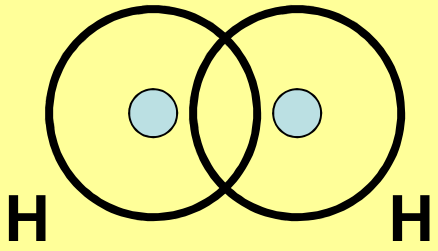
*Intra*molecular Force Summary

Bond Energies

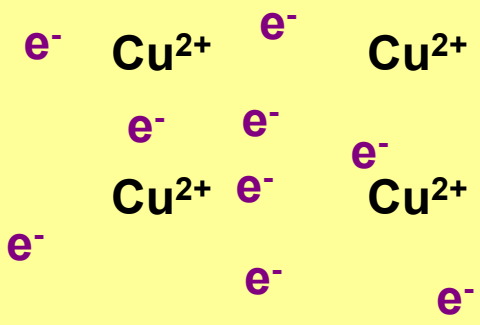
Ionic $Na^+ \rightleftarrows Cl^-$ **400 – 4000 kJ/mol**

Covalent



150 - 1110 kJ/mol

Metallic

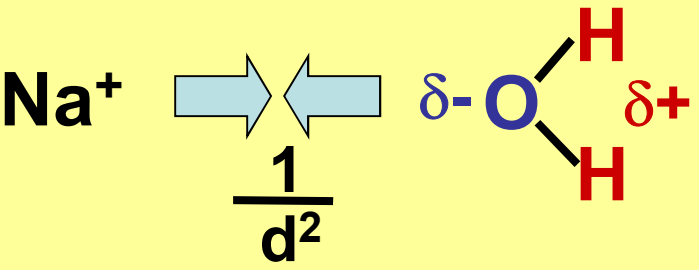


75 - 1000 kJ/mol

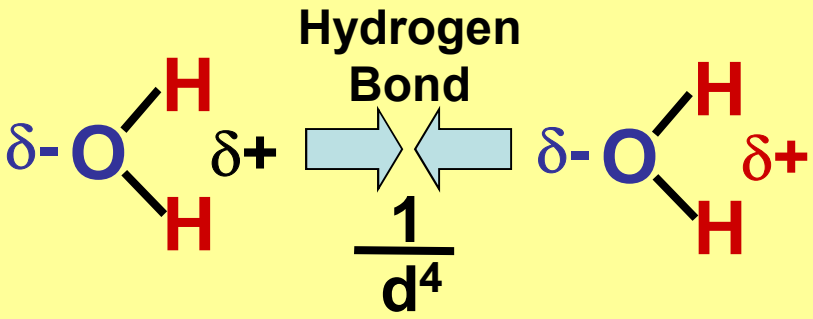
electron sea....

*Inter*molecular Force Summary

Energies

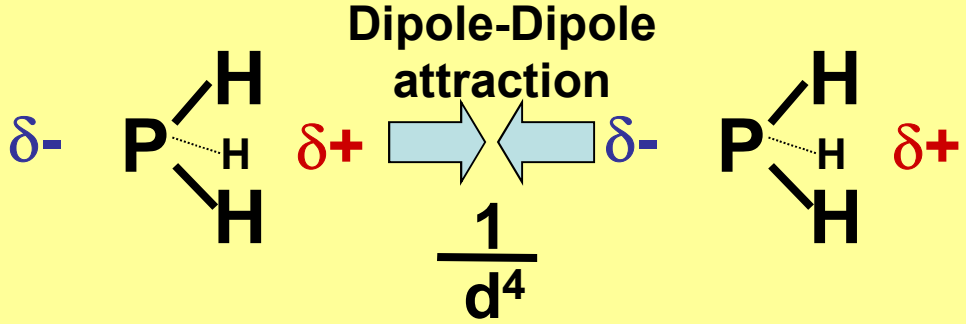
Ion-Dipole 

40 – 60 kJ/mol

Hydrogen Bond 

(O, N, F ... & H)

10 – 40 kJ/mol

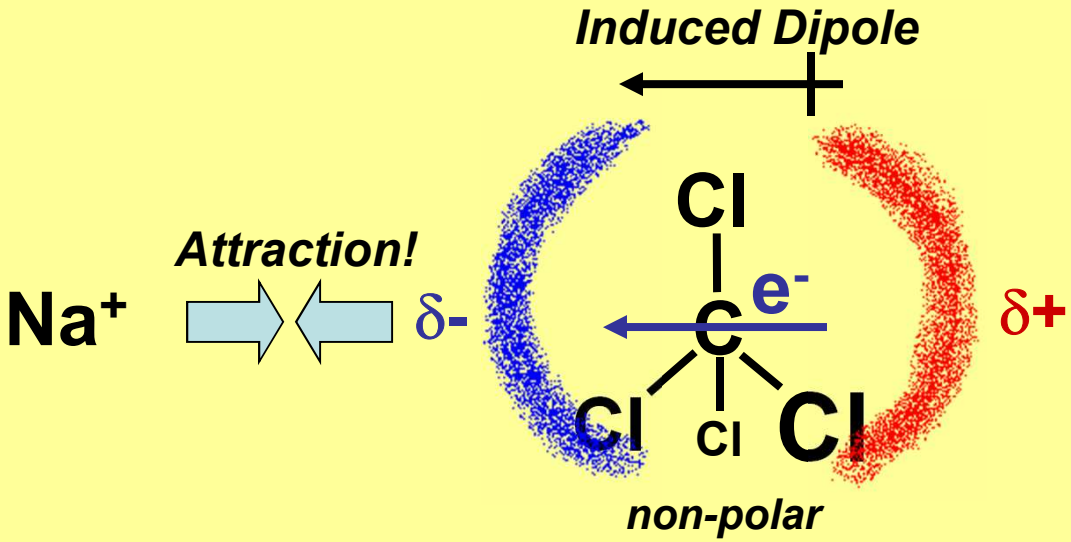
Dipole - Dipole 

5 – 25 kJ/mol

*Inter*molecular Force Summary

Ion-Induced Dipole

Induce *: " ...to cause the formation of ..."* *www.webster.com*



Nearby Na^+ attracts electrons within the CCl_4 *(non-polar)* molecule.

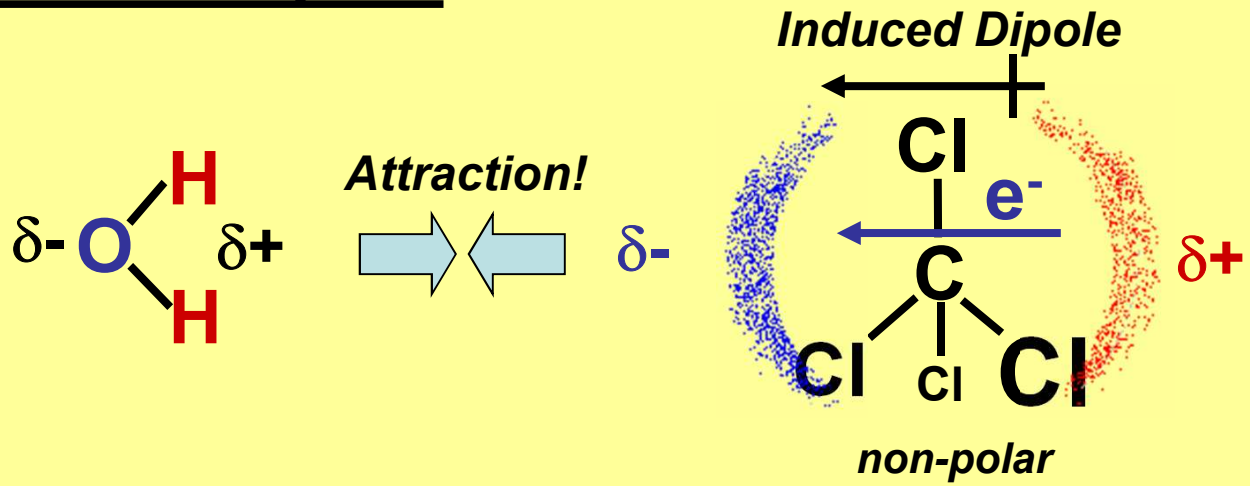
Electrons shift within CCl_4 and produce δ^+ and δ^- poles.

Na^+ now attracted to the δ^- pole. (Intermolecular force)

Energies **3 - 15 kJ/mol**

*Inter*molecular Force Summary

Dipole Induced Dipole



Nearby H_2O δ+ attracts electrons within the CCl_4 *(non-polar)* molecule.

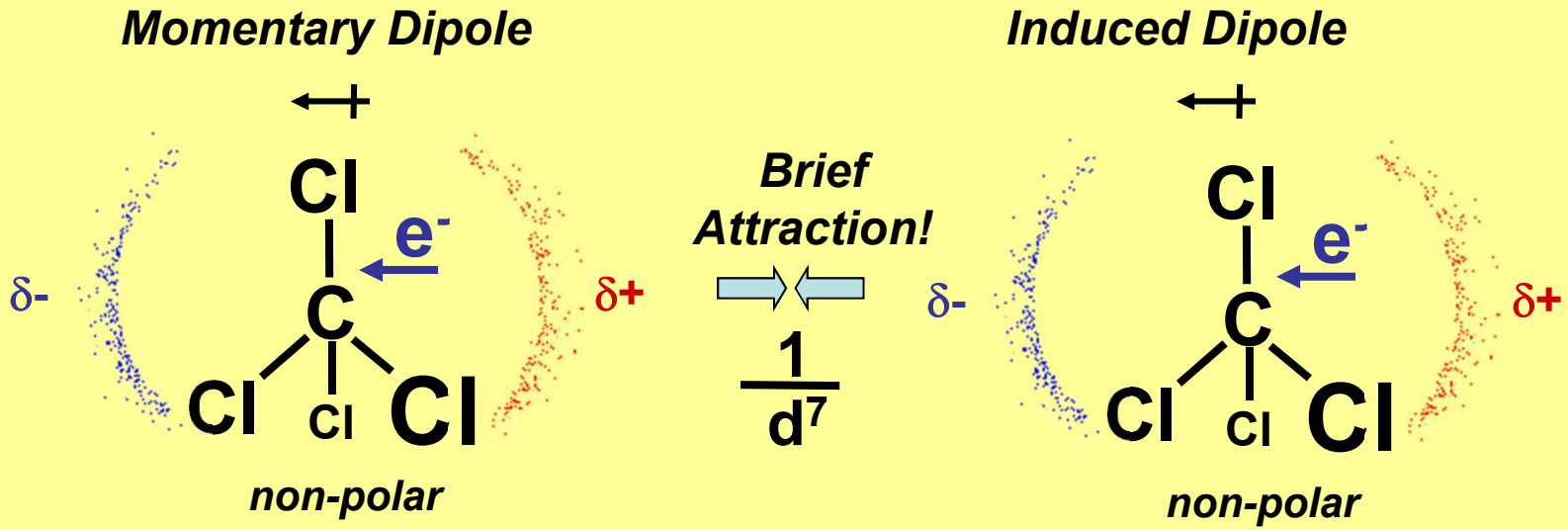
Electrons shift within CCl_4 and produce δ^+ and δ^- poles.

H_2O δ+ now attracted to the δ^- pole. (Intermolecular force)

Energies **2 - 10 kJ/mol**

Intermolecular Force Summary

London Dispersive Forces ...exist for all molecules!



Momentary electron shift within CCl_4 makes it *briefly* polar.

Electrons shift within neighboring CCl_4 and produce δ^+ and δ^- poles.

Two CCl_4 molecules briefly attract each other.

Energies **0.05 - 40 kJ/mol**