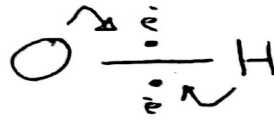


* Covalent Bond
الرابطة التساهمية



is the strongest

تشارك
Sharing of e⁻

إلكترونات

* Electronegativity
الكهرسالية

قوة لذرة في سحب
الإلكترونات الرابطة
لغندھا

tendency to
attract e⁻

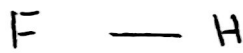
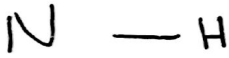
* Polar Bond
الرابطة قطبية

الكهرسالية
الكهرسالية



partial
-ve

partial
+ve



sharing of e⁻
Unequally
بشكل غير متساوي

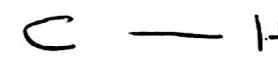
F	4.0
O	3.5
N	3.0
S	2.6
C	2.5
P	2.2
H	2.1

القيمة تزداد
الكهرسالية
الفرق في الكهرسالية
is small

قيم الكهرسالية

* Non-polar bonds
الروابط الغير قطبية

sharing of
e⁻ equally



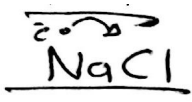
نفس الكهرسالية
الفرق في الكهرسالية
متساوي

* Dipole = polar
قطب

* Dipole moment
العزم القطبي

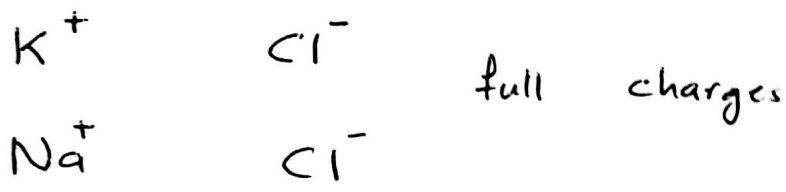


يسرع من الإلكترونات

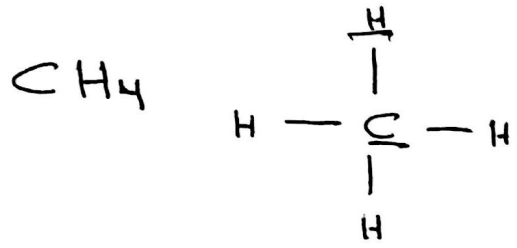


أقوى قطبية

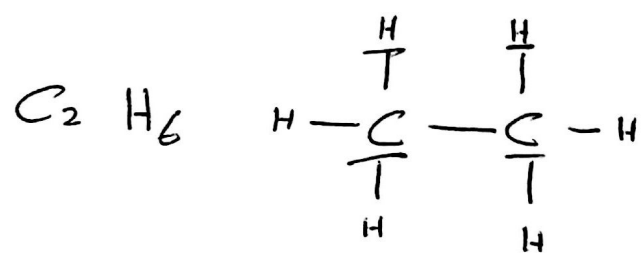
الفرق في الكهرسالبية
 Δ Electronegativity
 أكبر $1.75 \rightarrow$ Ionic
 أقل $0.45 \rightarrow$ Non-polar
 $(0.45 - 1.75)$ polar



* قطبية of الجزيئات molecules
 * Polarity of molecules



* all bonds are
Non-polar
 \rightarrow CH_4 Non-polar



* all bonds are
Non-polar
 \rightarrow C_2H_6 Non-polar

Hydrocarbons:

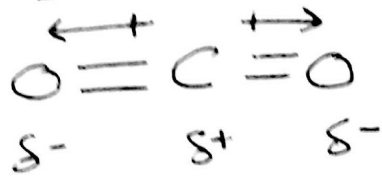
مركبات تتكون فقط من
 H & C

are Non-polar



Carbon Dioxide
سحب من الأوكسجين

Linear خطي



180

* Bonds are polar but

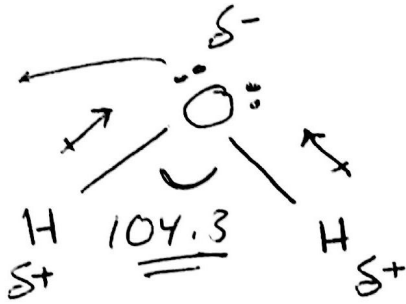
* Net dipole moment = Zero
إذا كانت لحظة العزم القطبي = صفر



→ CO₂ Non-polar



2 pairs of Unshared e⁻



Bend غير مستقيم
104.3

* Bonds are polar

* Net dipole moment ≠ Zero

ليس linear

Polarity of molecules depends on:-

1. polarity of bonds
2. Configuration (Structure)

water is polar because :-

A. electrons are not distributed symmetrically

B. the hydrogen atoms are found in one side

C. Hydrogen is less electronegative than oxygen

D. B + C
~~all of these are correct.~~

E. all of these are correct.

solubility in water

الذائبة

Like

love

Like

dissolve

Polar

love
dissolve

Polar (water)

Non-polar

Hate
Not dissolve

Polar (water)

⇒	Polar compounds	Love
	Ionic compounds	& dissolve

water (Hydrophilic)
حب الماء

⇒	Non-polar compounds	Hate
	Ex: Hydrocarbons	& Not dissolve

water (Hydrophobic)
كره الماء

⇒ amphipathic molecules

المساقصة الكريشان

تتوي طرفه وجه دهره كاره

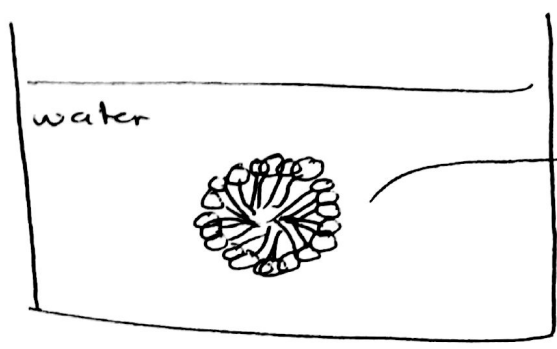
Ex: Fatty acids salts Ex: Sodium palmitate

phospholipids

Detergents الصابون

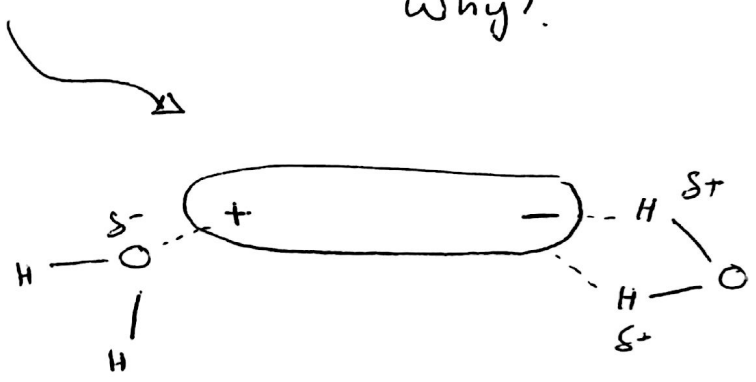
* Note: Fatty acids considered Hydrophobic
but Fatty acid: salts are amphipathic

phipathic molecules In water Form Micelles



Polar compounds & Ionic compounds dissolve in water ?

why?



they make Electrostatic interactions with water

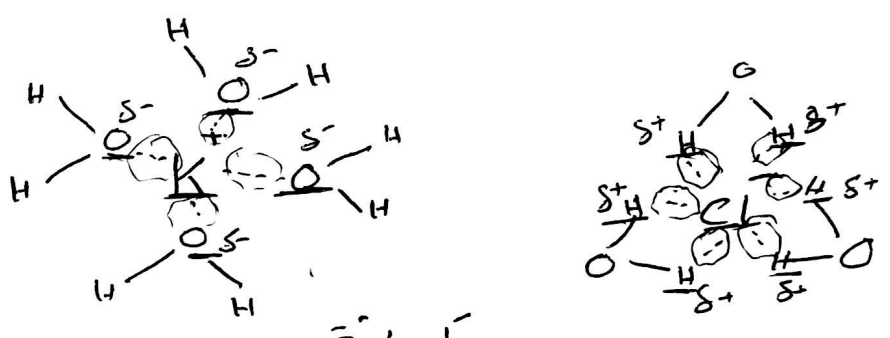
↑ قوة الارتباط بين جزيئات
↓ Energy ↑ stability → تدون في سعة

Table 2.2	
Examples of Hydrophobic and Hydrophilic Substances	
Hydrophilic	Hydrophobic
<ul style="list-style-type: none"> 1. Polar covalent compounds (e.g., alcohols such as C_2H_5OH [ethanol] and ketones such as $(CH_3)_2C=O$ [acetone]) 2. Sugars 3. Ionic compounds (e.g., KCl) $NaCl$ 4. Amino acids, phosphate esters 	<ul style="list-style-type: none"> 1. Nonpolar covalent compounds (e.g., hydrocarbons such as C_6H_{14} hexane) 2. Fatty acids, cholesterol

فيس

II Ion - Dipole Interaction

$\frac{\text{Ionic Compound}}{KCl}$ ----- $\frac{\text{Polar Compound}}{\text{water}}$

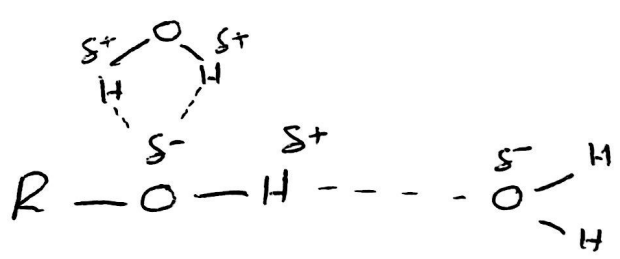


كهربائية
 → Electrostatic
Not covalent

[2] Dipole - Dipole Interaction

$\frac{\text{Polar compound}}{\text{alcohol}}$ ----- $\frac{\text{Polar compound}}{\text{water}}$

$R - \overset{\delta-}{O} - \overset{\delta+}{H}$



→ Electrostatic
Not covalent

$1 + 2 \downarrow \text{Energy} \quad \uparrow \text{stability} \Rightarrow$

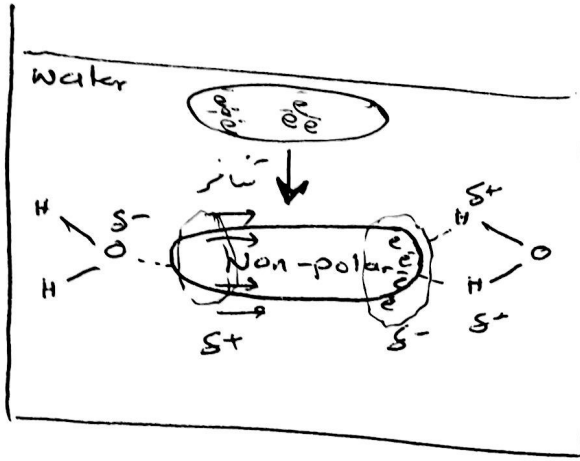
المرئبة للبرينة
 والمركبات القطبية
 تذوب بالماء

Dipole - Induced dipole interaction

قطبة محفزة

مركب قطبي
Polar
Compound
water

مركب غير قطبي
Non-polar
Compounds
Hydrocarbons



→ electrostatic
→ temporary & weak
مؤقتة

لا تتعلق قطبة ال System
ولا تؤدي الى Stability

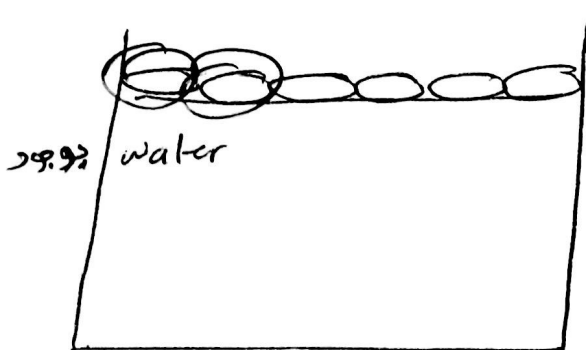
→ Non-polar Compound لا ترتبط
باللحار

4 Hydrophobic interaction

روابط كارهة للماء

Non-polar ----- Non-polar In Water

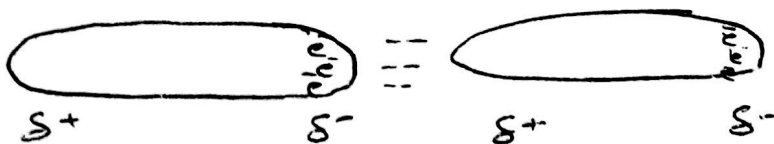
Ex: Oil in water



weak

5 Van der Waals

Non-polar ----- Non-polar



→ Temporary & weak

dissolve in water due to :-

- a. Ion-dipole interaction
- b. electrostatic interaction
- c. Van der waals
- d. dipole-dipole interactions
- e. a + b

Triple > Double > single

≡ > = > -

↑
Covalent Bonds

أقوى الروابط highest bond Energy

↓
Ionic bonds, Ion-dipole, dipole-dipole, H-bonds

↓
Hydrophobic, Van der waals الروابط أضعف الروابط lowest bond Energy

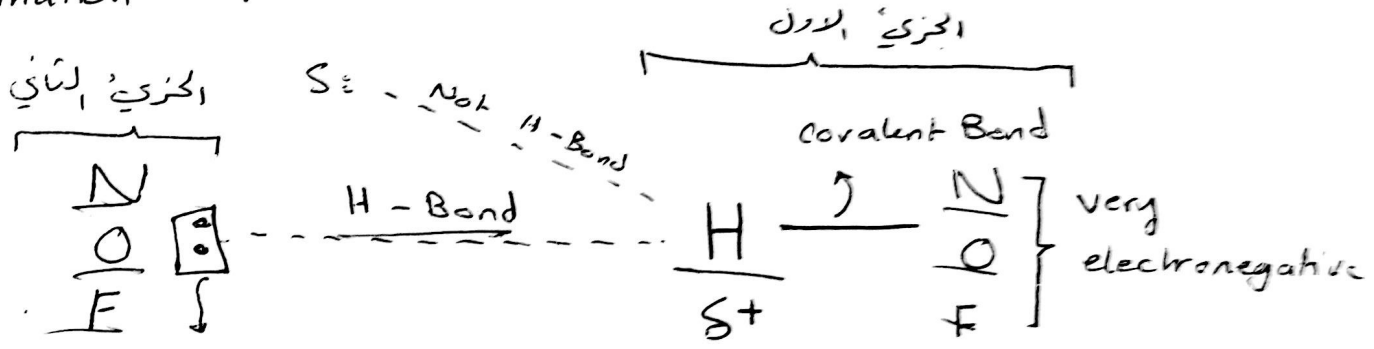
Strong = short

Bonds الروابط الجزيئية

→ Not Covalent

→ Special type of Dipole-Dipole interaction

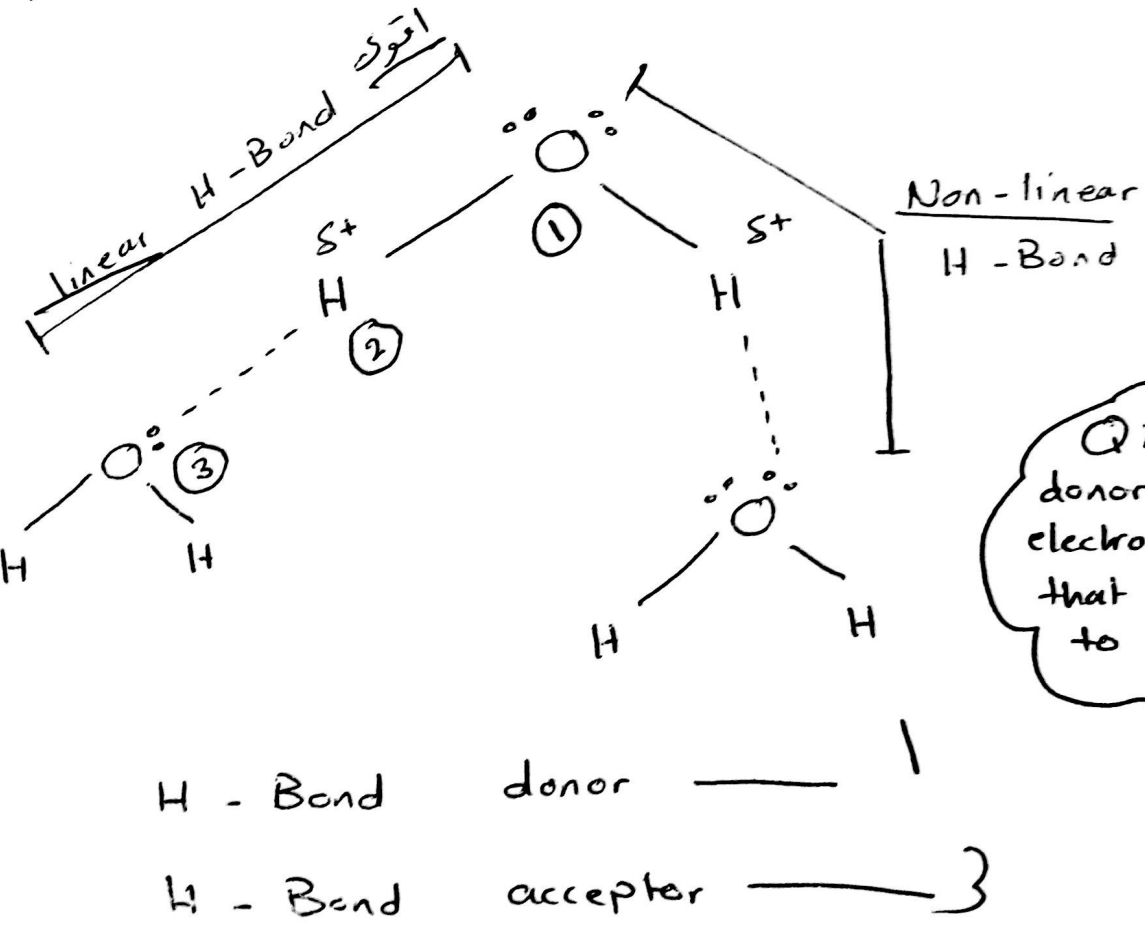
Formation of H-Bonds



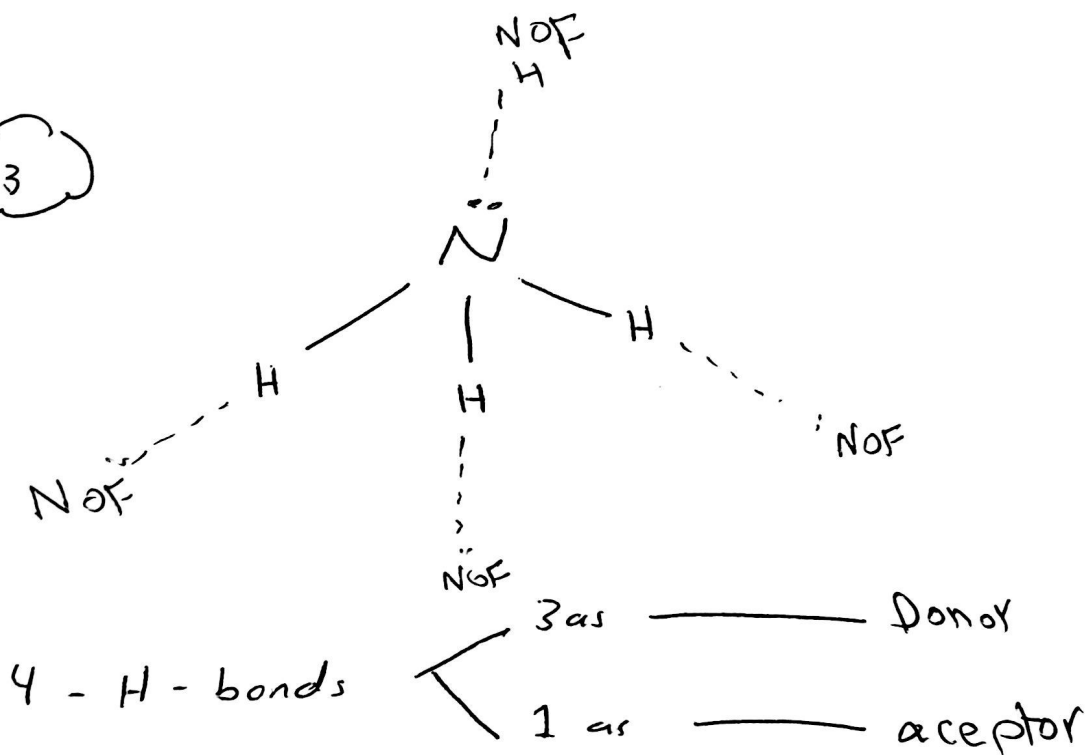
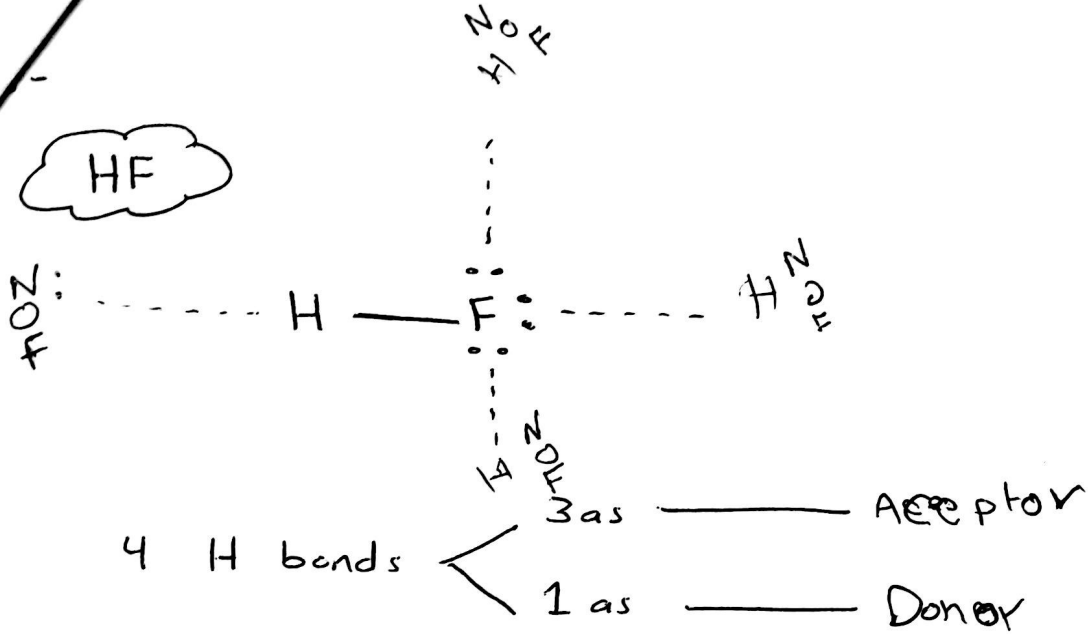
Unshared e^-
 H-bond مستقبل acceptor
 (مائل \therefore)

مكونة الرابطة
 المبروزة

H-bond مصدر donor
 (مائل \therefore)

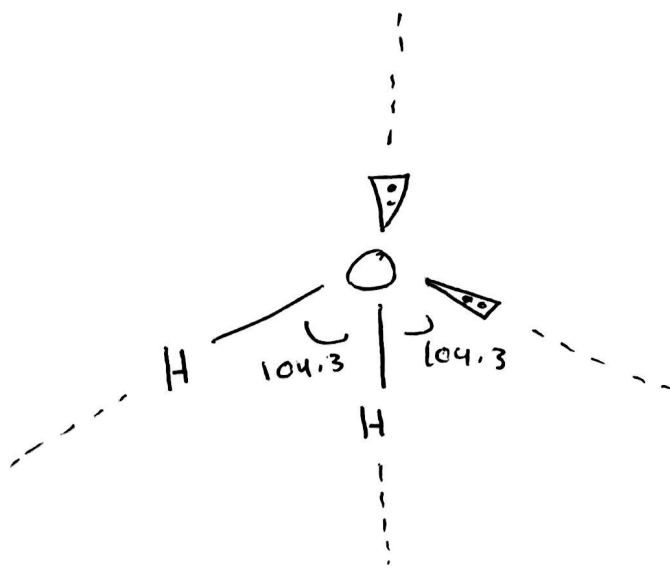


Q:- Hydrogen-bond donor is the high electronegative atom that covalently bonded to Hydrogen
True False



of Hydrogen Bond donor = # of H

of Hydrogen Bond acceptor = # of ..



4 - H-bonds $\begin{cases} 2 \text{ as donor} \\ 2 \text{ as acceptor} \end{cases}$

* The most optimum ^{افضل} Situation ^{حرف} for H-bonds in Water

← اقوى لبروانه افضل و احسن بين هيدرات الهل

Q: XH_6 , X is very electronegative atom and has one pair of unshared electrons

a. How many H-bonds this compound can form?

7

b. How many H-bond acceptor XH_6 has?

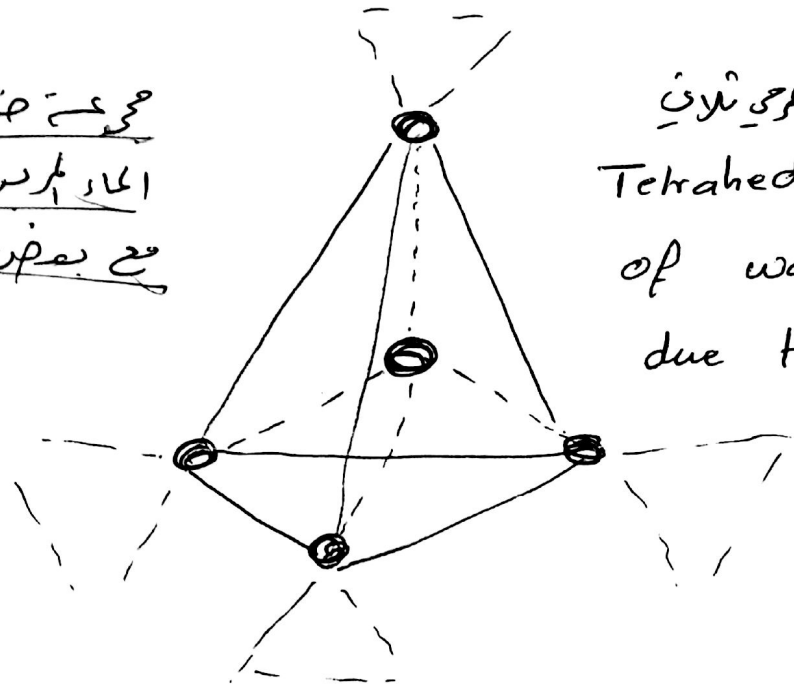


1 acceptor

6 donor

بندھوں میں خاصہ خاصہ خصوصیات
 Bonds in water give special characteristics

array: مجموعۂ جزئیات
الکوارٹریٹر
 مع بعض خصوصیات



مجموعۂ جزئیات
 Tetrahedral Structure
 of water molecules
 due to H-bond

- ① High melting point
- ② High boiling point

درجہ انجماد، عالیہ
 درجہ ابلیق، عالیہ

Substance	Molecular Weight	Melting Point (°C)	Boiling Point (°C)
Water (H ₂ O)	18.02	0.0	100.0
Ammonia (NH ₃)	17.03	-77.7	-33.4
Methane (CH ₄)	16.04	-182.5	-161.5

bonds in
Liquid water

H-bonds in ice
بلورات الجليد Crystals

array 100 molecules

array millions

H-bonds break and
reform continuously

Stable H-bonds

مدة حياة الروابط الهيدروجينية
في الماء السائل

لا تتغير

$10^{-10} - 10^{-11}$ sec

Less Extensive

more extensive.

"2.3" كدها اقل

"4"

But : water molecules

But : water molecules

are more packed
مترابطة اكثر

are less packed
مترابطة اقل

No empty spaces
لا فراغات

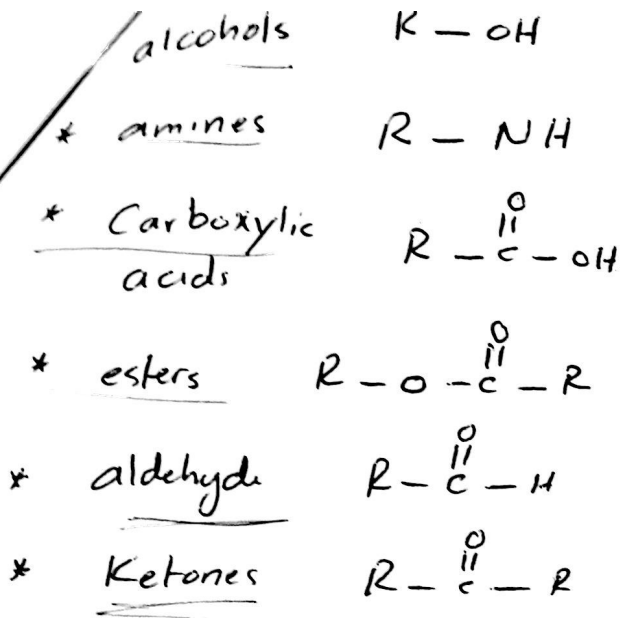
alot of empty spaces

Higher density كثافة اقل

lower density كثافة اقل
للجليد

lower size حجم اقل

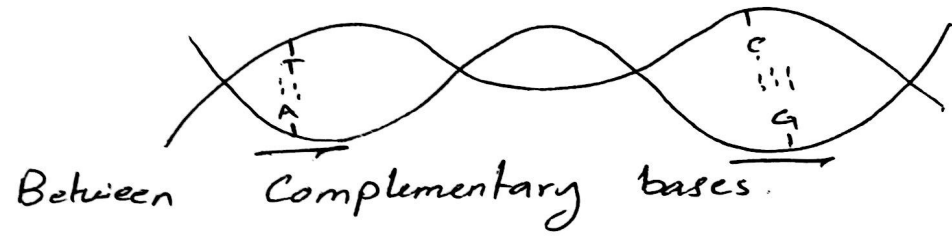
Larger size حجم اكبر



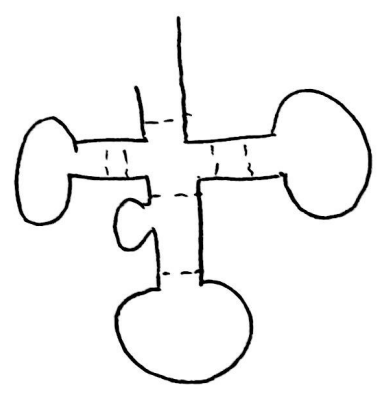
Can make
H-bonds with
water
 ↓
Dissolve.

Biological important H-bonds

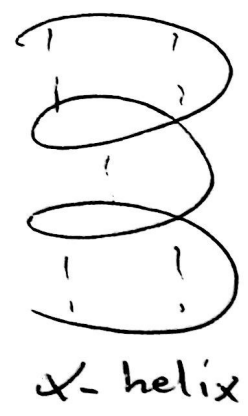
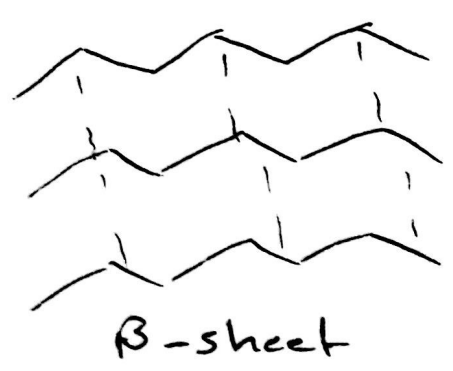
- DNA



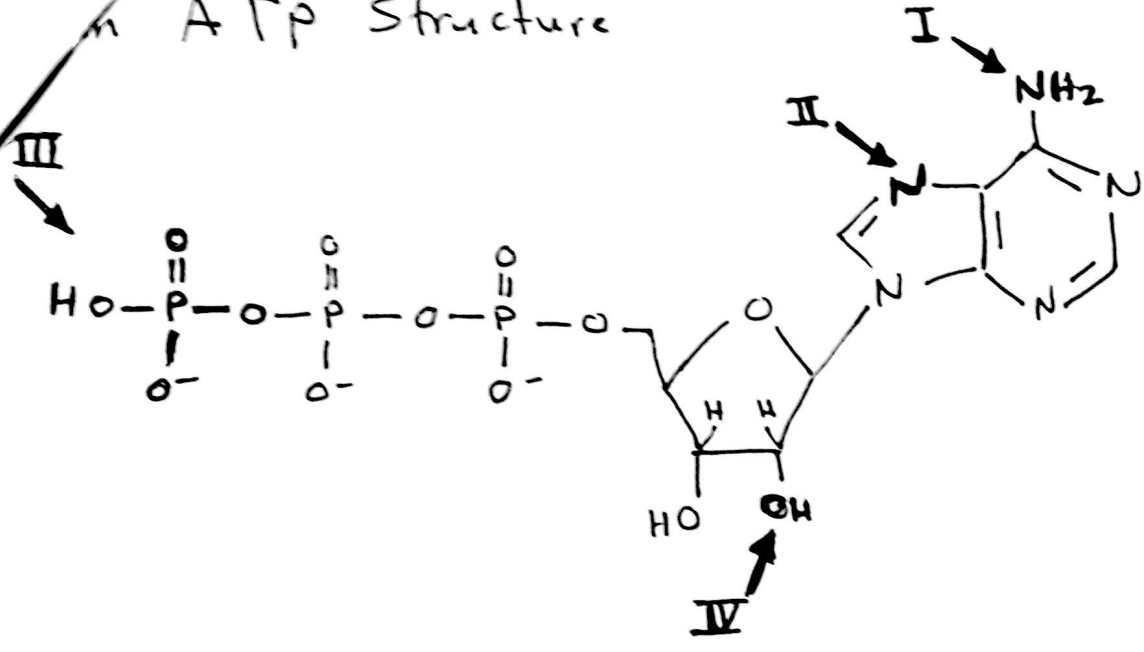
- RNA : tRNA



- Structure of proteins



ATP Structure



Q: which of the following functional groups cannot function as hydrogen donor to water?

- A. I
- B. II
- C. III
- D. IV
- E. all can donate a hydrogen to water

Q:- which of the following groups can not act as a proton acceptor in a hydrogen bond

- A. I
- B. II
- C. III
- D. IV
- E. all can accept a hydrogen in a hydrogen bond.

which of the following statements about H-bond

False:-

- A. The Donor is a hydrogen atom bonded to less electronegative atom
- B. the more linear the bond, the stronger the attraction
- C. the acceptor must contain a non-bonded pair of electrons
- D. It's a type of non-covalent bonds.

Q: which of the following characteristics makes for a good hydrogen bond donor:-

- A. high electronegativity
- x B. non bonding pair of electron ~~also~~
- C. both
- D. Neither

Q: Hydrogen bonds can only form when hydrogen atom is involved in polar bond

- A. True
- B. False