Chapitre 11 - Représentations de Lewis

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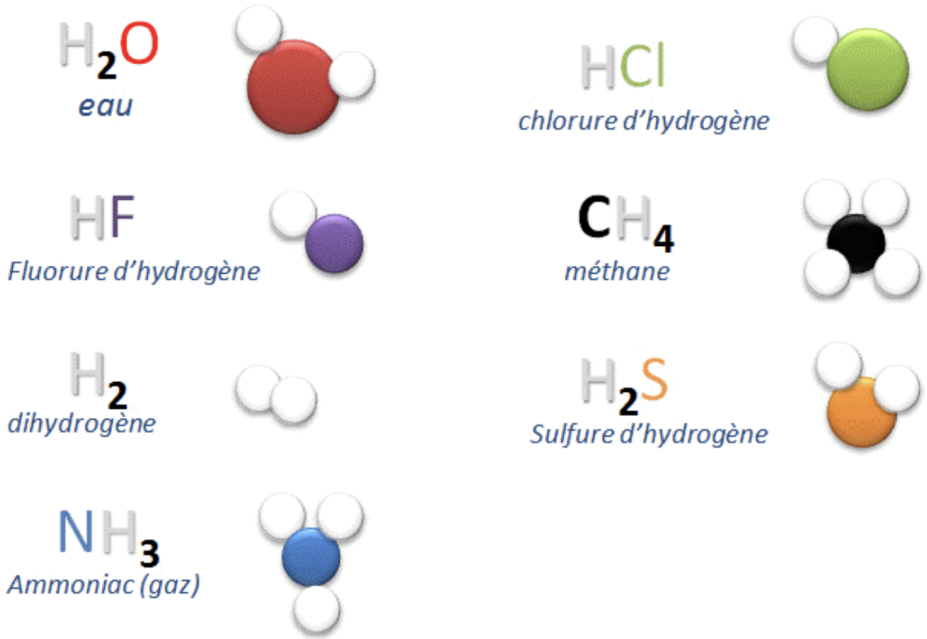
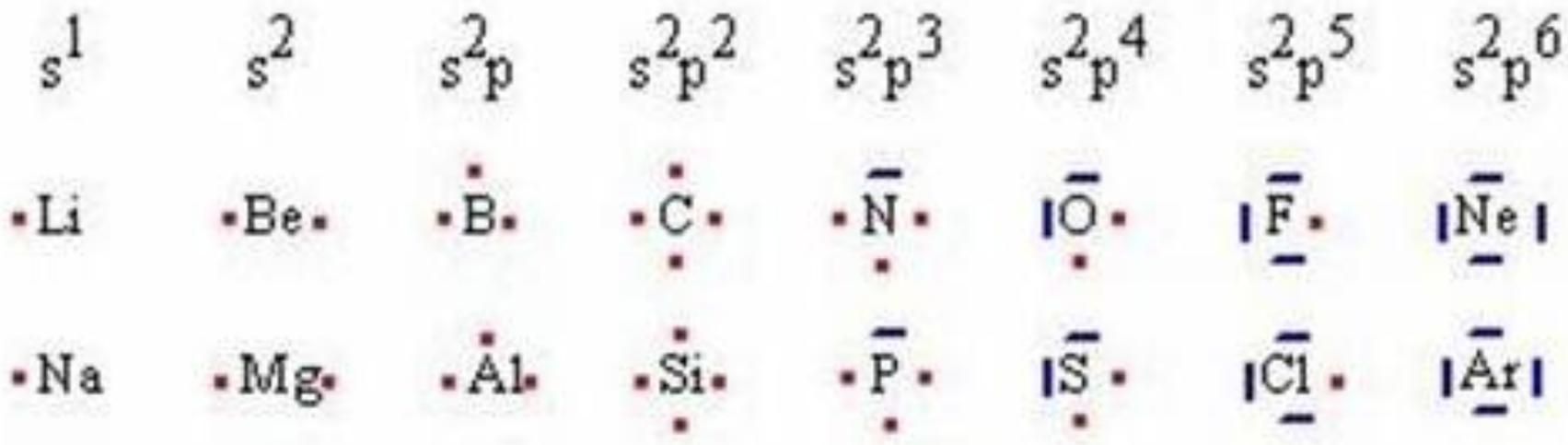
Plan

1. I - Formation de molécules
   - 1. Valence d'un atome
   - 2. Représentations
   - 3. Représentation de Lewis
2. II - Molécules polaires
3. III - Interactions intermoléculaires

- Définition et exemples
- $_{6}C$, $_{7}N$, $_{8}O$, $_{11}Na$, $_{17}Cl$



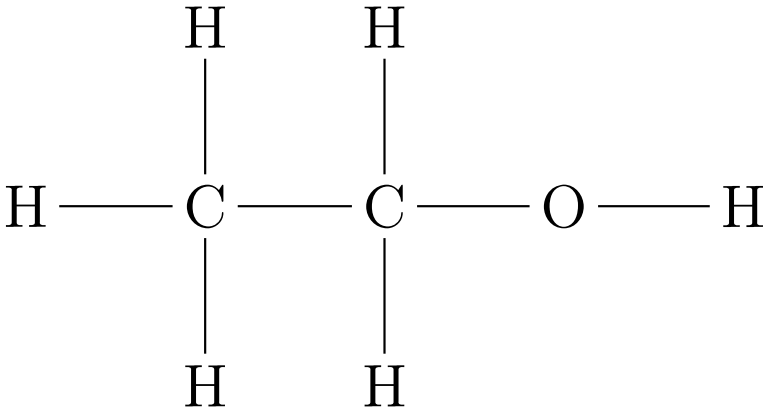
- Symboles de Lewis



- Formule brute

$$C_2H_6O$$

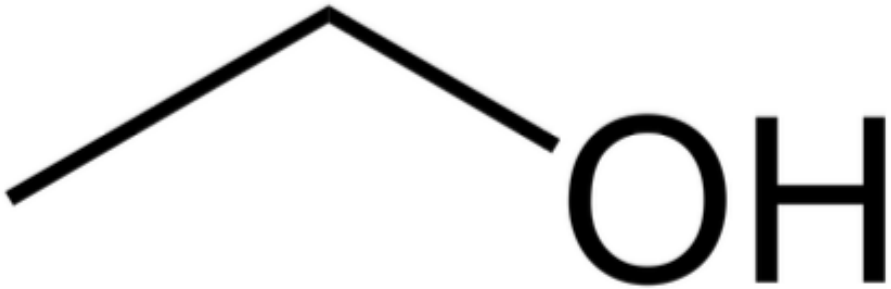
- Formule développée



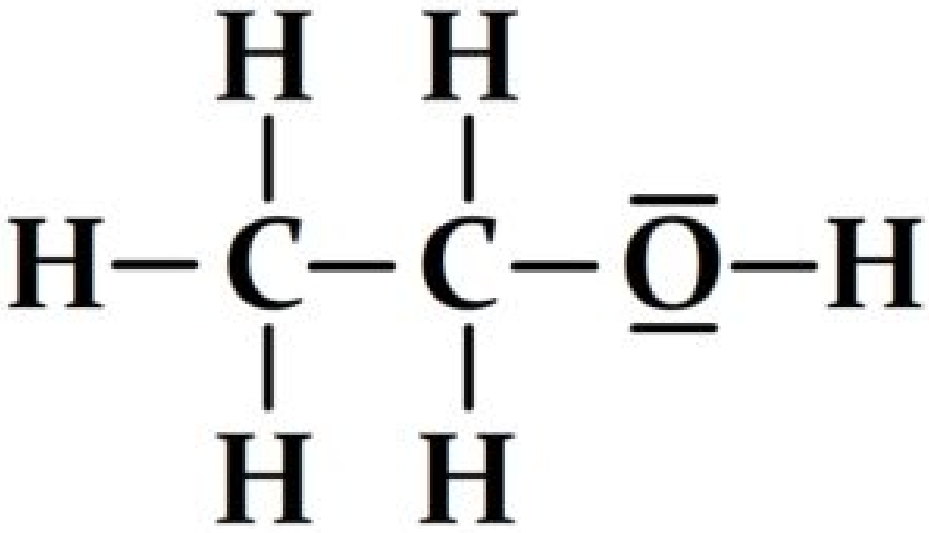
- Formule semi-développée

$$CH_3-CH_2-OH$$

- Formule topologique



- Formule de Lewis



- CH_4
  - Brouillon
  - Règle de l'octet
  - Charges formelles

- H_2O
  - Brouillon
  - Règle de l'octet
  - Charges formelles

- CO_2
  - Brouillon
  - Règle de l'octet
  - Charges formelles

- O_2
  - Brouillon
  - Règle de l'octet
  - Charges formelles

- N_2
  - Brouillon
  - Règle de l'octet
  - Charges formelles

- NH_3
  - Brouillon
  - Règle de l'octet
  - Charges formelles

- $NH_4{}^+$
  - Brouillon
  - Règle de l'octet
  - Charges formelles

- H_3O^+
  - Brouillon
  - Règle de l'octet
  - Charges formelles

- HO^-
  - Brouillon
  - Règle de l'octet
  - Charges formelles

- NO_3^-
  - Brouillon
  - Règle de l'octet
  - Charges formelles

- $SO_4{}^{2-}$
  - Brouillon
  - Règle de l'octet
  - Charges formelles

TD

- **134** : formules de Lewis

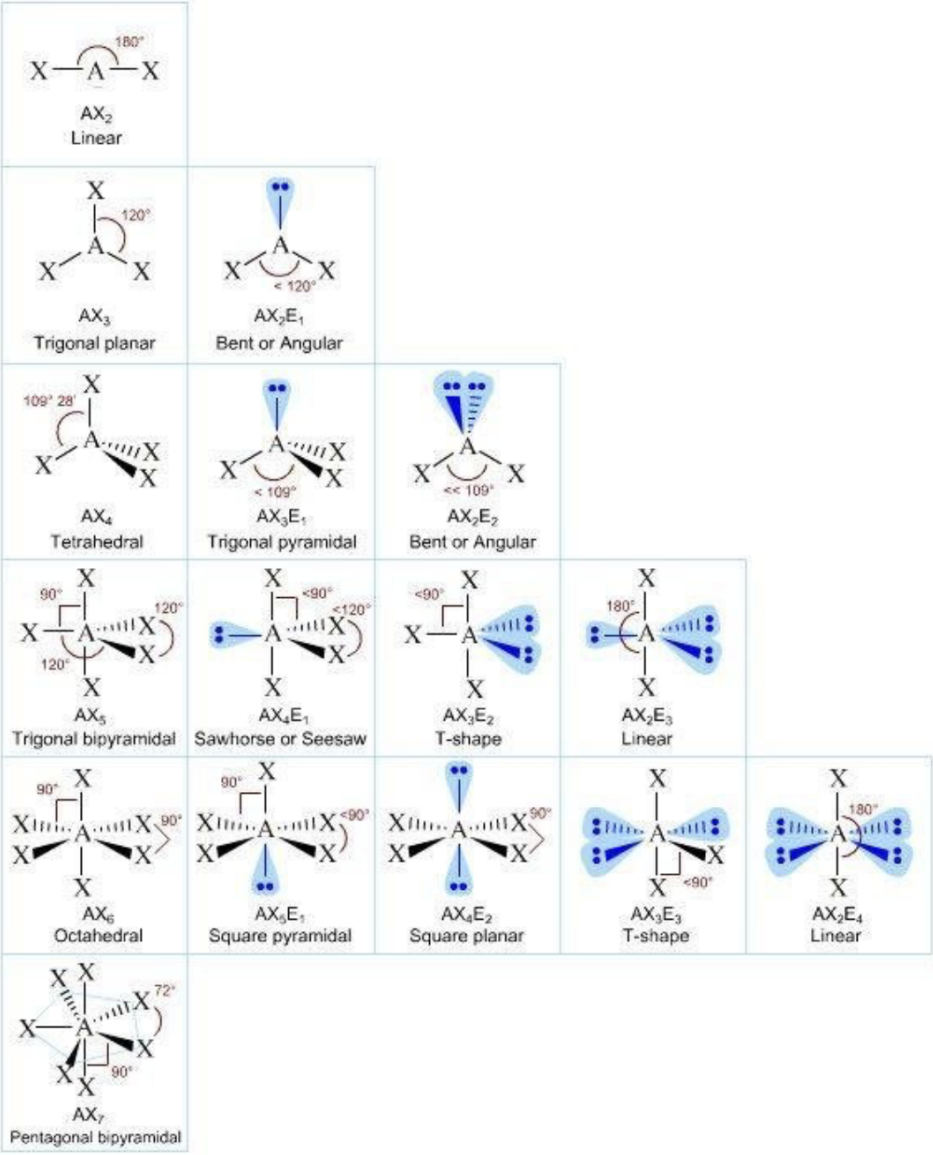
Plan

1. I - Formation de molécules
2. II - Molécules polaires
   - 1. Théorie VSEPR
   - 2. Liaison polarisée
   - 3. Moment dipolaire
   - 4. Moléculaire polaire ou apolaire
3. III - Interactions intermoléculaires

Exemples

- CO_2
- SO_3
- CH_4
- NH_3
- H_2O

https://phet.colorado.edu/sims/html/molecule-shapes/latest/molecule-shapes_fr.html



- Rappel

Periodic Table of the Elements

Electronegativity

http://chemistry.about.com
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About Chemistry

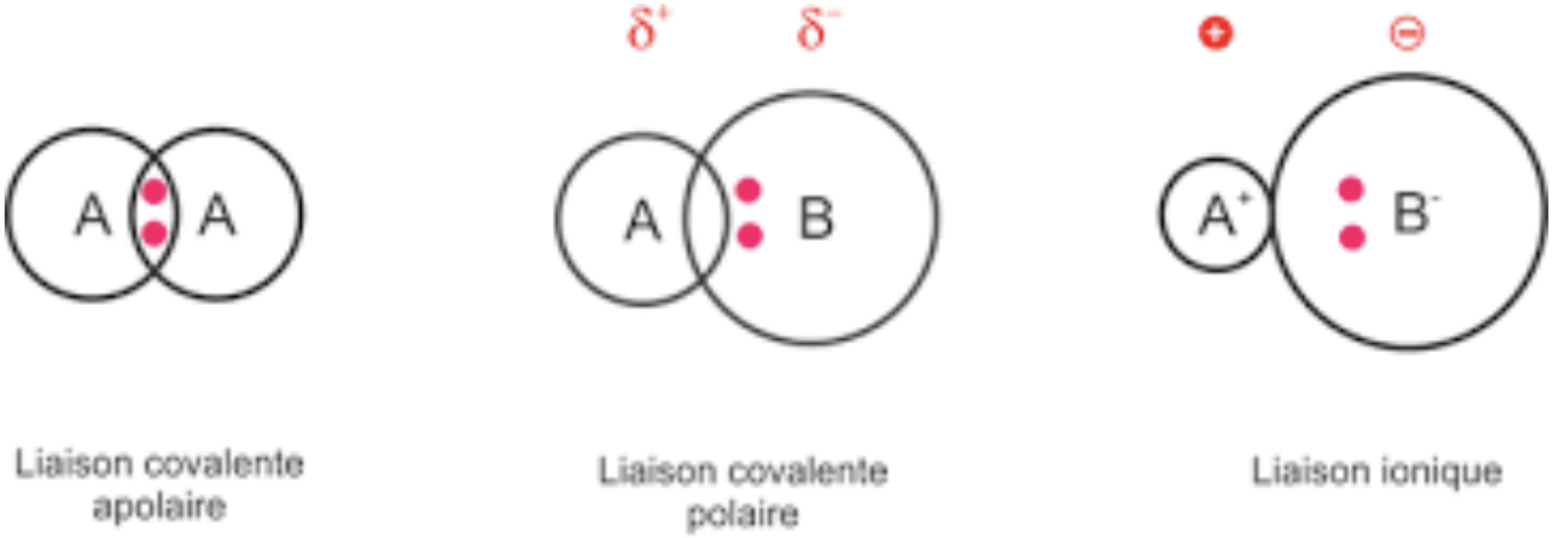
1.0 1.3 1.6 1.9 2.2 2.5 2.8 3.1

1A	2A	3B	4B	5B	6B	7B	8B			1B	2B	3A	4A	5A	6A	7A	8A
1 H 2.20																	2 He no data
3 Li 0.98	4 Be 1.57											5 B 2.04	6 C 2.55	7 N 3.04	8 O 3.44	9 F 3.98	10 Ne no data
11 Na 0.93	12 Mg 1.31											13 Al 1.61	14 Si 1.90	15 P 2.19	16 S 2.58	17 Cl 3.16	18 Ar no data
19 K 0.82	20 Ca 1.00	21 Sc 1.36	22 Ti 1.54	23 V 1.63	24 Cr 1.66	25 Mn 1.55	26 Fe 1.83	27 Co 1.88	28 Ni 1.91	29 Cu 1.90	30 Zn 1.65	31 Ga 1.81	32 Ge 2.01	33 As 2.18	34 Se 2.55	35 Br 2.96	36 Kr 3.00
37 Rb 0.82	38 Sr 0.95	39 Y 1.22	40 Zr 1.33	41 Nb 1.6	42 Mo 2.16	43 Tc 1.9	44 Ru 2.2	45 Rh 2.28	46 Pd 2.20	47 Ag 1.93	48 Cd 1.69	49 In 1.78	50 Sn 1.96	51 Sb 2.05	52 Te 2.1	53 I 2.66	54 Xe 2.6
55 Cs 0.79	56 Ba 0.89	57-71 Lanthanides	72 Hf 1.3	73 Ta 1.5	74 W 2.36	75 Re 1.9	76 Os 2.2	77 Ir 2.20	78 Pt 2.28	79 Au 2.54	80 Hg 2.00	81 Tl 1.62	82 Pb 2.33	83 Bi 2.02	84 Po 2.0	85 At 2.2	86 Rn no data
87 Fr 0.7	88 Ra 0.89	89-103 Actinides															

*** Elements > 104 exist only for very short half-lifes and the data is unknown.***

Lanthanides	57 La 1.10	58 Ce 1.12	59 Pr 1.13	60 Nd 1.14	61 Pm 1.13	62 Sm 1.17	63 Eu 1.2	64 Gd 1.2	65 Tb 1.2	66 Dy 1.22	67 Ho 1.23	68 Er 1.24	69 Tm 1.25	70 Yb 1.1	71 Lu 1.27
Actinides	89 Ac 1.1	90 Th 1.3	91 Pa 1.5	92 U 1.38	93 Np 1.36	94 Pu 1.28	95 Am 1.3	96 Cm 1.3	97 Bk 1.3	98 Cf 1.3	99 Es 1.3	100 Fm 1.3	101 Md 1.3	102 No 1.3	103 Lr no data

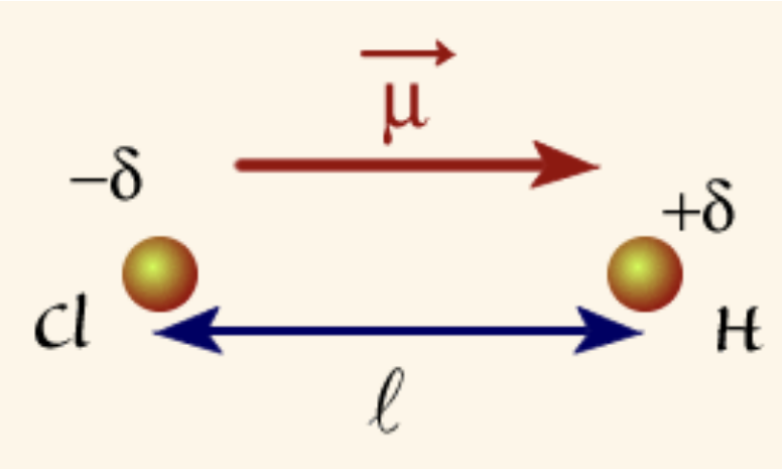
- Différents cas



Exemples :

- HCl
- O_2
- CO_2
- H_2O

- Définition



Exemples :

- HCl
- O_2
- CO_2
- H_2O
- NH_3

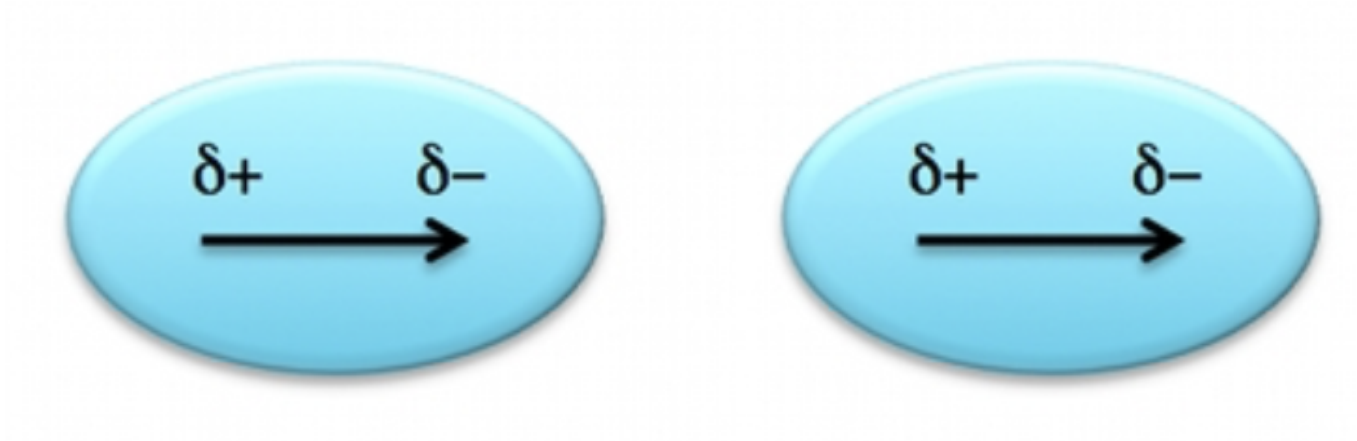
TD

- **135** : l'élément chlore

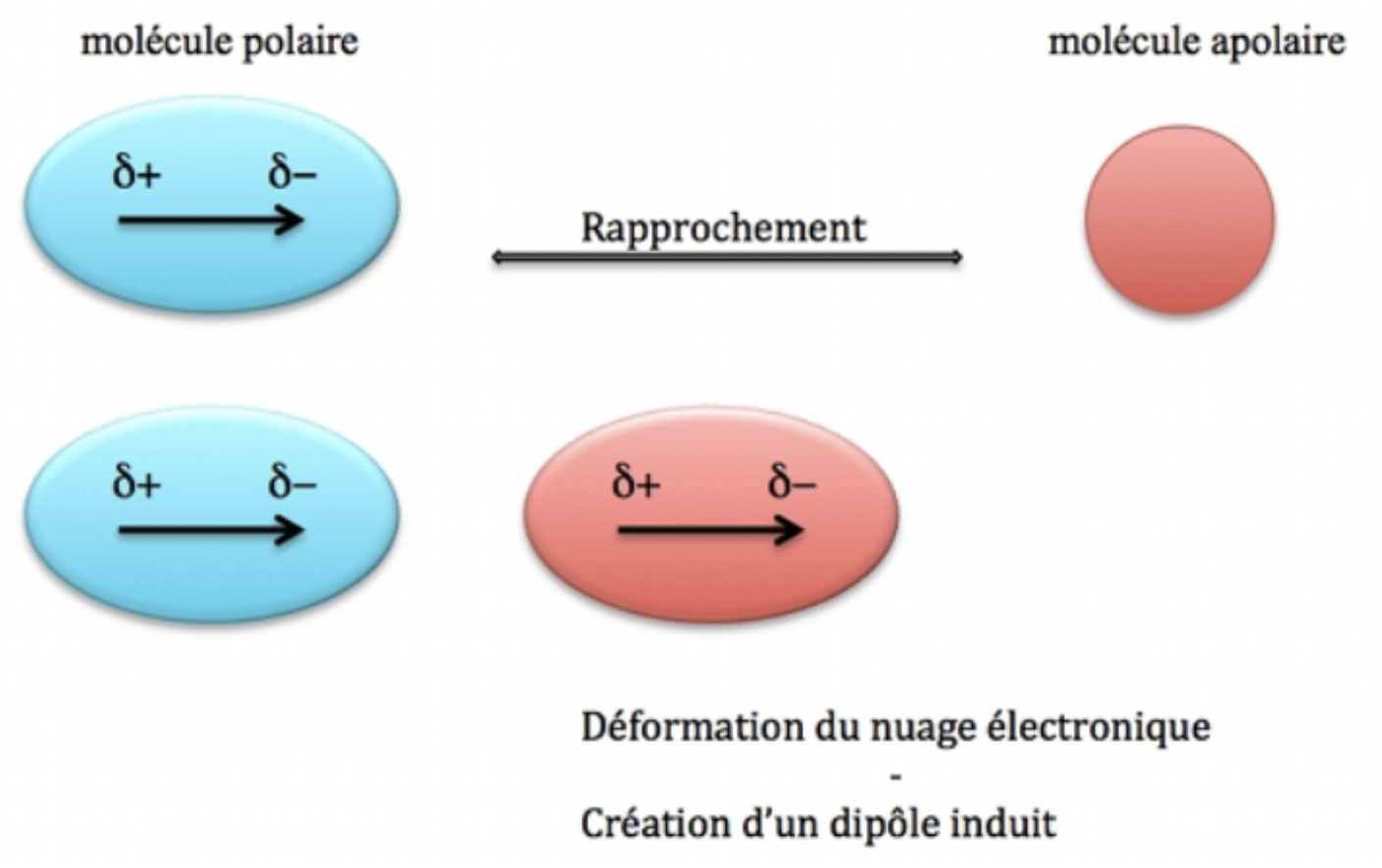
Plan

1. I - Formation de molécules
2. II - Molécules polaires
3. III - Interactions intermoléculaires
   - 1. Liaisons de Van der Waals
   - 2. Liaison hydrogène
   - 3. Ordres de grandeurs
   - 4. Propriétés physiques
   - 5. Solvants

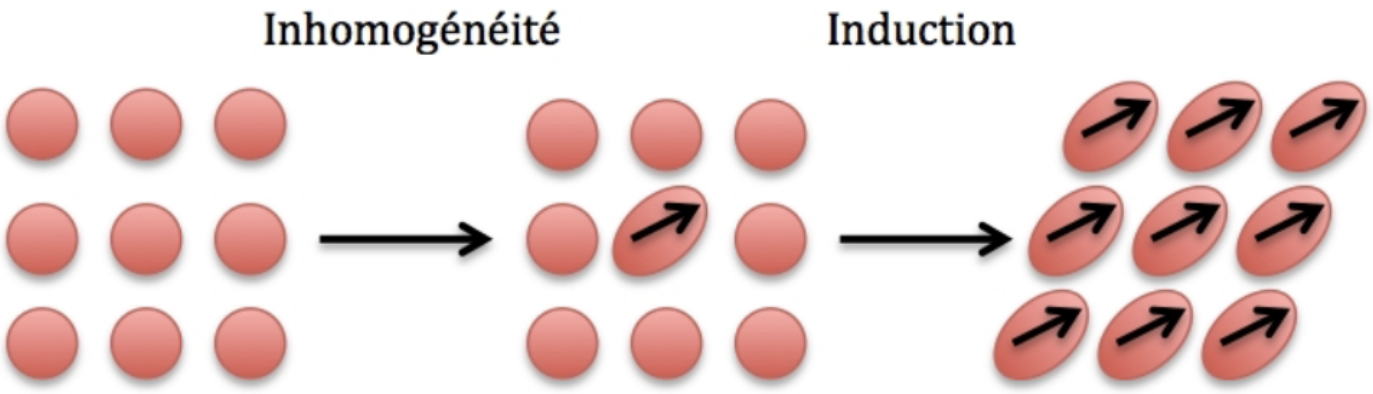
- Keesom

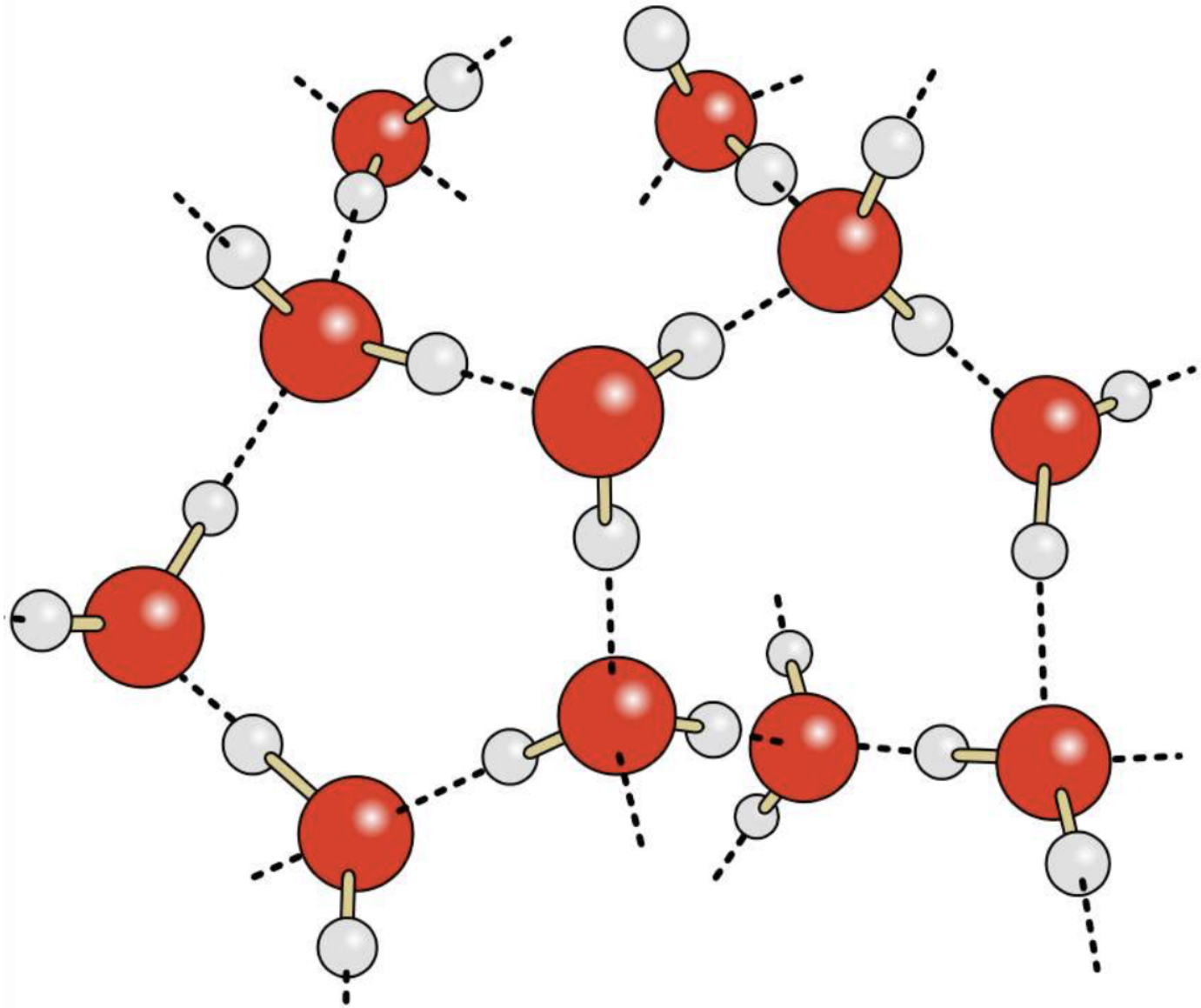


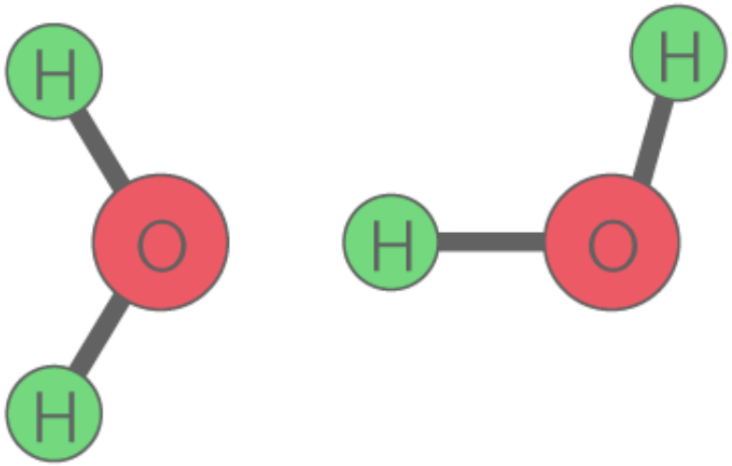
- Debye

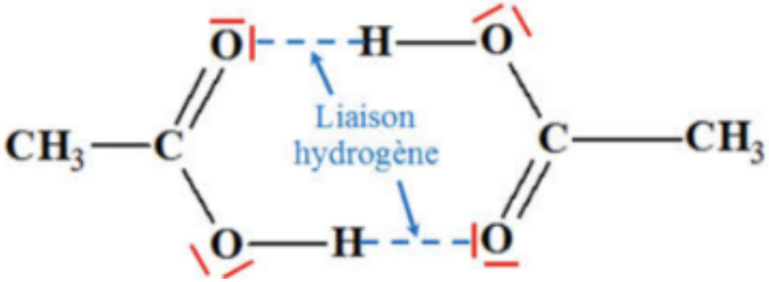

molécule polaire
molécule apolaire
δ+
δ−
Rapprochement
δ+
δ−
δ+
δ−
Déformation du nuage électronique
-
Création d'un dipôle induit

- London



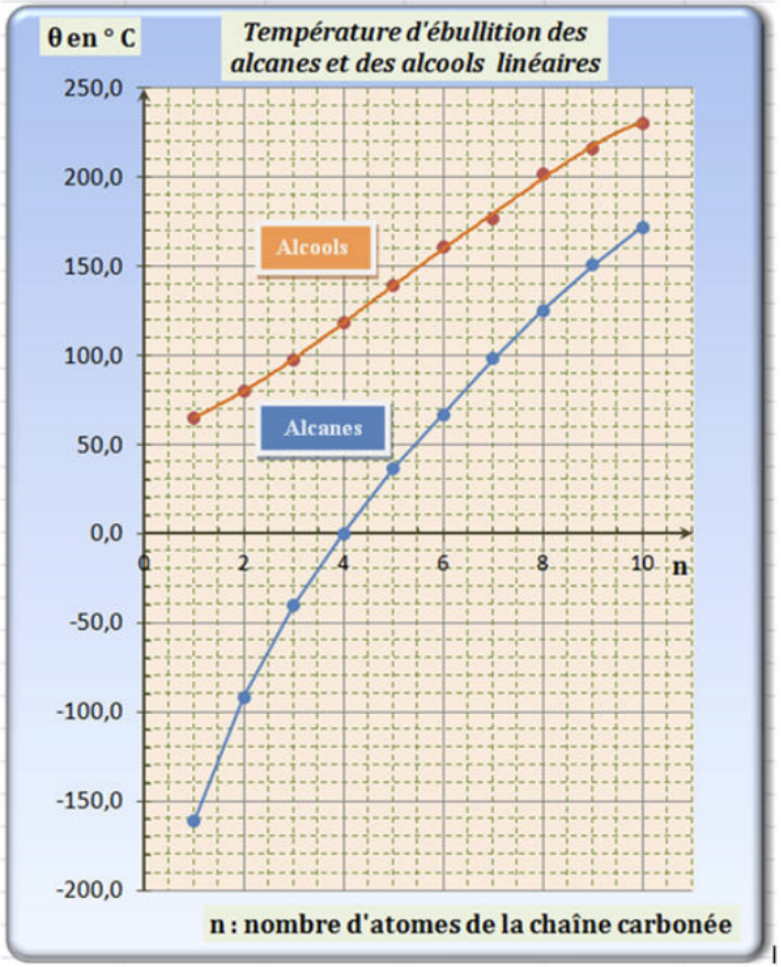



H
O
H
H
H
O


O
H
O
CH3
C
Liaison
hydrogène
C
CH3
O
H
O

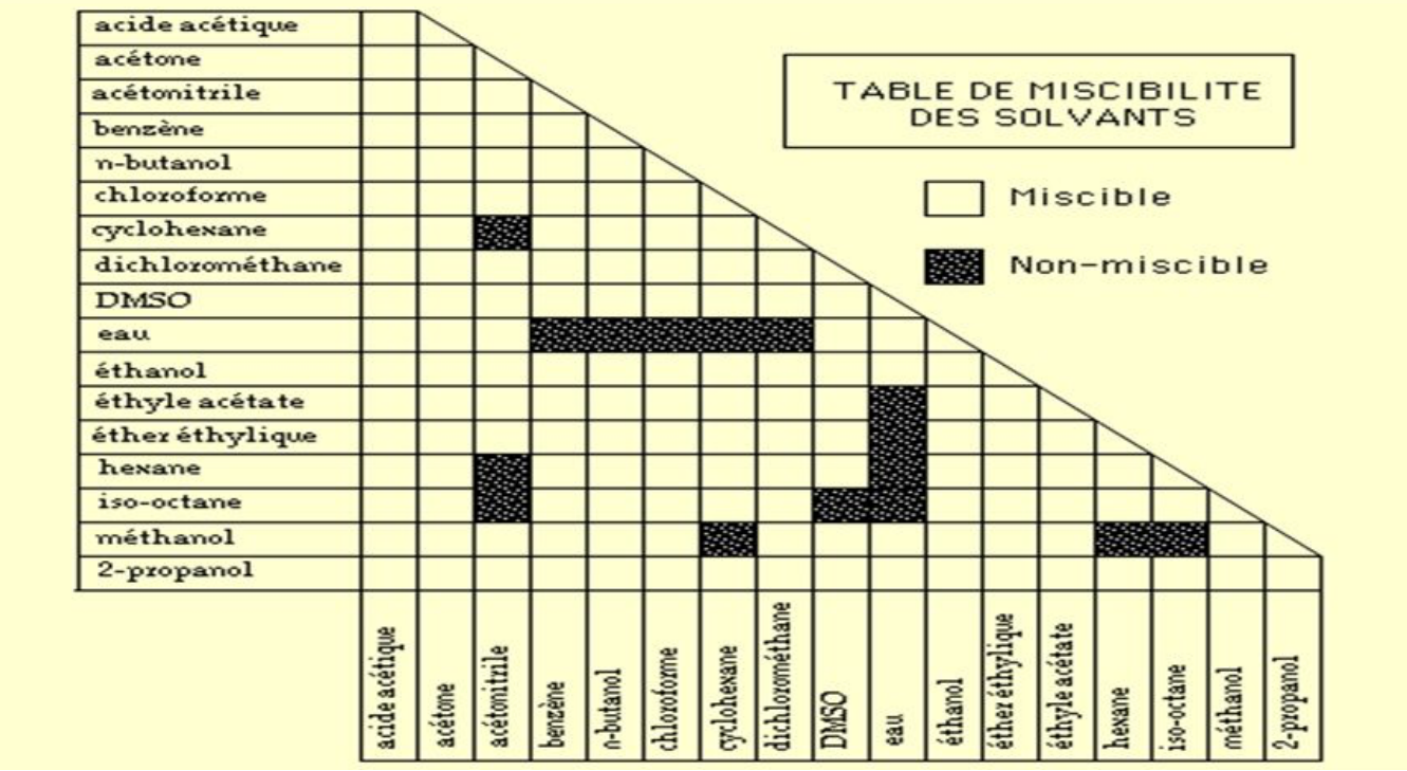
- Liaison de Van der Waals : kJ/mol
- Liaison hydrogène : 10 kJ/mol
- Liaison covalente : 100 kJ/mol
- Liaison nucléaire : 1 à 10 GJ/mol

- Évolution de la température d'ébullition



Alcane	Température d'ébullition (°C)
CH_4	-164
CH_3CH_3	-89
$CH_3CH_2CH_3$	-42
$CH_3CH_2CH_2CH_3$	-0,5
$CH_3CH_2CH_2CH_2CH_3$	36
$CH_3CH_2CH_2CH_2CH_2CH_3$	69
$CH_3CH_2CH_2CH_2CH_2CH_2CH_3$	98
$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	125
$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	151

- Miscibilité



- Solubilité

SOLUBILITY OF THE ACIDS, HYDROOXIDES AND SALTS IN WATER

P soluble — H insoluble — M less soluble — – do not exist or dissolve in water

anions \ cations	H^+	Li^+	K^+	Na^+	NH_4^+	Ba^{2+}	Ca^{2+}	Mg^{2+}	AL^{3+}	Cr^{3+}	Fe^{2+}	Fe^{3+}	Ni^{2+}	Co^{2+}	Mn^{2+}	Zn^{2+}	Ag^+	Hg^{2+}	Rb^{2+}	Sn^{2+}	Cu^{2+}
OH^-		P	P	P	P	P	M	H	H	H	H	H	H	H	H	H	–	–	H	H	H
F^-	P	H	P	P	P	M	H	H	P	P	M	H	H	M	M	M	P	H	H	P	H
CL^-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	H	P	M	P	P
Br^-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	H	M	M	P	P
I^-	P	P	P	P	P	P	P	P	P	P	P	–	P	P	P	P	H	H	H	M	–
S^{2-}	P	P	P	P	P	P	P	P	–	–	H	–	H	H	H	H	H	H	H	H	H
SO_3^{2-}	P	P	P	P	P	H	H	H	–	–	H	–	H	H	H	H	H	–	H	–	–
SO_4^{2-}	P	P	P	P	P	H	M	P	P	P	P	P	P	P	P	P	M	P	H	P	P
PO_4^{3-}	P	H	P	P	P	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO_3^{2-}	P	P	P	P	P	H	H	H	–	–	H	–	H	H	H	H	H	–	H	H	H
SiO_3^{2-}	H	P	P	P	–	H	H	H	H	–	H	H	–	–	H	H	–	–	H	–	H
NO_3^-	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	–	P
CH_3COO^-	P	P	P	P	P	P	P	P	M	P	P	P	P	P	P	P	P	P	P	P	P

ORDER OF RELATIVE ACTIVITY OF METALS

Li...Rb...K...Ba...Sr...Ca...Na...Mg...Al...Mn...Zn...Cr...Fe...Cd...Co...Ni...Sn...Pb...
H...Sb...Bi...Cu...Hg...Pd...Ag...Pt...Au

TD

- **136** : Lewis 1
- **137** : Lewis 2
- **138** : moments dipolaires