



مدونة المناهج السعودية

<https://eduschool40.blog>

الموقع التعليمي لجميع المراحل الدراسية

في المملكة العربية السعودية

Renad Al-Zubaidi

كيمياء عامة

General Chemistry

402101-4

المحاضرة الأولى: P. مراجعة الرستدي



1

General Chemistry 402101-4

Lecture Chapter	Topics	Chang Chapters	Weekly schedule
1	Introduction to Chemistry	CH1	Week 1
1	States of matter, measurements, precision and accuracy, and significant figures	CH2	Week 2
2	Atoms, quantum numbers and electron configurations	CH2, CH7	Week 3
3	The periodic table: Chemical properties of elements in the periodic table	CH8	Week 4
4	Atomic weight, molecular weight, moles and mass percent calculations.	CH3	Week 5
5	Chemical reactions in solutions: Concentration calculations, chemical equations, and types of chemical reactions	CH3, CH4, CH12	Week 6
6	Chemical equilibrium: Equilibrium constant calculations	CH14	Week 7
Midterm Exam			Week 8
6	Chemical equilibrium: Factors affecting chemical equilibrium	CH14	Week 9
7	Acids and bases, and pH calculations	CH15	Week 10
8	Thermochemistry: Introduction to thermodynamics, and calculation of heat capacity	CH6	Week 11
8	Thermochemistry: Enthalpy of reaction calculation	CH6	Week 12
9	Organic chemistry: Hydrocarbons, and alkane nomenclature and reactions	CH24	Week 13
Review			Week 14



Primary reference: "Chemistry," R. Chang, McGraw-Hill Higher Education

Grading: The midterm exam will account for 20%, final exam for 40%, lab for 30%, and quizzes or scientific activities for 10% of the final grade.

2

Classification

Chemical

Physical
"states of matter"

Mixtures

by physical methods

Pure substances

Solid

liquid

Hetero

Homo

homogeneous

Compounds

by chemical

Elements

Gas

Molecules containing different low atom or more

Atoms

Molecules

H₂O
H₂SO₄

C, Al
Ti

Poly atomic

Di atomic

S₈
O₃

O₂
H₂

Particle energy

gas
liquid

↓ larger

Solid

Particle arrangement

Solid
liquid
Gas

↓ larger

Particle distance

Solid
gas
liquid
gas

↓ larger

Matter Properties

chemical

- ▶ Reactivity
- ▶ flammability
- ▶ toxicity
- ▶ PH
- ▶ conductivity
- ▶ tarnishing
- ▶ Oxidation

describes the ability of substance to undergo changes identity new substance is produced

physical

- ▶ color
- ▶ Mass
- ▶ size
- ▶ density
- ▶ viscosity
- ▶ change in state
- ▶ solubility
- ▶ Volume

Can be observed without changing identity of the substance

Measurable Properties of matter

Intensive

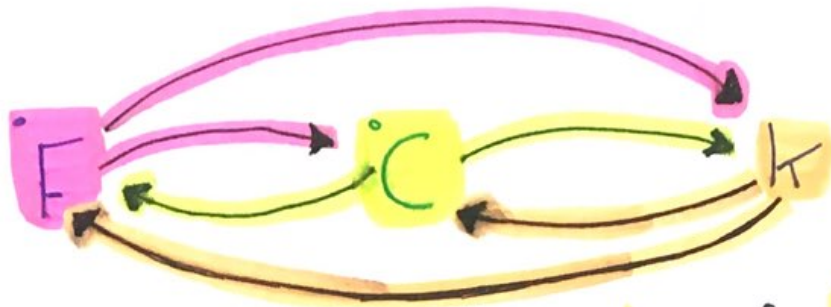
Properties that do not depend on the amount of the matter present

- color
- hardness حركه
- melting ذوبان
- Freezing Point تجر
- boiling Point غليان
- density كثافه
- malleability قابليه سحق

Extensive

Properties that depend on the amount of matter present

- ← Mass
- ← weight
- ← Volume
- ← length



$$F \rightarrow C$$

$$C = (F - 32) \times \frac{5}{9}$$

or

$$C = \frac{(F - 32)}{1.8}$$

$$C \rightarrow F$$

$$F = (C \times \frac{9}{5}) + 32$$

$$F = (C \times 1.8) + 32$$

$$C \rightarrow K$$

$$K = C + 273$$

$$\approx 273.15$$

$$K \rightarrow C$$

$$C = K - 273$$

$$F \rightarrow K$$

$$F \xrightarrow{\frac{F-32}{1.8}} C$$

$$C \xrightarrow{C+273} K$$

$$K \rightarrow F$$

$$K \xrightarrow{K-273} C$$

$$C \xrightarrow{(C \times 1.8) + 32} F$$

* Significant Figures

* الأرقام حسب
 * الأضفار لا تحسب ما عدا حالتين:
 لو كان الضمن منحصر بين رقمين
 لو كان الضمن نحوه اليمين
 606
 0.00420 , 2.0

* sig. Fig.: Addition & subtraction

* تشوطة:
 (1) المقوى نفس بوض "متساوية"
 (2) الأجابه تكون أضمن sig. fig
 (3) ذكبت الجواب



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Atomic Weight Molecular Weight Moles Calculations

Chapter

2

Chang-chapter3

COURSE NAME: CHEMISTRY 101
COURSE CODE:

Molecular weights: M_{wt}

$$N = (\text{عدد الذرات} \times \text{كتلة الذرة}) + (\text{عدد الذرات} \times \text{كتلة الذرة}) = \text{amu}$$

Number of moles: n

$$n = \frac{\text{Wt "g" "كتلة g"}}{M_w \text{ g/mol}} = \text{mol}$$

How many atoms:

$$\frac{\text{Wt "g" "كتلة g"} \times 6.022 \times 10^{23} \text{ "ذرات"} \times n}{M_w \text{ g/mol}} = \text{عدد الذرات}$$

Percent composition of compounds:

$$\% X = \frac{n \times A_w(X)}{M_w} \times 100$$

Percent composition

empirical

- ① $\frac{\text{كتلة العنصر} \% \text{ في العينة}}{\text{كتلة الذرة}}$
- ② $\frac{\text{كتلة العنصر}}{\text{كتلة المركب}}$
- ③ $\frac{\text{عدد كل عنصر في العينة}}{\text{عدد كل عنصر في العينة}}$

$$n = \frac{\text{Molar mass of molecule "compound"}}{\text{empirical formula}}$$


$$n = \frac{\text{كتلة}}{\text{أصغر كتلة الذرة}}$$

$$x \frac{9}{5} + 22 + 273$$


٤/٠٢/٤١

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Umm Al-Qura University

Chapter 3

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Chang-chapter3,4,12

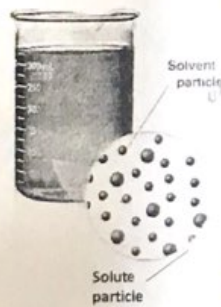
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COURSE CODE:

1

المحاضرة الثالثة : حالات الراشدي

General Properties of Aqueous Solutions:

definitions



Solution: a homogeneous mixture of two or more substances

Solute: a substance that is being dissolved (smaller amount)

Solvent: a substance which dissolves a solute (larger amount)




Aqueous Solution: the solute is initially a solid or a liquid and the solvent is water


Solution = solvent + solute

2

١٨/٠٤/٤١

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Chapter
4

Chang-chapter15

COURSE NAME: CHEMISTRY 101
COURSE CODE:

1

المحاضرة الرابعة: حالات الأيونية

أصناف


Acids & Bases

Definition of acids and bases

<p>أرنيوس</p> <p>Arrhenius concept</p>	<p>برونستد لوري</p> <p>Brønsted-Lowry concept</p>
---	--

لوي

Lewis concept



2

Strong

Acids

HCl
HNO₃
H₂SO₄

bases

NaOH
KOH

$$K_w = [OH^-][H^+]$$

↓ ↓

$$1 \times 10^{-14} = 1 \times 10^{-7} \quad 1 \times 10^{-7}$$

$$pH = -\log [H^+] \rightarrow [H^+] = 10^{-pH}$$

$$pOH = -\log [OH^-] \rightarrow [OH^-] = 10^{-pOH}$$

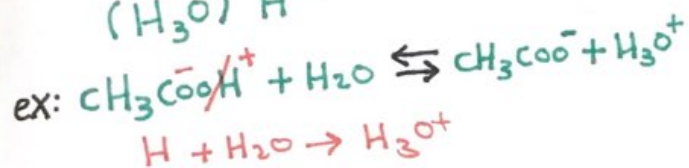
$$pK_w = 14 \rightarrow K = 1 \times 10^{-14}$$

$$[H^+][OH^-] = 1 \times 10^{-14}$$

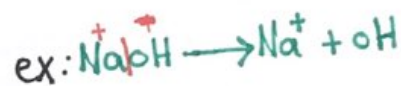
$$pH + pOH = 14$$

* Arrhenius Concept

Acid
releases
(H₃O)⁺ H⁺

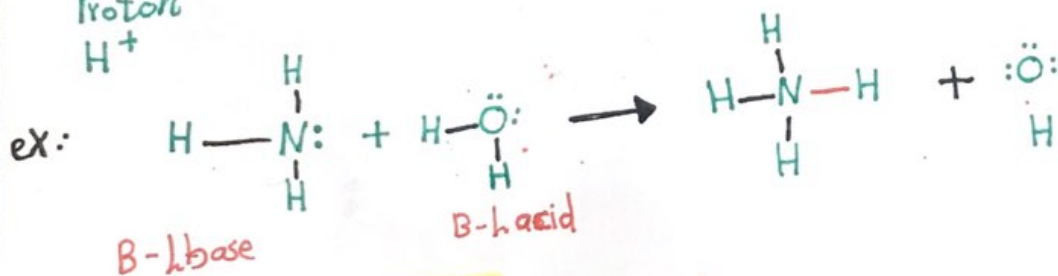


base
releases
OH



* Bronsted-Lowry Concept

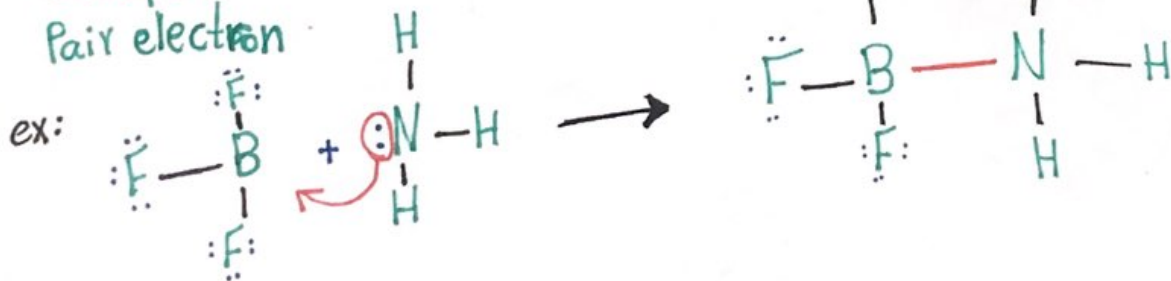
Acid
donate
Proton
H⁺



base
accept
Proton
H⁺

* Lewis Concept

Acid
acceptor
Pair electron




base
donor
Pair electron


٢٥/٠٢/٤١


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التسمية العامة





Chemical Equilibrium

Chapter 5

Chang-chapter14

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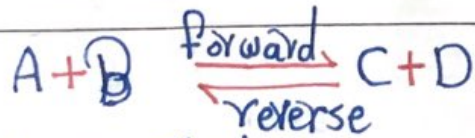
المحاضرة الخامسة
٢. مباحث التوازن

The Concept of Equilibrium and the Equilibrium Constant

- Few reaction are proceed in **one** direction.

$$A + B \rightarrow C + D \quad c + D \neq A + B$$
- Most reactions are **reversible**.

$$A + B \rightleftharpoons C + D \quad A + B = c + D$$
- Equilibrium** is a **state** in which there are **no observable changes** as time goes by.
- Chemical equilibrium**: is achieved when:
 - the **rates** of the **forward** and **reverse** reactions are **equal**
 - and the **concentrations** of the **reactants** and **products** remain **constant**



معدل سرعة التفاعل الأمامي = r_1
 معدل سرعة التفاعل العكسي = r_2

تحدث الأثران الكيميائي :-

$$r_1 = r_2$$

* التراكيز المواد متساوية

Equilibrium Constant K

K_p
(Pressure)
بالضغط
الغازي
 $\frac{n_p P_p}{n_r P_r}$

K_c
(Concentration)
تحت شروط الوضع العادي
جميع الحالات الغازية
 $\frac{n [P]}{n [R]}$

Equilibrium Position

$K > 1$
النواتج
يسار إلى اليمين

$K < 1$
المتفاعلات
يسار إلى اليمين

Reaction Quotient Q_c

$Q_c > K_c$
Proceeds to left
متفاعلات
من اليمين إلى اليسار

$Q_c = K_c$
equilibrium

$Q_c < K_c$
Proceeds to right
النواتج
من اليسار إلى اليمين

Equilibrium

Physical

Equilibrium between two states of the same substances

ex



chemical

Equilibrium between two or more different chemical substances

ex

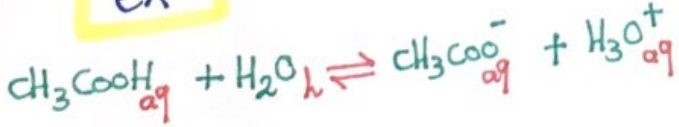


Geneous Equilibrium

Homo

Applies to reactions in which all reacting species are in the same phase

ex



Hetero

Applies to reactions in which reactants and products are in different phases

ex



*Not °°

نعتبر aq حالت لہ
لانہ کلاساوائل
عشان کنڈا صی
"homo"

changes in concentration



- add NH_3



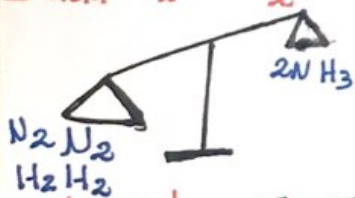
تفلك النواتج إلى أن تزيد التفاعلات وتصل توازن

to the left

Reactants

* لا تتغير ثابت K

- add N_2 or H_2



تفاعل التفاعلات إلى أن تزيد النواتج وتصل توازن

to the right

Product

Not ∞

* ثابت K لا يتغير له تغير

* حتى لو نقصت بدرجة عن الأضافة الحد نفس الشيء

changes Volume and Pressure

"عكس بعض"

علاقة عكسية ∞ $V \uparrow P \downarrow$

1) أحسب عدد مولات التفاعلات ثم النواتج

2) أكتب ضغط Pressure عند أكبر عدد المولات

3) أكتب الحد نفس الطريقة السابقة للتراكيز



2 التفاعلات

3 النواتج

الضغط يكتب عند النواتج لأن أعلى مولات



to the left

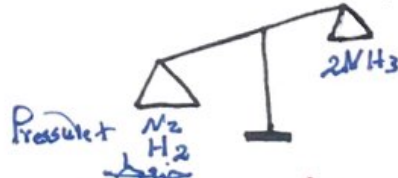
Reactants



3 التفاعلات

2 النواتج

الضغط يكتب عند التفاعلات لأن أعلى مولات



to the right "Product"

* Not ∞

* الثابت K لا يتغير له تغير

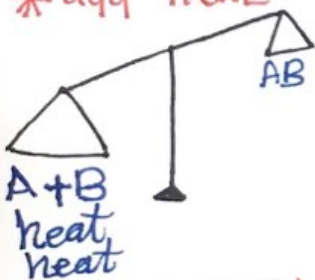
* الضغط "P" علاقة عكسية الحجم V

Changes Temperature

Endothermic



* add heat



$[A] \downarrow [B] \downarrow [AB] \uparrow$
From Left to Right
Shift to Products

* Remove heat

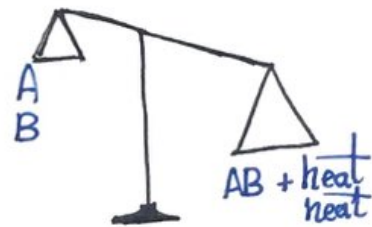


$[B] \uparrow [A] \uparrow [AB] \downarrow$
From Right to Left
Shift to Reactants

Exothermic

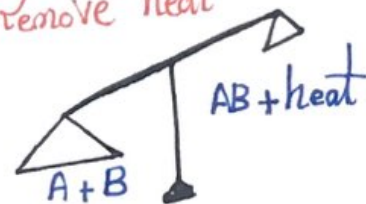


* add heat



$[A] \uparrow [B] \uparrow [AB] \downarrow$
From Right to Left
Shift to Reactants

* Remove heat



$[A] \downarrow [B] \downarrow [AB] \uparrow$
From Left to Right
Shift to Products

* ملاحظة *

تغير بالحرارة يؤثر
ويغير بالشابيت

ال ك

قوانين شاربتر 5

* العلاقة بين K_p و K_c و Δn

$$K_p = K_c (RT)^{\Delta n}$$

$$R = 0.0821$$

T = بكلفن

$$\Delta n = \left(\begin{array}{c} \text{مجموع} \\ \text{مولات} \\ \text{النواتج} \end{array} - \begin{array}{c} \text{مجموع} \\ \text{مولات} \\ \text{المتفاعلات} \end{array} \right)$$



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Thermochemistry

Chapter

6

Chang-chapter6

COURSE NAME: CHEMISTRY 101
COURSE CODE:

143

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8th lecture

Energy

Energy is the capacity to do work.

• **Thermal energy** is the energy associated with the random motion of atoms and molecules

• **Chemical energy** is the energy stored within the bonds of chemical substances

• **Nuclear energy** is the energy stored within the collection of neutrons and protons in the atom

• **Potential energy** is the energy available by virtue of an object's position



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144

Thermodynamic

State Functions

dependent state
system only regardless pathway

Path Functions

dependent on pathway
from one state to other

Examples

work
w

heat
q

Examples

Energy

Pressure

Volume

temperature

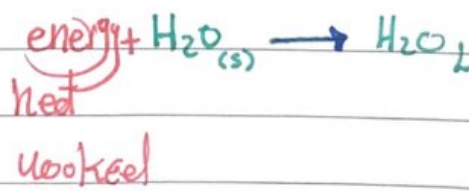
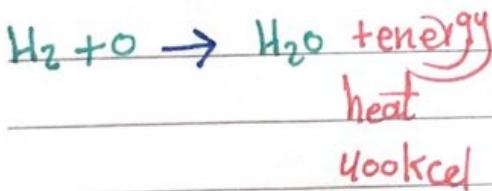
Thermochemistry

Exothermic Process

From system to surroundings

Endothermic Process

From surroundings to system



$$\Delta H = - \text{ق} \quad \Delta H = + \text{ق}$$

Kinds of Processes

physical
changes



Endothermic Processes



From surround to system



$$q = \oplus$$

chemical
reactions



Exothermic Processes

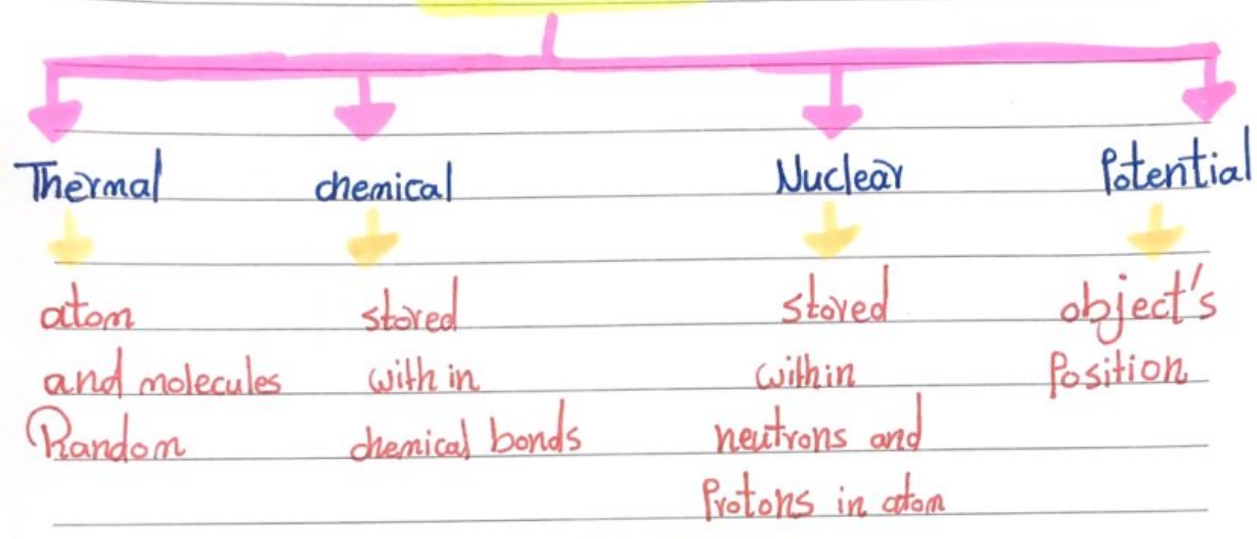


From system to surround

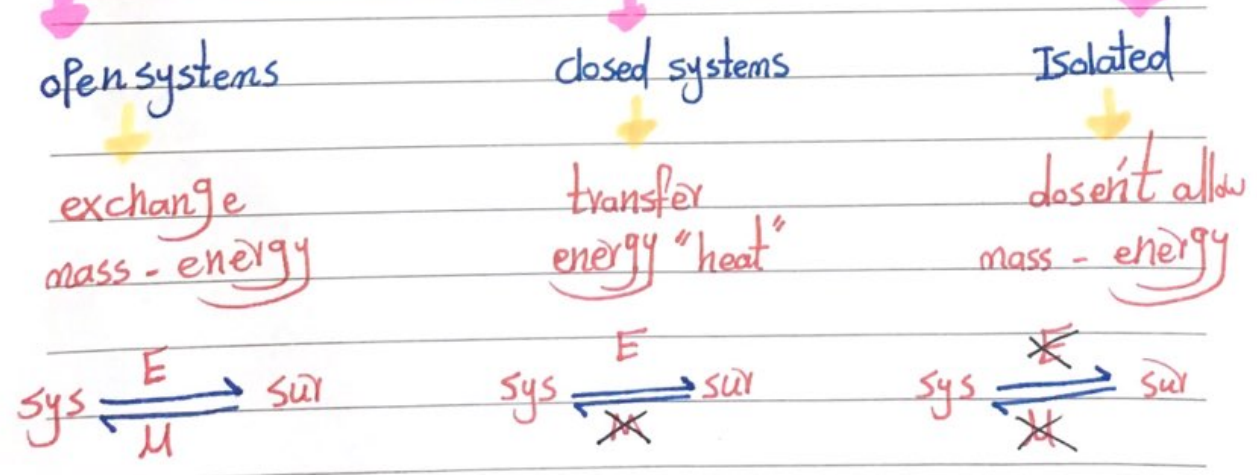


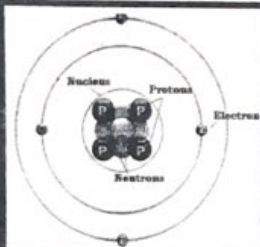
$$q = \ominus$$

Energy



Kinds of systems





Atoms, Quantum numbers & Electron configurations

Chapter

7

Chang-chapter2,7

توزيع الإلكتروني

COURSE NAME: CHEMISTRY 101
COURSE CODE:

31

12/11

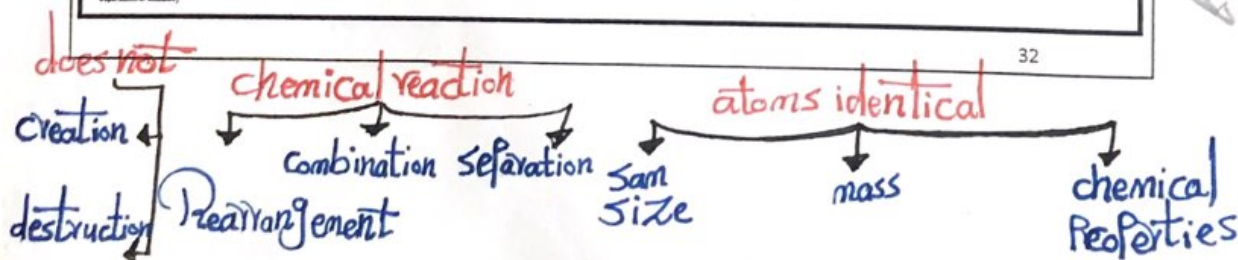
2nd lecture

Dalton's Atomic Theory (1808)

1. **Elements** are composed of extremely **small** particles called **atoms**.
2. All **atoms** of a given element are **identical**, having the **same size**, **mass** and **chemical properties**. The atoms of **one element** are **different** from the atoms of all **other elements**.
3. **Compounds** are composed of **atoms** of more than **one element**. In any compound, the **ratio** of the numbers of atoms of any two of the elements present is either an **integer** or a **simple fraction**.
4. A **chemical reaction** involves only the **separation**, **combination**, or **rearrangement** of atoms; **it does not** result in their **creation** or **destruction**.



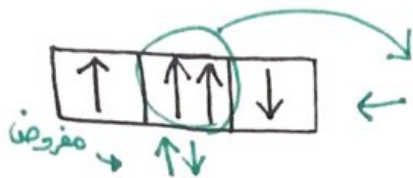
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Pauli exclusion Principle

No two electrons in an atom can have the same four quantum numbers

تظهر لثلاثة نفس لو كانت بنفس الاتجاه لا تحق مبدأ باولي



لا تحق مبدأ باولي

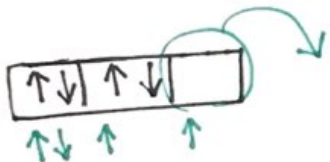


تحق مبدأ باولي

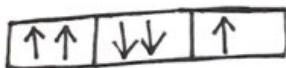
* ما يعني ترتيبها مع أو لا أهم شئ متعاكسينا الاتجاه

Hund's Rule

The most stable arrangement of electrons in subshells is the one with the greatest number of parallel spins



لا تحق مبدأ هوند



تحق مبدأ هوند

* ما يعني اتجاهها نفس شئ تكون متوزية على الغرفة بأفرادها

Aufbau Principle

"Fill up" electrons in lowest energy orbitals first

1s			
2s	2p		
3s	3p	3d	
4s	4p	4d	4f
5s	5p	5d	5f
6s	6p	6d	
7s	7p		
8s			

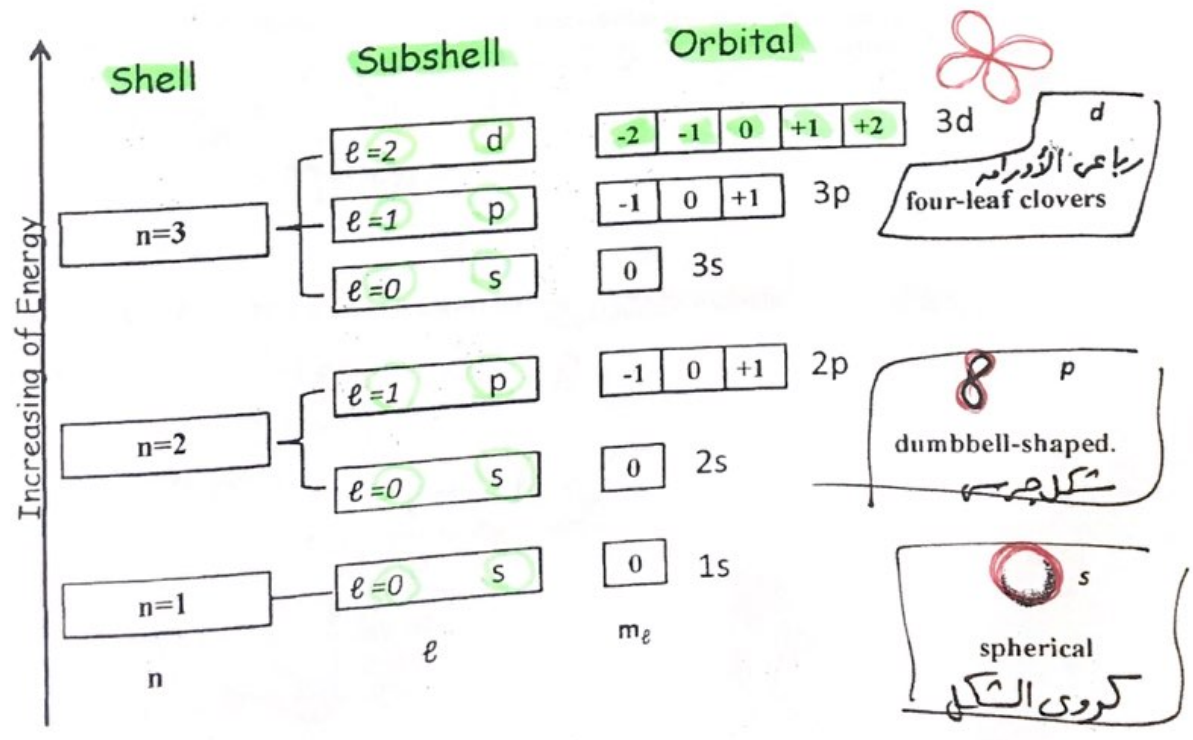
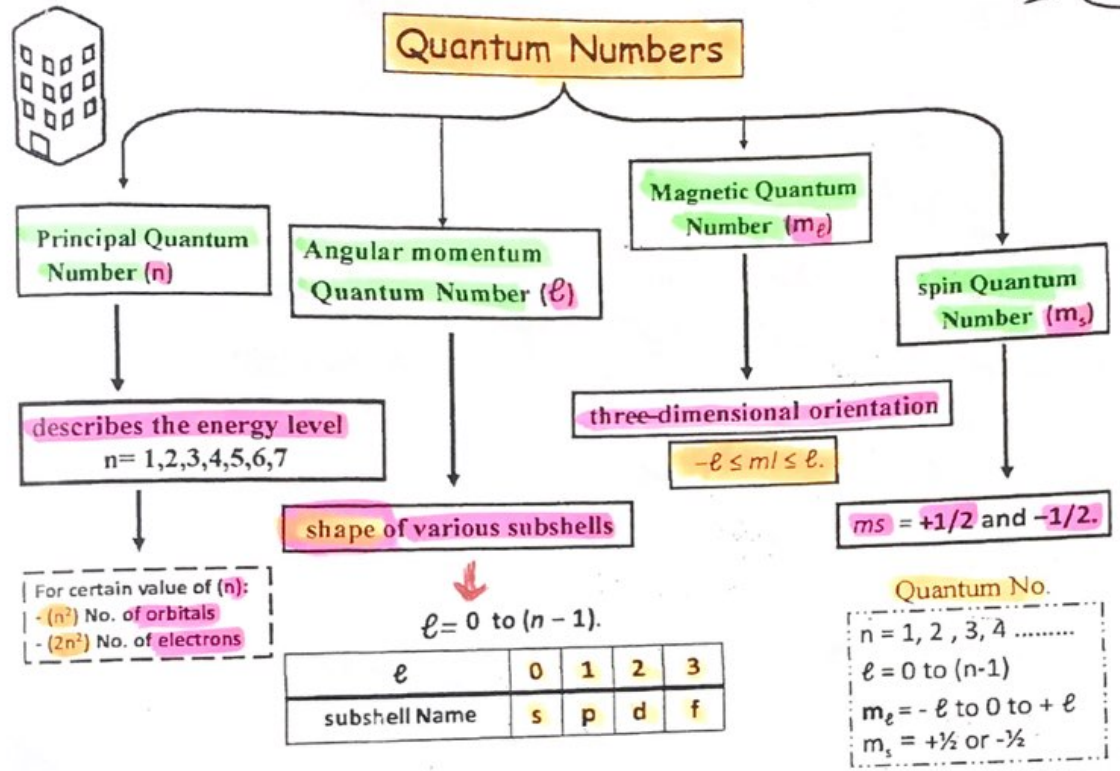
قوانین شاپتر 7

Bohr's

قانون

$$E_n = -R_H \left(\frac{1}{n^2} \right)$$

$\therefore R_H = 2.18 \times 10^8 \text{ J}$



2019

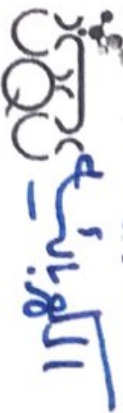
Chemical Properties of Elements in Periodic Table

النظير الذري Atomic Radius *increases*

الطاقات Ionization Energy

الألفة الإلكترونية Electronic Affinity

الكهرسلبية Electronegativity



decreasing

تساوي الحالة

decreases *increases*

2019

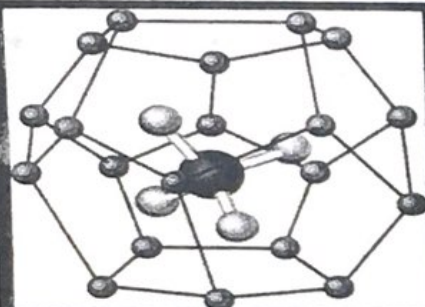


تأثير الألفا الأليفاتية في التحفيز الطائفة
* ΔH ΔS EA



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ORGANIC CHEMISTRY

Chapter

9

Chang-chapter24

COURSE NAME: CHEMISTRY 101
COURSE CODE:

167

1440/3/11

9th lecture

Organic Chemistry

- The study of the compounds of carbon
- Over 10 million compounds have been identified
 - about 1000 new ones are identified each day!
- C is a small atom
 - it forms single, double, and triple bonds
 - it is intermediate in electronegativity (2.5)
 - it forms strong bonds with C, H, O, N, and some metals

مركبات
C

مركبات كربون

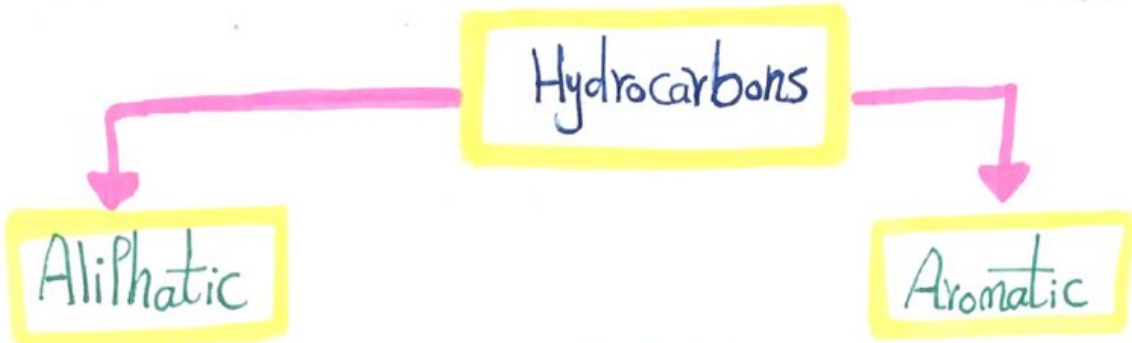


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Department of Chemistry



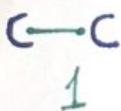
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Classification of Hydrocarbons

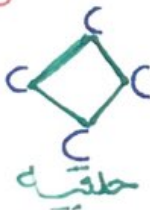


حلقة البنزين

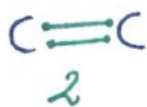
Alkanes



cycloalkanes



Alkenes



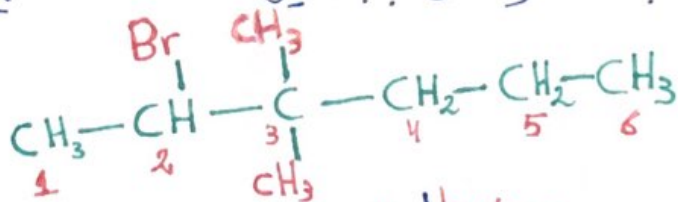
Alkynes



* Alkane Nomenclature ::
تسمية الألكان

Drop the "ane" (1)
Methane → Meth
Add "yl" (2)
Meth → Methyl

- (1) ترتيب المركب من الأقرن للفرع
- (2) تسمى لو كان فيه فرعين مختلفين ترتيب حسب الأجنبيات بالإنجليزي A و B وكهذه
- (3) يكتب رقم الفرع أمامه ثم "-"
- (4) نسيب "ane" خط ال "y"
- (5) نكتب أسماء المركب بالآخر



2-Bromo-3,3-dimethylhexane

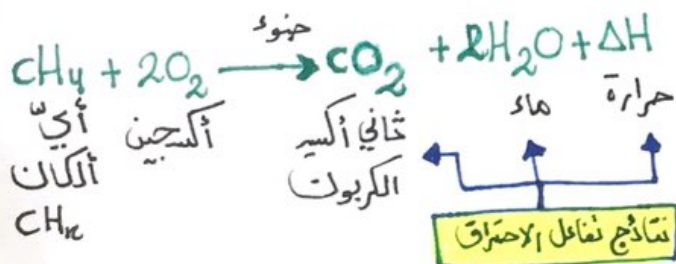
* لو كنا مركب نفس النوع نستخدم (di, tri, tetra) ونكتب أمامها الرقم حتى لو كان مكرر رقم، رقم

* الـ Br يكتب قبل Meth لأنه حسب الأجنبيات
* الفلوجينات نضيف لها "o" آخر الأسفل

Alkane Reactions

Combustion

أحترق

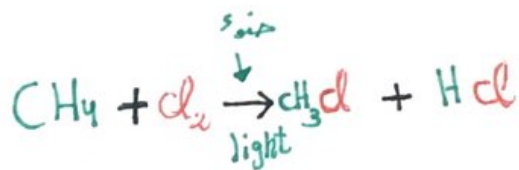
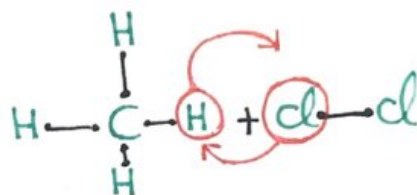


Halogenation

هالوجنة

تسمى أيضا

Substitution
بأحد عناصر الهالوجينات



الهالوجينات 7A
I, Br, Cl, F