

الباب السابع عشر
الكيمياء الحيوية

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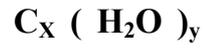
أولاً : الكربوهيدرات Carbohydrates

-1

-2

-3

-4



(1 : 2)

ose

(Aldose)

(Ketose)

(3) (Triose)

(Pentose)

(4) (Tetrose)

(6) (Hexose) (5)

: (Classification of Sugars) تصنيف السكريات

: Monosaccharide

-1

(10 - 2)

n



: (Oligosaccharides)

-2

10 - 2

:



. (Cellobiose) (Sucrose)



- (raffinose)

-



Stachyose

(glycoside bond)

. (4 - 1) β (4 - 1) α

:(Poly Sacchrides) -3



(4 - 1)

α (1 - 4)

. (6 - 1)

: (Monosaccharide) السكريات الأحادية

:

. (Poly Saccharides)

(Oligo Saccharides)

(CH₂OH.CHO)

(Assymetric carbon atom)

. (Optically in active)

. (Optically active)

(Glyceraldehydes)

(Triose)

. (Aldotriose)

(Dihydroxy acetone)

. (Ketotrios)

صيغة الـ D والـ L للسكريات :

D

D

L

(Optical active)

CH₂OH . CHO (Glycoaldehyde)

OH - CH₂ - CO CH₂OH

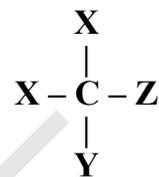
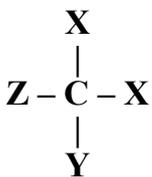
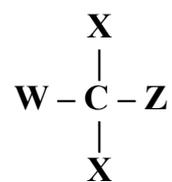
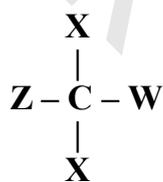
(Dihydrbxy acetone)

(Optical active)

(Symmetric Carbon atom)

(Optically in active)

:



(Enantomers)

(Optically active)

(Polorameter)

(Analyzer)

(Polarised)

(Tube)

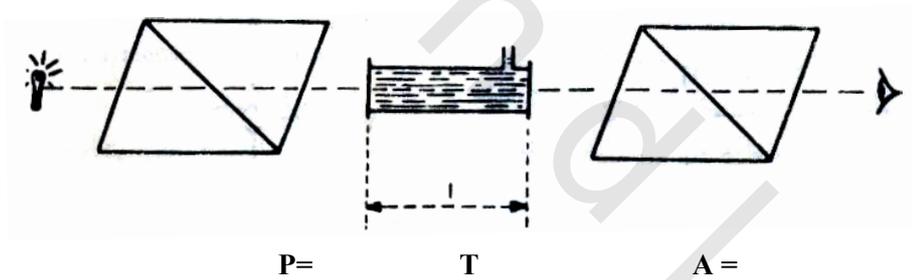
(Source)

() °A5461

(dextrorotary)

(Levorotarvy)

(d l)



Specific

rotation

$$[\alpha]_D^{25} = \frac{\bar{R}}{L \times d}$$

= L

= R

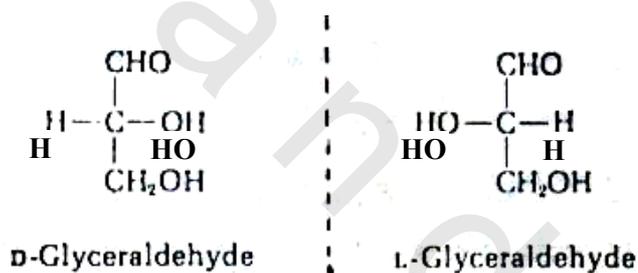
. / = d

:

(Vant Hoff) n (C^n)

.ⁿ2 =

. 2 = ¹2 = ⁿ2



L , D

L , D

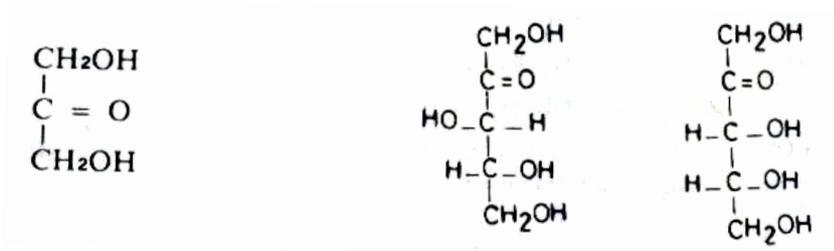
L , D

L , D

:

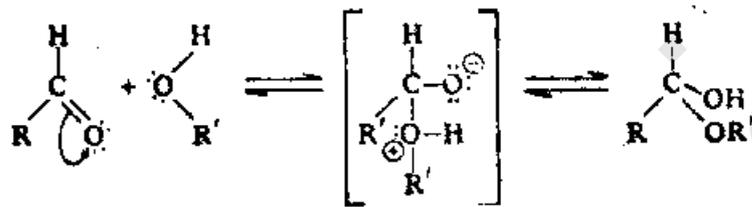
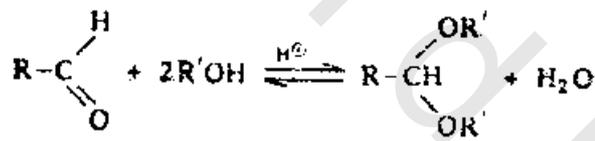
L

D

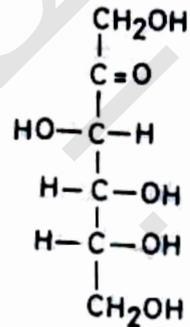
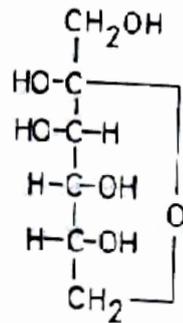
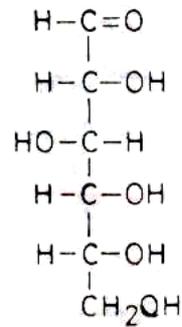
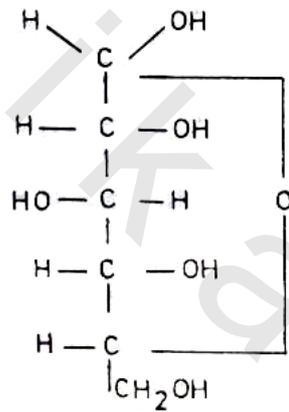
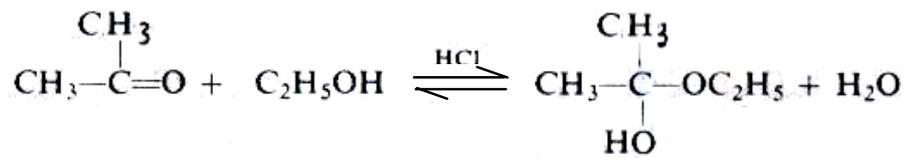


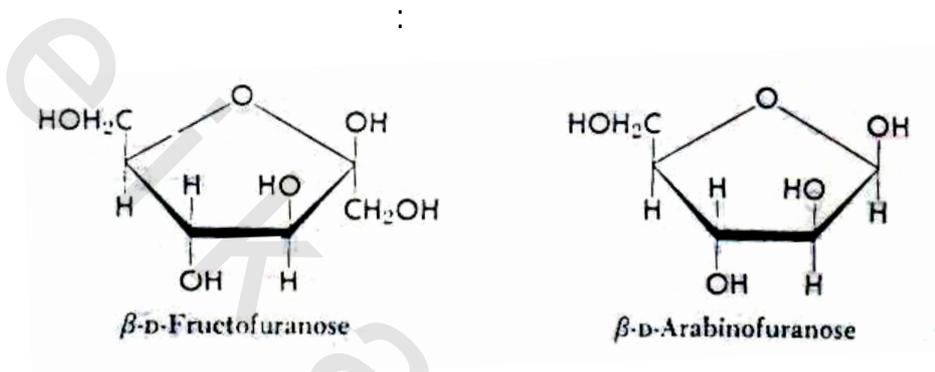
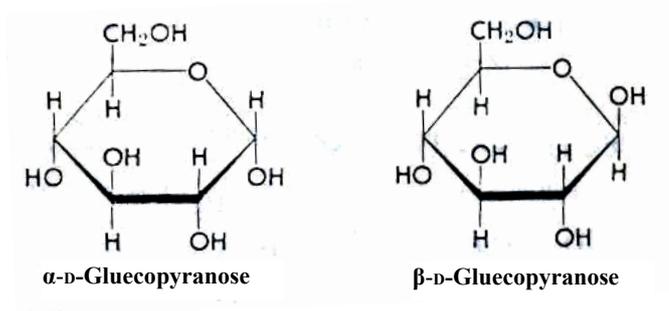
التركيب الكيميائي (Chemical Structure) :

(Hemiacetal)



(Hemiketal)





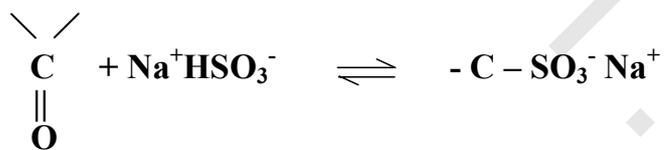
:

Fuchine

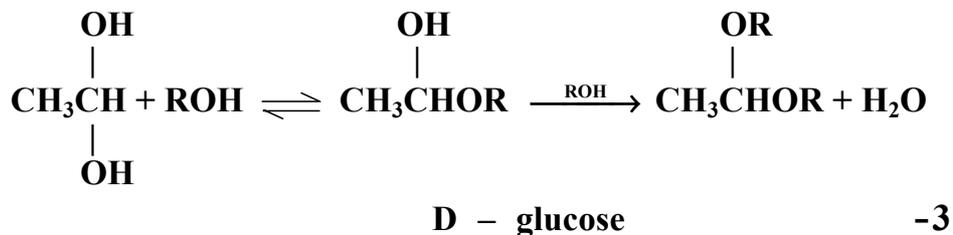
-1

Bisulfate

Schiffreagent



-2

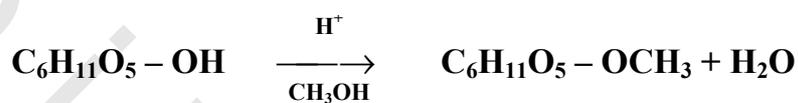


α - methyl -glucoside -

β - methyl glucoside -

$$159 + = [\alpha]_D^{20}$$

$$.34 - = [\alpha]_D^{20}$$



D - glucose **-4**

$$52.7 = [\alpha]^{20}$$

β - D - glucose

Mutarotation

β - D - glucose

α - D - glucose

$$.25$$

-5

α - D - glucose

-D

Pyridine

$$112.1 = [\alpha]_D^{20}$$

β - D - glucose

$$18.7 + = [\alpha]_D^{20}$$

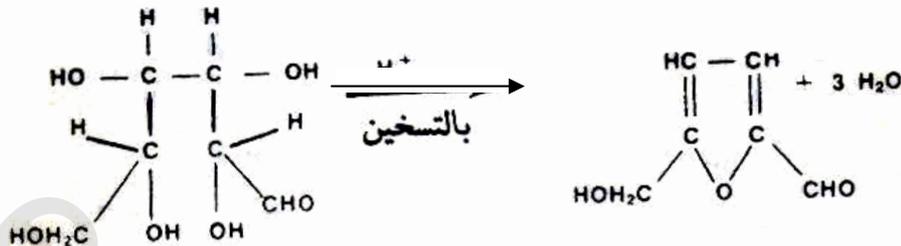
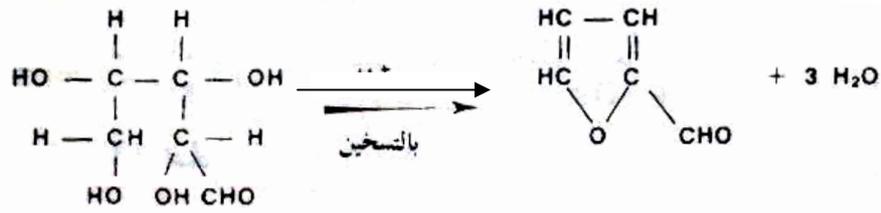
-6

(Pyranose)

. (Pyran)

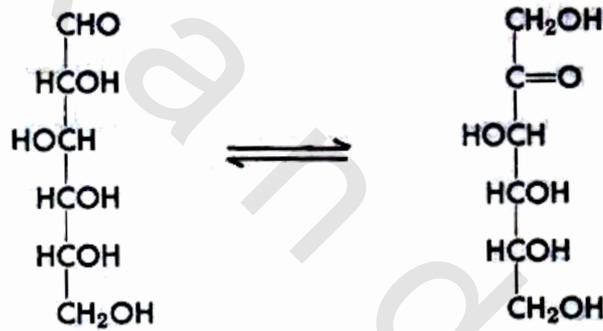
: (Chemical reactions) التفاعلات الكيميائية

(Fur fural)

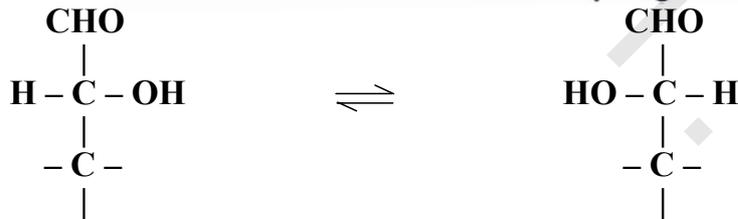


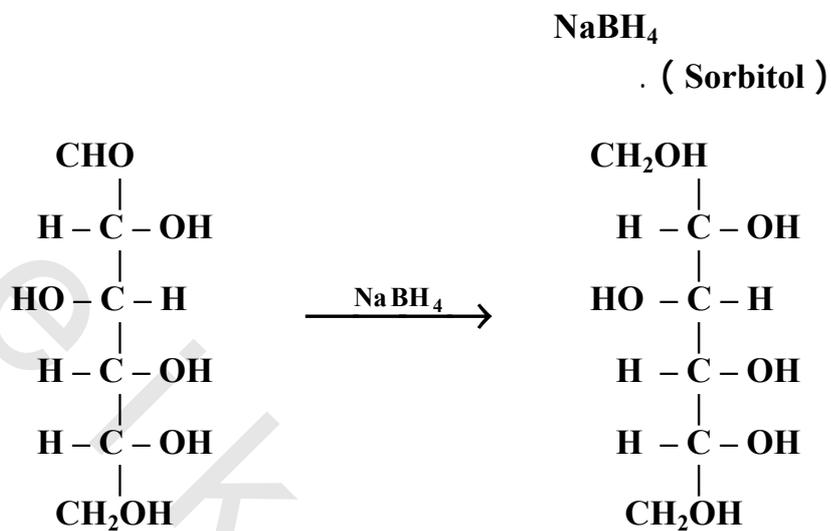
(Interconversion)

(Epimeriza)

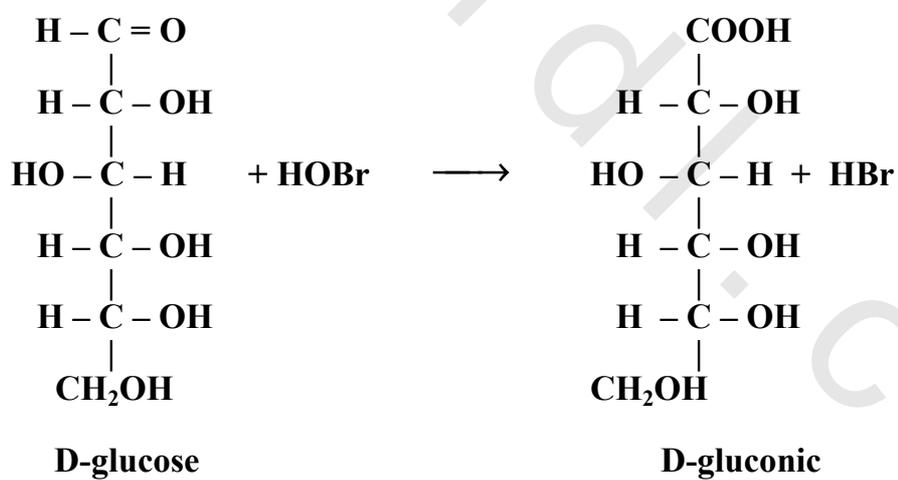


تحول متبادل



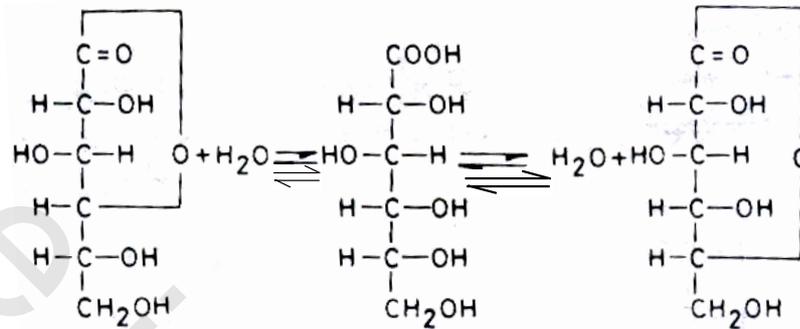


I₂ Br₂ : -4





(Lactone) (δ) (γ)



δ γ

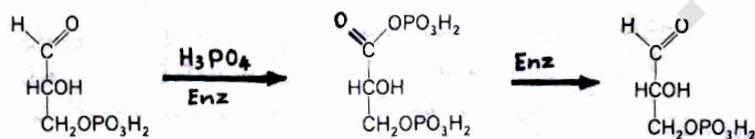
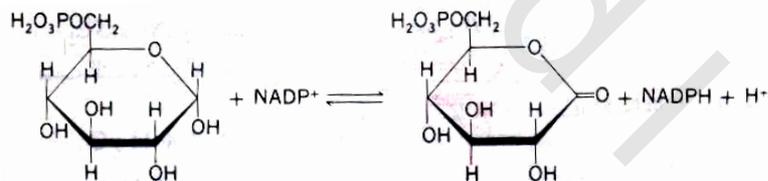
(onic -)

- 6

- 3

(δ - Lactone)

- 3



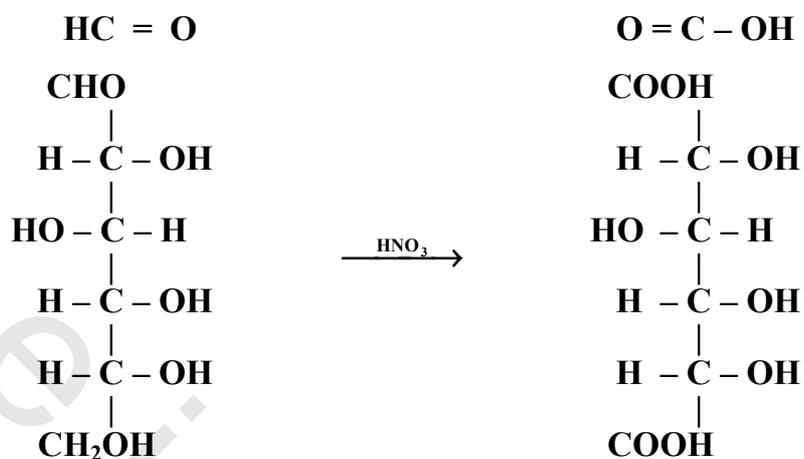
- 3

%50

Aldose

Aldaric

Saccharic



(Phenylhydrazine) : -5

. Ozasone

-1

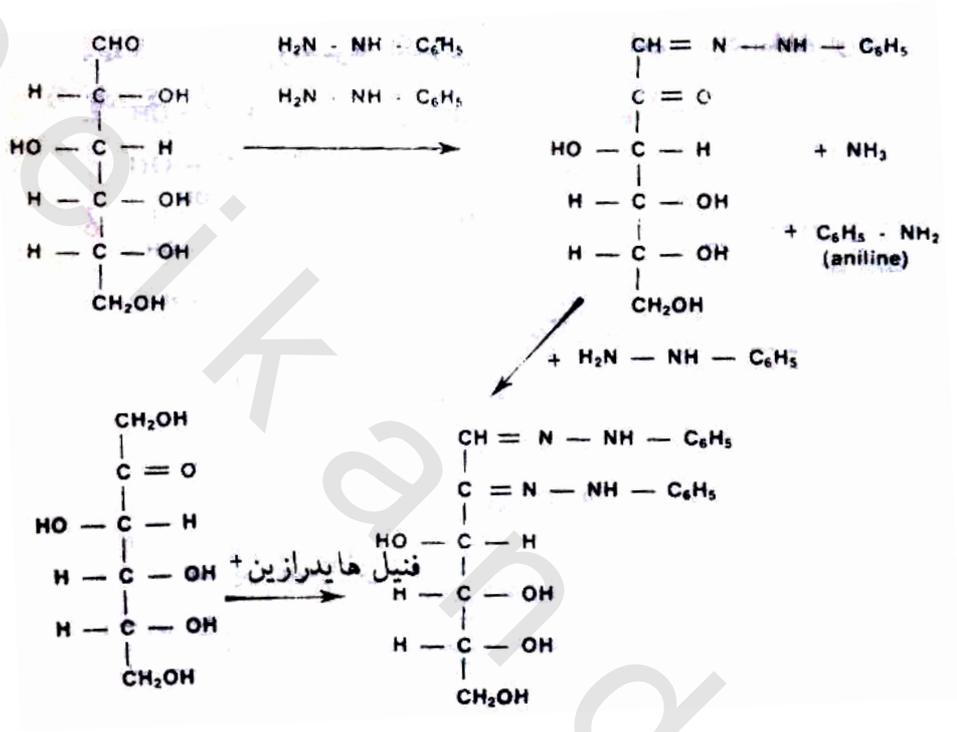
. (Phenyl hydra zone)

-2

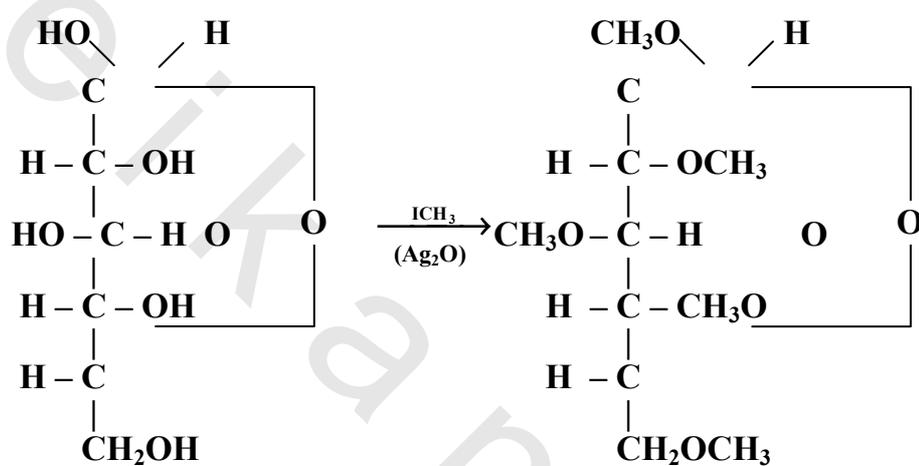
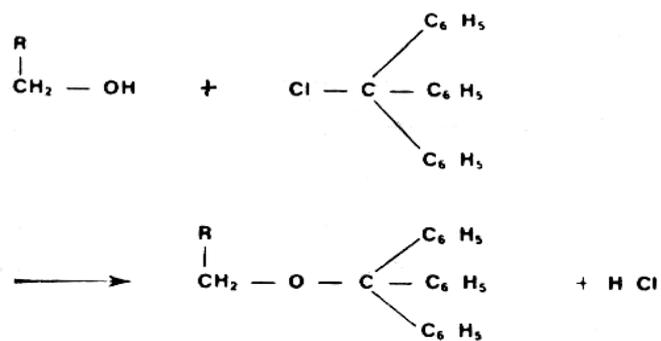
(Aniline)

. (Ammonia)

-3

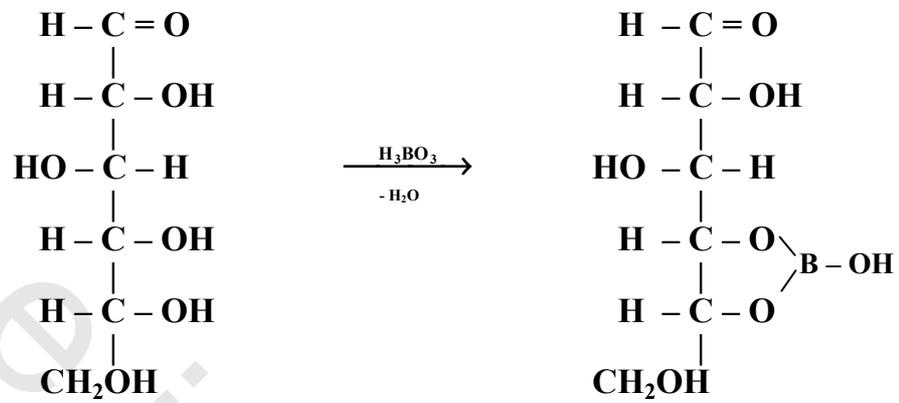


6- تشکیل اُکسید الاثیر Ether oxide :

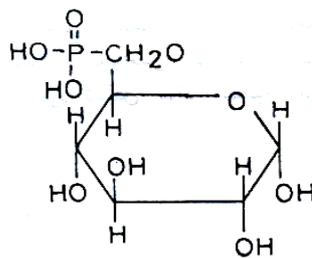


-7

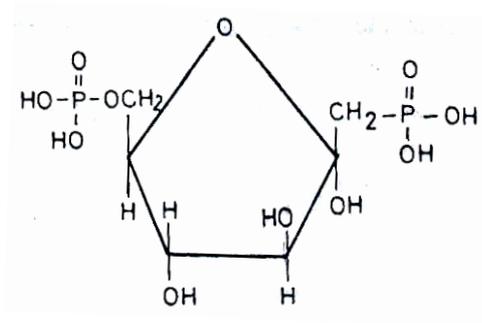
(Glycosaminoglycane)



(Ether oxides)

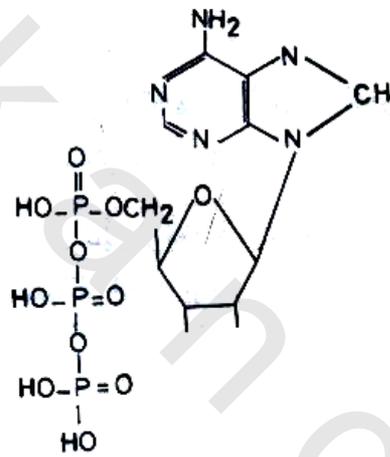


6 - 1



Adenosine triphosphate

. ATP

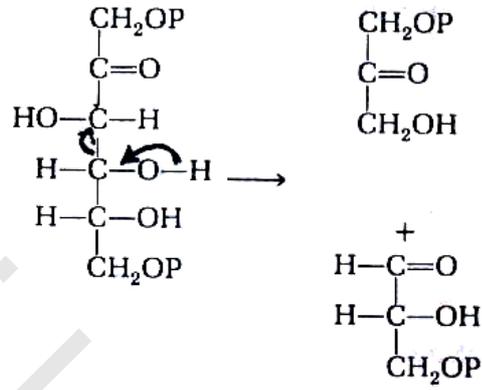


Adenosine triphosphate (ATP)

السكريات الأحادية :

: Triose

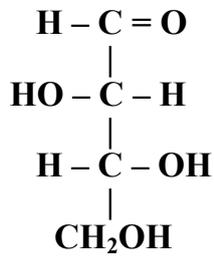
6 - 1



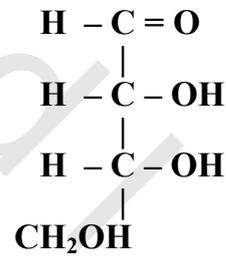
: Triose

D

D

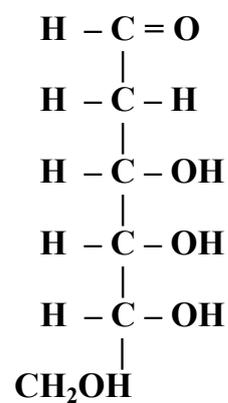
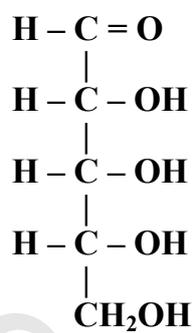


- 4 -



: Pentose

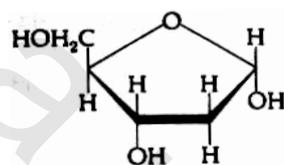
- D



- D

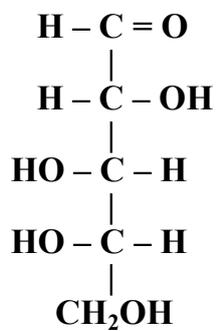
(2)

- 2

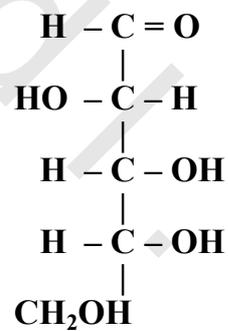


L D

L



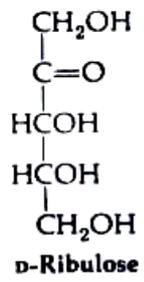
- D



- D

- 5

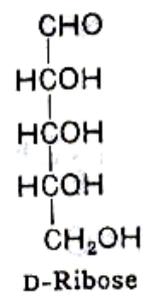
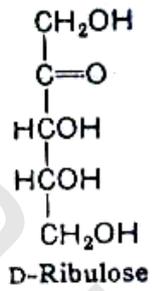
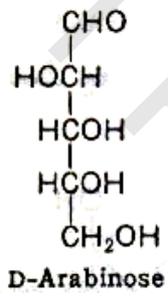
- 5



D

- D

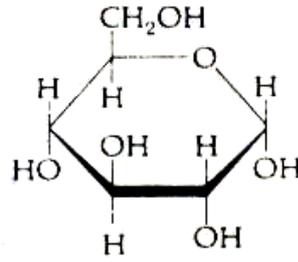
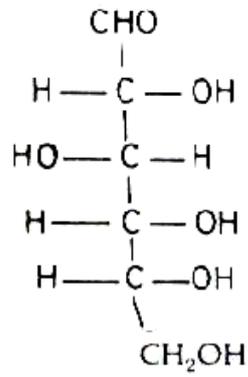
- D



: Hexose

: Glucose

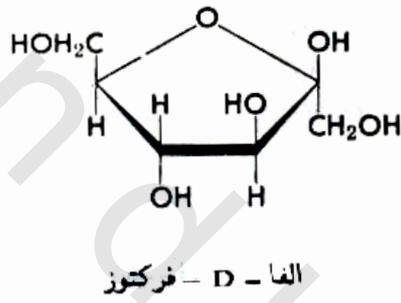
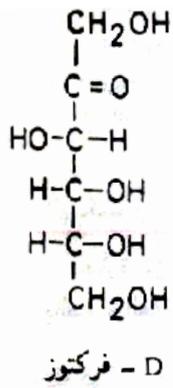
♦ Dextorotory



:

) Levulose

.(



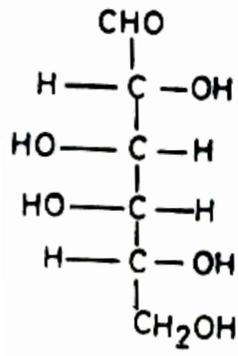
- 6

:

6 - 1

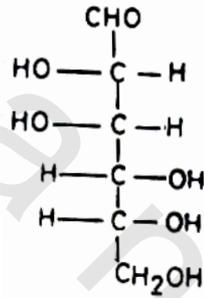
:

- D



- D

: - D



- D

: Oligosaccharides السكريات قليلة القطع

10 - 2 6 - 2

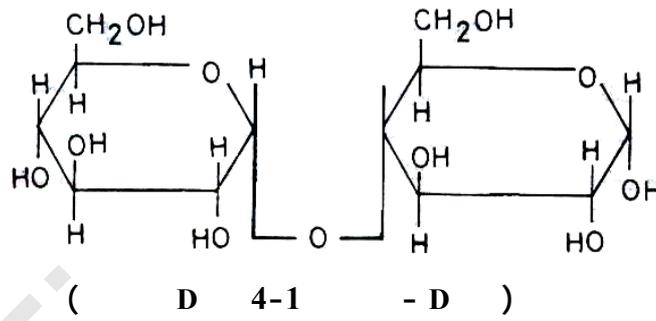
:

السكريات الثنائية Disaccharides :

Hydrolysis

+	Maltose -
+	Lactose -
+	Cillibiose -→
+	Isomaltose -
+	Sucrose -
+	Lactose -

: Maltos

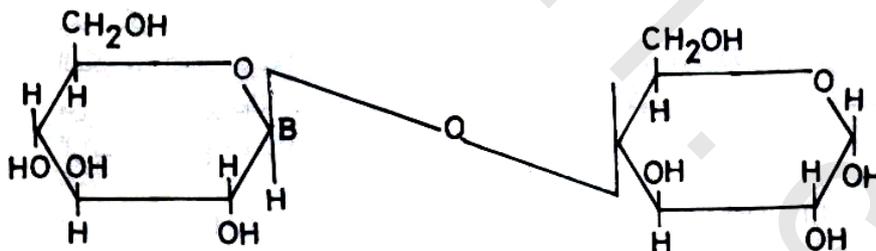


Amylase

: Cillibiose

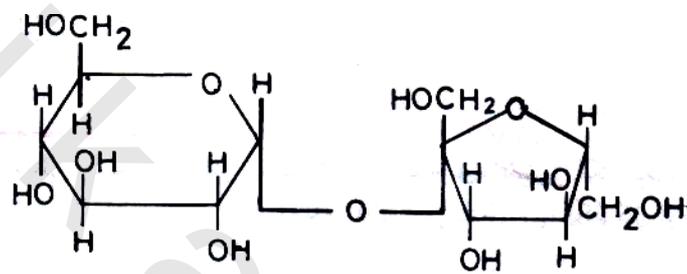
(4 - 1)

β - D - Glucopyranost



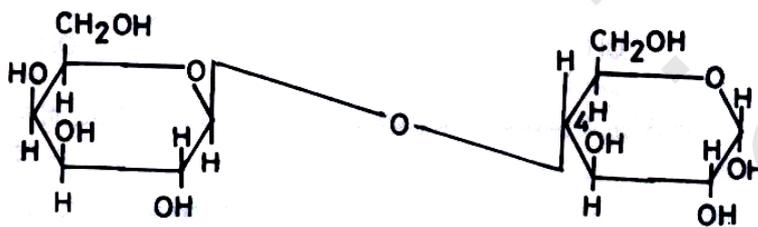
: Sucrose

β - D - Fructo furanose (2 - 1) α - D - Glucopyranosyl



: Lactose

β (1 - 4)



السكريات المتعددة Polysaccharides :

(15)

(Polysaccharides)

(Glycan)

-1

-2

Storage poly saccharides

الطرق المستعملة لدراسة التركيب البنائي للسكريات المتعددة :

Acetic Anhydride

(1 6)

Acetolysis -

(Methylation) -

أمثلة على السكريات المتعددة :

: Starch

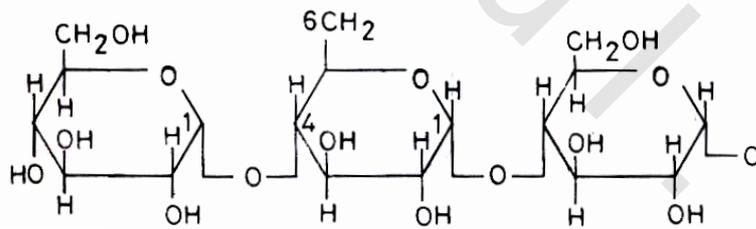
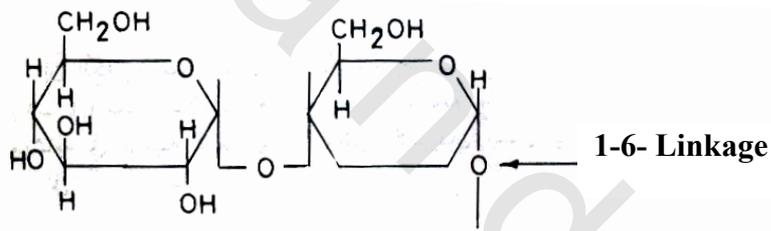
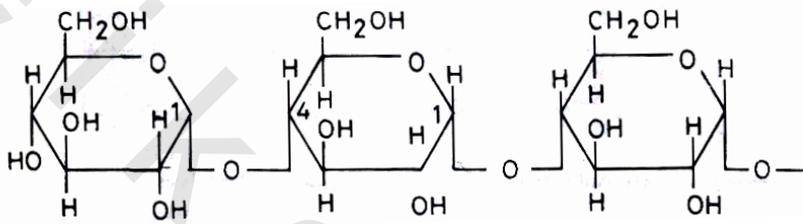
amylase

(Amylopectin)

(4 - 1)
(12)

- D

%25



: Cellulose

. (4 - 1)

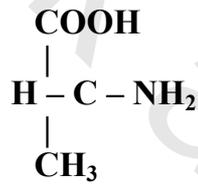
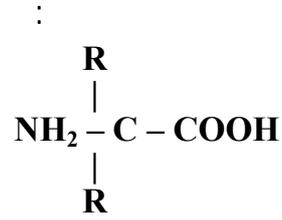
: (Glycogen)

(6 - 1)

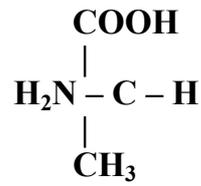
(4 - 1)

*** * ***

ثانياً : الأحماض الأمينية (Amino Acids)



D - amino acid



L - amino acid

L

D

تصنيف الأحماض الأمينية (Classification of amino acids) :

-2

-1

-3

: (Neutral amino acid)

-1

:

-

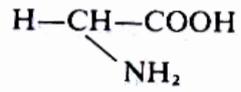
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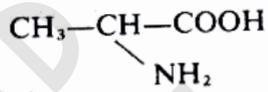
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: (Aliphatic amino acids)

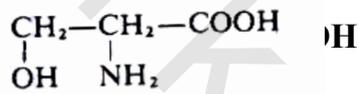
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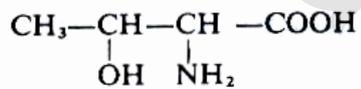
Glycine (Gly)



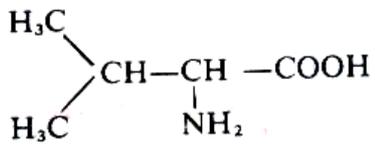
Alanine (Ala)



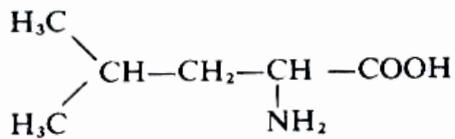
Serine (Ser)



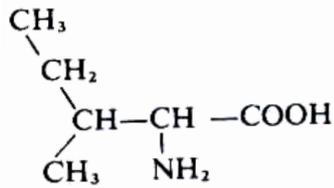
Threonine (Thr)



Valine (Val)



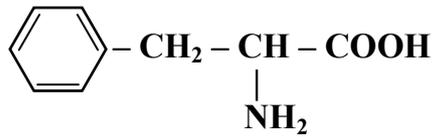
Leucine (Leu)



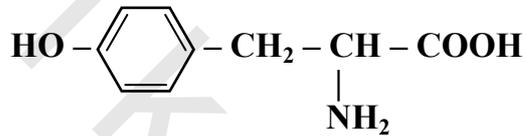
Isoleucine (Ile)

:(Aromatic Amino Acids)

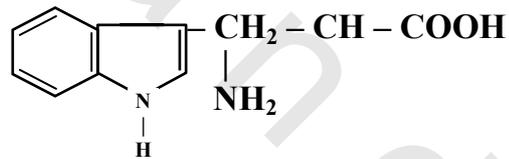
: Phenyl alanine (Phe)



: Tyrosine (Tyr)



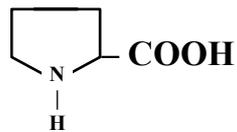
: Trptophan (Try)



:

->

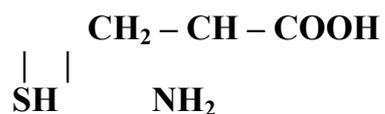
: Proline (Pro)



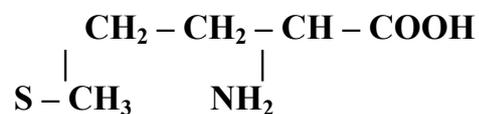
:

-

: Cysteine



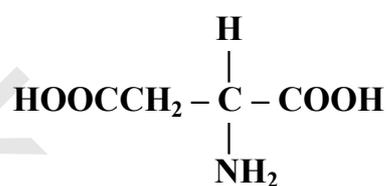
: Methionine



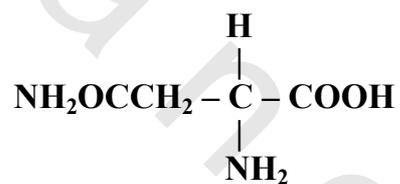
:(Acidic amino acids)

-2

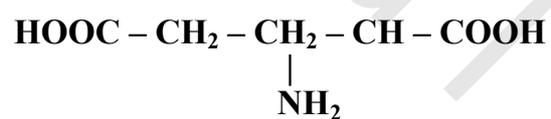
: Aspartic acid (Asp)



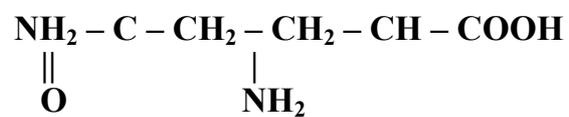
: Asparagine (Aspn)



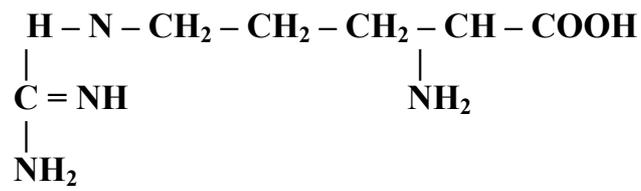
: Glutamic acid (Glu)



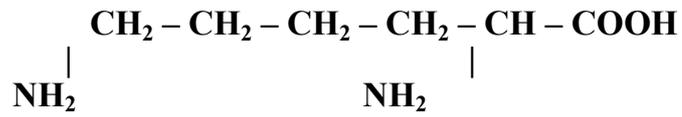
: Glutamine (Gln)



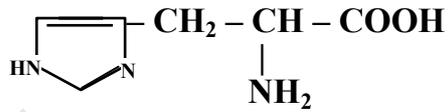
: Arginine (Arg)



: Lysine



: Hisidine



. Pyrrolidine ring



(Metabolism)

خواص الأحماض الأمينية (Properties of amino acids)

: -

(Cysteine)

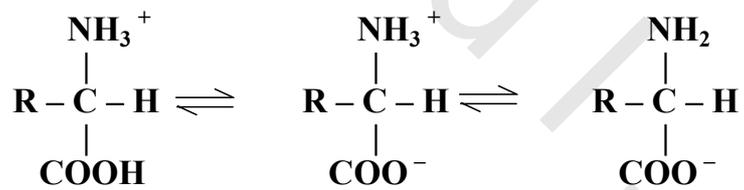
(Levorotatory)

Zwitterion

Dipolar ions

(Amphoteric)

(Ampholytes)



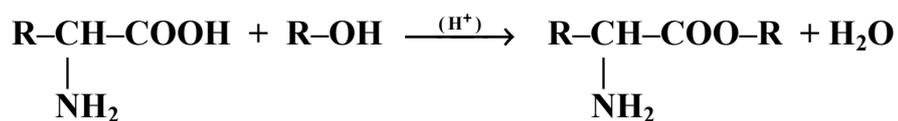
: (Chemical Properties)

-

:

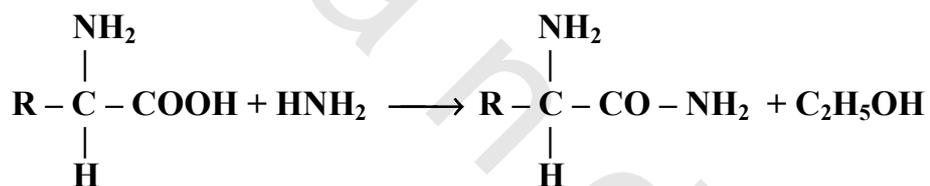
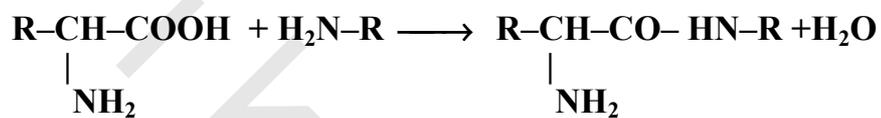
:

-1



:

-2



(LiBH₄)

-3

(NH₂NH₂)

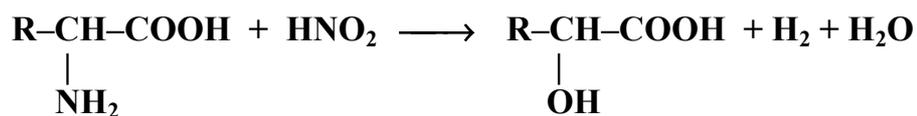
-4

(Hydrazide)

:

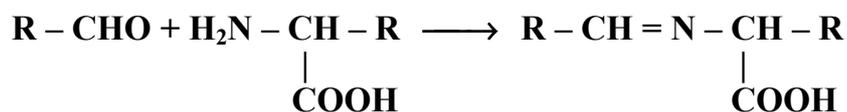
-1

. (Deamination)



-2

. (Imines)

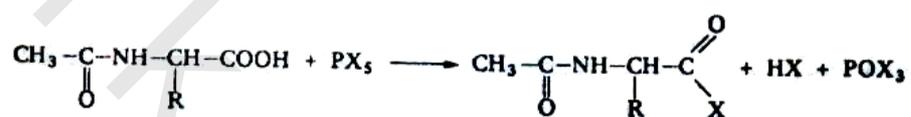


-3

Anhydrides

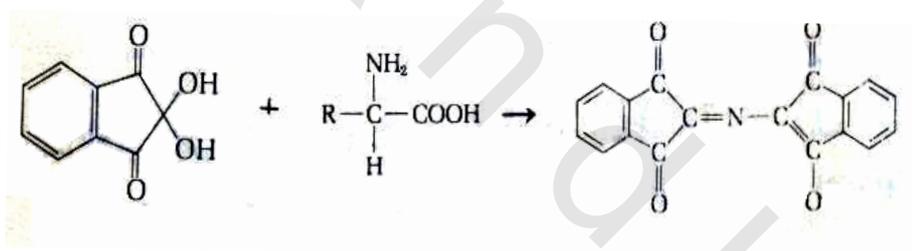
- N

-4



Ninhydrine reaction

-5

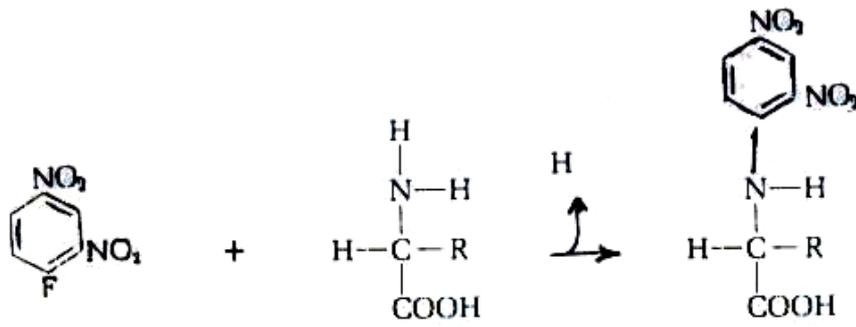


FDNB

FDNB

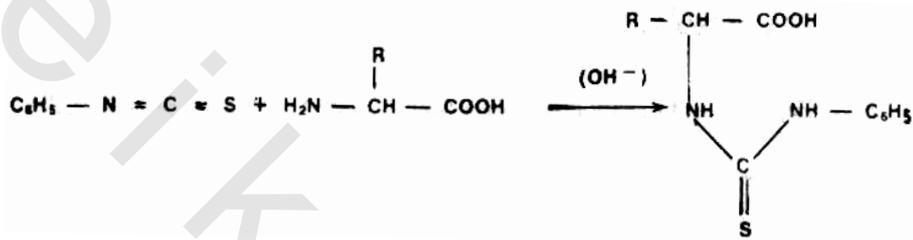
-6

Fluoro - 2,4 - Dinitro Benzene

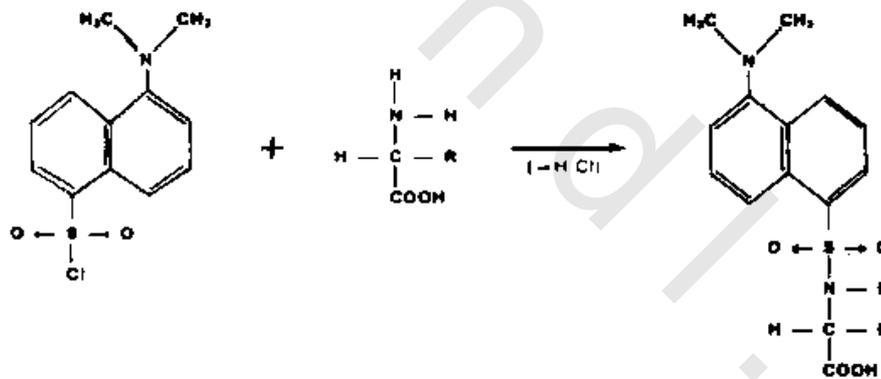


: Edmann reaction

-7



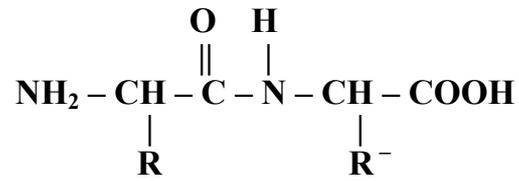
-8



: Peptides الببتيدات

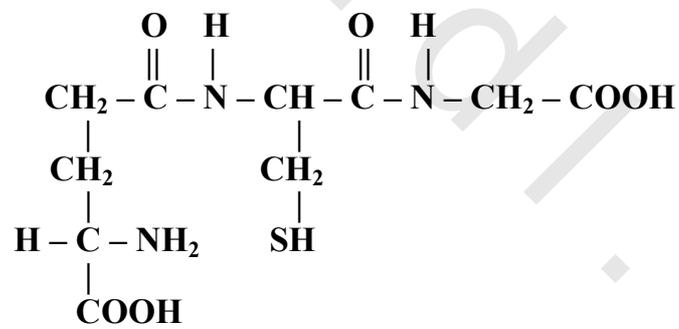
-CH -

Peptide bond



البيبتيدات ذات الأهمية البيولوجية :

:
: Glutathione -1

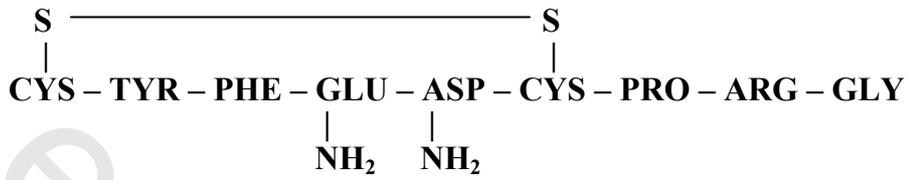
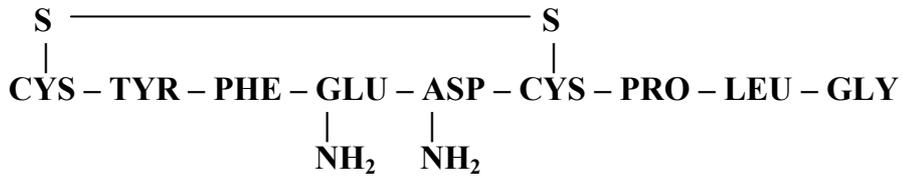


: Post - hyposis -2

Vasopressin

Oxytocin

: . **Hyoertension**



: -3

: D

: **Tycoldin -**

(10)

Tycoldin

. **Baccillus brevis**

Gramicidin -

(10)

Baccillus brevis

.**Gramicidin J₂,J₁**

* * *

ثالثاً : البروتينات (Proteins)

السلاسل متعددة الببتيدات للبروتينات :

Peptide bond

. Poly peptides

تصنيف البروتينات : Classification of proteins

- . Simple protein -1
- . Conjugated protein -2
- . Derived protein -3

أولاً : البروتينات البسيطة :

:

- :

Ammonium Sulphate

:

- :

- - :

Prolamines

: Prolamines

(%70)

: Histones -

: (Protamines) -

: Conjugated protein : -2

: (Nucleoproteins) -

: (Glycoproteins) -

: (Chromo proteins) - →

:

(1200)

: (LiPoproteins) -

: (Metallo proteins) -

Zn

Mn

CO

Fe

Mg

Cu

: Derived protein -3

Denaturation

:

Fibronigen

(Fibrin)

(Myosin)

- :

. Meta Protein

الصفات الفيزيائية للبروتينات : (Physical Properties of proteins)

الوزن الجزيئي	البروتين	الوزن الجزيئي	البروتين
17.000	مايكلوبيين	15.600	سايتوكروم C
44.000	ألبومين البيض	35.500	بيسين
63.000	هيموكوبين	47.800	أنسولين
330.000	فايبروجين	69.000	سيرم البوكين
		59.000.000	فيروس موازيك

(Amphoteric nature of Proteins)

-COOH

:

- NH₂

Zwitterion

pH

Viscosity of proteins Solution :

(Fibrous Proteins)

(Fibrinogen)

(Globular Proteins)

الصفات الكيميائية للبروتينات (Chemical Properties) :

-NH₂

-COOH

-COOH - NH₂

-OH

: -

: - -

Denaturation

Folded

(Unfolded)

التفاعلات الملونة للبروتينات (Color reaction of proteins) :

: (Biuret) -

(NaOH)

CuSO₄

-CONH-

: (Millon) -

: (Sakaguchi) - ↗

α - naphthol

(Folins) -

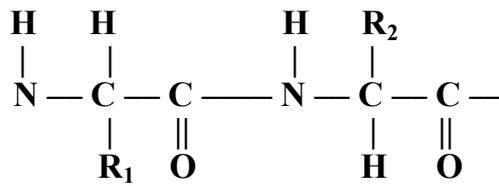
-4 - -2,1

sulfonate-4 1,2-naphthoquinone

: (Structure of the Protein Molecule) تركيب جزيئة البروتين

: (Primary Structure) -1

NH₂
-COOH



: (Secondary Structure)

-2

C=O

α -)

NH₂

(helix

: التركيب الحلزوني (α -helix)

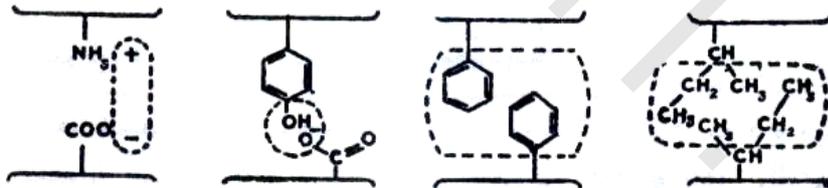
(x-ray)

(NH-) (C=O)

: (Tertiary structure)

-3

(folding)



(Native State)

Hydrophobic

: Quarternary structure

-4

(Phosphorylase)

. (Homogenous Quarternary Structure)

. (Heterogenous Quarternary Structure)

الأحماض النووية والبروتينات النووية :

:

:

. (Prosthetic group)

. (Protamin)

:

(Dioxyribo nucleic acid DNA)

-1

(Ribonucleic acid RNA)

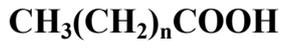
-2

* * *

n Cnx

x

: (Saturated Fatty acids) الأحماض الدهنية المشبعة



n

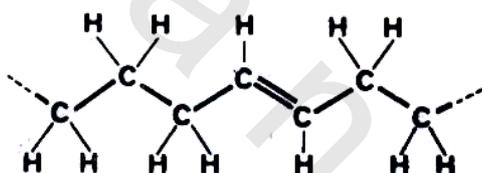
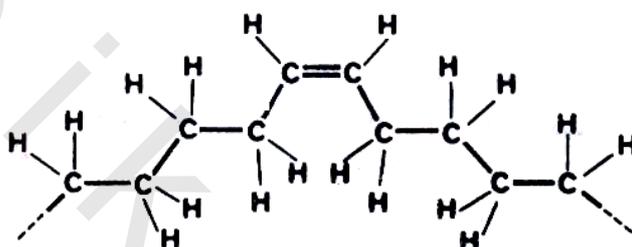
n = 0

: (Unsaturated Fatty acids) الأحماض الدهنية غير المشبعة

(Cis – Trans)

زبد البقر أو الماعز	-7° ,gc	Butyric	n- Butanoic	C ₄ H ₈ O ₂
	-3° ,gc	Caproic	n- Hexanic	C ₆ H ₁₂ O ₂
	+16° ,3c	Caprylic	n- oxanoic	C ₈ H ₁₆ O ₂
	+31° ,3c	Capric	n- Decanoic	C ₁₀ H ₂₀ O ₂
الزيوت أو الشحوم	+44° ,1c	Lauric	n-Dodecanoic	C ₁₂ H ₂₄ O ₂
	+54° c	Myristic	n- Teradecananic	C ₁₄ H ₂₈ O ₂
	+63° c	Palmitic	n- Hexadecanic	C ₁₆ H ₃₂ O ₂

الحيوانية أو النباتية	+69° ,5c	Stearic	n- Octadecanic	C ₁₈ H ₃₆ O ₂
	+75° ,3c	Arachidic	n- Eicosanic	C ₂₀ H ₄₀ O ₂
	+80° c	Behnic	n- Docasanic	C ₂₂ H ₄₄ O ₂
	+84° c	Lignoceric	n- Teracosanoic	C ₂₄ H ₄₈ O ₂
الشموع	+87° ,7 gl° c	Cerotic	n- Hexacosanoic	C ₂₆ H ₅₂ O ₂
	+g3° c	Montanic	n- Octacosanoic	C ₂₈ H ₅₆ O ₂
	+96° c	Melissic	n- Triacontanoic	C ₃₀ H ₆₀ O ₂
		Lacceroic	n-Dotriacontanoic	C ₃₂ H ₆₄ O ₂



:

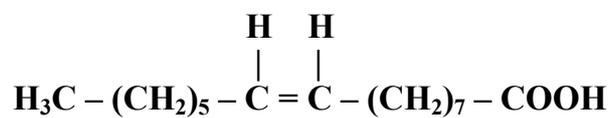
CH ₃ (CH ₂) ₅ CH=CH(CH ₂) ₇ (COOH)	C ₁₆ H ₃₀ O ₂	Palmitoleic	9- Hexadecanic
CH ₃ (CH ₂) ₇ CH=CH(CH ₂) ₇ COOH	C ₁₈ H ₃₄ O ₂	Oleic	C ₁₅ -9-Octadecanic
CH ₃ (CH ₂) ₇ CH=CH(CH ₂) ₇ COOH	C ₁₈ H ₃₄ O ₂	Elaidic	trans-9-Octadecanic
CH ₃ (CH ₂) ₅ CH=CH(CH ₂) ₉ COOH	C ₁₈ H ₃₄ O ₂	Vaccenic	II-Octadecanic
CH ₃ (CH ₂) ₃ (CH ₂ CH=CH ₂) ₂ (CH ₂) ₇ COOH	C ₁₈ H ₃₂ O ₂	Linoleic	cis, cis, -9,12-Octadecanic
CH ₃ (CH ₂ CH=CH) ₃ (CH ₂) ₇ COOH	C ₁₈ H ₃₀ O ₂	Linoleic	8,12,15-Octadecanic
CH ₃ (CH ₂) ₃ CH=CHCH=CHCH=CH ₂	C ₁₈ H ₃₀ O ₂	Eleostearic	9,11,13-Octadecanic
HOOC-(CH ₂) ₃			
CH ₃ (CH ₂) ₃ (CH ₂ CH=CH) ₄ (CH ₂) ₃ COOH	C ₂₀ H ₃₂ O ₂	Arachidonic	5,8,11,14-Eicosonoil

Cis

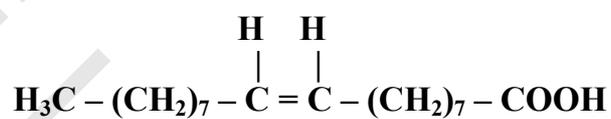
:

: (Palmitoleic) -1

(Palmitic acid)



: (Oleic acid) -2

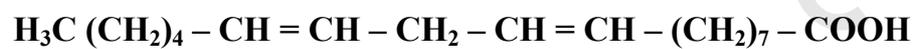


(Trans)

(Elaidic acid)

: Linoleic acid -3

:



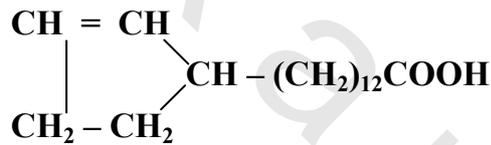
(Stearic acid)



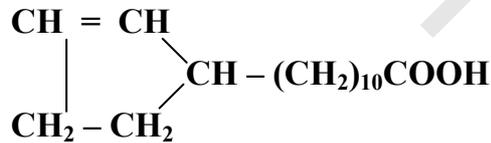
: (Arachidonic acid) -5

: (Cyclic Fatty acid) الأحماض الدهنية الحلقية

. (Chaulmoogric)

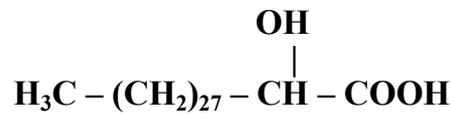


: Hydncapric



: الأحماض الدهنية المشتقة الأحادية الهيدروكسيل

(Cerebronic)



الأحماض الدهنية غير المشبعة الأحادية الهيدروكسيل :

(Ricinoleic)

18

الخواص الفيزيائية (Physical Properties) :

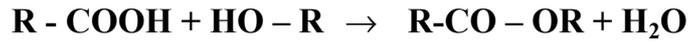
فصل الأحماض الدهنية بواسطة كروموتوجرافي الغاز- السائل :

الخواص الكيميائية (Chemical Properties) :

-1 :

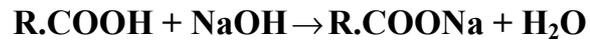
()

- 545 -



:

-2

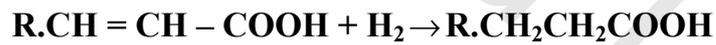


:

-3

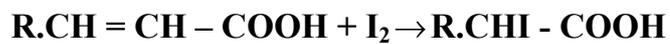
التفاعلات الكيميائية الناتجة من وجود الرابطة المزدوجة :

: Hydrogenation -



: Halogenation -

(-)

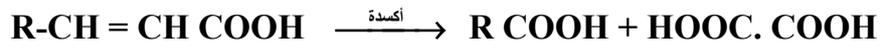


)

.(

: Oxidation

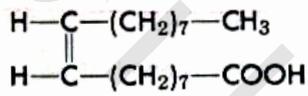
-



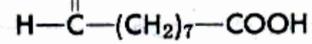
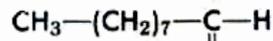
: Isomerization

-

:



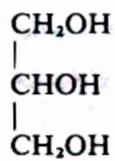
()



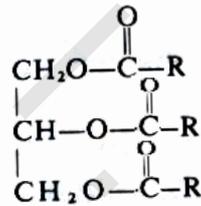
()

: (Simple Lipids)

: Neutral Fats



+



(3 1)

L-

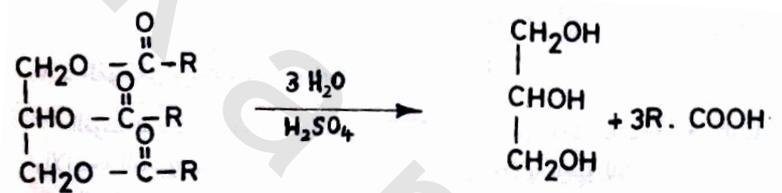
(2)

R₃ R₂ R₁ glyceraldehydes

: (Physical Properties) الخواص الفيزيائية

: (Chemical Properties) الخواص الكيميائية

: -1



: (Addition Reactions) -2

: Oxidation : -3

: (Rancidity) -4

: الليبيدات المعقدة (Complex Lipids)

: (Phospholipids) -1

تصنيف الفوسفوليبيدات :

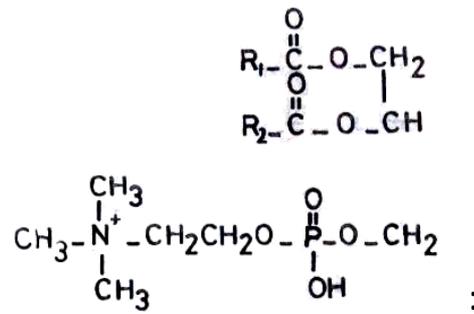
(Phosphatidyl

(Phosphatidyl ethanol amine)

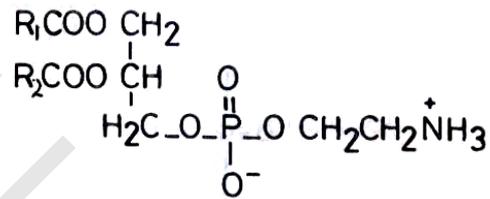
(Phosphatidyl choline)

serine)

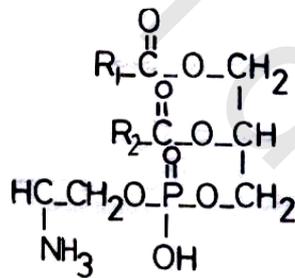
. ()



(NH₂CH₂CH₂OH)



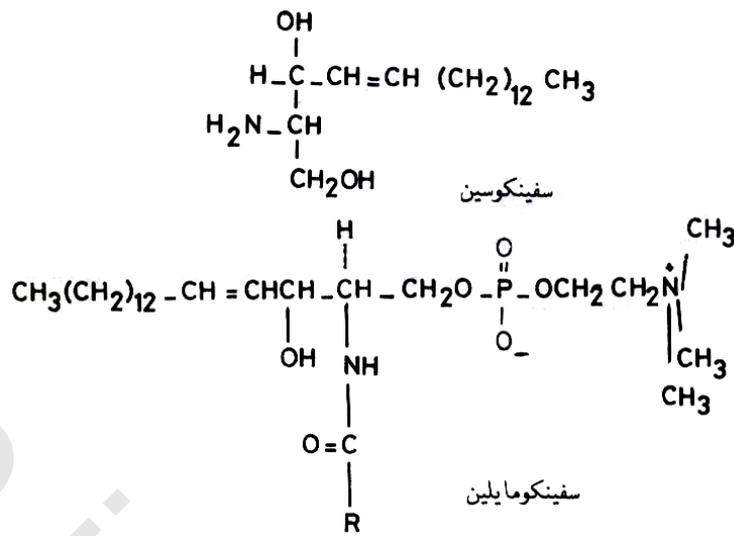
(OHCH₂CHNH₂COOH)



:Sphingolipids

. Sphingosine

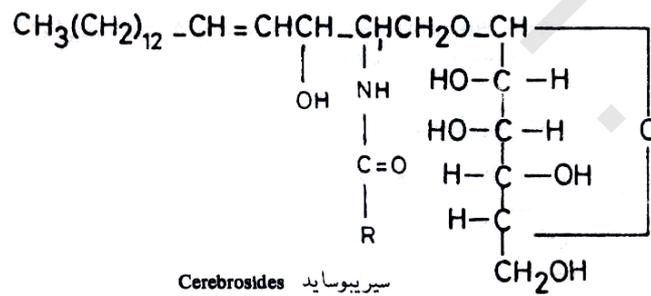
:



: Glycolipids

-

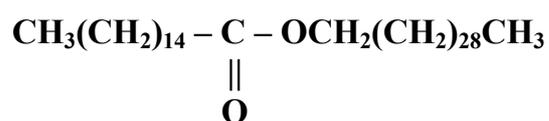
:



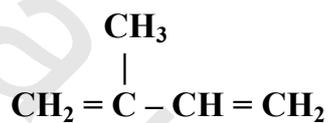
Cerebrosides سیریوساید

: Waxes الشموع

. (C₃OH₆₁OH)



: Terpenes : التربينات



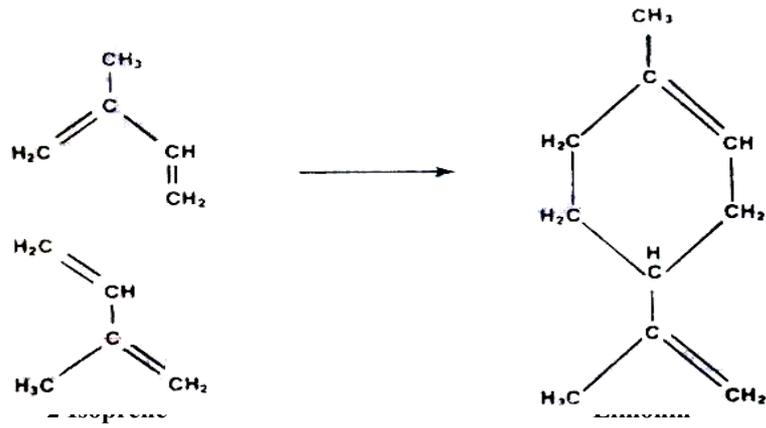
Isoprene

(Bouchardat)

(Terpenes)

(Isoprene)

(1879)



A₁ E₁ K

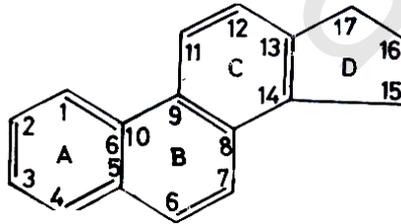
: Derived Lipids الليبيدات المشتقة

: Sterols

Steroidsystem

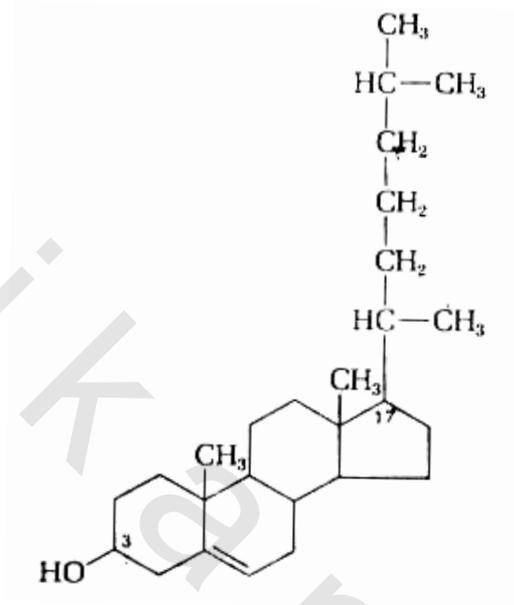
:

A B C D



D

(C₂₇H₄₅OH)



Cis

: Other sterols

(C₂₈H₄₃OH) Ergosterol

(17)

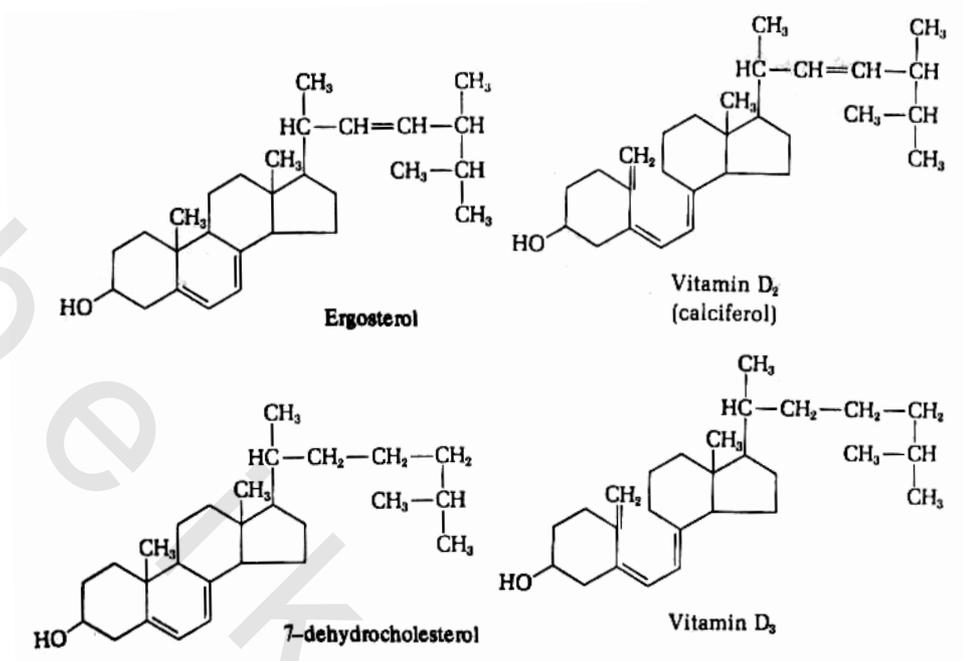
D₂

C₈ - C₇

dehydrocholesterol-7

D₃

:



: (Bile acids) الأحماس الصفراوية

(24)

(17)

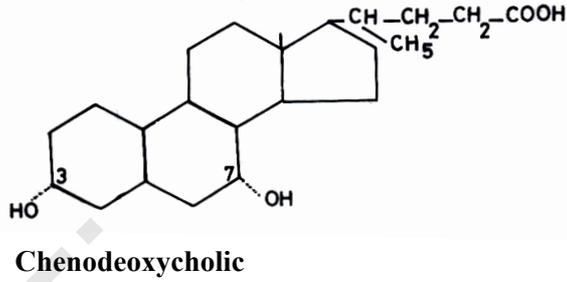
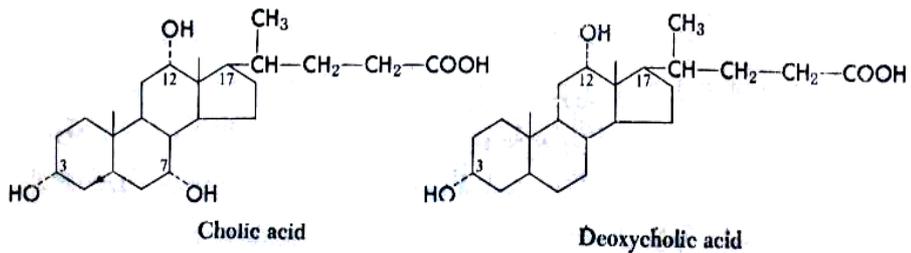
(Cholic acid)

:

3- hydroxycholic acid

3, 12- dihydroxycholic acid

3,7,12 - Tihydroxycholic acid



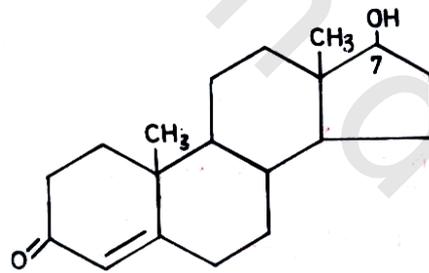
: Sex Hormons الهرمونات الجنسية

Androgens

19 18

19

. Testosterone

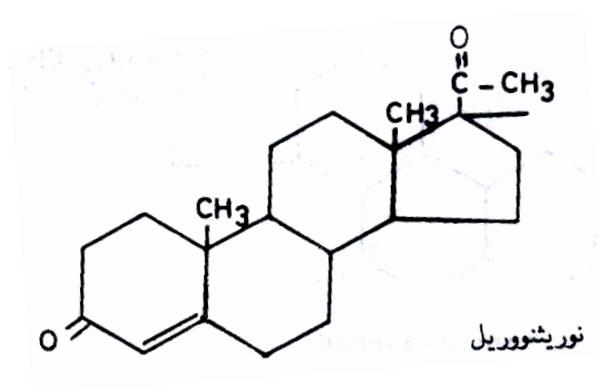


Estrogens

-17

(18)

. Estrogens



(17)

* * *

المصطلحات العلمية

المصطلحات العلمية

Absorption	
Absolute temperature	
Acetate	
Acetic acid	
Acetone	
Active site	
Activity	
Activity coefficient	
Aldehyde	
Alkalinity	
Alkanes	
Alkenes	
Alkynes	
Alloy	
Alumina	
Aluminum	
Amines	
Amino acids	
Analysis	
Analytical balance	
Analytical method	
Anhydride	
Anhydrous	
Anion	
Anode	

Aromatic Hydrocarbons	
Aqueous	
aqueous solution	
Atomic number	
Atomic weight	
Balanced reaction	
Base	
Basicity	
Benzine	
Benzoic acid	
Boric acid	
Bond	
Buffer solution	
Burning	
Burette	
Bond length	
Bond cleavage	
Calibrate	
Calipation	
Carbohydrate	
Carbonic acid	
Carbon dixide (CO₂)	
Carbon monoxide (CO)	
Carbonyl geoup	
Catalyst	
Cathode	
Cation	
Cell	
Cellulose	

Chemical activity	
Chlorate	
Chromate	
Chromic acid	
Coagulation	
Colloid	
Colourimeter	
Combustion	
Common ion	
Complex ion	
Coordinate – Covalent	-
Covalent bond	
Crystal field	
Concentration	
Constant of acid	
Constant of base	
Constant of formation	
Constant of equilibrium	
Constant of stability	
Conversion	
Correction	
Curve	
Damped Current	
Decomposition	
Decontaminant	
Degradation	
Degree of accuracy	
Degree of dissociation	
Degree of hydrolysis	

Degree of ionization	
Deformation	
Dehydration	
Density	
Deoxidization	
Desiccate	
Deviation	
Dilution	
Digestion	
Dipole – dipole	
Displacement	
Dissociation constant	
Dispersion	
Electrode	
Elemental analysis	
Ethanol	
Ether	
Extraction	
Exothermic	
End point	
Emulsion	
Endothermic	
Energetic	
Energy activation	
Equivalent point	
Error	
Factor gravimetric	
Fehlings solution	
Ferric Chloride	

Ferric oxide	
Filterate	
Filtration	
Flame	
Flow	
Foam	
Formic acid	
Fractionation	
Free energy	
Freezing	
Fundamental	
Fuse	
Free radicals	
Gel	
Gelatin	
Gram – equivalent	
Gravimetric analysis	
Grinding	
Grignard reagent	
Halogen compounds	
Hard water	
Heat - Content	
Heterogeneous	
Homogeneous	
Humidity	
Hydrogen electrode	
Hydrogenation	
Hydrogen peroxide	
Hydrogen - bond	

Hydrolysis constant	
Hydrophile	
Hydronium ion	
Hydroxyl ion	
Identification	
Ignition	
Indicator	
Insoluble	
Instrumental Analysis	
Interionic attraction	
Interference	
Iodine solution	
Ionic activity	
Ionic product	
Ionic strength	
Ionization	
Ionization constant	
Ionization potential	
Irreversible reaction	
Junction potential	
Labile Complexes	
Leaching	
Limestone	
Macro molecular	
Marcoscobis	
Magnesia	
Mean	
Mean activity	
Measurement – Mechanism	

Melting point	
Membrane	
Migration	
Minimum	
Mixture	
Neutralization	
Neutron	
Nomenclature	
Non – aqueous solution	
Normal concentration	
Non volatile	
Octahedral	
Odour	
Odorless	
Oleic acid	
Optical activity	
Orbital	
Octane number	
Osmotic pressure	
Oxidation number	
Oxidizable	
Oxidize	
Periodic table	
Percentage concentration	
Polarization	
Precipitation	
Quaternary structure	
Quality	
Qualitative Analysis	

Quantitative analysis	
Radiation	
Reactants	
Recovery	
Recrystallization	
Reducing power	
Refining	
Replacement	
Research	
Residue	
Rigid	
Rotation power	
Rotatory dispersion	
Salicylates	
Sample	
Saponification	
Saturated solution	
Sensitive	
Separation	
Silica gel	
Solubility	
Solute	
Solution	
Solution Colloidal	
Sorption	
Space lattice	
Standard solution	
Starch	
Substance	

Substitution	
Surface tension	
Suspension	
Symmetry element	
Symmetry orbital	
Tertiary structure	
Trace	
Triple bond	
Turbidity	
Ultra – red (infra – red)	()
Ultra – violet (UV)	
Unstable compound	
Unstable equilibrium	
Urea	
Vacuum distillation	
Valance (valency)	
Valence bond	
Volumetric	
Volumetric analysis	
Water bath	
Water content	
Water of crystallization	
Water soluble	
Wave length	
Wave function	
X- ray	
Yield	

* * *

الملاحق

الملاحق

جدول (1)

وحدات النظام الدولي (SI)

m		
Kg		
S		
A		
K		
Mol		
m²		
m³		
Kg m⁻³		
ms⁻¹		
rad s⁻¹		
ms⁻²		
N = Kg ms⁻² = Jm⁻¹	(N)	
Nm⁻²		

جدول (2)
بعض الثوابت الفيزيائية

$2.997 \times 10^8 \text{ ms}^{-1}$	c	
$1.60219 \times 10^{-19} \text{ C}$	e	
$6.62620 \times 10^{-34} \text{ JS}$	h	
$6.02217 \times 10^{23} \text{ mol}^{-1}$	N	
$9.10956 \times 10^{-31} \text{ kg}$	m	
$1.66053 \times 10^{-27} \text{ kg}$	m_p	
$9.64867 \times 10^4 \text{ C mol}^{-1}$	P	
$5.291772 \times 10^{-11} \text{ m}$	a_0	
$8.3143 \text{ JK}^{-1} \text{ mol}^{-1}$	R	
$1.3806 \times 10^{-23} \text{ J deg}^{-1}$	k	
101.325 Nm^{-2}	1 atm	

* * *

جدول (3)

قيم بعض الكميات الفيزيائية

101.325 Nm^{-2}	(atm)	
133.322 Nm^{-2}	(mm Hg)	
10^5 Nm^{-2}		
10^{-7} J		
4.1840 J	(cal)	
$0.16021 \times 10^{-18} \text{ Z}$	(e V)	
745.700 W	(hp)	
$10^{-1} \text{ Kg m}^{-1} \text{ s}^{-1}$	(η)	
$3.338 \times 10^{-30} \text{ mC}$		

* * *

جدول (4)

الكسور والمضاعفات المستعملة مع وحدات النظام الدولي

10^{12}	T	
10^9	G	
10^6	M	
10^7	k	
10^{-1}	d	
10^{-2}	c	
10^{-3}	m	
10^{-6}	μ	
10^{-9}	n	
10^{-12}	p	

* * *

جدول (5)

صفات بعض الأحماض والقواعد

17.5	1.05	99.5	60.05	CH ₂ COOH	
11.0	1.18	35	36.47	HCl	
26.5	1.15	46	20.01	HD	
16.0	1.42	70 – 71	63.02	HNO ₂	
			63.03	(COOH) ₂ 2H ₂ O	
36	1.84	96	49.04	H ₂ SO ₄	
11.6	1.66	70	100.47	HClO ₄	
44	1.89	85	32.67	H ₂ PO ₄	
14.3	0.88	27	17.03	NH ₂	
			56.11	KOH	
			40.01	NaOH	

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المراجع

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		"		" -2
.1989	-		-	
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