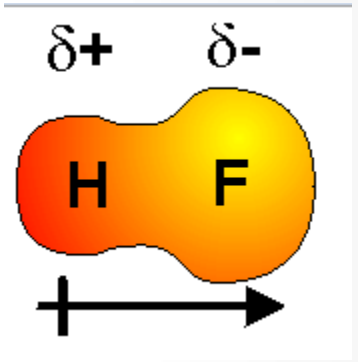
Molecular Polarity

Polar Covalent Bonds

- Polar covalent bonds involve an unequal sharing of electrons between two bonded atoms
  - Creates a partial separation of charge and a dipole moment
  - Represented by δ+ and δ-
  - Dipole moment represented by arrow toward more electronegative element



- Covalent bonds are polar if there is a difference in electronegativity between the bonded atoms

Electronegativity:

Ability of an atom to attract shared electrons in a covalent bond

H 2.1						
Li 1.0	Be 1.5	B 2.0	C 2.5	N 3.0	O 3.5	F 4.0
Na 0.9	Mg 1.2	Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0
K 0.8	Ca 1.0	Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8
Rb 0.8	Sr 1.0	In 1.7	Sn 1.8	Sb 1.9	Te 2.1	I 2.5
Cs 0.7	Ba 0.9	Tl 1.8	Pb 1.9	Bi 1.9	Po 2.0	At 2.1

Polar Bonds

- Which of the following bonds found in organic molecules are polar?
- C-C
- C-O
- C-N
- O-H
- N-H
- C-F
- C-Cl

(Answer on last slide of presentation)

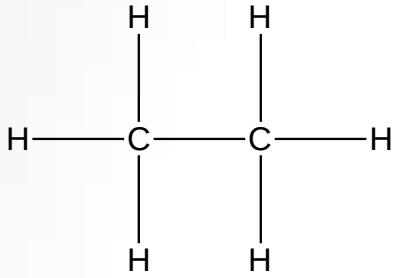
Polar Bonds

- C-H bonds are considered to be nonpolar. (The electronegativity difference between C and H is small).
- This means that many organic compounds contain significant numbers of nonpolar bonds.

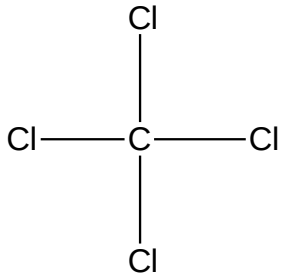
Polar Molecules

- A molecule is polar if
  - It contains polar bonds AND
  - There are unshared electrons on a central atom OR
  - The bonds from the central atom involve different atoms
- A molecule is nonpolar if
  - It contains only nonpolar bonds OR
  - All the bonds to the central atom are the same and there are no unshared pairs on the central atom
  - So a nonpolar molecule may contain polar bonds because the dipole moments of the individual bonds cancel out

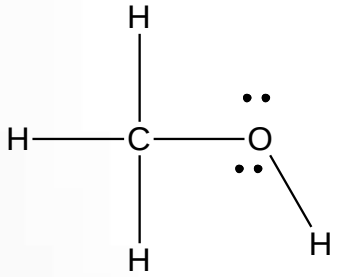
Polar Molecules



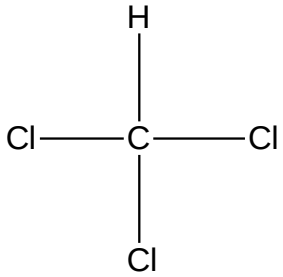
Nonpolar - only nonpolar bonds



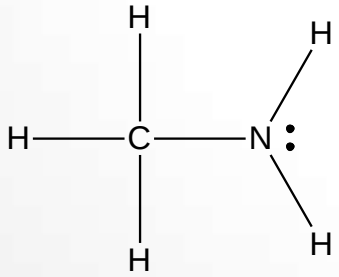
Nonpolar - all bonds the same & no unshared pairs on central atom



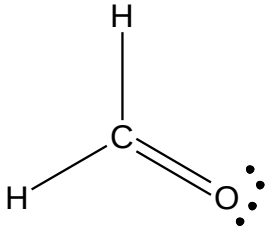
Polar - a central atom has unshared pairs and polar bonds



Polar - a central atom has different atoms attached



Polar - a central atom has an unshared pair and polar bonds



Polar - a central atom has different atoms attached

Polar Bonds

- Answer: Which of the following bonds found in organic molecules are polar?
- C-C
- C-O
- C-N
- O-H
- N-H
- C-F
- C-Cl

All are polar, except C-C