

Organic Chemistry

4022301-4

(Integrated course in plane 37 for 8 groups in
first term 1441H)

by

Ass. Prof. Hanadi Ahmed Katouah

Course Outline

- **Course Name:** Organic chemistry
- **Code #:** 4022301-4
- **Type:** Theoretical
- **Credits:** 3 hours theoretical + 1 practical
- **Plane:** 1437 (Integrated course in plane 37 for 8 groups in first term 1441 H)
- **Pre-course requirements:** General Chemistry 1
- **Lecturer:** Ass. Prof. Hanadi Ahmed Katouah
- **Specialization:** Biochemistry
- **Contact details:**

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Course Outline

Lecture schedule

Day	Lecture	Class	Type	Group
Mon	5&67	210B	Theoretical	2
	8&9&10	210B	Theoretical	8
Wed	1&2&3	213 ط	Theoretical	4
	4&5&6	213 ط	Theoretical	5
	7&8&9	213 ط	Theoretical	6

Scheduling office hours:

Day	Lecture	Location
Mon	1&2&3&4	Office of the faculty members of the department of chemistry (Level 2, Building B)

Distribution of grades:

All year grades	10
Practical	30
Med exam	20
Final exam	40
Total	100

Course Outline

- **References:**

- 1. Required Reference**

Organic chemistry, T.W. Graham Solomons and Craig Fryhle, 9th ed., Wiley, 2007.

- 1. Essential Reference**

Organic Chemistry, Jonathan Clayden, Nick Greeves, Stuart Warren, Peter Wothers, OUP Oxford, 2001.

- Recommended Reference**

Organic Chemistry, Jonathan Clayden, Nick Greeves, Stuart Warren, Peter Wothers, OUP Oxford, 2001.

- Electronic Materials, Web Sites etc**

Scopus ,Science direct , Reaxys, Science finder.

Course Outline

Med term exam:

Day

Lecture

Class

Date

Group

Course Outline

Deadline of homework (1):

Day	Lecture	Class	Date	Group
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Deadline of homework (2):

Day	Lecture	Class	Date	Group
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Course Outline

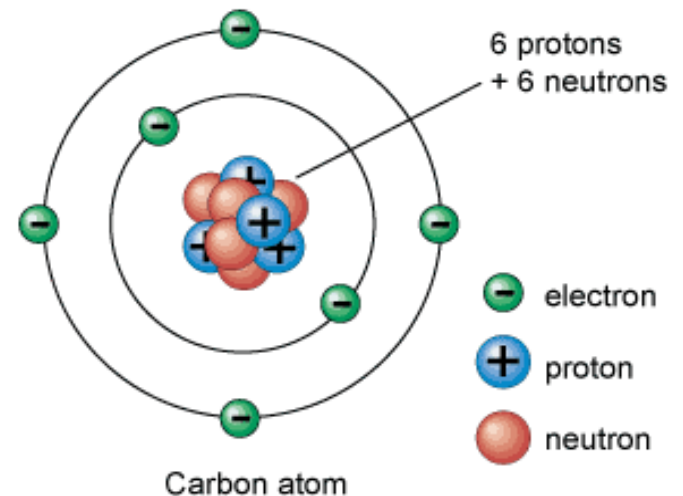
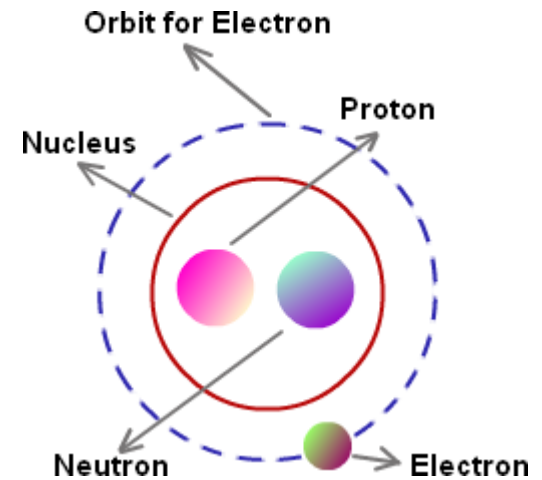
- **Shapes of organic molecules**
- **Chemical bonding**
- **Functional groups**
- **Hybridization**
- **Stereochemistry**
- **Hydrocarbons (alkanes; alkenes; alkynes)**
- **Alkyl halides**
- **Alcohols**
- **Ethers and thioethers**
- **Carbonyl compounds (aldehydes and ketones)**
- **Carboxylic acids and their derivatives**
- **Amines**

Review on Atomic structure and Electronic configuration

Atomic structure

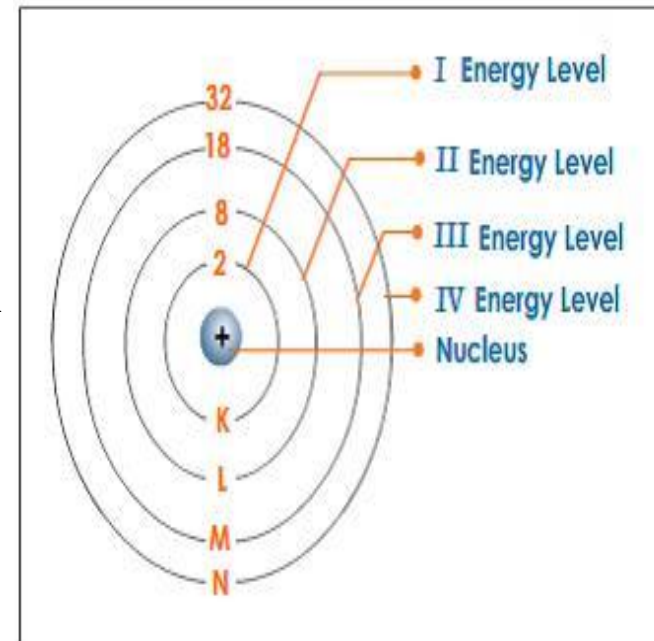
- **Electrons and energy levels:**

1. Atoms consist of three particles: neutrons, protons and electrons.
2. Neutrons and protons are found in the nucleus; electrons are outside the nucleus.
3. Neutrons are particles that have no charge, protons are positively charged particles and electrons are negatively charged particles.
4. The **atomic number** of an element indicates the **number of protons**.
5. Electrons are distributed around the nucleus in successive shells or principle energy levels of increasing radius.



Atomic structure

6. The electrons in levels close to the nucleus have lower energy than do electrons in levels farther from the nucleus.
7. The various energy levels are designated by capital letters or whole numbers (n)=the number of the energy level (shell)= quantum number.
8. The first energy level, the one closest to the nucleus and therefore the one having the lowest energy, is called the *K* level and corresponds to $n=1$.
9. The second energy level, farther from the nucleus and with a higher energy content than the *K* level, is called the *L* level and corresponds to $n=2$.
10. The third energy level, the *M* level, corresponds to $n=3$; the fourth energy level, the *N* level, corresponds to $n=4$ and so on.
11. Each energy level has a given capacity for electrons. The *K* level may contain a maximum of 2 electrons and never more. The *L* energy level for 8 electrons the *M* level for 18 electrons and the *N* level for 32 electrons.
12. The maximum capacity of a shell is equal to $2n^2$ electrons, where n is the number of the energy level.



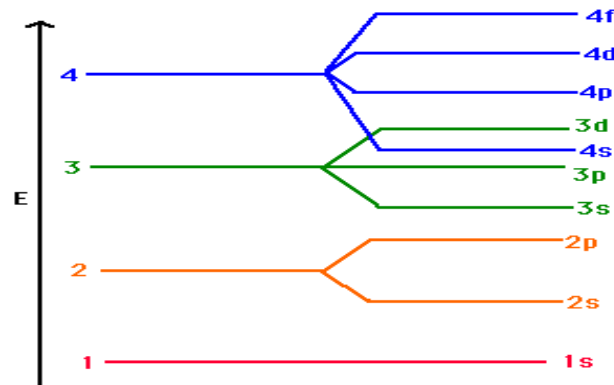
The number of electrons in the shell= $2n^2$

Atomic structure

- Arrangement of electrons in energy levels (shell):

How many electrons are needed to fill a particular shell?

- The first 2 electrons enter the *K* shell. The next 8 electrons enter the *L* shell.
- After the *L* energy level is filled, electrons do not fill the third energy level *M* before the fourth energy level *N* is started.
- In fact, there are never more than 8 electrons in the outermost energy level of an atom. The reason is that 8 electrons in the outermost shell give atoms their greatest stability (noble gas configuration).
(Valence shell=outer shell)
- Electrons within each energy level (shell) are located in orbitals.



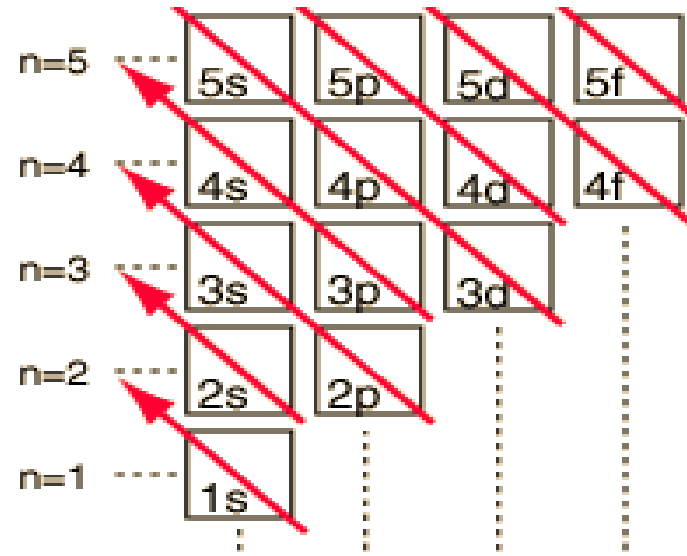
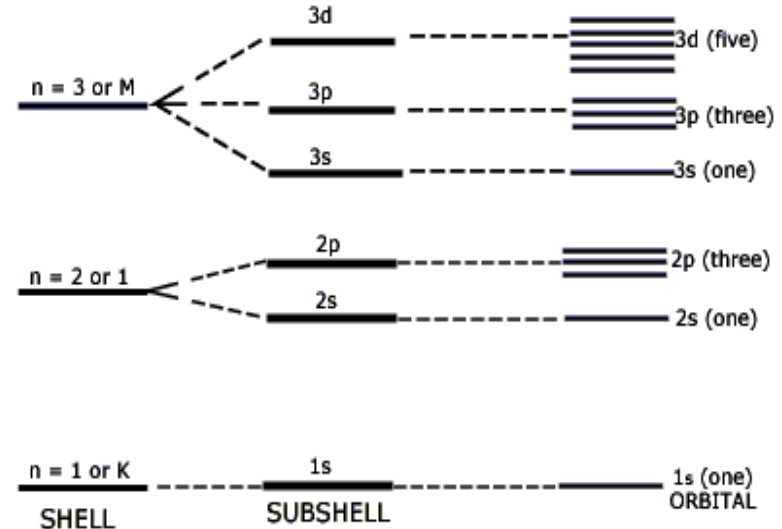
The table below lists the electron shell arrangements for the first 20 elements.

Electron shell configurations:					
Element	Z	1st shell	2nd shell	3rd shell	4th shell
hydrogen	1	1			
helium	2	2			
lithium	3	2	1		
beryllium	4	2	2		
boron	5	2	3		
carbon	6	2	4		
nitrogen	7	2	5		
oxygen	8	2	6		
fluorine	9	2	7		
neon	10	2	8		
sodium	11	2	8	1	
magnesium	12	2	8	2	
aluminium	13	2	8	3	
silicon	14	2	8	4	
phosphorus	15	2	8	5	
sulphur	16	2	8	6	
chlorine	17	2	8	7	
argon	18	2	8	8	
potassium	19	2	8	8	1
calcium	20	2	8	8	2

Atomic structure

- Atomic subshells and orbitals:**

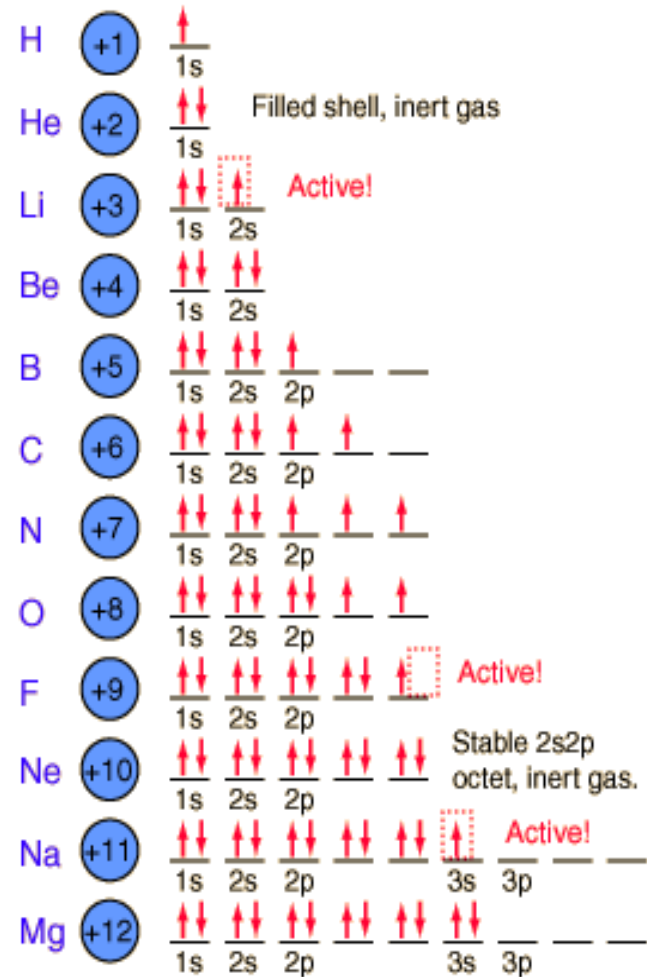
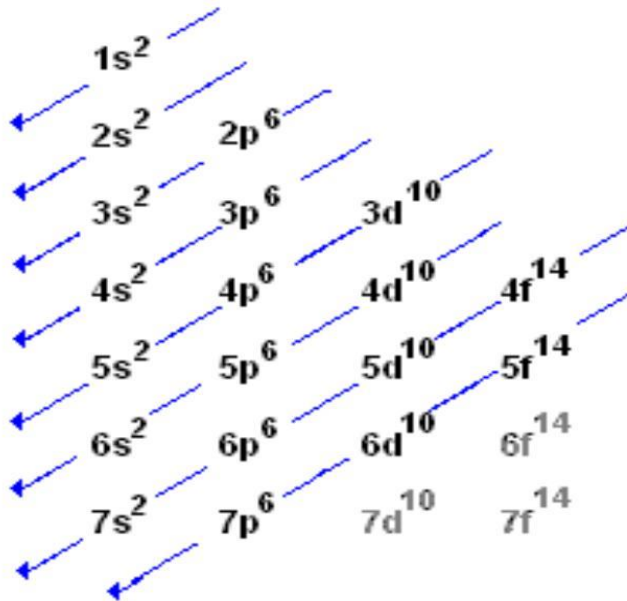
1. Represented a specific region in space in which an electron is most likely to be found.
2. Designated by the letters *s*, *p*, *d* and *f*.
3. The number of orbitals in the shell = n^2
4. The first energy level (*K* shell) has only one orbital, the 1*s*.
5. The second energy level (*L* shell) has four orbitals: one 2*s* and three 2*p* orbitals.
6. The third energy level (*M* shell) has nine orbitals: one 3*s* and three 3*p* and five 3*d* orbitals.
7. The fourth energy level (*N* shell) has 16 orbitals: one 4*s* and three 4*p*, five 4*d* orbitals and seven 4*f*.



Electronic configuration

Note that when filling the atomic orbitals:

1. An atomic orbital can contain no more than two electrons.
2. Electrons fill orbitals of lower energy first.
3. No orbital is filled by two electrons until all the orbitals of equal energy have at least one electron.



Review

Energy	Shells	Quantum Number n	Subshells	Number Of Orbitals n^2	Orbitals & Drawing Levels Boxes	Number Of Electrons $2n^2$	Orbitals & Electronic coding
Increase ↓	<i>K</i>	1	<i>s</i>	1	 1	2	<i>1s</i>
	<i>L</i>	2	<i>s, p</i>	4	 1  3	8	<i>2s, 2p 2p 2p</i>
	<i>M</i>	3	<i>s, p, d</i>	9	 1  3  5	18	<i>3s, 3p 3p 3p, 3d 3d 3d 3d 3d</i>
	<i>N</i>	4	<i>s, p, d, f</i>	16	 1  3  5  7	32	<i>4s, 4p 4p 4p, 4d 4d 4d 4d 4d, 4f 4f 4f 4f 4f 4f 4f</i>
	<i>O</i>	5		25		50	
	<i>P</i>	6		36		72	
	<i>Q</i>	7		49		98	

Periodic table

Increasing electronegativity

1

PERIODIC TABLE OF THE ELEMENTS

<http://www.ktf-split.hr/periodni/en/>

PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
GROUP	IA	IIA											IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1 H HYDROGEN																	2 He HELIUM
2	3 Li LITHIUM	4 Be BERYLLIUM																
3	11 Na SODIUM	12 Mg MAGNESIUM																
4	19 K POTASSIUM	20 Ca CALCIUM	21 Sc SCANDIUM	22 Ti TITANIUM	23 V VANADIUM	24 Cr CHROMIUM	25 Mn MANGANESE	26 Fe IRON	27 Co COBALT	28 Ni NICKEL	29 Cu COPPER	30 Zn ZINC	31 Ga GALLIUM	32 Ge GERMANIUM	33 As ARSENIC	34 Se SELENIUM	35 Br BROMINE	36 Kr KRYPTON
5	37 Rb RUBIDIUM	38 Sr STRONTIUM	39 Y YTTORIUM	40 Zr ZIRCONIUM	41 Nb NIOBIUM	42 Mo MOLYBDENUM	43 Tc TECHNETIUM	44 Ru RUTHENIUM	45 Rh RHODIUM	46 Pd PALLADIUM	47 Ag SILVER	48 Cd CADMIUM	49 In INDIUM	50 Sn TIN	51 Sb ANTIMONY	52 Te TELLURIUM	53 I IODINE	54 Xe XENON
6	55 Cs CAESIUM	56 Ba BARIUM	57-71 La-Lu Lanthanide	72 Hf HAFNIUM	73 Ta TANTALUM	74 W TUNGSTEN	75 Re RHENIUM	76 Os OSMIUM	77 Ir IRIDIUM	78 Pt PLATINUM	79 Au GOLD	80 Hg MERCURY	81 Tl THALLIUM	82 Pb LEAD	83 Bi BISMUTH	84 Po POLONIUM	85 At ASTATINE	86 Rn RADON
7	87 Fr FRANCIUM	88 Ra RADIUM	89-103 Ac-Lr Actinide	104 Rf RUTHERFORDIUM	105 Db DUBNIUM	106 Sg SEABORGIUM	107 Bh BOHRIUM	108 Hs HASSIUM	109 Mt MEITNERIUM	110 Uun UNUNNIUM	111 Uuu UNUNUNIUM	112 Uub UNUNBIUM	114 Uuq UNUNQUADIUM					

Increasing electronegativity

(1) Pure Appl. Chem., 73, No. 4, 667-683 (2001)

Relative atomic mass is shown with five significant figures. For elements having no stable nuclides, the value enclosed in brackets indicates the mass number of the longest-lived isotope of the element.

However three such elements (Th, Pa, and U) do have a characteristic terrestrial isotopic composition, and for these an atomic weight is tabulated.

Editor: Aditya Vardhan (adivar@netlinx.com)

LANTHANIDE

57 138.91 La LANTHANUM	58 140.12 Ce CERIUM	59 140.91 Pr PRASEODYMIUM	60 144.24 Nd NEODYMIUM	61 (145) Pm PROMETHIUM	62 150.36 Sm SAMARIUM	63 151.96 Eu EUROPIUM	64 157.25 Gd GADOLINIUM	65 158.93 Tb TERBIUM	66 162.50 Dy DYSPROSIUM	67 164.93 Ho HOLMIUM	68 167.26 Er ERBIUM	69 168.93 Tm THULIUM	70 173.04 Yb YTTERIUM	71 174.97 Lu LUTETIUM
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ACTINIDE

89 (227) Ac ACTINIUM	90 232.04 Th THORIUM	91 231.04 Pa PROTACTINIUM	92 238.03 U URANIUM	93 (237) Np NEPTUNIUM	94 (244) Pu PLUTONIUM	95 (243) Am AMERICIUM	96 (247) Cm CURIUM	97 (247) Bk BERKELIUM	98 (251) Cf CALIFORNIUM	99 (252) Es EINSTEINIUM	100 (257) Fm FERMIUM	101 (258) Md MENDELEVIUM	102 (259) No NOBELIUM	103 (262) Lr LAWRENCIUM
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