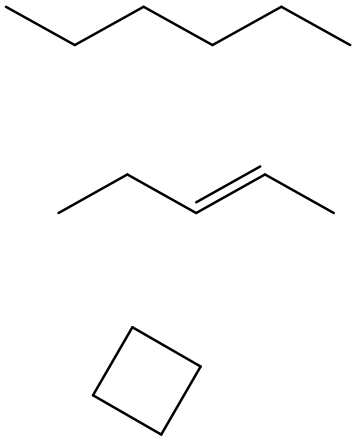


Cholesterol

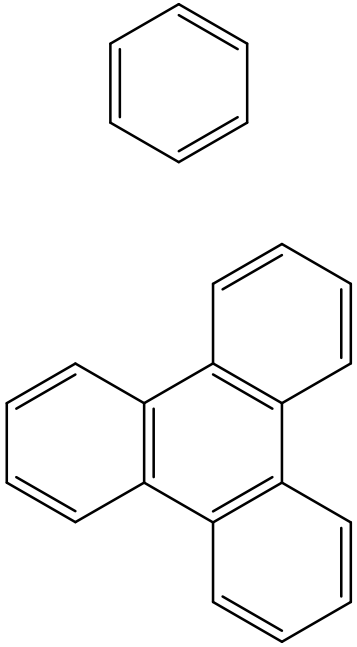
Classification

Phân loại

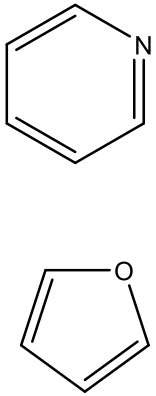
Aliphatic



Aromatic



Heterocyclic

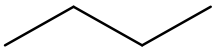


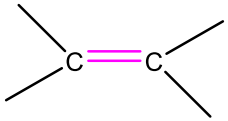
Polymers

Biomolecules

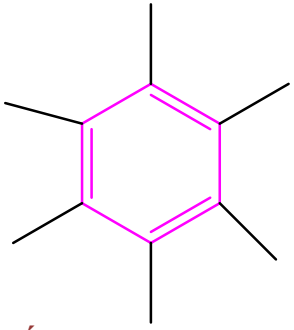
Classification

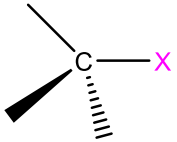
Functional groups (theo nhóm chức)

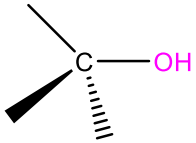
alkane 

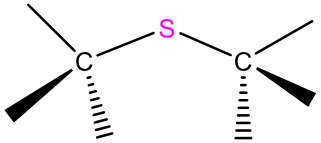
alkene 

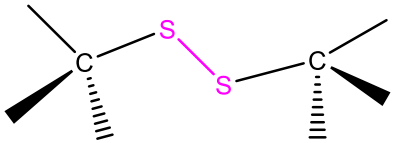
alkyne 

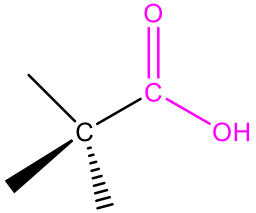
arene 

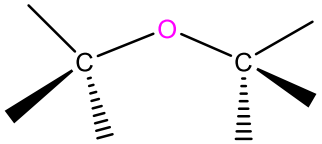
halide 

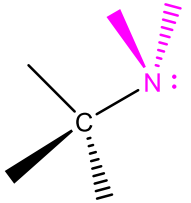
alcohol 

sulfide 

disulfide 

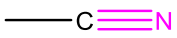
carboxylic acid 

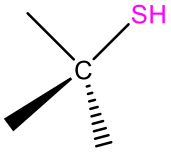
ether 

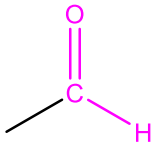
amine 

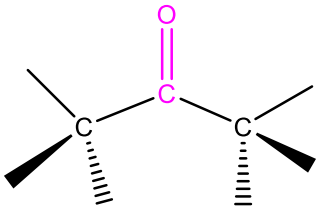
Classification

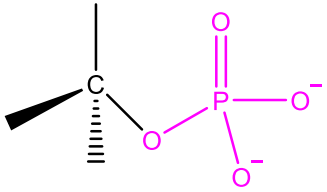
Functional groups

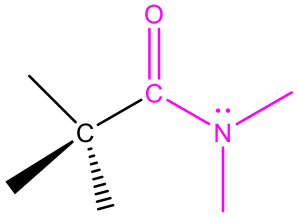
nitrile 

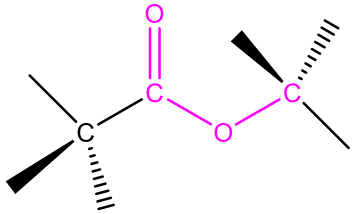
thiol 

aldehyde 

ketone 

phosphate 

amide 

ester 

Một số từ khóa trong Hóa Hữu Cơ

Organic Chemistry

molecule

structure reactivity

bond mechanism

atom **synthesis**

electron orbital

making bond & breaking bond

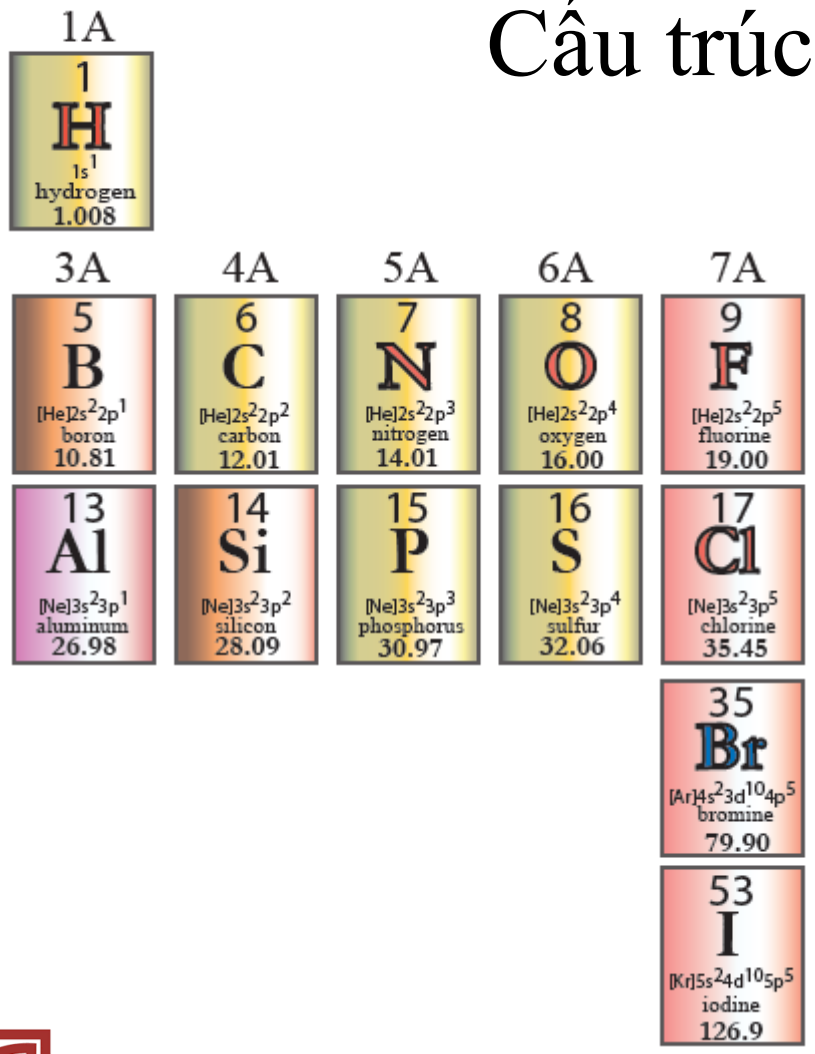
nucleophile & electrophile

computational chemistry & beyond

Arts & sciences !

Structure and bonding

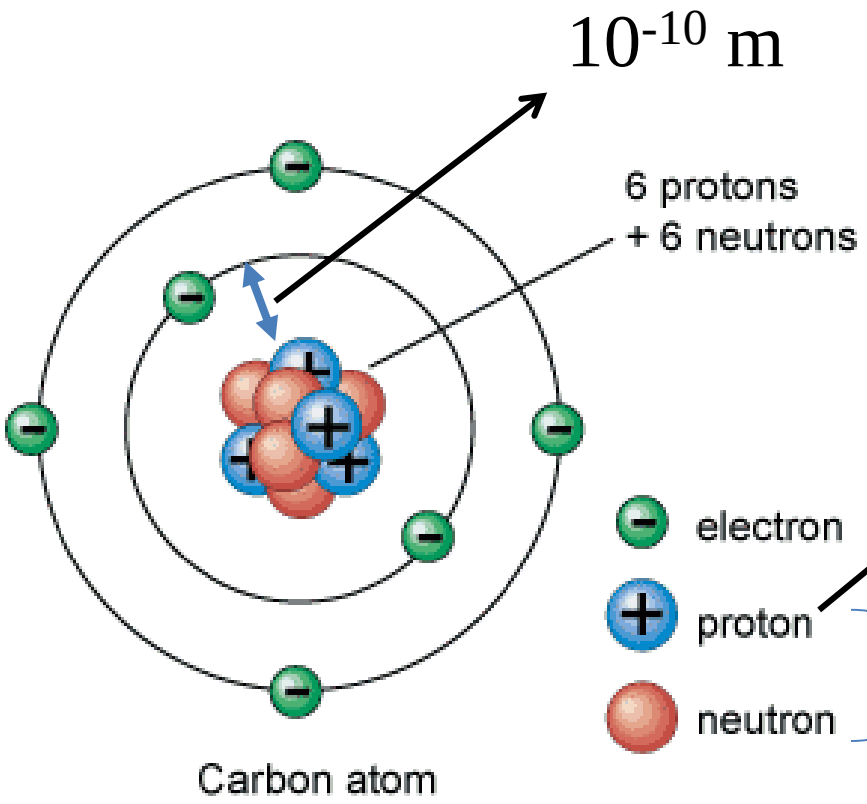
Cấu trúc và liên kết



Key concepts (khái niệm chính trong bài này)

- Nucleus & electron
- Electron configuration
- Valence bond theory
- Orbital hybridization
- Molecular orbital theory
- Drawing chemical structure

Nucleus & electron



atomic number (Z)

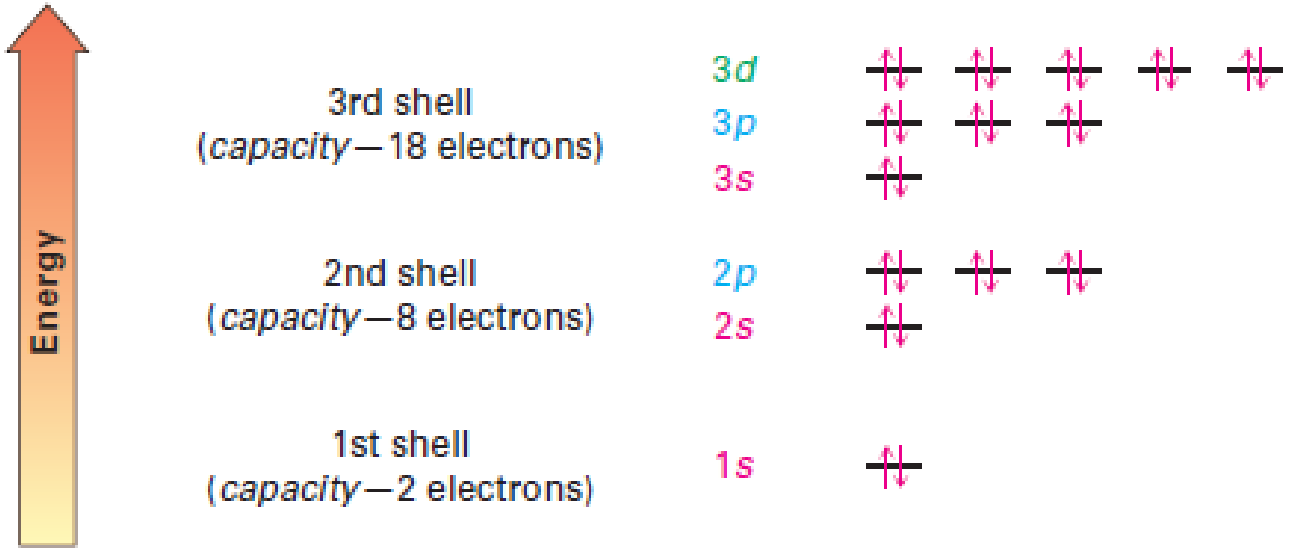
electron

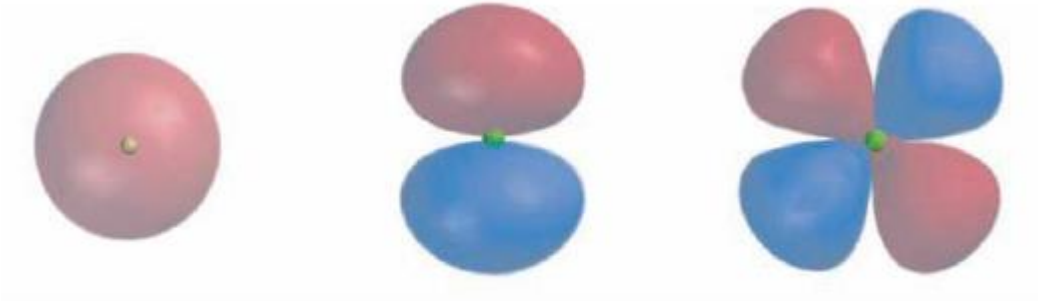
proton

neutron

mass number (A)

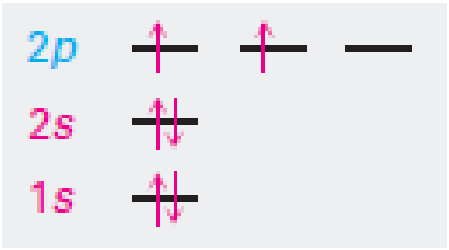
Orbitals





s orbital p orbital d orbital

C: $1s^2 2s^2 2p^2$



at ground state

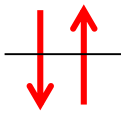
Electron configuration

Cấu hình electron

Orbital filling according to order:

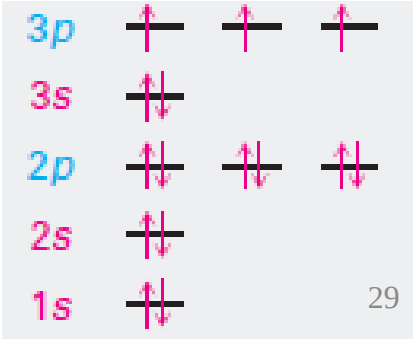
1s 2s 2p 3s 3p 4s 3d

Electron has spin with 2 directions: up & down
An orbital contains maximum 2 electrons



Electrons tend to occupy orbital to get maximum number of parallel spin direction.

Phosphorus (P)
with 15 electrons



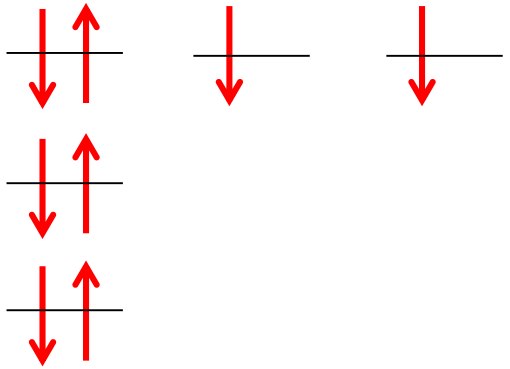
Problem 1.1

Write the electron configuration of O, N and S at ground-state?

6A

8
O
$[He]2s^2 2p^4$
oxygen
16.00

$1s^2\ 2s^2\ 2p^4$



5A

7
N
$[He]2s^2 2p^3$
nitrogen
14.01

$1s^2\ 2s^2\ 2p^3$

16
S
$[Ne]3s^2 3p^4$
sulfur
32.06

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$

Problem 1.2

How many electrons does each of the following element have in its outer-most electron shell? Mg, Co, Se

PERIODIC TABLE

Atomic Properties of the Elements

NIST National Institute of Standards and Technology U.S. Department of Commerce

Physics Laboratory physics.nist.gov

Standard Reference Data www.nist.gov/srd

Frequently used fundamental physical constants

For the most accurate values of these and other constants, visit physics.nist.gov/constants

1 second = 9 192 631 770 periods of radiation corresponding to the transition between the two hyperfine levels of the ground state of ^{133}Cs

speed of light in vacuum	c	299 792 458 m s^{-1}	(exact)
Planck constant	h	6.6261 x 10^{-34} J s	($\hbar = h/2\pi$)
elementary charge	e	1.6022 x 10^{-19} C	
electron mass	m_e	9.1094 x 10^{-31} kg	
	$m_e c^2$	0.5110 MeV	
proton mass	m_p	1.6726 x 10^{-27} kg	
fine-structure constant	α	1/137.036	
Rydberg constant	R_∞	10 973 732 m^{-1}	
	$R_\infty c$	3.289 842 x 10^{15} Hz	
	$R_\infty hc$	13.6057 eV	
Boltzmann constant	k	1.3807 x 10^{-23} J K^{-1}	

Solids
Liquids
Gases
Artificially Prepared

Period	Group 1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIII	10	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	1 $^2S_{1/2}$ **H** Hydrogen 1.00794 1s 13.5984																	2 $^1S_0$ **He** Helium 4.002602 1s^2 24.5874
2	3 $^2S_{1/2}$ **Li** Lithium 6.941 1s^{2}2s 5.3917	4 $^1S_0$ **Be** Beryllium 9.012182 1s^{2}2s^2 9.3227											5 $^2P^o_{1/2}$ **B** Boron 10.811 1s^{2}2s^{2}2p 8.2980	6 $^3P_0$ **C** Carbon 12.0107 1s^{2}2s^{2}2p^2 11.2603	7 $^4S^o_{3/2}$ **N** Nitrogen 14.0067 1s^{2}2s^{2}2p^3 14.5341	8 $^3P_2$ **O** Oxygen 15.9994 1s^{2}2s^{2}2p^4 13.6181	9 $^2P^o_{3/2}$ **F** Fluorine 18.9984032 1s^{2}2s^{2}2p^5 17.4228	10 $^1S_0$ **Ne** Neon 20.1797 1s^{2}2s^{2}2p^6 21.5645
3	11 $^2S_{1/2}$ **Na** Sodium 22.98976928 [Ne]3s 5.1391	12 $^1S_0$ **Mg** Magnesium 24.3050 [Ne]3s^2 7.6462											13 $^2P^o_{1/2}$ **Al** Aluminum 26.9815386 [Ne]3s^{2}3p 5.9858	14 $^3P_0$ **Si** Silicon 28.0855 [Ne]3s^{2}3p^2 8.1517	15 $^4S^o_{3/2}$ **P** Phosphorus 30.973762 [Ne]3s^{2}3p^3 10.4867	16 $^3P_2$ **S** Sulfur 32.065 [Ne]3s^{2}3p^4 10.3600	17 $^2P^o_{3/2}$ **Cl** Chlorine 35.453 [Ne]3s^{2}3p^5 12.9676	18 $^1S_0$ **Ar** Argon 39.948 [Ne]3s^{2}3p^6 15.7596
4	19 $^2S_{1/2}$ **K** Potassium 39.0983 [Ar]4s 4.3407	20 $^1S_0$ **Ca** Calcium 40.078 [Ar]4s^2 6.1132	21 $^2D_{3/2}$ **Sc** Scandium 44.955912 [Ar]3d4s^2 6.5615	22 $^3F_2$ **Ti** Titanium 47.867 [Ar]3d^{2}4s^2 6.8281	23 $^4F_{3/2}$ **V** Vanadium 50.9415 [Ar]3d^{3}4s^2 6.7462	24 $^7S_3$ **Cr** Chromium 51.9961 [Ar]3d^{5}4s 6.7665	25 $^6S_{5/2}$ **Mn** Manganese 54.938045 [Ar]3d^{5}4s^2 7.4340	26 $^5D_4$ **Fe** Iron 55.845 [Ar]3d^{6}4s^2 7.9024	27 $^4F_{9/2}$ **Co** Cobalt 58.933195 [Ar]3d^{7}4s^2 7.8810	28 $^3F_4$ **Ni** Nickel 58.6934 [Ar]3d^{8}4s^2 7.6399	29 $^2S_{1/2}$ **Cu** Copper 63.546 [Ar]3d^{10}4s 7.7264	30 $^1S_0$ **Zn** Zinc 65.38 [Ar]3d^{10}4s^2 9.3942	31 $^2P^o_{1/2}$ **Ga** Gallium 69.723 [Ar]3d^{10}4s^{2}4p 5.9993	32 $^3P_0$ **Ge** Germanium 72.64 [Ar]3d^{10}4s^{2}4p^2 7.8994	33 $^4S^o_{3/2}$ **As** Arsenic 74.92160 [Ar]3d^{10}4s^{2}4p^3 9.7886	34 $^3P_2$ **Se** Selenium 78.96 [Ar]3d^{10}4s^{2}4p^4 9.7524	35 $^2P^o_{3/2}$ **Br** Bromine 79.904 [Ar]3d^{10}4s^{2}4p^5 11.8138	36 $^1S_0$ **Kr** Krypton 83.798 [Ar]3d^{10}4s^{2}4p^6 13.9996
5	37 $^2S_{1/2}$ **Rb** Rubidium 85.4678 [Kr]5s 4.1771	38 $^1S_0$ **Sr** Strontium 87.62 [Kr]5s^2 5.6949	39 $^2D_{3/2}$ **Y** Yttrium 88.90585 [Kr]4d5s^2 6.2173	40 $^3F_2$ **Zr** Zirconium 91.224 [Kr]4d^{2}5s^2 6.6339	41 $^6D_{1/2}$ **Nb** Niobium 92.90638 [Kr]4d^{4}5s 6.7589	42 $^7S_3$ **Mo** Molybdenum 95.96 [Kr]4d^{5}5s 7.0924	43 $^6S_{5/2}$ **Tc** Technetium (98) [Kr]4d^{5}5s^2 7.28	44 $^5F_5$ **Ru** Ruthenium 101.07 [Kr]4d^{7}5s 7.3605	45 $^4F_{9/2}$ **Rh** Rhodium 102.90550 [Kr]4d^{8}5s 7.4589	46 $^1S_0$ **Pd** Palladium 106.42 [Kr]4d^{10} 8.3369	47 $^2S_{1/2}$ **Ag** Silver 107.8682 [Kr]4d^{10}5s 7.5762	48 $^1S_0$ **Cd** Cadmium 112.411 [Kr]4d^{10}5s^2 8.9938	49 $^2P^o_{1/2}$ **In** Indium 114.818 [Kr]4d^{10}5s^{2}5p 5.7864	50 $^3P_0$ **Sn** Tin 118.710 [Kr]4d^{10}5s^{2}5p^2 7.3439	51 $^4S^o_{3/2}$ **Sb** Antimony 121.760 [Kr]4d^{10}5s^{2}5p^3 8.6084	52 $^3P_2$ **Te** Tellurium 127.60 [Kr]4d^{10}5s^{2}5p^4 9.0096	53 $^2P^o_{3/2}$ **I** Iodine 126.90447 [Kr]4d^{10}5s^{2}5p^5 10.4513	54 $^1S_0$ **Xe** Xenon 131.293 [Kr]4d^{10}5s^{2}5p^6 12.1298
6	55 $^2S_{1/2}$ **Cs** Cesium 132.9054519 [Xe]6s 3.8939	56 $^1S_0$ **Ba** Barium 137.327 [Xe]6s^2 5.2117		72 $^3F_2$ **Hf** Hafnium 178.49 [Xe]4f^{14}5d^{2}6s^2 6.8251	73 $^4F_{3/2}$ **Ta** Tantalum 180.94788 [Xe]4f^{14}5d^{3}6s^2 7.5496	74 $^5D_0$ **W** Tungsten 183.84 [Xe]4f^{14}5d^{4}6s^2 7.8640	75 $^6S_{5/2}$ **Re** Rhenium 186.207 [Xe]4f^{14}5d^{5}6s^2 7.8335	76 $^5D_4$ **Os** Osmium 190.23 [Xe]4f^{14}5d^{6}6s^2 8.4382	77 $^4F_{9/2}$ **Ir** Iridium 192.217 [Xe]4f^{14}5d^{7}6s^2 8.9670	78 $^3D_3$ **Pt** Platinum 195.084 [Xe]4f^{14}5d^{9}6s 8.9588	79 $^2S_{1/2}$ **Au** Gold 196.966569 [Xe]4f^{14}5d^{10}6s 9.2255	80 $^1S_0$ **Hg** Mercury 200.59 [Xe]4f^{14}5d^{10}6s^2 10.4375	81 $^2P^o_{1/2}$ **Tl** Thallium 204.3833 [Hg]6p 6.1082	82 $^3P_0$ **Pb** Lead 207.2 [Hg]6p^2 7.4167	83 $^4S^o_{3/2}$ **Bi** Bismuth 208.98040 [Hg]6p^3 7.2855	84 $^3P_2$ **Po** Polonium (209) [Hg]6p^4 8.414	85 $^2P^o_{3/2}$ **At** Astatine (210) [Hg]6p^5	86 $^1S_0$ **Rn** Radon (222) [Hg]6p^6 10.7485
7	87 $^2S_{1/2}$ **Fr** Francium (223) [Rn]7s 4.0727	88 $^1S_0$ **Ra** Radium (226) [Rn]7s^2 5.2784		104 $^3F_2$? **Rf** Rutherfordium (265) [Rn]5f^{14}6d^{2}7s^2? 6.0?	105 **Db** Dubnium (268)	106 **Sg** Seaborgium (271)	107 **Bh** Bohrium (272)	108 **Hs** Hassium (277)	109 **Mt** Meitnerium (276)	110 **Ds** Darmstadtium (281)	111 **Rg** Roentgenium (280)	112 **Cn** Copernicium (285)	113 **Uut** Ununtrium (284)	114 **Uuq** Ununquadium (289)	115 **Uup** Ununpentium (288)	116 **Uuh** Ununhexium (293)	117 **Uus** Ununseptium (294)	118 **Uuo** Ununoctium (294)

Lanthanides	57 $^2D_{3/2}$ **La** Lanthanum 138.90547 [Xe]5d6s^2 5.5769	58 $^1G^o_4$ **Ce** Cerium 140.116 [Xe]4f5d6s^2 5.5387	59 $^4I^o_{9/2}$ **Pr** Praseodymium 140.90765 [Xe]4f^{3}6s^2 5.473	60 $^5I_4$ **Nd** Neodymium 144.242 [Xe]4f^{4}6s^2 5.5250	61 $^6H^o_{5/2}$ **Pm** Promethium (145) [Xe]4f^{5}6s^2 5.582	62 $^7F_0$ **Sm** Samarium 150.36 [Xe]4f^{6}6s^2 5.6437	63 $^8S^o_{7/2}$ **Eu** Europium 151.964 [Xe]4f^{7}6s^2 5.6704	64 $^9D^o_2$ **Gd** Gadolinium 157.25 [Xe]4f^{7}5d6s^2 6.1498	65 $^6H^o_{15/2}$ **Tb** Terbium 158.92535 [Xe]4f^{9}6s^2 5.8638	66 $^5I_8$ **Dy** Dysprosium 162.500 [Xe]4f^{10}6s^2 5.9389	67 $^4I^o_{15/2}$ **Ho** Holmium 164.93032 [Xe]4f^{11}6s^2 6.0215	68 $^3H_6$ **Er** Erbium 167.259 [Xe]4f^{12}6s^2 6.1077	69 $^2F^o_{7/2}$ **Tm** Thulium 168.93421 [Xe]4f^{13}6s^2 6.1843	70 $^1S_0$ **Yb** Ytterbium 173.054 [Xe]4f^{14}6s^2 6.2542	71 $^2D_{3/2}$ **Lu** Lutetium 174.9668 [Xe]4f^{14}5d6s^2 5.4259
Actinides	89 $^2D_{3/2}$ **Ac** Actinium (227) [Rn]6d7s^2 5.3807	90 $^3F_2$ **Th** Thorium 232.03806 [Rn]6d^{2}7s^2 6.3067	91 $^4K_{11/2}$ **Pa** Protactinium 231.03588 [Rn]5f^{2}6d7s^2 5.89	92 $^5L_6$ **U** Uranium 238.02891 [Rn]5f^{3}6d7s^2 6.1939	93 $^6L_{11/2}$ **Np** Neptunium (237) [Rn]5f^{4}6d7s^2 6.2657	94 $^7F_0$ **Pu** Plutonium (244) [Rn]5f^{6}7s^2 6.0260	95 $^8S^o_{7/2}$ **Am** Americium (243) [Rn]5f^{7}7s^2 5.9738	96 $^9D^o_2$ **Cm** Curium (247) [Rn]5f^{7}6d7s^2 5.9914	97 $^6H^o_{15/2}$ **Bk** Berkelium (247) [Rn]5f^{9}7s^2 6.1979	98 $^5I_8$ **Cf** Californium (251) [Rn]5f^{10}7s^2 6.2817	99 $^4I^o_{15/2}$ **Es** Einsteinium (252) [Rn]5f^{11}7s^2 6.3676	100 $^3H_6$ **Fm** Fermium (257) [Rn]5f^{12}7s^2 6.50	101 $^2F^o_{7/2}$ **Md** Mendelevium (258) [Rn]5f^{13}7s^2 6.58	102 $^1S_0$ **No** Nobelium (259) [Rn]5f^{14}7s^2 6.65	103 $^2P^o_{1/2}$? **Lr** Lawrencium (262) [Rn]5f^{14}7s^{2}7p? 4.9 ?

Atomic Number — Ground-state Level
Symbol — **58 $^1G^o_4$ Ce** — Name: Cerium
Atomic Weight†: 140.116
Ground-state Configuration: [Xe]4f5d6s^2
Ionization Energy (eV): 5.5387

†Based upon ^{12}C. ( ) indicates the mass number of the longest-lived isotope.

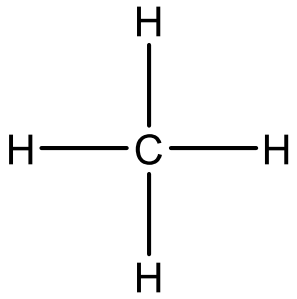
For a description of the data, visit physics.nist.gov/data

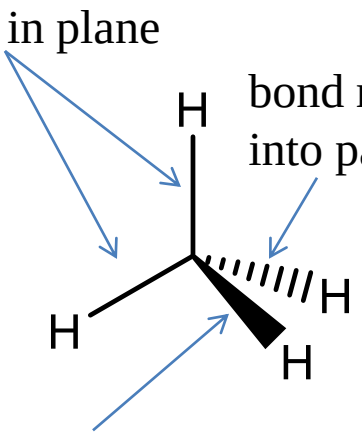
NIST SP 966 (September 2010)

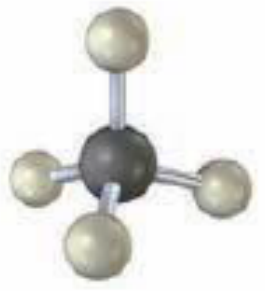
Chemical bond theory

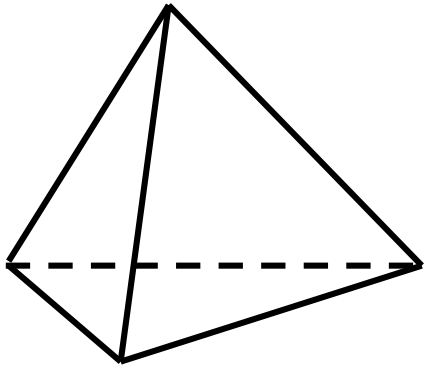
Lý thuyết liên kết hóa học

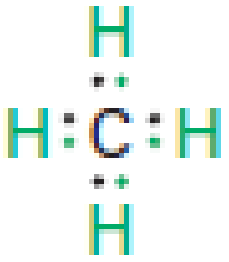
CH_4







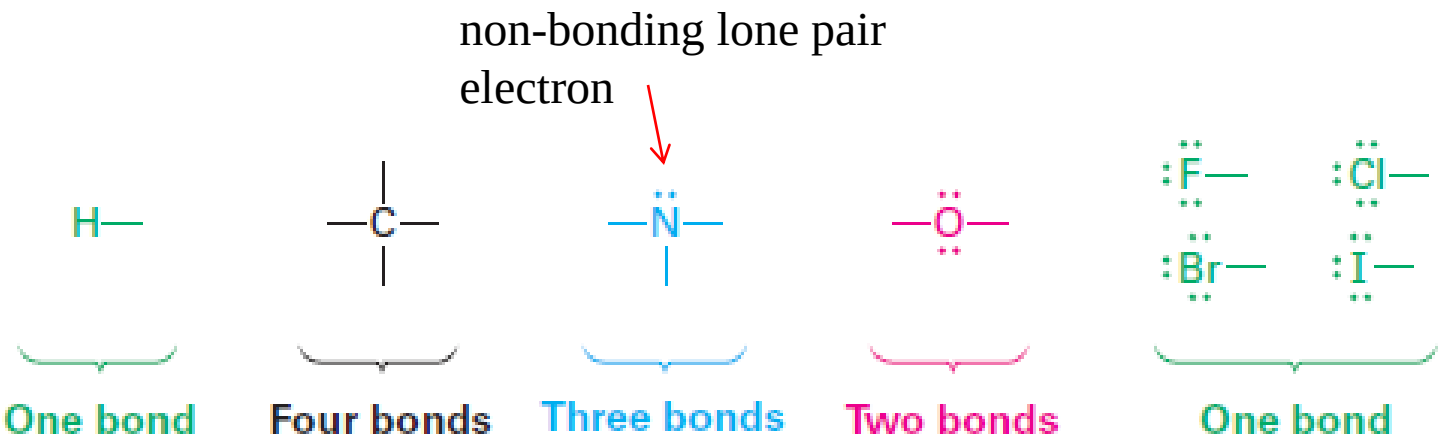




Lewis structure

Regular tetrahydron

Chemical bond theory



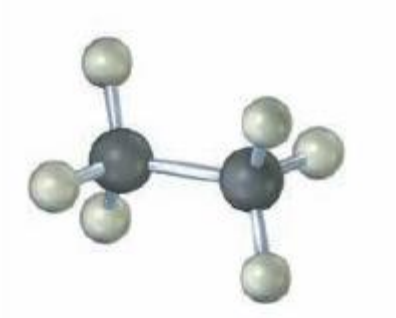
Công thức phân tử của phosphine là gì? $PH_?$

Vẽ cấu trúc của chloromethane CH_3Cl, dùng công thức Lewis

Problem 1.3 & 1.4

Show the tetrahedral geometry of chloroform $CHCl_3$ using solid, dashed and wedged lines?

And for ethane?



Problem 1.5,1.6 & 1.7

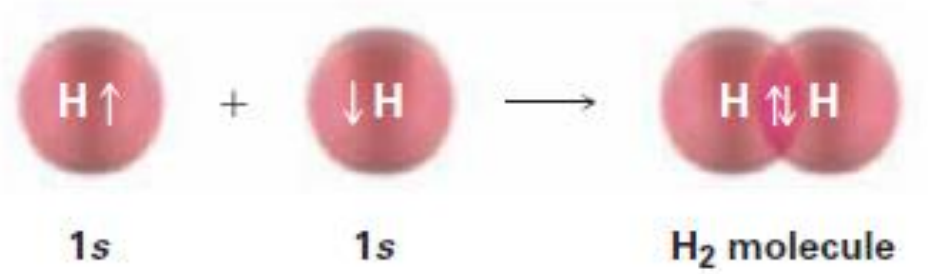
1.5. Guess the chemical formula of these substances: $CCl_?$, $AlH_?$, $CH_?Cl_2$, $SiF_?$, $CH_3NH_?$.

1.6. Write line-bond structures for the following substances, showing all non-bonding electrons: $CHCl_3$, CH_3NH_2, H_2S, CH_3Li

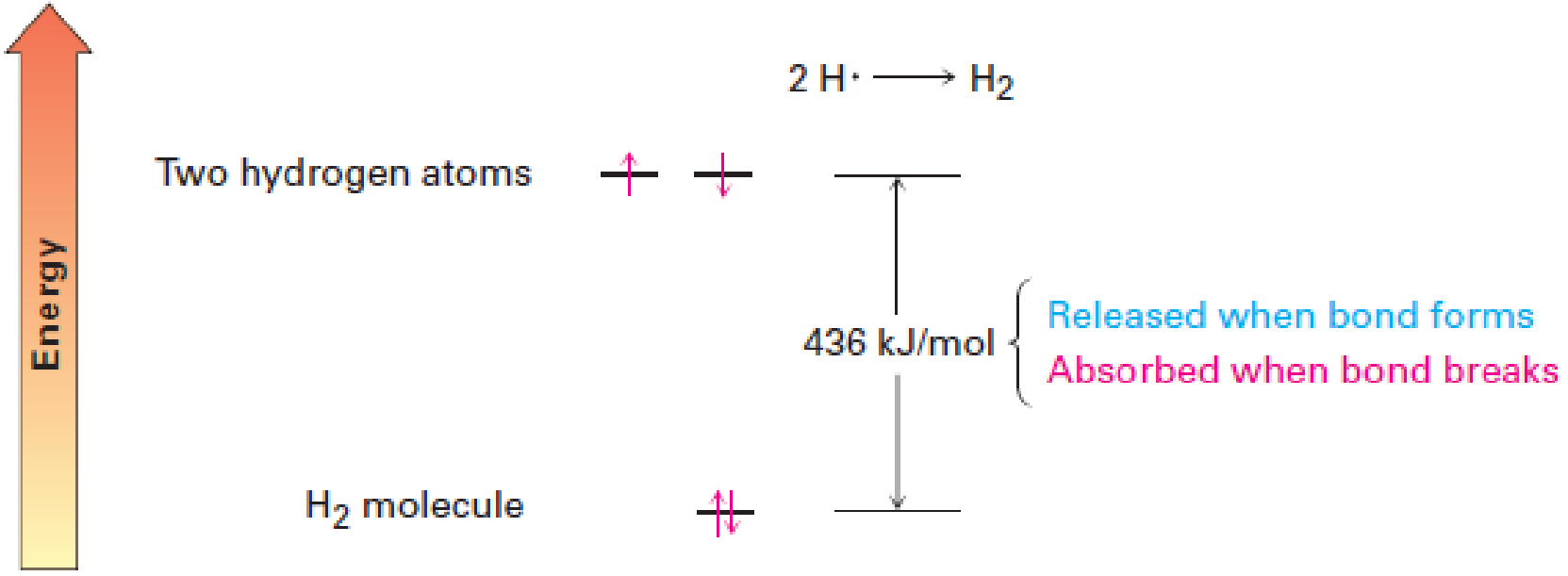
1.7. Does this formula exist in organic chemistry C_2H_7?

Valence bond theory

Thuyết liên kết cộng hóa trị

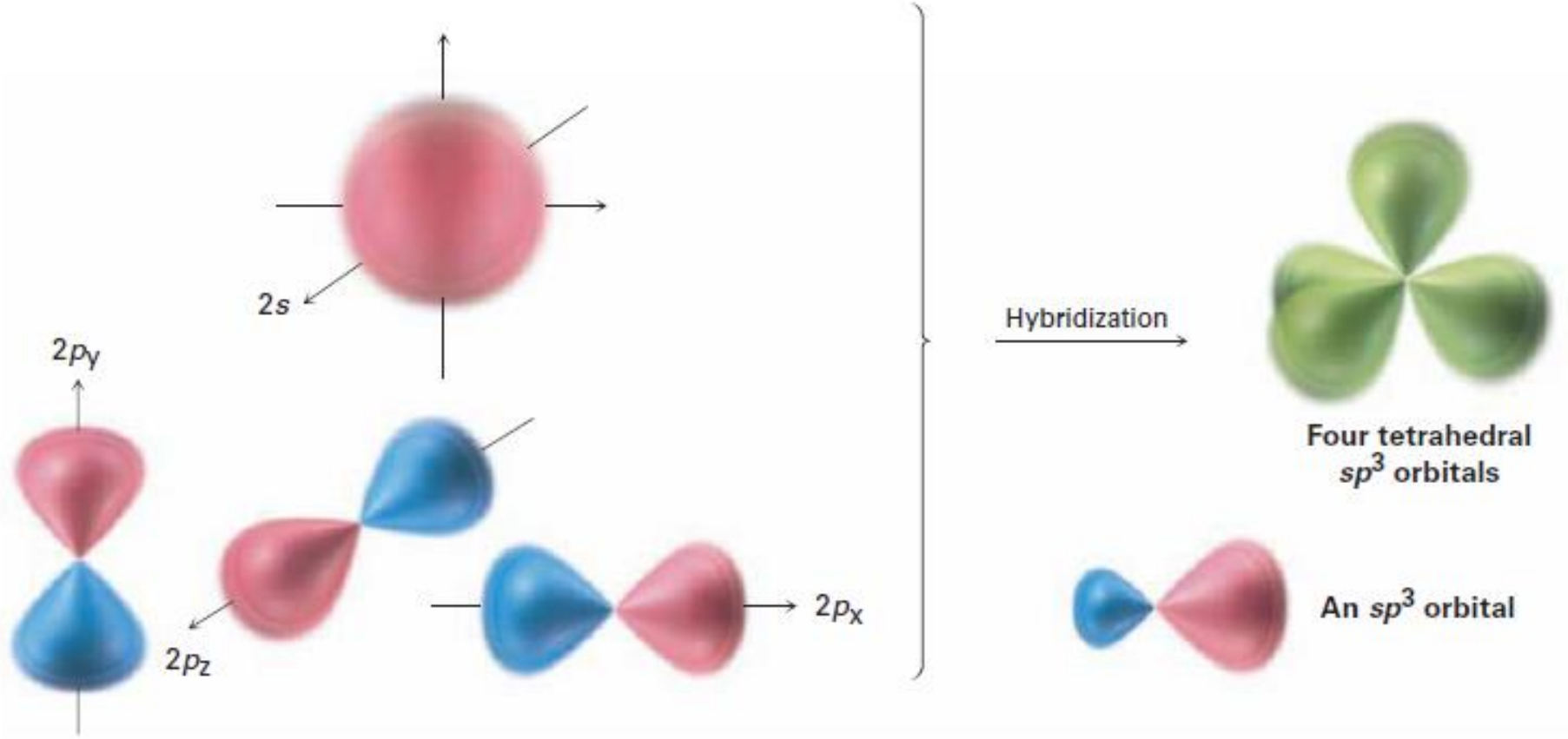


Two orbital overlap and forming bond

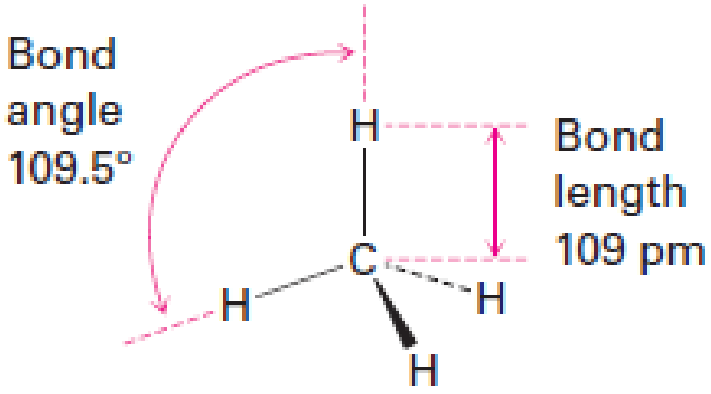


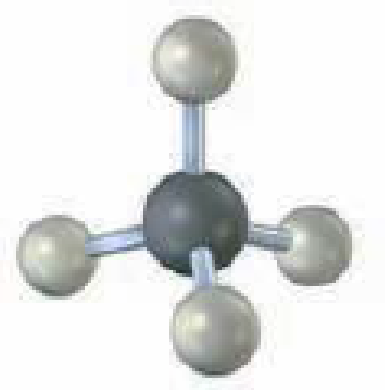
Valence bond theory: sp^3 hybridization Lai hóa sp^3

Methane: CH_4

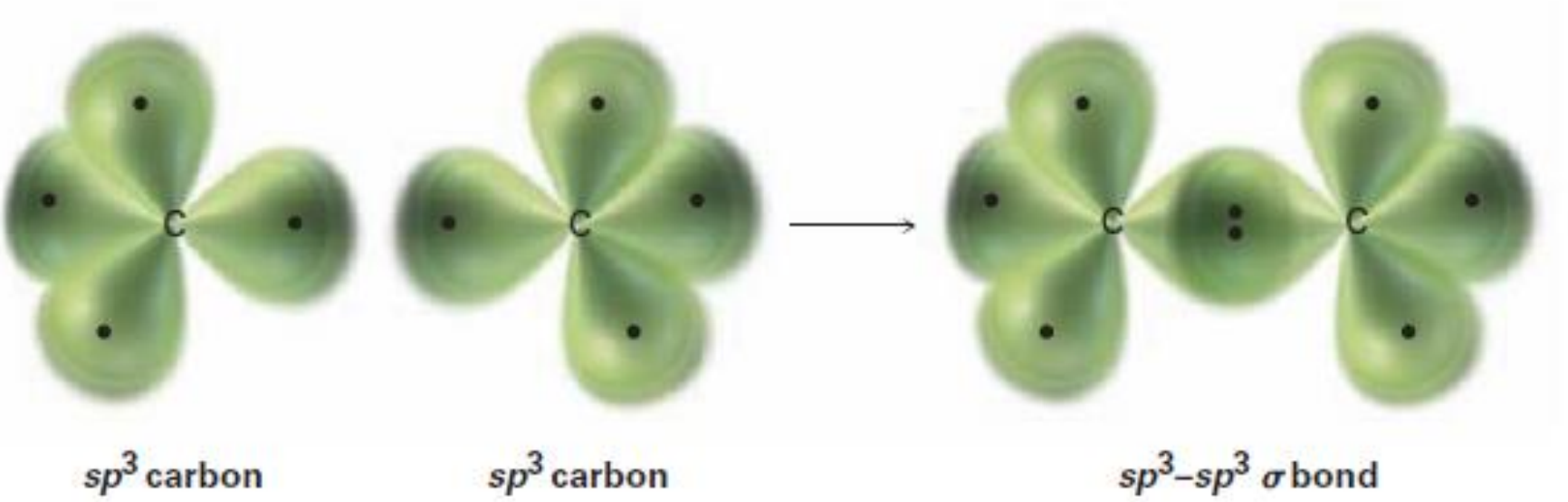


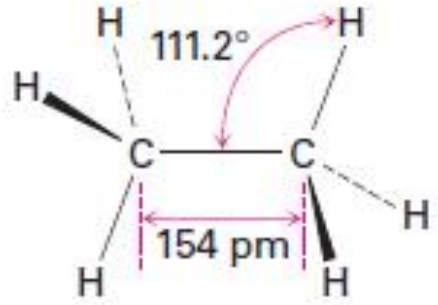
Valence bond theory: sp^3 hybridization

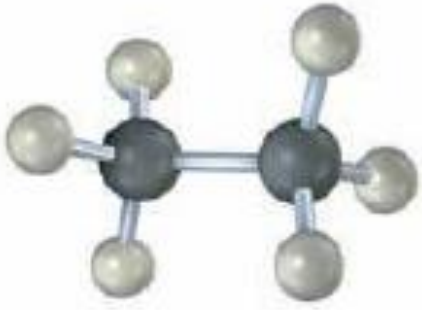




Ethane: sp^3 hybridization







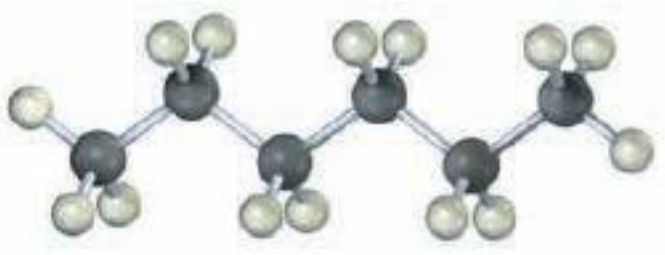
Problem 1.8

PROBLEM 1-8

Draw a line-bond structure for propane, $CH_3CH_2CH_3$. Predict the value of each bond angle, and indicate the overall shape of the molecule.

PROBLEM 1-9

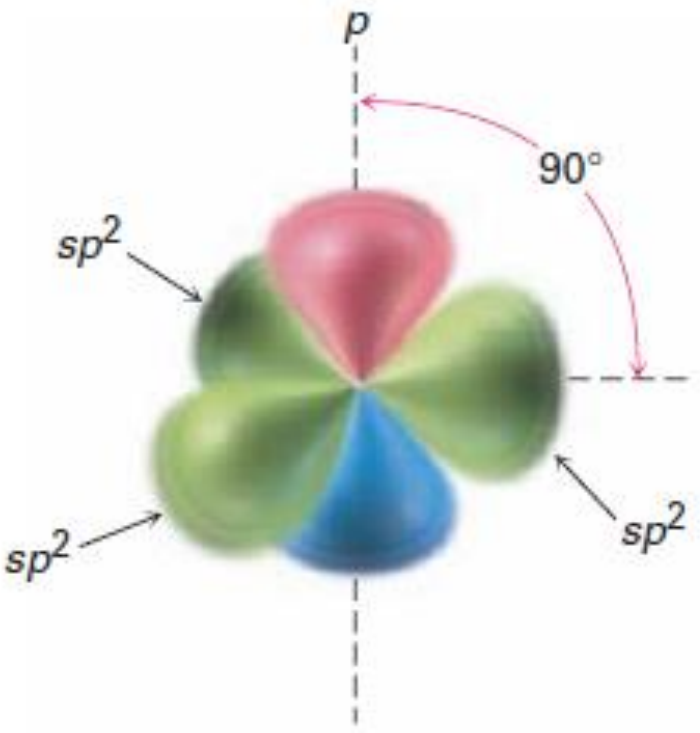
Convert the following molecular model of hexane, a component of gasoline, into a line-bond structure (gray = C, ivory = H).



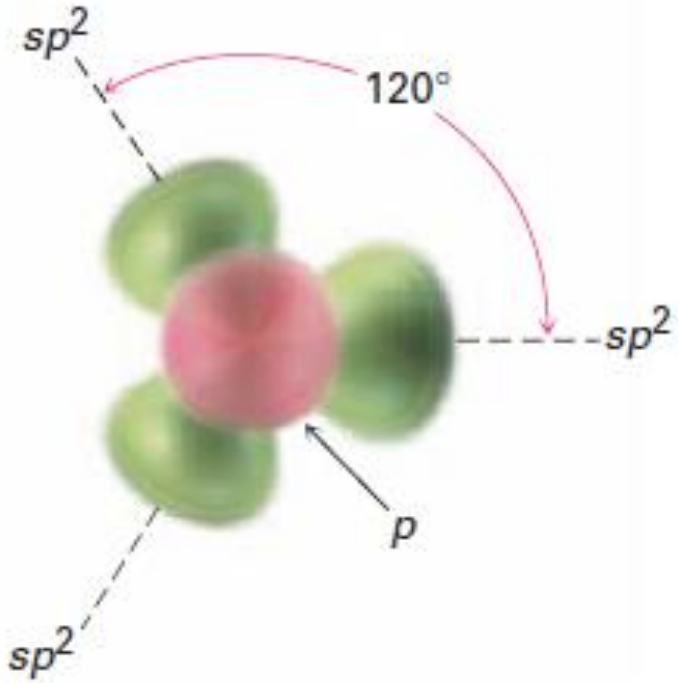
Hexane

sp^2 hybridization

Lai hóa sp^2

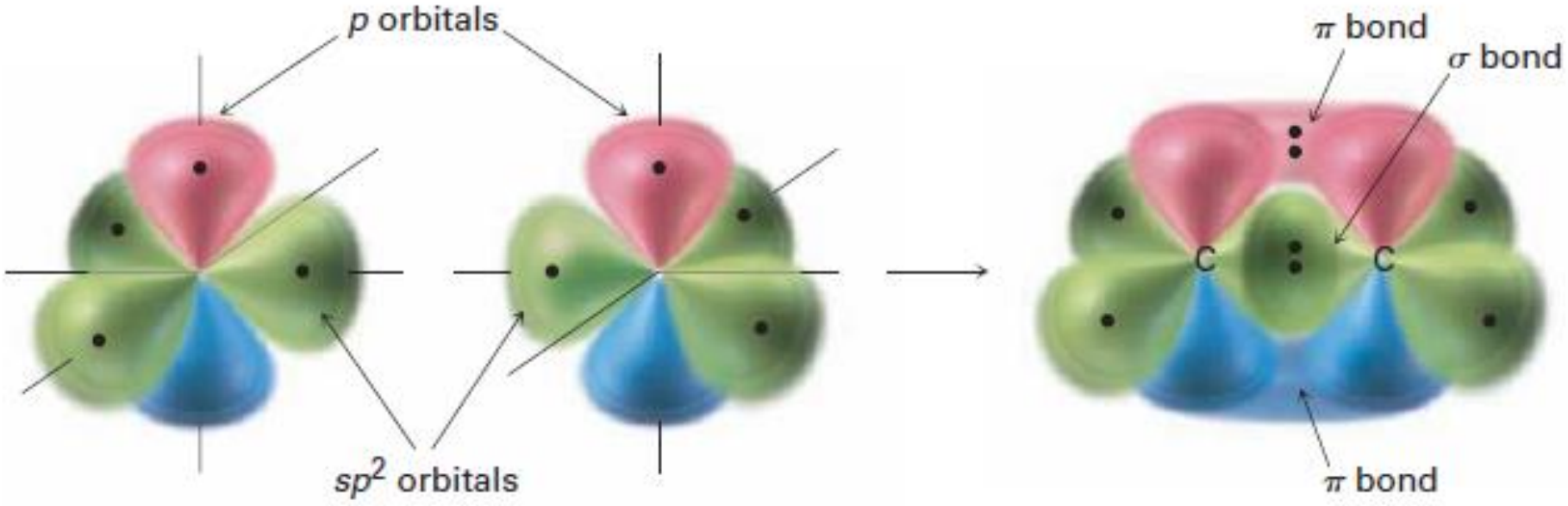


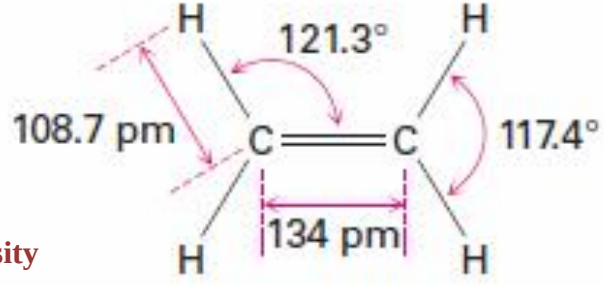
Side view



Top view

sp^2 hybridization: ethylene



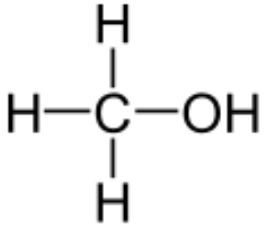


Problem

Draw electron-dot and line-bond structure of formaldehyde (HCHO) and indicate the hybridization of this substance?

CH_3CHO

glutaraldehyde



methanol

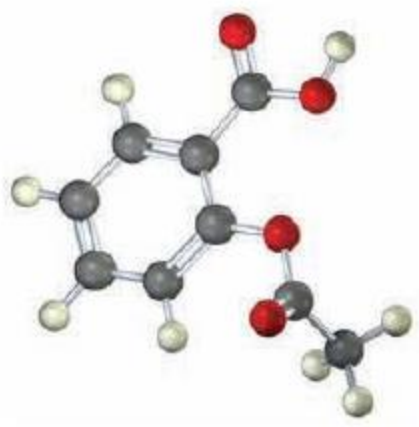
Rosalia Lombardo
1918-1920
in Sicily, Italia

Problem 1.10-1.12

Draw line-bond structure of propene, 1,3- butadiene. Indicate the hybridization of the orbitals on each carbon and value of each bond angle.

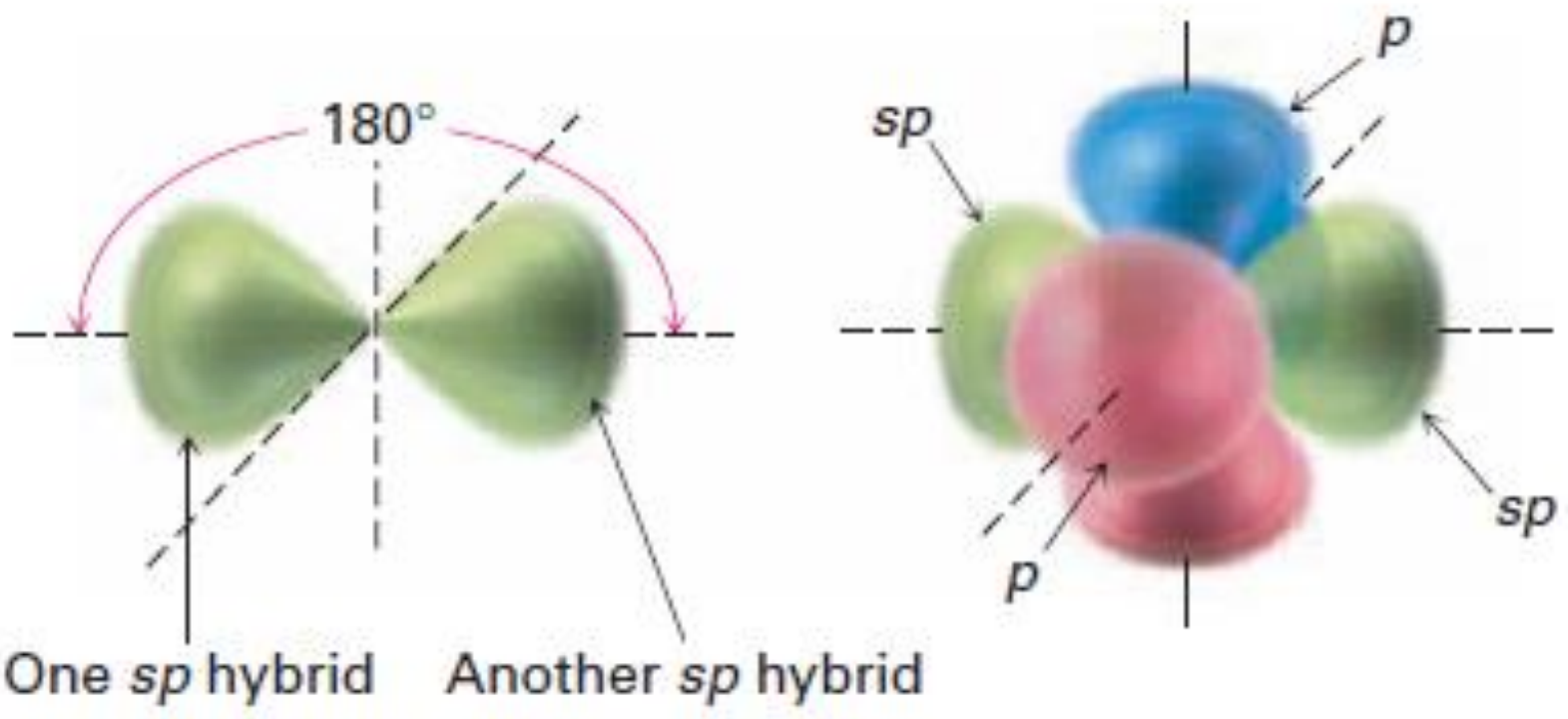
Look at structure of aspirin (acetylsalicylic acid) and identify the orbital hybridization and tell which atoms have lone pairs of electrons.

Red: oxygen
Grey: carbon
Ivory: hydrogen

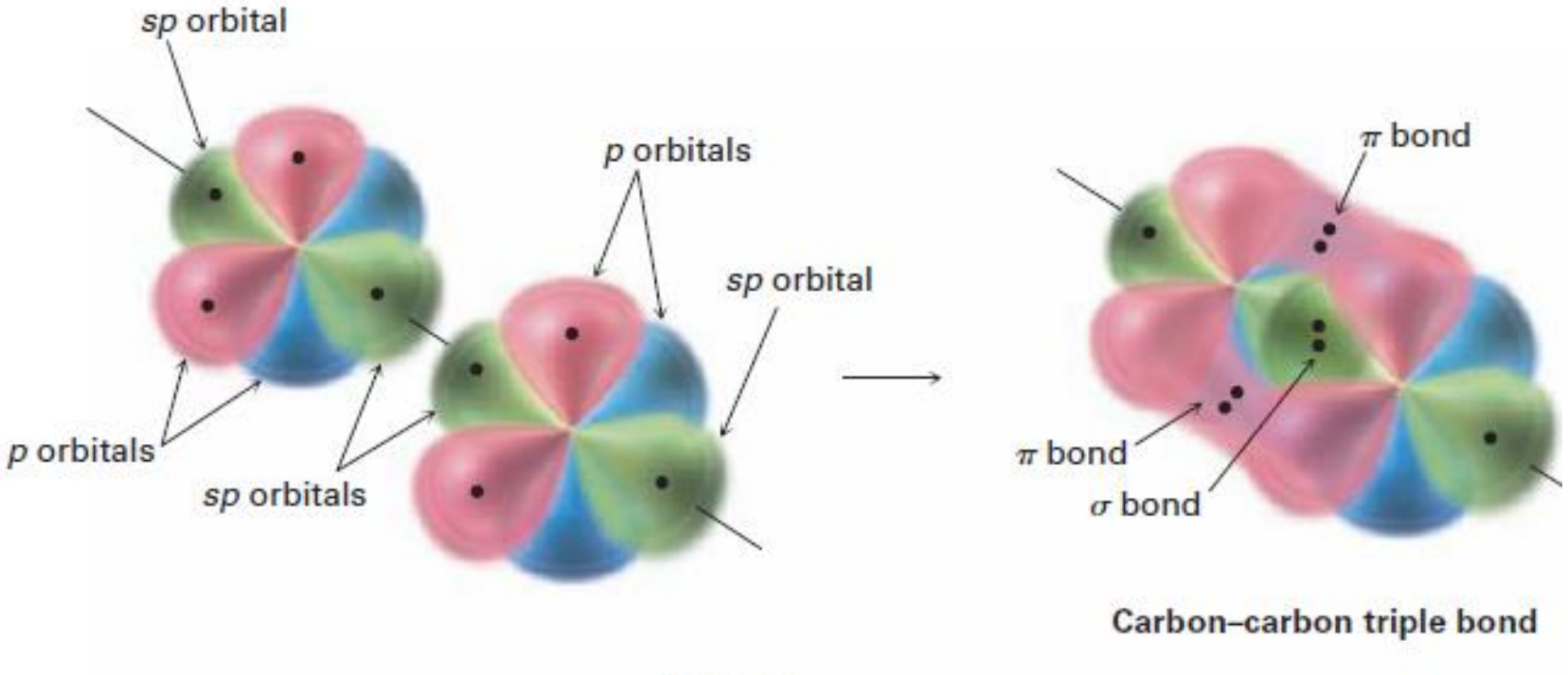


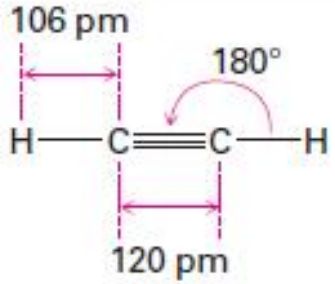
sp hybridization

Lai hóa sp



sp hybridization





Problem 1.13

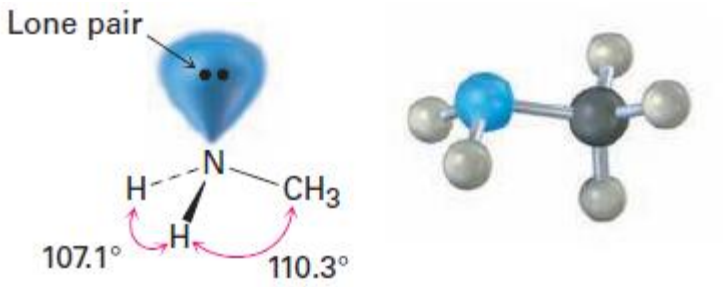
Draw a line-bond structure for propyne, C_3H_4. Indicate the hybridization of the orbitals on each carbon, predict bond angle.

Summary

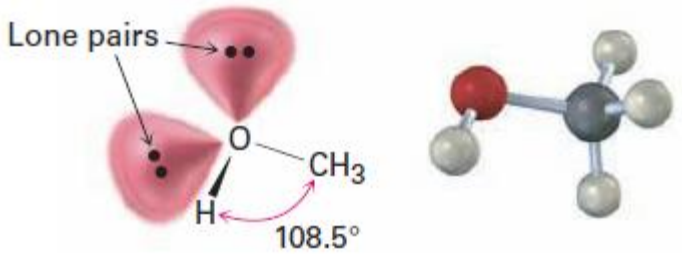
TABLE 1-2 Comparison of C–C and C–H Bonds in Methane, Ethane, Ethylene, and Acetylene

Molecule	Bond	Bond strength (kJ/mol)	Bond strength (kcal/mol)	Bond length (pm)
Methane, CH_4	(sp^3) C—H	439	105	109
Ethane, CH_3CH_3	(sp^3) C—C (sp^3)	377	90	154
	(sp^3) C—H	421	101	109
Ethylene, $H_2C{=}CH_2$	(sp^2) C=C (sp^2)	728	174	134
	(sp^2) C—H	464	111	109
Acetylene, $HC{\equiv}CH$	(sp) C≡C (sp)	965	231	120
	(sp) C—H	558	133	106

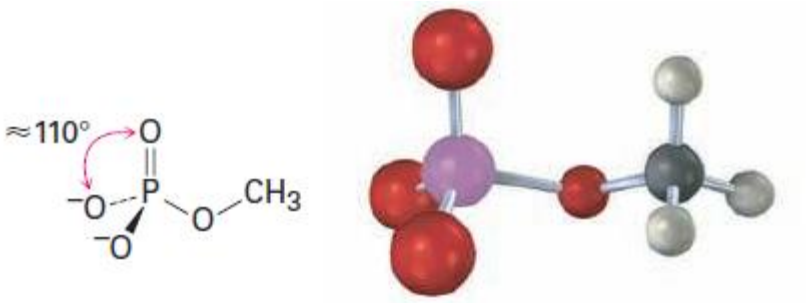
Hybridization of N, O, S



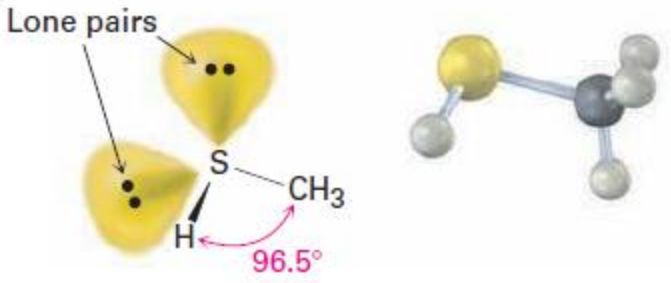
Methylamine



Methanol
(methyl alcohol)



Methyl phosphate
(an organophosphate)



Methanethiol

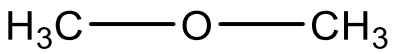
Orbital hybridization can also applied to N, O, S and P.

Problem 1.14

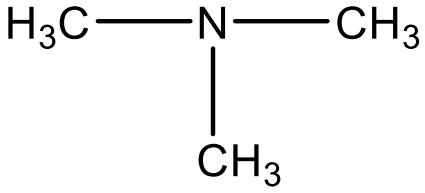
Identify the nonbonding lone pairs of electrons of atom O, N, P and S in the following molecules. Can you predict the angle between substituents attached to those atoms?

PH_3

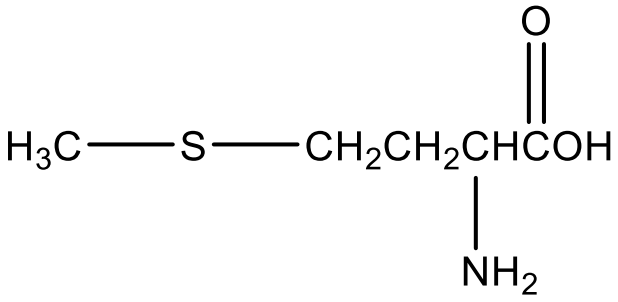
phosphine



dimethyl ether



trimethylamine



amino acid methionine

Molecular orbital theory

(Thuyết orbital phân tử)

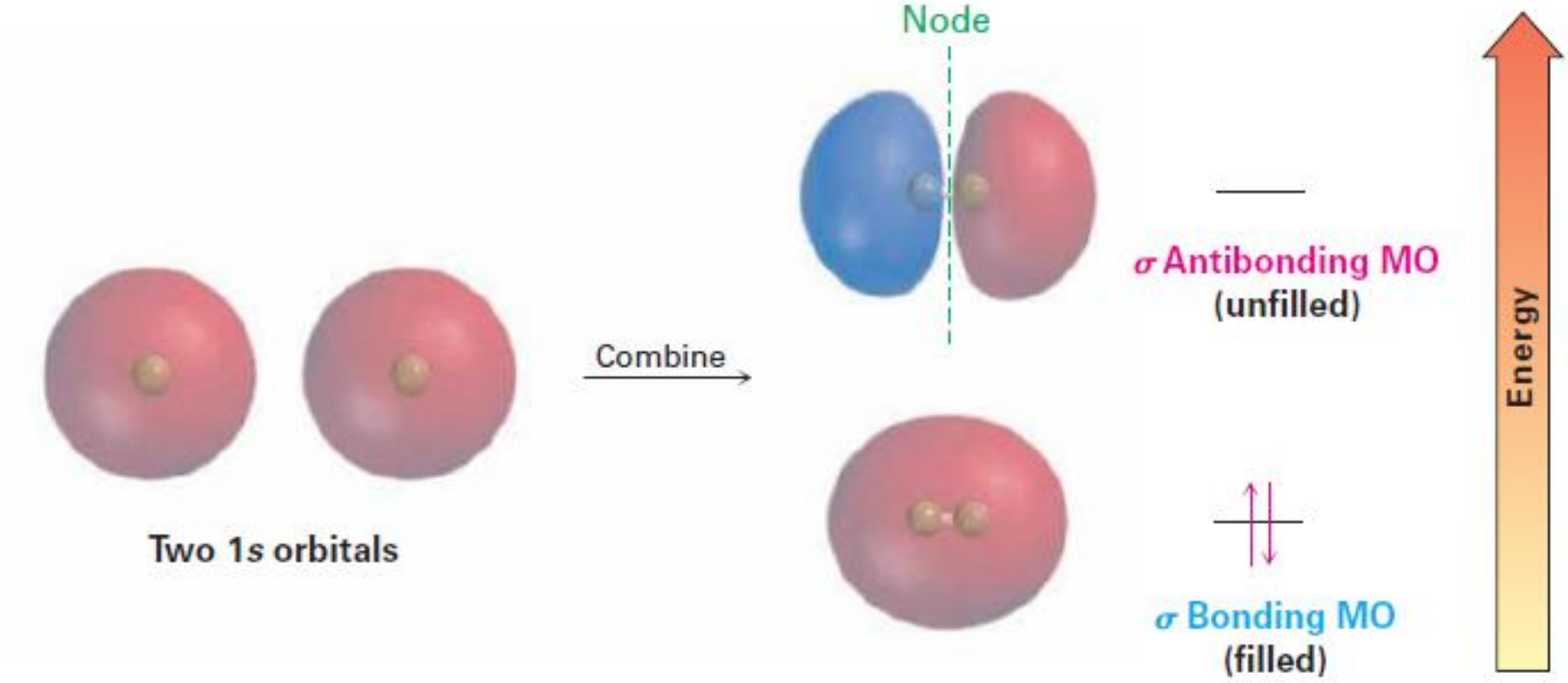
Atomic orbitals versus molecular orbitals

Overlapping versus combination (additive or subtractive)

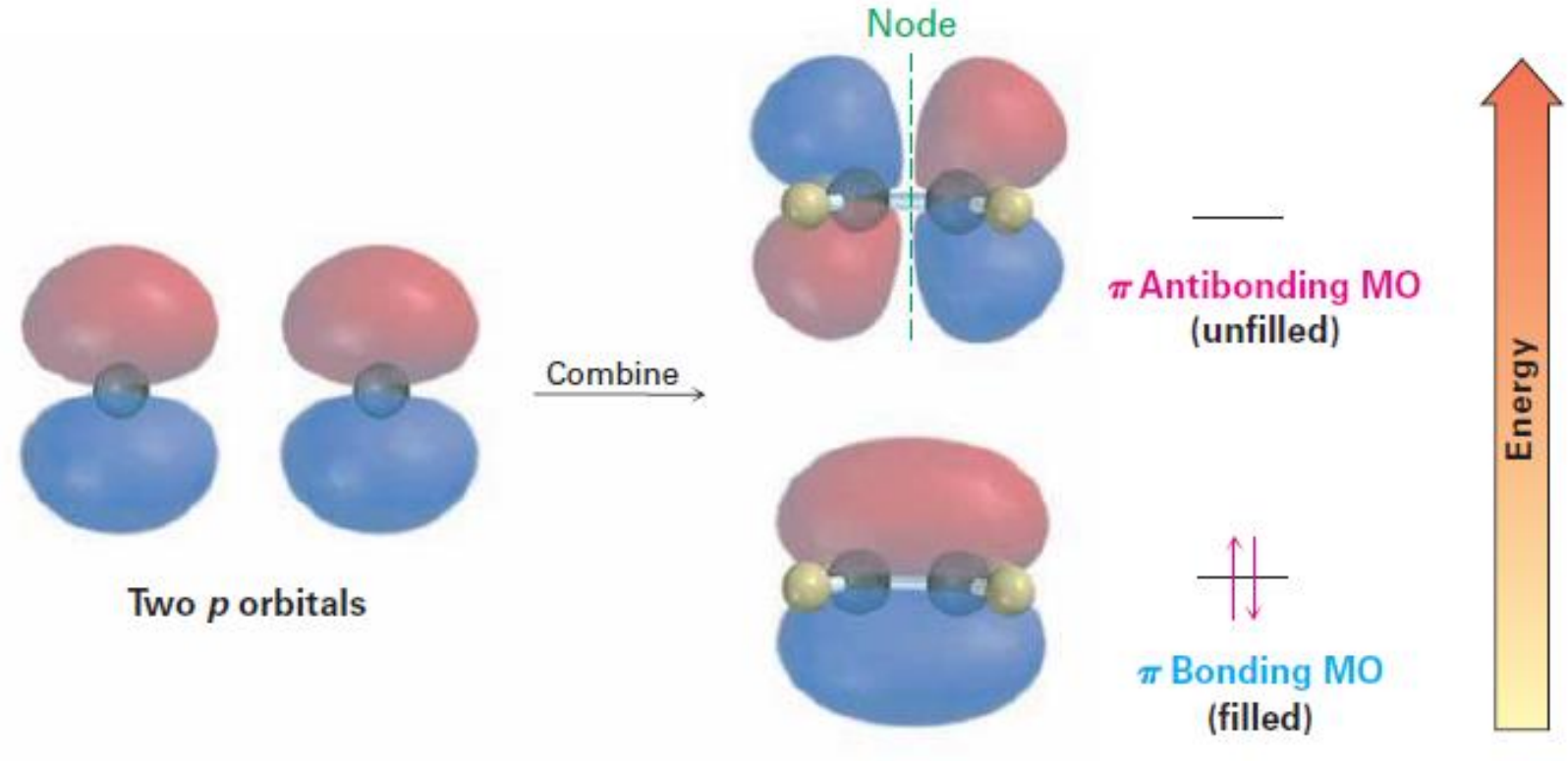
Overlapping or not

bonding MO or antibonding MO

Molecular orbital theory



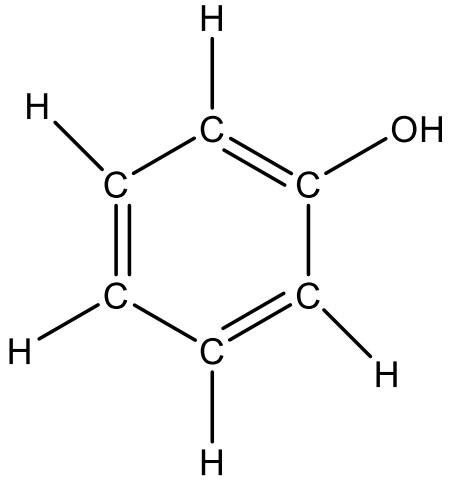
Molecular orbital theory



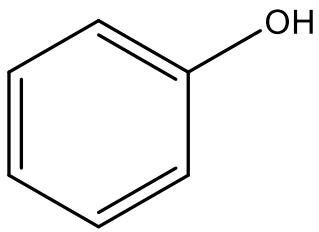
Drawing Chemical Structures

Condensed structures C_6H_5OH

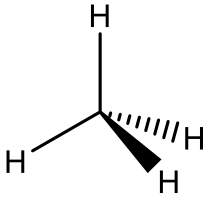
Kekulé structures



Skeletal structure



Wedged, dashed, line structures

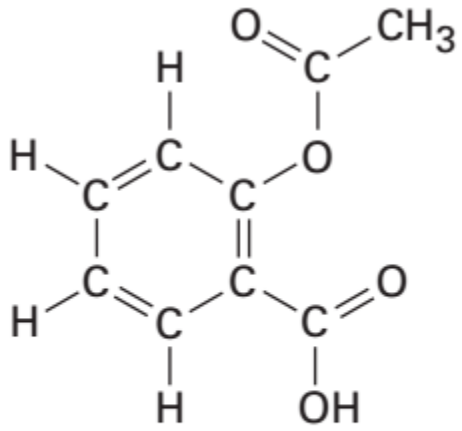


Problems

Are you ready with Paper and Pen?

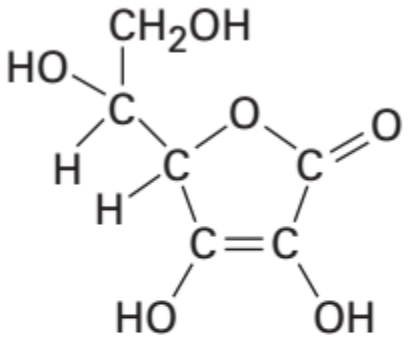
1. Convert the following line-bond structures into molecular formulas

(a)



Aspirin
(acetylsalicylic acid)

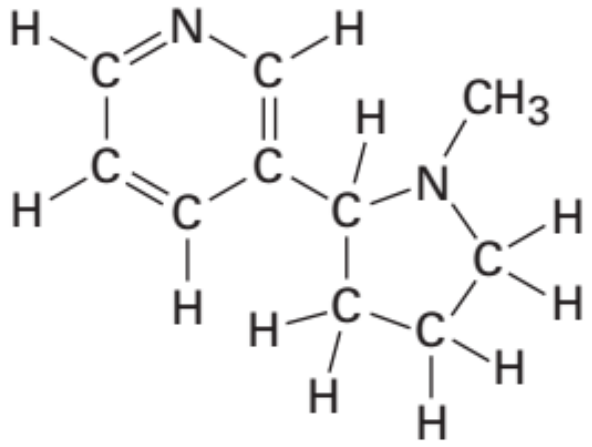
(b)



Vitamin C
(ascorbic acid)

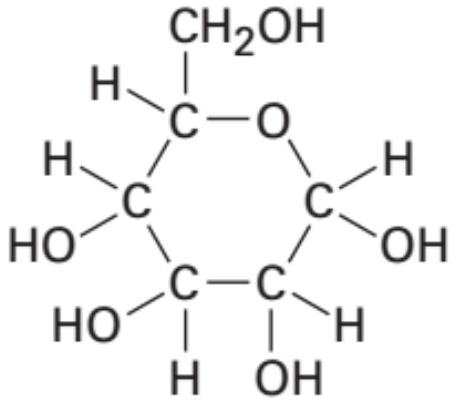
2. Convert the following line-bond structures into molecular formulas

(c)



Nicotine

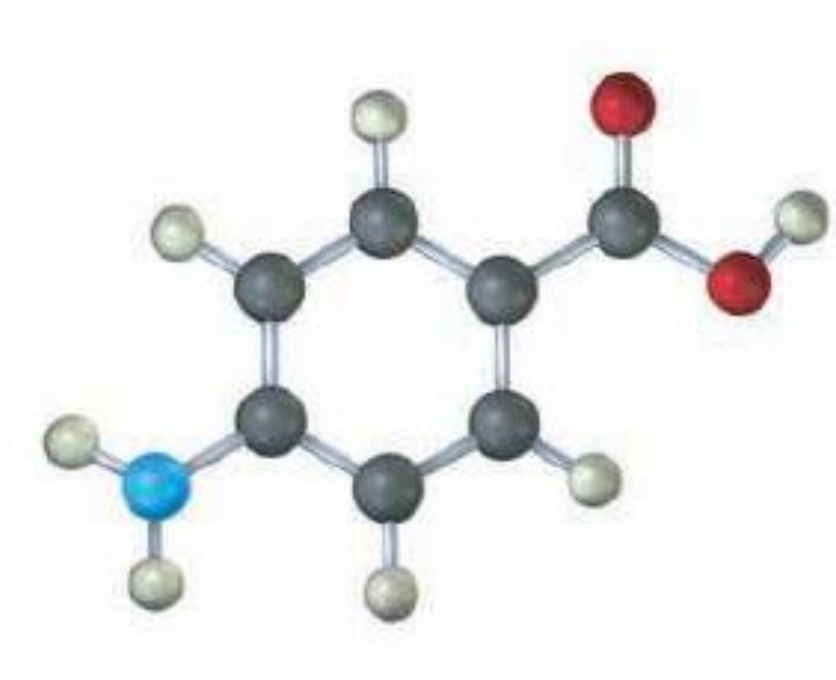
(d)



Glucose

3. Problem 1.17

Identify multiple bonds in this molecule and draw skeletal structure of it. Red = O, green = N, ivory = H

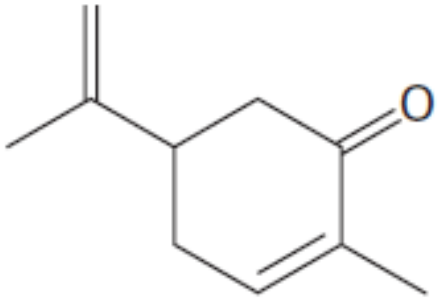


para-Aminobenzoic acid
(PABA)

(it was used as active ingredient in sunscreen to absorb UVB)

4. Problem

Give molecular formula of Carvone (odor of spearmint)

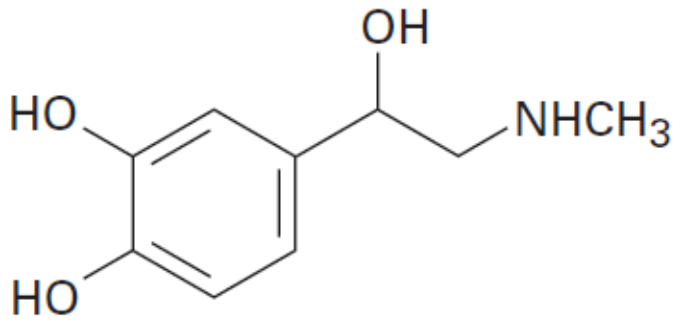


Carvone

5. Problem 1.15

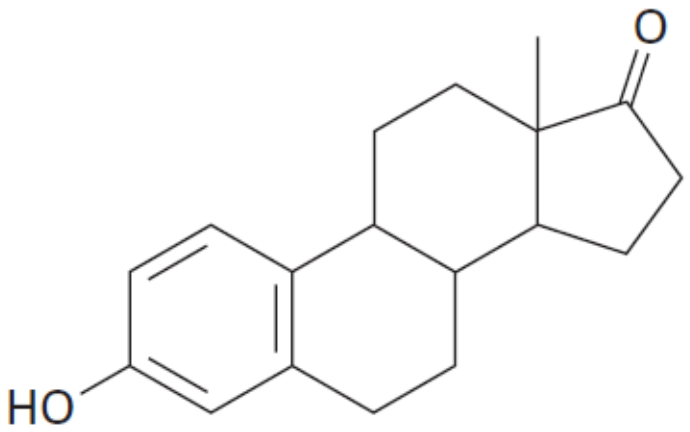
Give molecular formula of each substance:

(a)



Adrenaline

(b)



Estrone (a hormone)

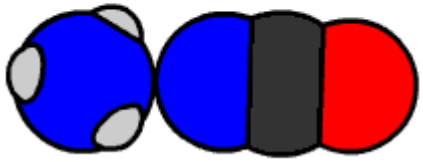
6. Problem 1.16

Propose skeletal structures for these following compounds (> 1 possibility):

(a) C_5H_{12} **(b)** C_2H_7N **(c)** C_3H_6O **(d)** C_4H_9Cl

Formation of Urea

$[NH_4^+][NCO^-]$



Volume 94 Issue 13 | pp. 24-25
Issue Date: March 28, 2016

Is there a crisis in organic chemistry education?

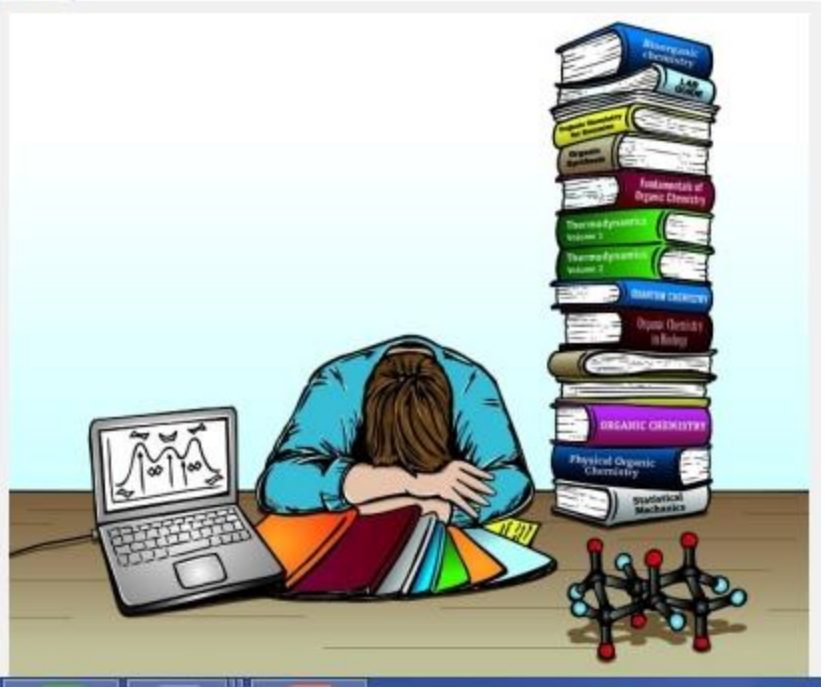
Teachers say yes, but most of the problems aren't new

By **Bethany Halford**

Symposium organizers drew attention to a session earlier this month at the ACS national meeting in San Diego with a provocative title: "Is There a Crisis in Organic Chemistry Education?" But many of the speakers—most of whom work in academic publishing—responded with a "no," threatening to deflate the advertised anxiety.

Quite the contrary, they said. Never before have organic chemistry students and teachers had so many resources at

[+]Enlarge



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Organic chemistry

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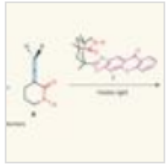
Organic chemistry is the study of the synthesis, structure, reactivity and properties of the diverse group of chemical compounds primarily constructed of carbon. All life on earth is carbon-based, thus organic chemistry is also the basis of biochemistry. The ability to form compounds containing long chains of carbon atoms is the basis of polymer chemistry.

News and Views | 12 December 2018

An exciting tool for asymmetric synthesis



Cheng Yang & Yoshihisa Inoue

Nature **564**, 197–199

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