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(30) a) mod. polar — H (2.1) Br (2.8)

b) ionic — K (0.8) Cl (3.5)

c) mod/very polar — C (2.5) O (3.5)

d) mod./very polar — Cl (3.0) F (4.0)

e) ionic — Li (1.0) O (3.5)

f) nonpolar — Br (2.8) Br (2.8)

b) H - Cl (0.9) (4)

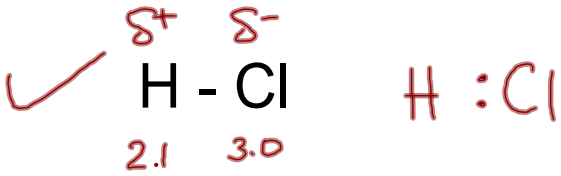
H - Br (0.7) (3)

H - S (0.4) (1)

H - C (0.4) (1)

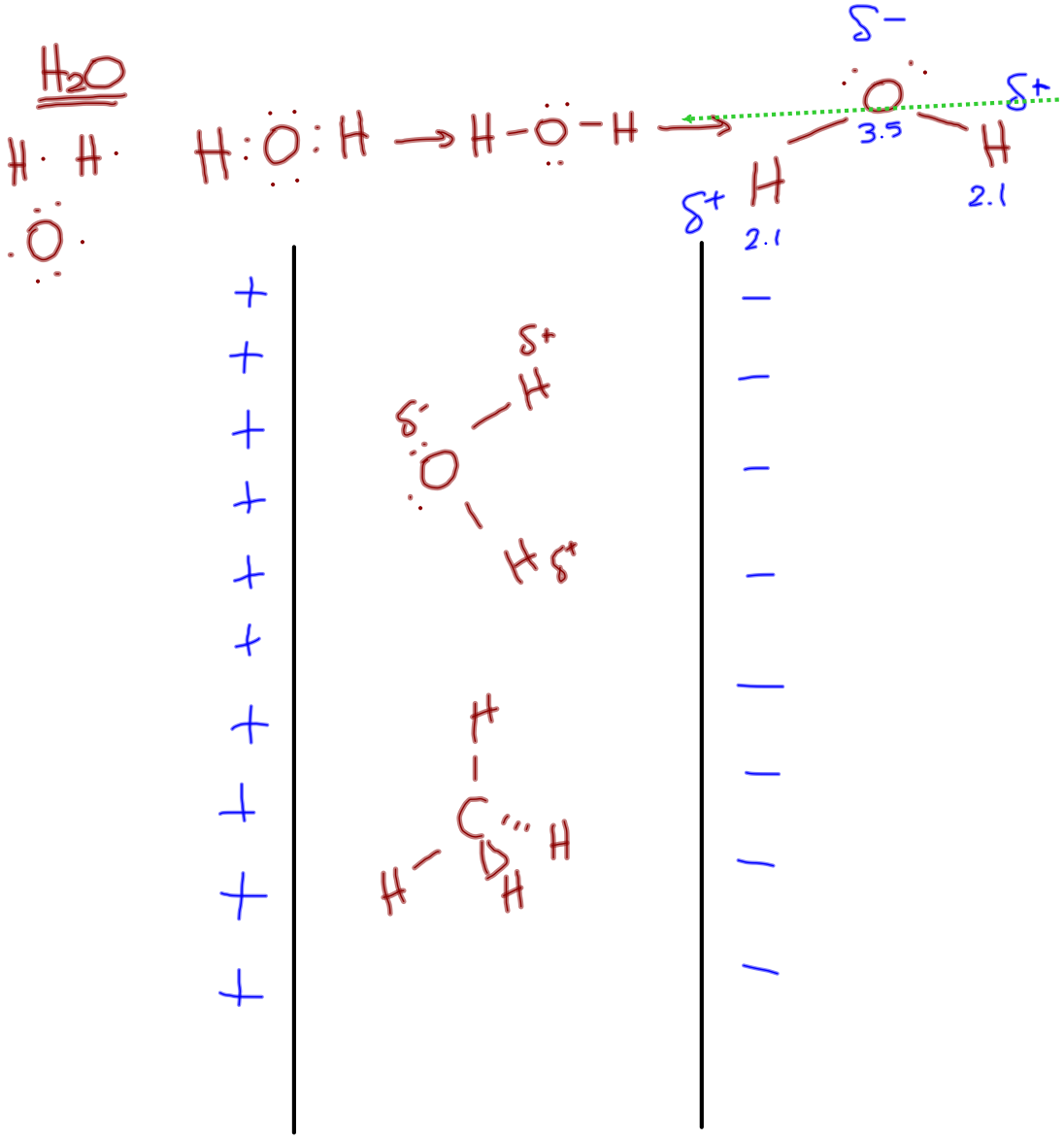
Polar Molecules

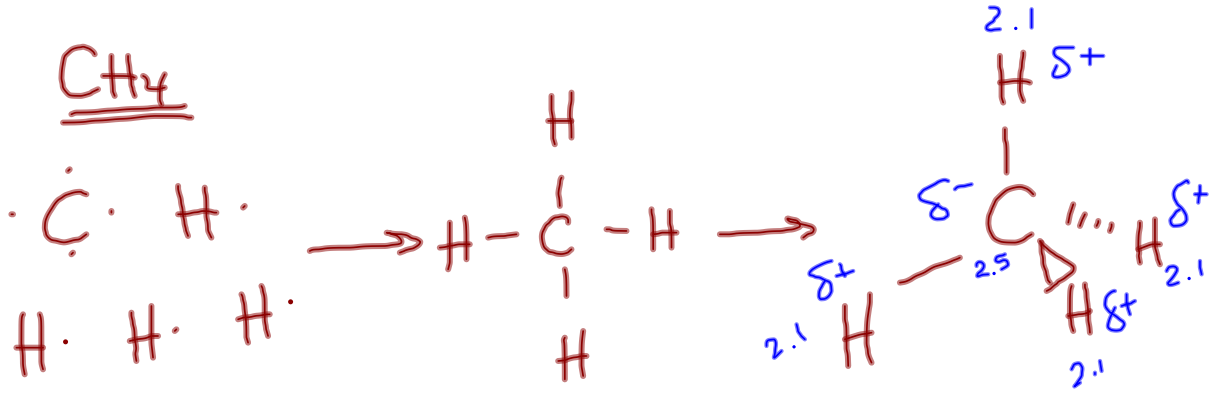
In a polar molecule, one end of the molecule is slightly negative, and the other end is slightly positive.



-Partial charges are often called charged regions or poles.

A molecule with two poles is called a dipole.




CH4
2.1
δ+
δ−
2.5
2.1
δ+
2.1
δ+
2.1

Attraction Between Molecules

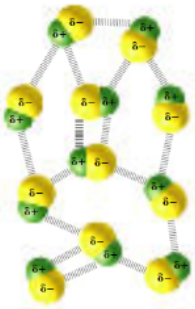
Intermolecular forces are weaker than both ionic and covalent bonds.

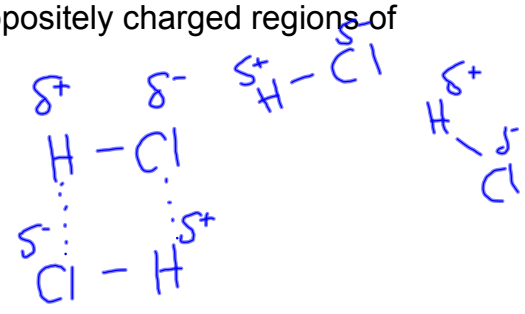
Van der Waals Forces

-Weakest attractions between molecules.
-Can be separated into two categories:

Dipole Interactions

Electrical attraction between oppositely charged regions of polar molecules.

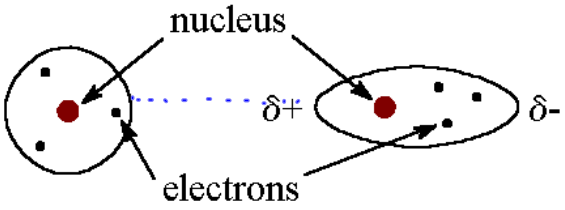




Dispersion Forces (London Dispersion Forces)

-weakest of all molecular interactions
-occur between even non-polar molecules
-caused by the motion of electrons

when moving electrons are momentarily on one side of a molecule, the electrons of the neighbouring molecule will move to the opposite side, causing a weak attraction.



1 2

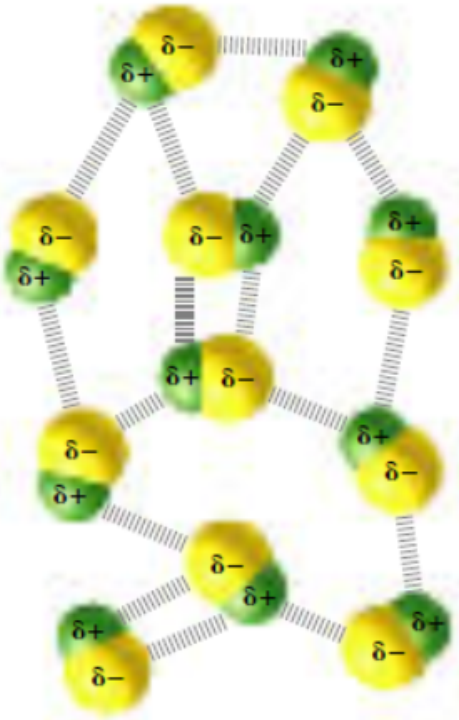
Na^+ Cl^-

$1s^2 2s^2 2p^6$ $1s^2 2s^2 2p^6 3s^2 3p^6$

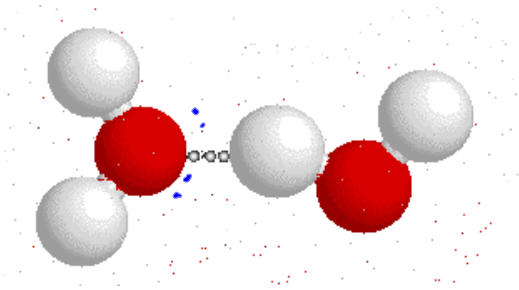
δ^+ δ^-

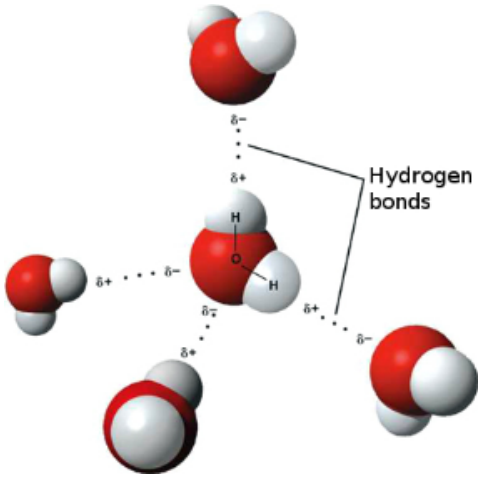
$H : Cl$

2.1 3.0


δ−
δ+
δ+
δ−
δ−
δ+
δ−
δ+
δ+
δ−
δ+
δ−
δ−
δ+
δ+
δ−
δ−
δ+
δ+
δ−

Hydrogen Bonds

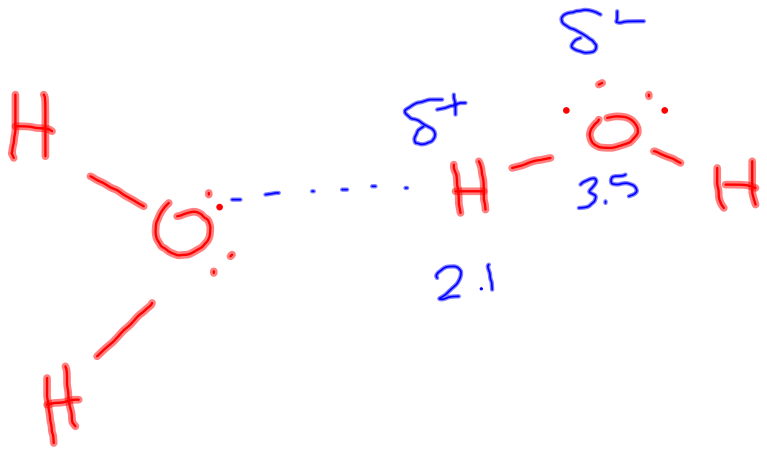


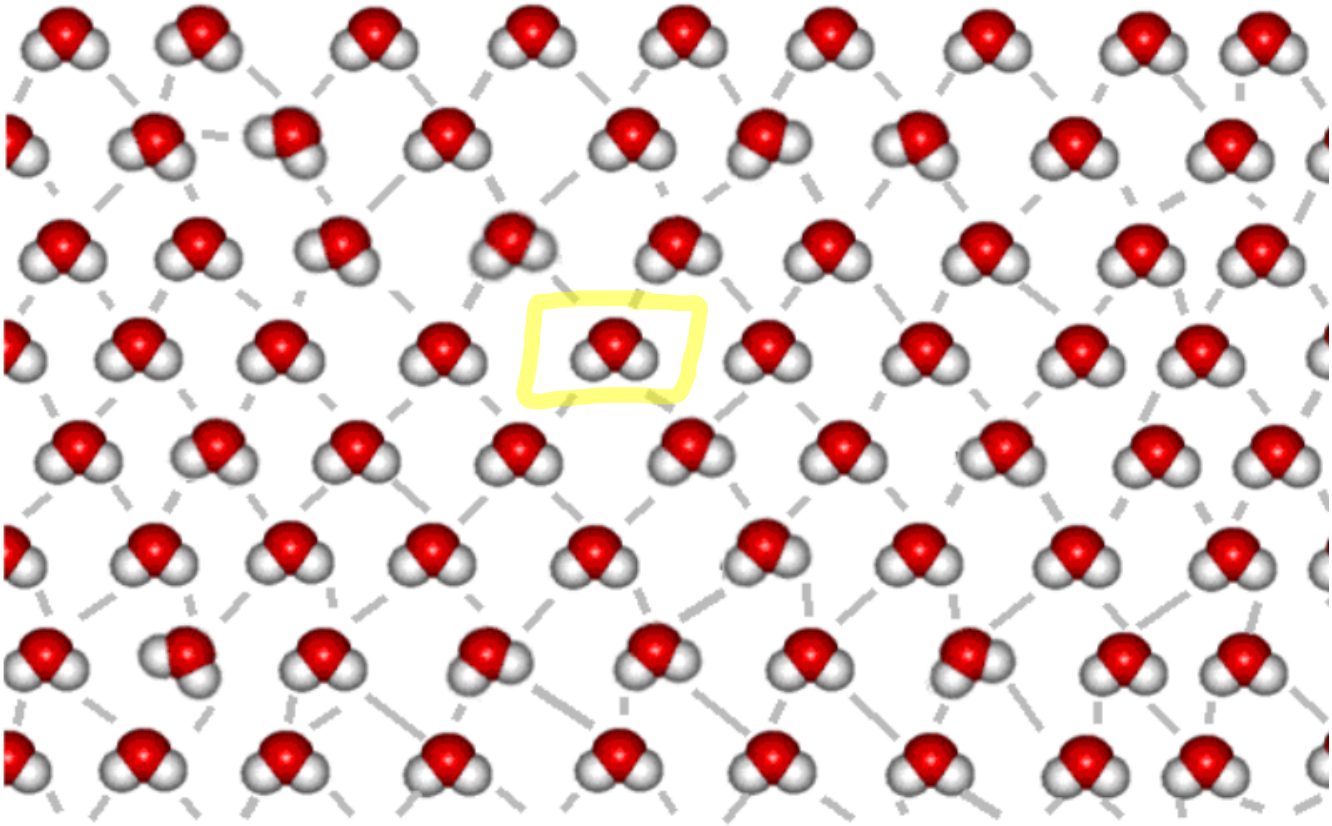


Hydrogen Bonds

Strong attractive forces in which a hydrogen covalently bonded to a very electronegative atom (O, N, F), is weakly bonded to an unshared electron pair of another electronegative atom.

- strongest intermolecular force
- not as strong as an ionic or covalent bond


δ-
δ+
H
O
H
H
O
H
3.5
2.1



Hydrogen Bonding in Water

- Hydrogen bonding causes many molecules to be attracted, meaning H_2O is very dense.

- High density results in water being a liquid at room temperature. Requires a great deal of energy to separate the particles and disrupt the attraction.

Network Solids

Strong!

solids in which all of the atoms are covalently bonded to each other

- very stable substances with very high melting and boiling points

-melting requires breaking covalent bonds throughout the solid