

VEIN BATCH 2027



Sub: Organic المادة:

Lecture: 1 المحاضرة:

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Edited: تعديل:

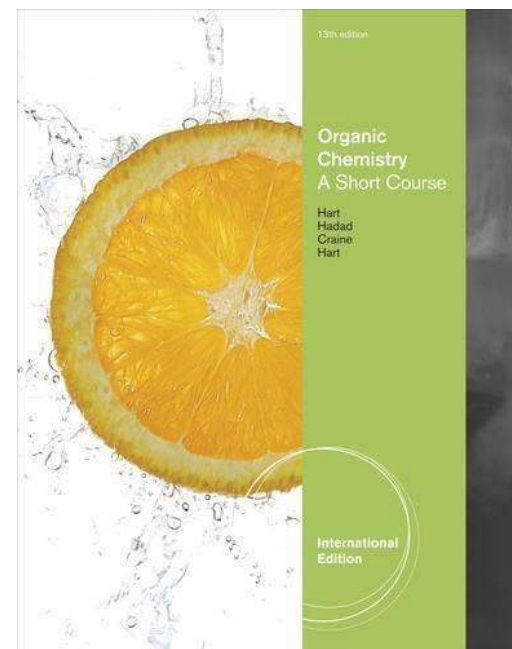
Chem 237 Basics of Organic Medicinal Chemistry

- **Course description**

This is the first year organic chemistry course, introducing basic concepts and principles of organic chemistry (chapters 1 – 11).

- **Texts**

Hart, Craine, Hart and Hadad, Organic Chemistry, A Short Course, 13th Edition (Brooks/Cole, Cengage Learning, CA 94002-3098 USA, 2012).



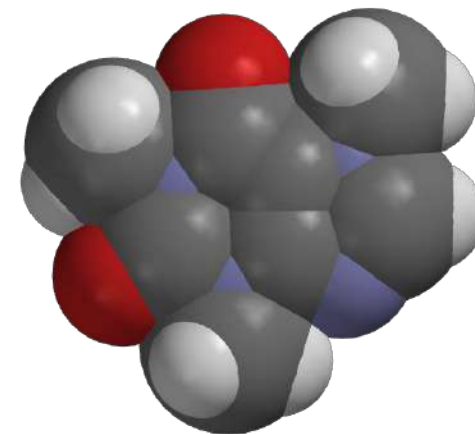
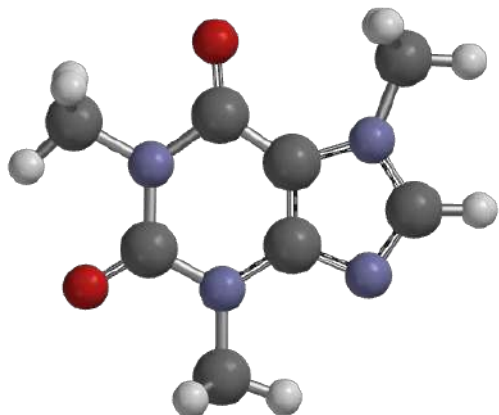
Periodic Table of the Elements

1 IA H Hydrogen 1.008 1	2 IIA He Helium 4.0026 2											13 IIIA B Boron 10.81 2-3	14 IVA C Carbon 12.01 2-4	15 VA N Nitrogen 14.007 2-5	16 VIA O Oxygen 15.999 2-6	17 VIIA F Fluorine 18.998 2-7	18 VIIIA Ne Neon 20.180 2-8
3 Li Lithium 6.94 2-1	4 Be Beryllium 9.012 2-2											13 Al Aluminium 26.982 2-8-3	14 Si Silicon 28.085 2-8-4	15 P Phosphorus 30.974 2-8-5	16 S Sulfur 32.06 2-8-6	17 Cl Chlorine 35.45 2-8-7	18 Ar Argon 39.948 2-8-8
11 Na Sodium 22.98976928 2-8-1	12 Mg Magnesium 24.305 2-8-2	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 VIII	9 VIII	10 VIII	11 IB	12 IIB	13 Ga Gallium 69.723 2-8-3	14 Ge Germanium 72.630 2-8-4	15 As Arsenic 74.922 2-8-5	16 Se Selenium 78.971 2-8-6	17 Br Bromine 79.904 2-8-8	18 Kr Krypton 83.798 2-8-18
19 K Potassium 39.0983 2-8-9-1	20 Ca Calcium 40.078 2-8-9-2	21 Sc Scandium 44.955908 2-8-9-2	22 Ti Titanium 47.867 2-8-9-2	23 V Vanadium 50.9415 2-8-9-2	24 Cr Chromium 51.9961 2-8-9-2	25 Mn Manganese 54.938044 2-8-9-2	26 Fe Iron 55.845 2-8-9-2	27 Co Cobalt 58.933 2-8-9-2	28 Ni Nickel 58.693 2-8-9-2	29 Cu Copper 63.546 2-8-9-2	30 Zn Zinc 65.38 2-8-9-2	31 In Indium 114.82 2-8-18-3	32 Sn Tin 118.71 2-8-18-4	33 Sb Antimony 121.76 2-8-18-5	34 Te Tellurium 127.60 2-8-18-6	35 I Iodine 126.90 2-8-18-7	36 Xe Xenon 131.29 2-8-18-8
37 Rb Rubidium 85.4678 2-8-18-3-1	38 Sr Strontium 87.62 2-8-18-3-2	39 Y Yttrium 88.90584 2-8-18-3-2	40 Zr Zirconium 91.224 2-8-18-3-2	41 Nb Niobium 92.90637 2-8-18-3-2	42 Mo Molybdenum 95.94 2-8-18-3-2	43 Tc Technetium 98.00 2-8-18-3-2	44 Ru Ruthenium 101.07 2-8-18-3-2	45 Rh Rhodium 102.91 2-8-18-3-2	46 Pd Palladium 106.42 2-8-18-3-2	47 Ag Silver 107.87 2-8-18-3-2	48 Cd Cadmium 112.41 2-8-18-3-2	49 In Indium 114.82 2-8-18-3-2	50 Sn Tin 118.71 2-8-18-4	51 Sb Antimony 121.76 2-8-18-5	52 Te Tellurium 127.60 2-8-18-6	53 I Iodine 126.90 2-8-18-7	54 Xe Xenon 131.29 2-8-18-8
55 Cs Cesium 132.90545196 2-8-18-18-3-1	56 Ba Barium 137.327 2-8-18-18-3-2	57-71 Lanthanides	72 Hf Hafnium 178.49 2-8-18-32-18-2	73 Ta Tantalum 180.94788 2-8-18-32-18-2	74 W Tungsten 183.84 2-8-18-32-18-2	75 Re Rhenium 186.21 2-8-18-32-18-2	76 Os Osmium 190.23 2-8-18-32-18-2	77 Ir Iridium 192.22 2-8-18-32-18-2	78 Pt Platinum 195.08 2-8-18-32-18-2	79 Au Gold 196.97 2-8-18-32-18-2	80 Hg Mercury 200.59 2-8-18-32-18-2	81 Tl Thallium 204.38 2-8-18-32-18-3	82 Pb Lead 207.2 2-8-18-32-18-4	83 Bi Bismuth 208.98 2-8-18-32-18-3	84 Po Polonium 209 2-8-18-32-18-4	85 At Astatine (210) 2-8-18-32-18-7	86 Rn Radon (222) 2-8-18-32-18-8
87 Fr Francium (223) 2-8-18-32-18-6-1	88 Ra Radium (226) 2-8-18-32-18-6-2	89-103 Actinides	104 Rf Rutherfordium (261) 2-8-18-32-32-18-2	105 Db Dubnium (268) 2-8-18-32-32-18-2	106 Sg Seaborgium (266) 2-8-18-32-32-18-2	107 Bh Bohrium (270) 2-8-18-32-32-18-2	108 Hs Hassium (277) 2-8-18-32-32-18-2	109 Mt Meitnerium (276) 2-8-18-32-32-18-2	110 Ds Darmstadtium (281) 2-8-18-32-32-18-1	111 Rg Roentgenium (282) 2-8-18-32-32-18-2	112 Cn Copernicium (285) 2-8-18-32-32-18-2	113 Nh Nihonium (284) 2-8-18-32-32-18-3	114 Fl Flerovium (289) 2-8-18-32-32-18-4	115 Mc Moscovium (290) 2-8-18-32-32-18-5	116 Lv Livermorium (293) 2-8-18-32-32-18-6	117 Ts Tennessine (294) 2-8-18-32-32-18-7	118 Og Oganesson (294) 2-8-18-32-32-18-8

57 La Lanthanum 138.91 2-8-18-32-2	58 Ce Cerium 140.12 2-8-18-32-2	59 Pr Praseodymium 140.91 2-8-18-32-2	60 Nd Neodymium 144.24 2-8-18-32-2	61 Pm Promethium (145) 2-8-18-32-2	62 Sm Samarium 150.36 2-8-18-32-2	63 Eu Europium 151.96 2-8-18-32-2	64 Gd Gadolinium 157.25 2-8-18-32-2	65 Tb Terbium 158.93 2-8-18-32-2	66 Dy Dysprosium 162.50 2-8-18-32-2	67 Ho Holmium 164.93 2-8-18-32-2	68 Er Erbium 167.26 2-8-18-32-2	69 Tm Thulium 168.93 2-8-18-32-2	70 Yb Ytterbium 173.05 2-8-18-32-2	71 Lu Lutetium 174.97 2-8-18-32-2
89 Ac Actinium (227) 2-8-18-32-18-2	90 Th Thorium 232.04 2-8-18-32-18-2	91 Pa Protactinium 231.04 2-8-18-32-18-2	92 U Uranium 238.03 2-8-18-32-18-2	93 Np Neptunium (237) 2-8-18-32-18-2	94 Pu Plutonium (244) 2-8-18-32-18-2	95 Am Americium (243) 2-8-18-32-18-2	96 Cm Curium (247) 2-8-18-32-18-2	97 Bk Berkelium (247) 2-8-18-32-18-2	98 Cf Californium (251) 2-8-18-32-18-2	99 Es Einsteinium (252) 2-8-18-32-18-2	100 Fm Fermium (257) 2-8-18-32-18-2	101 Md Mendelevium (258) 2-8-18-32-18-2	102 No Nobelium (259) 2-8-18-32-18-2	103 Lr Lawrencium (260) 2-8-18-32-18-2

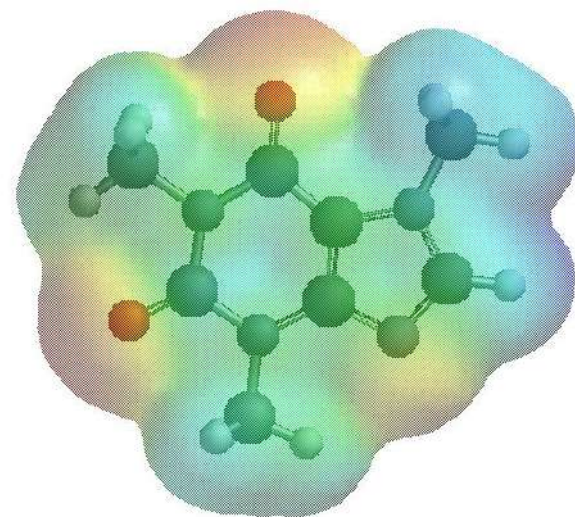
Atomic Number → 1
 Symbol → **H**
 Name → Hydrogen
 Atomic Weight → 1.008
 Electrons per shell → 1

- State of matter (color of name)
 GAS LIQUID SOLID UNKNOWN
- Subcategory in the metal-metalloid-nonmetal trend (color of background)
- Alkali metals
 - Alkaline earth metals
 - Transition metals
 - Lanthanides
 - Actinides
 - Post-transition metals
 - Metalloids
 - Reactive nonmetals
 - Noble gases
 - Unknown chemical properties



Chapter 1: Bonding and Isomerism

Compounds with the same formula
but different arrangement of atoms.



Done by : Johainah Taha

Organic Chemistry

- Organic compounds are compounds containing carbon



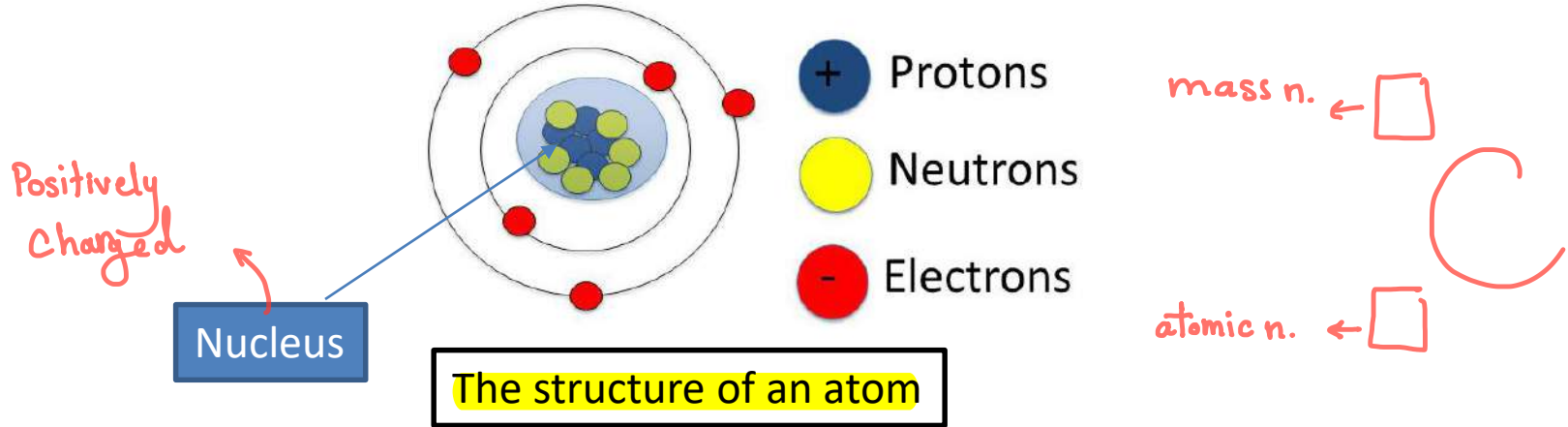
- Atoms to the left of carbon ^{تخس} give up electrons.
- Atoms to the right of carbon ^{تكسب} accept electrons.
- Carbon ^{***} shares electrons.

← وهاي الخاصية بتخليه يكون عدد كبير من المركبات

Bonding and Isomerism

1.1 How Electrons Are Arranged in Atoms

- An atom is: *the smallest particle* of an element that retains all of the chemical properties of that element. تحتفظ
- An atom consists of negatively charged electrons, positively charged protons, and neutral neutrons



Atomic number: العدد الذري numbers of protons in its nucleus and it's the number of electrons in the neutral atom. ** = num of P^+ = num of e^-

Mass number: العدد الكلي the مجموع sum of the protons and neutrons of an atom. $= P^+ + n^0$
(Protons and neutrons are ~ 1837 times the mass of an e^-)

Isotopes نظائر have the same atomic number but different mass numbers (^{12}C and ^{13}C)

- Electrons are located in **atomic orbitals** (S, P, d, f).
مدار
لـ مرتبة بالـ shells .
- Orbitals tell us **the energy of the electron** and **the volume of space around the nucleus** where an electron is most likely to be found.
① ②
- Orbitals are grouped in **shells**.
مستوى

Each orbital can hold a maximum of **2e⁻** and the two electrons have **opposite spin**.
لف

Table 1.1 Distribution of Electrons in the First Four Shells That Surround the Nucleus
توزيع

السلايد الي بعده عليه شرح	First shell	Second shell	Third shell	Fourth shell
Atomic orbitals	s	s, p	s, p, d	s, p, d, f
Number of atomic orbitals	1	1, 3	1, 3, 5	1, 3, 5, 7
Maximum number of electrons	2	8	18	32

Example :



Note
كل ما كان المستوى (shell) أقرب الى النواة كل ما كان:
١. High stability
٢. Low energy

أشرح الكم بلغة أبسط :- (تخيلوا معي)

• المستويات اي حول النواة ← اسمهم Shell → حينما نعتبر انه ال Shell هو طابق وكل طابق فيه اقسام

وكل قسم فيه عدد من الغرف وكل غرفة بتوسع

شخصين ، بشرط يكونوا عكس بعضا .

بناءً على هاد الكلام ، الطابق الأول فيه قسم واحد اي هو S واد S

يعني غرفة وحدة بتوسع شخصين ، اذاً المستوى الأول بيوسع $2e^-$.

الطابق الثاني فيه قسمين S و P ، قسم S فيه غرفة ، وقسم

P فيه ٣ غرف . وكل غرفة بتوسع شخصين اذاً طابق 2 بيوسع

$8e^-$

• هساكل قسم الة عدد من الغرف ، فمثلاً :

ال S ← فيه غرفة وحدة .

ال P ← فيه ٣ غرف .

ال d ← فيه ٥ غرف .

ال f ← فيه ٧ غرف .

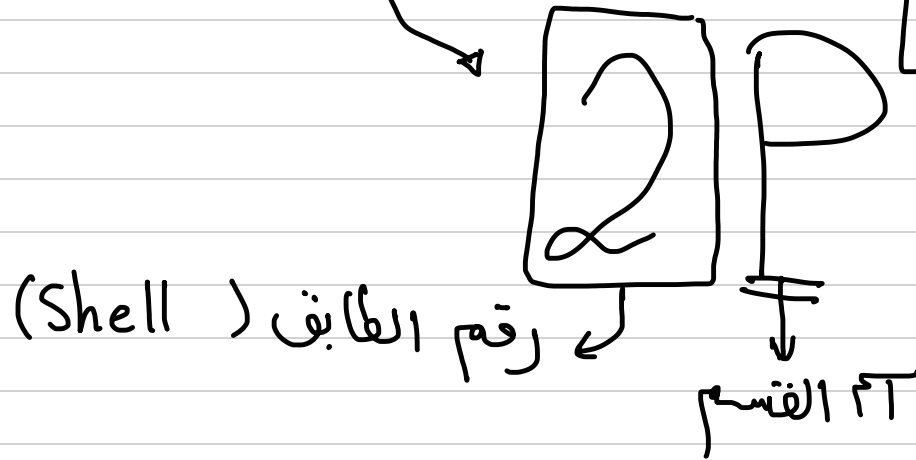
Shell = طابق

Atomic orbital = اسم القسم (S, P, d, f)

Number of atomic orbital = عدد الغرف بكل قسم

Maximum number of e^- = كم شخصاً بوسع بالطابق =

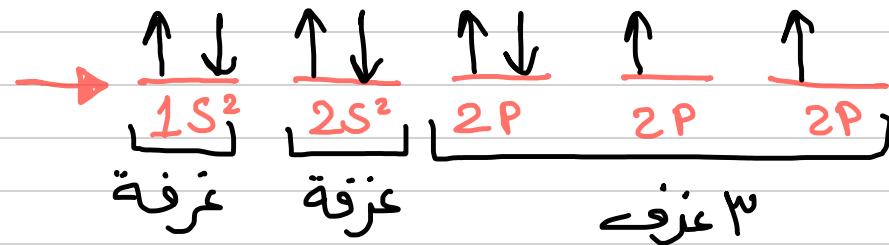
الملخص



كم تحتلها بالقسم

n=1	1s
n=2	2s 2p
n=3	3s 3p 3d
n=4	4s 4p 4d 4f
n=5	5s 5p 5d 5f
n=6	6s 6p 6d 6f
n=7	7s 7p 7d 7f

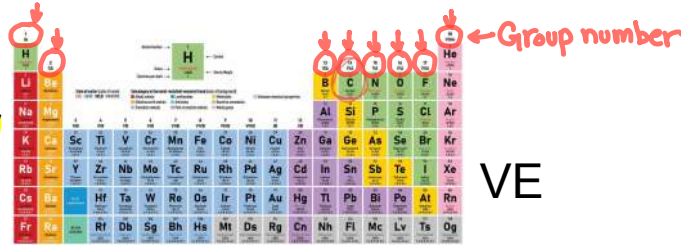
في أثناء الحل
ضروري نلتزم
بالمخطط ابي افدناه
بأول ثانوي



الالكترونات التكافؤ

المستوى الأبعد

Valence electrons (VE) are located in the outermost shell. They are involved in **chemical reactions**.



VE = Group number

له والتي تساوي عدد المدار الأخير
أو الطابق الأخير

Examples: ¹H: $1s^1$ → $1e^-$

الرقم الطابق

⁸O: $1s^2, 2s^2, 2p^4$ → $2+4=6$

← آخر طابق

⁶C: $1s^2, 2s^2, 2p^2$

VE

Lewis symbol of atom

1

H·

6

··
O·
··

4

·
C·
·

Table 1.3 Valence Electrons of the First 18 Elements

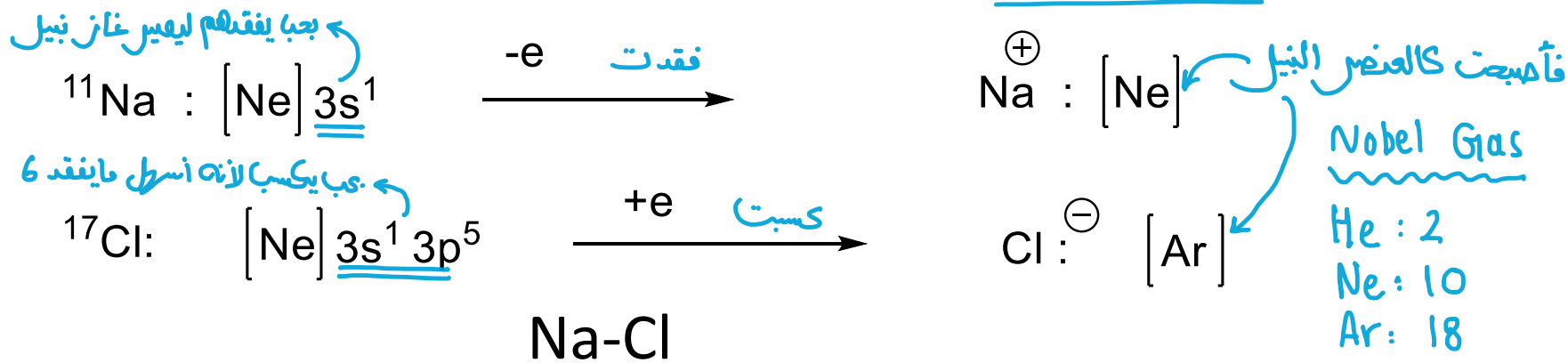
Group	I	II	III	IV	V	VI	VII	VIII
	H·							He :
	Li·	Be·	·B·	·C·	·N·	·O·	·F·	·Ne·
	Na·	Mg·	·Al·	·Si·	·P·	·S·	·Cl·	·Ar·

Chemical Bonds

- Ionic.
- Covalent.
- Hydrogen.
- Metallic.

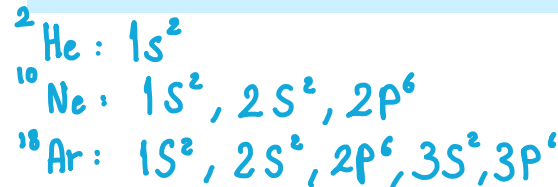
1. Ionic Bonding

An ionic bond is an electrostatic attraction between positive & negative ions resulting from e⁻ transfer ^{شرط}.



The resulting e⁻ configuration of both ions are those of the nearest noble gas, Ne and Ar respectively, both satisfy the octet rule.

Nobel gas are elements which are unreactive and stable
 Ex: He . Ne . Ar



2. Covalent Bonding

- Ionic bonds occur when an e^- is transferred between a metal and nonmetal.
- Covalent bonds are resulting from sharing e^-

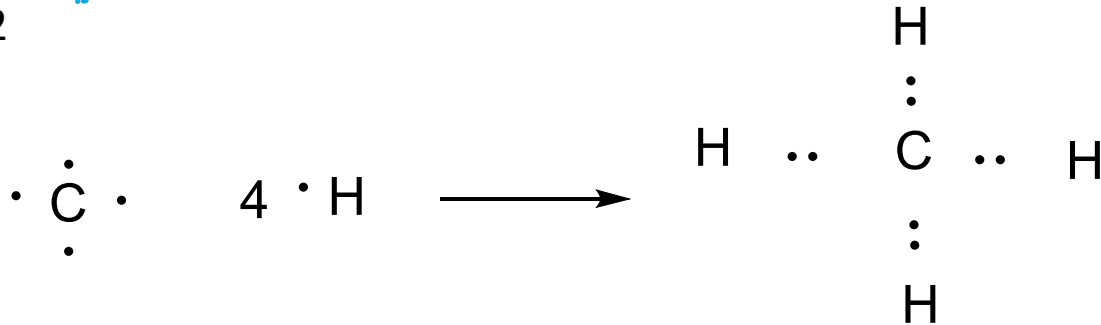


The result is both atoms have a $[\text{He}] e^-$ configuration, *i.e.*

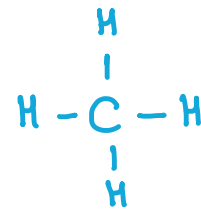
The bond is commonly display as a line rather than a pair of e^- ($:$), *i.e.* $\text{H}\overset{\text{عرفنا}}{\ominus}\text{H}$ rather than $\text{H} : \text{H}$

Example 2

رابطة تساهمية
أحادية



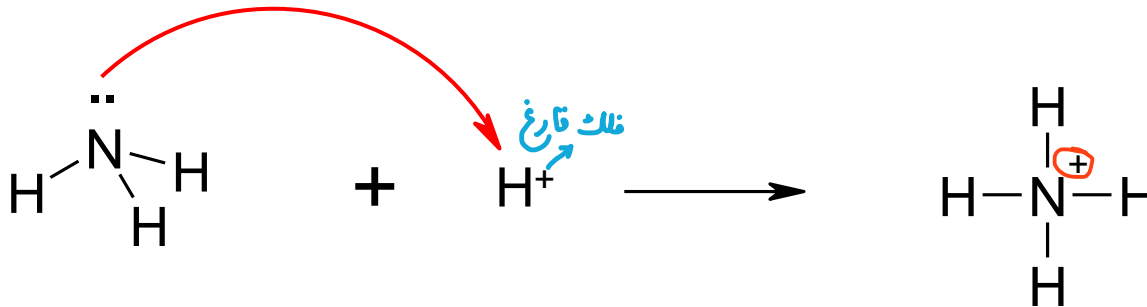
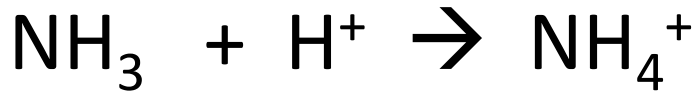
وكل رابطة أحادية



A second general version of a covalent bond is possible. This occurs when BOTH e⁻ come from one atom: a **coordinate covalent bond**

رابطة تساهمية تناسقية

i.e. الآخر عنده فلك فارغ



Chemical bond	When does it occur	Result
Ionic bond	When an e^- is transferred between 2 elements one of them is <u>metal</u> and the other is <u>nonmetal</u>	e^- configuration of both atoms
Covalent bond	Sharing e^-	e^- configuration of both atoms
Coordinate Covalent bond	2 atoms, one of them has an empty shell, and the other one will share the e^- . So both e^- come from one atom	e^- configuration of both atoms

ميل

جذب

Electronegativity (EN) : measures the tendency of an atom to attract a shared pair of electrons (or electron density).

* الحجم مو
كثير باثر

TABLE 1.3 The Electronegativities of Selected Elements^a

IA	IIA	IB	IIB	IIIA	IVA	VA	VIA	VIIA
H 2.1								
Li 1.0	Be 1.5			B 2.0	C 2.5	N 3.0	O 3.5	F 4.0
Na 0.9	Mg 1.2			Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0
K 0.8	Ca 1.0							Br 2.8
								I 2.5

increasing electronegativity

increasing electronegativity

^aElectronegativity values are relative, not absolute. As a result, there are several scales of electronegativities. The electronegativities listed here are from the scale devised by Linus Pauling.

بتزيد بروتون موجب

نقل الحجم

↑ EN
↓
بسبب e⁻ اكثر

مين اي جيسحب ؟ القوة
لانو شحنتها موجبة فيتجذب
الالكترونات

الارقام موصوفو بين C و H

Covalent bonds can be classified as

غير قطبية

A. Nonpolar covalent bond ($\Delta EN = 0-0.5$)

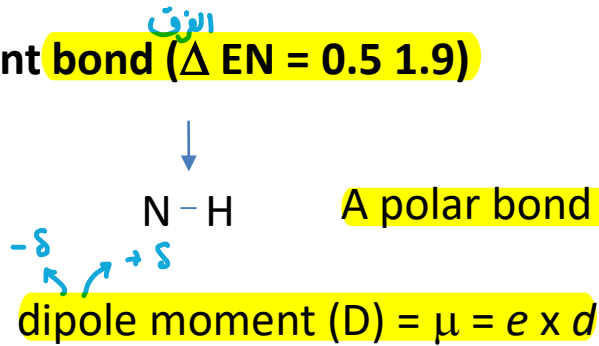
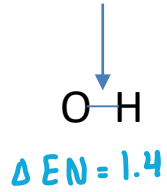
الرقم

تكونت e⁻ تقريباً بالنفس

Examples

A..A	أو	A..B
C-C		C-H
H-H		
Cl-Cl		

B. Polar covalent bond ($\Delta EN = 0.5 - 1.9$)



A polar bond has a negative end and a positive end

- δ + δ

↓ ↓

أعلى كهروسلبية أقل كهروسلبية

↓ ↓

شحنة جزئية سالبة شحنة جزئية موجبة

(e) : magnitude of the charge on the atom

(d) : distance between the two charges

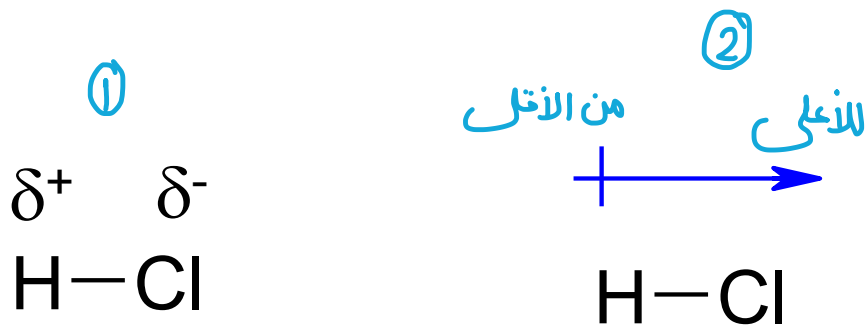
Table 1.4 The Dipole Moments of Some Commonly Encountered Bonds			
Bond	Dipole moment (D)	Bond	Dipole moment (D)
H—C	<u>0.4</u> nonpolar	C—C	0
H—N	<u>1.3</u> polar	C—N	0.2
H—O	<u>1.5</u>	C—O	0.7
H—F	1.7	C—F	1.6
H—Cl	1.1	C—Cl	1.5
H—Br	0.8	C—Br	1.4
H—I	0.4	C—I	1.2

if The ΔEN increases the polarity increases

Note : If ΔEN is more than 1.9 then the bond is ionic ↪ complete transfer. Ex: Li-F
 $\Delta EN = 3$

Bond Polarity & Electronegativity (cont'd)

The result of polar covalent bonding is that the e^- pair spend more time near the more EN atom. This means it will acquire a permanent excess negative charge. The other atom acquires a permanent excess positive charge. This is indicated by a δ^+ or δ^- (where δ means a "partial charge") or a dipole arrow which points from the positive end of the bond to the negative end.



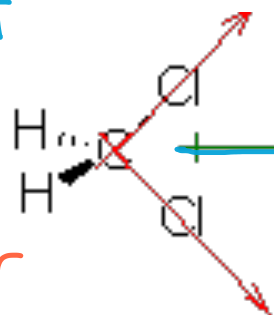
Bond Polarity & Electronegativity (cont'd)

The more polar the molecule the stronger the dipole moment. **The molecular dipole moment is the vector sum of the bond moments, i.e.**

net dipole moment

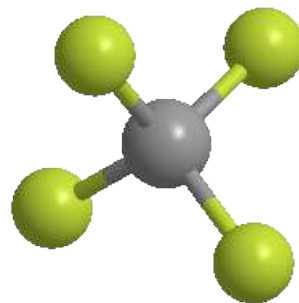
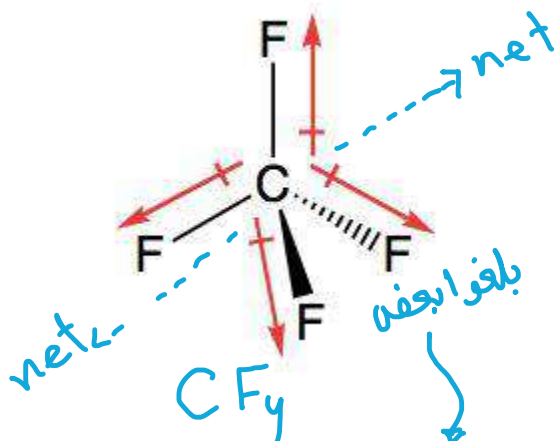
$= 0$
↓
Non polar

$\neq 0$
↓
Polar



Net dipole moment $\neq 0 \rightarrow$ Polar

CH₄ : non polar



Net dipole moment = 0 \rightarrow non polar.

Important terms from the first lecture:

- give up : يخسر
- accept : يستقبل و يحصل
- retain : يحافظ
- atomic number : العدد الذري
- mass number : العدد الكتلي
- atomic orbital : مدار ذري زي spdf
- shell : المستوى
- outermost shell : المستوى و المدار الابدع
- Valence electron : الكترونات التكافؤ
- configuration: الترتيب
- coordinate covalent bond : رابطة تساهمية تناسقية
- acquire : تكسب
- permanent : دائم
- attract : جذب

