Polar Molecules

A QUESTION OF SHAPE AND BOND TYPE

Sample Molecules

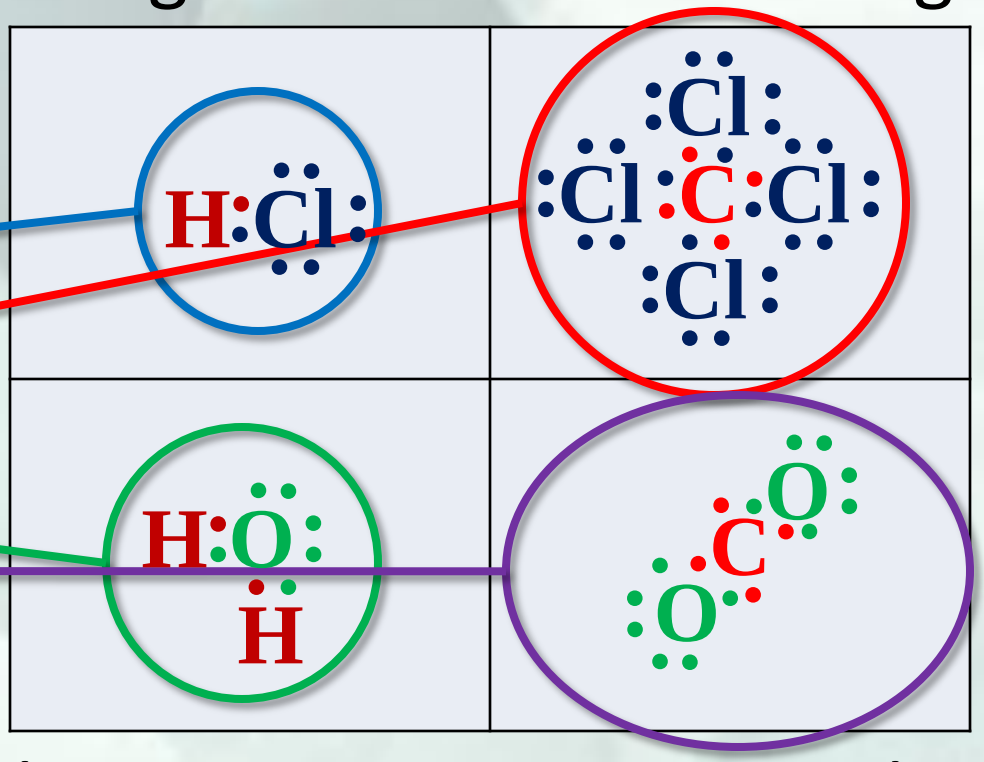
- Consider the following molecules:
  - HCl,
    Polar
  - CCl_4 ,
    Polar
  - H_2O,
    Polar
  - CO_2 , and
    Polar
  - CS_2 .
    Nonpolar

Molecule	Electronegativity		Electronegativity Difference
	Metal	Nonmetal	
HCl	2.1	3.2	1.1
CCl_4	2.6	3.2	0.6
H_2O	2.1	3.4	1.3
CO_2	2.6	3.4	0.8
CS_2	2.6	2.6	0.0

- Determine their bond types.
- CS_2 has nonpolar bonds. It can't be a polar molecule!

Electron Dot Diagrams

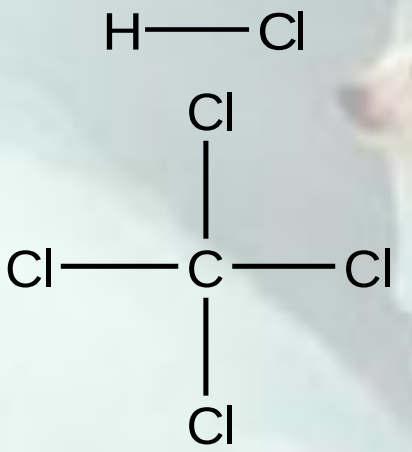
- Draw electron dot diagrams of the remaining molecules:
  - HCl,
  - CCl_4 ,
  - H_2O, and
  - CO_2 .

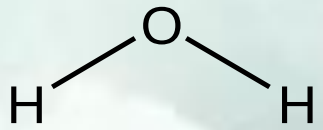


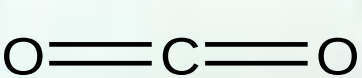
- The electron dot diagram gives you some idea of the shape of the molecule.

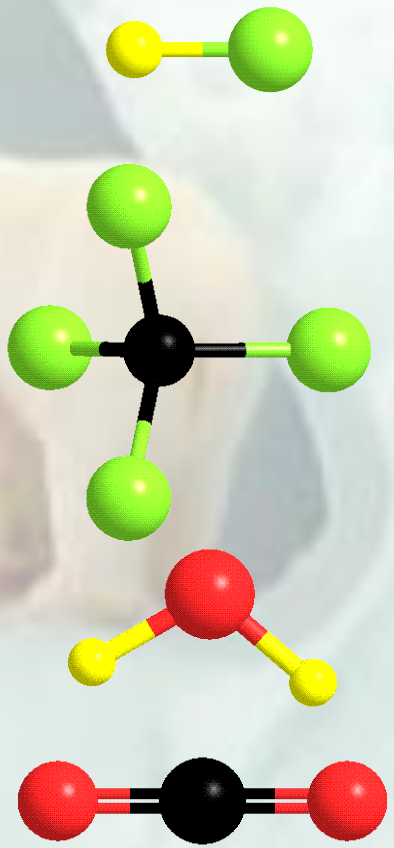
The Shape of the Molecules

- HCl
- CCl_4
- H_2O
- CO_2

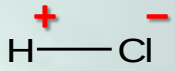
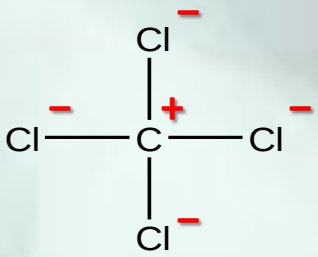
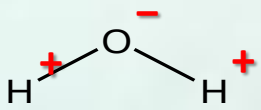
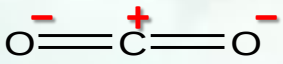








Charge Distribution

- The electronegativity tells the relative charge.
- HCl 
- CCl_4 
- H_2O 
- CO_2 

Molecule	Electronegativity	
	Metal	Nonmetal
HCl	2.1	3.2
CCl_4	2.6	3.2
H_2O	2.1	3.4
CO_2	2.6	3.4

- Consider HCl. Chlorine is more electronegative, so hydrogen is comparatively electropositive.
- What about the rest of them?

Symmetry and Polarity

- If the charge is distributed assymetrically, the molecule is polar.
- If a dividing line can separate the regions of positive and negative charge, the charge is distributed assymetrically.
  - HCl **polar**
  - CCl_4 **nonpolar**
  - H_2O **polar**
  - CO_2 **nonpolar**