# Cohesion of molecular compounds

## Van der Waals interaction

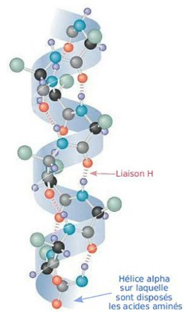
A polar molecule has localized electrical charges. It can therefore take part in interactions of an electrical nature: **Van der Waals** interactions.

For polar molecules (permanent dipoles), these interactions are called **Keesom** interactions. They are of low intensity, but are sufficient to ensure the cohesion of a solid or liquid made up of polar molecules.

Note: *Apolar molecules can also form solids or liquids. Their very fragile cohesion is ensured by the existence of instantaneous (or induced) dipoles, which are constantly being formed and destroyed. These instantaneous dipoles create very weak interactions, known as London interactions, which ensure cohesion, mainly at very low temperatures. This is the case of dry ice, for example.*
*There are also interactions between permanent and induced dipoles, known as* ***Debye*** *interactions*

## An interaction more intense than the others: the hydrogen bond

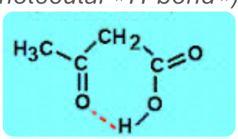
Long-chain organic molecules such as proteins and DNA have a distinctive helix structure. This folding of the molecule on itself is explained by intramolecular interactions of an electrostatic nature, like Van der Waals interactions, but much more intense.
These interactions, always involving a hydrogen atom, have long been mistaken for covalent bonds, hence the name **hydrogen bonds**.



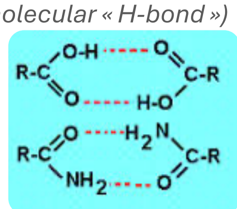

These electrical interactions also help to explain a large number of phenomena, such as certain high change-of-state temperatures (as in the case of water or ammonia) or the structure of many polymers, notably Kevlar.

Note: *The hydrogen involved in an "H-bond" is linked to a highly electronegative atom such as nitrogen, oxygen or fluorine. This hydrogen can then form a "bridge" with another highly electronegative atom (only nitrogen, oxygen or fluorine) carrying non-bonding doublets and belonging to:*

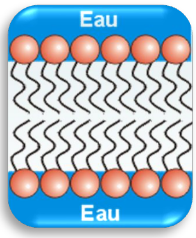
- *Either the same molecule (intramolecular « H-bond »)*



- *Either another molecule (intermolecular « H-bond »)*



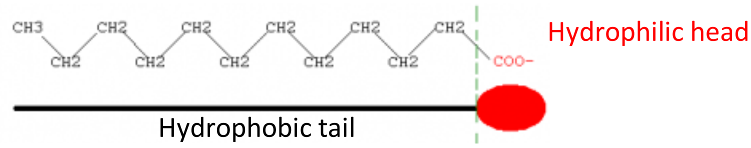
## Amphiphilic molecules



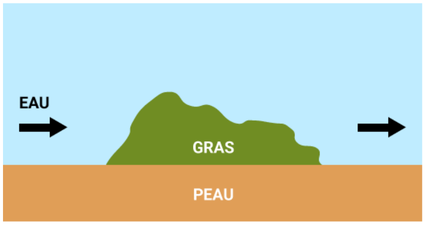

Some molecules have 2 parts with distinct features:

- One is polar, therefore hydrophilic (soluble in water) ;
- The other is non-polar, therefore hydrophobic/lipophilic (soluble in organic solvents)

These chemicals are amphiphilic.

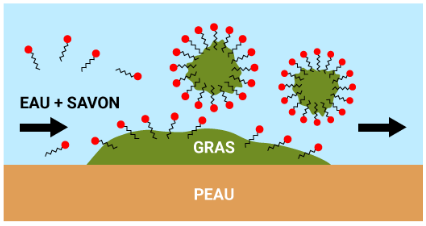



*Note: It is this amphiphilic character that explains the foaming and washing properties of soaps.*




*Sans Savon*

L'eau glisse sur le corps gras et ne s'y accroche pas ; elle ne nettoie donc pas la peau.




*Avec le Savon*

La queue hydrophobe des molécules de savon s'accroche au corps gras qui se retrouve piégé dans la micelle.
Les têtes hydrophiles s'accrochent quant à elles aux molécules d'eau, décollant la graisse de la peau et l'attirant dans l'eau.