POLAR AND NON POLAR MOLECULES

ELECTRONEGATIVITY

'The ability of an atom to attract the electron pair in a covalent bond to itself'

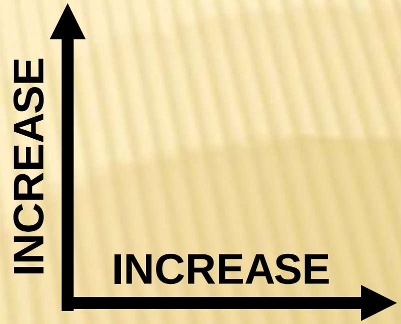
Non-polar bond	similar atoms have the same electronegativity they will both pull on the electrons to the same extent the electrons will be equally shared
Polar bond	different atoms have different electronegativities one will pull the electron pair closer to its end it will be slightly more negative than average, d- the other will be slightly less negative, or more positive, d+ a dipole is formed and the bond is said to be polar greater electronegativity difference = greater polarity
Pauling Scale	a scale for measuring electronegativity

ELECTRONEGATIVITY

'The ability of an atom to attract the electron pair in a covalent bond to itself'

Pauling Scale

a scale for measuring electronegativity
values increase across periods
values decrease down groups
fluorine has the highest value



H						
2.1						
Li	Be	B	C	N	O	F
1.0	1.5	2.0	2.5	3.0	3.5	4.0
Na	Mg	Al	Si	P	S	Cl
0.9	1.2	1.5	1.8	2.1	2.5	3.0
K						Br
0.8						2.8

The electronegativity of an atom depends on its ability to attract electrons and its ability to hold onto electrons.

Electronegativity increases across a period as the nuclear charge on the atoms increases but the shielding stays the same, so the electrons are more strongly attracted to the atom.

Electronegativity decreases down a group as the number of shells increases, so shielding increases and the electrons are less strongly attracted to the atom.

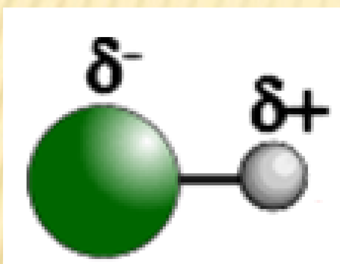
Note that the noble gases cannot be ascribed an electronegativity since they do not form bonds.

Electronegativity is a very useful concept for predicting whether the bonding between two atoms will be ionic, covalent or metallic.

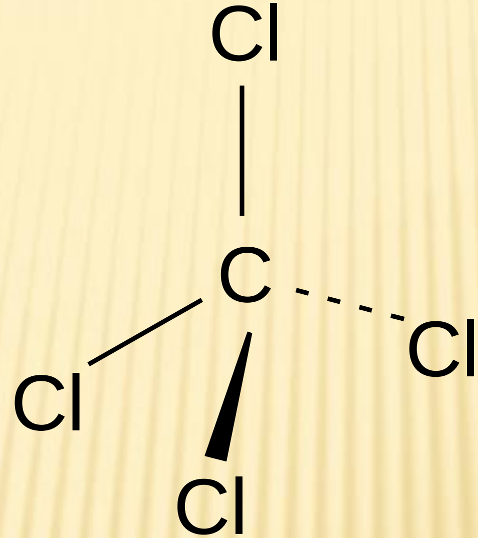
Most covalent bonds have a degree of ionic character resulting from a difference in electronegativity between the atoms. This results in a polar bond and a dipole.

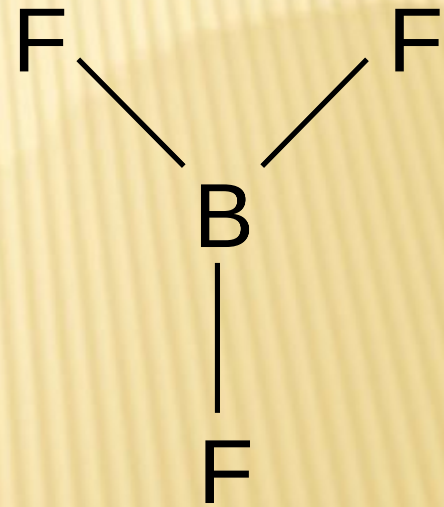
$$\overset{\delta^{+}}{H} — \overset{\delta^{-}}{Cl}$$

$$\overset{\delta^{-}}{O} — \overset{\delta^{+}}{C}$$



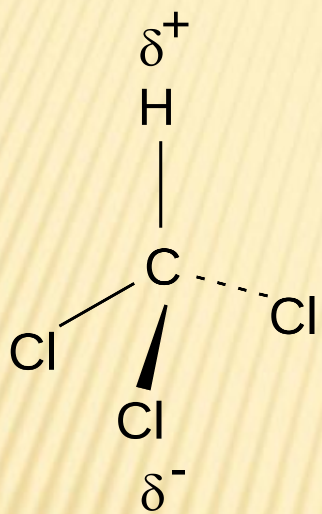
In many cases, however, the presence of polar bonds (dipoles) does not result in a permanent dipole on the molecule, as there are other polar bonds (dipoles) in the same molecule which have the effect of cancelling each other out. This effect can be seen in a number of linear, trigonal planar and tetrahedral substances:

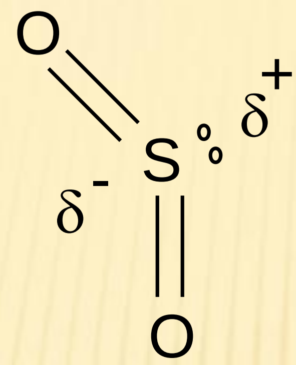


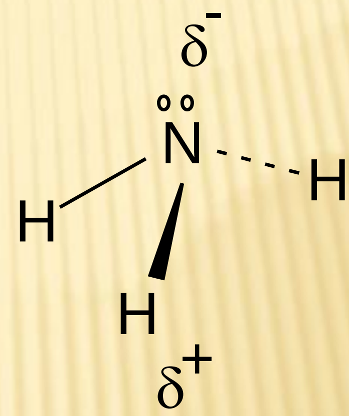


In all the above cases, there are dipoles resulting from polar bonds but the vector sum of these dipoles is zero; i.e. the dipoles cancel each other out. The molecule thus has no overall dipole and is said to be **non-polar**.

In other molecules, however, there are dipoles on the molecule which do not cancel each other out:







In all the above cases, there are dipoles resulting from polar bonds whose vector sum is not zero; i.e. the dipoles do not cancel each other out. The molecule thus has a permanent dipole and is said to be **polar**.

Polar molecules are those in which there are polar bonds and in which the dipoles resulting from the polar bonds do not cancel out.

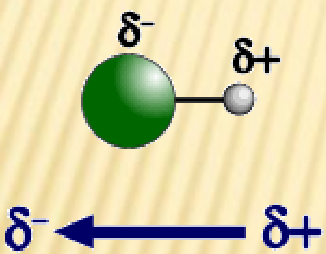
POLAR MOLECULES

Occurrence not all molecules containing polar bonds are polar overall

if bond dipoles 'cancel each other' the molecule isn't polar

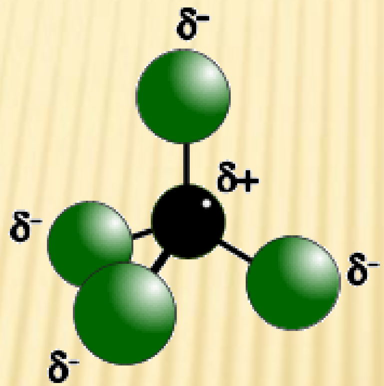
if there is a 'net dipole' the molecule will be polar

HYDROGEN CHLORIDE



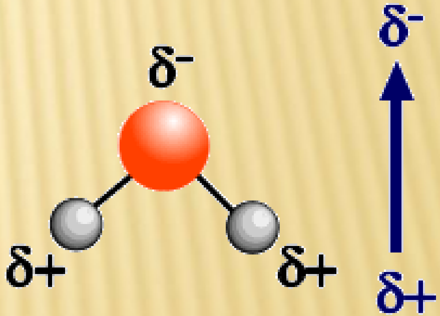
NET DIPOLE – POLAR

TETRACHLOROMETHANE



NON-POLAR

WATER

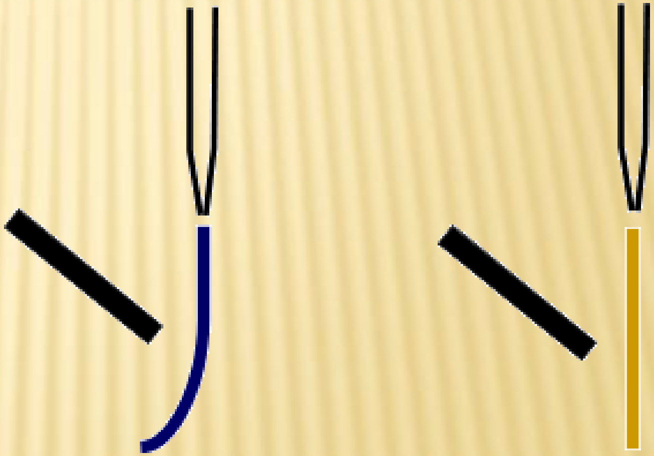


NET DIPOLE – POLAR

POLAR MOLECULES

Evidence

place a liquid in a burette
allow it to run out
place a charged rod alongside the stream of liquid
polar molecules are attracted by electrostatic attraction
non-polar molecules will be unaffected



NET DIPOLE - POLAR

NON-POLAR