[TP] Which of the following molecules are not polar?

17% 1. $BFCl_2$, whose shape is trigonal-planar, like that of BF_3
17% 2. SCl_2, which is a bent molecule, like H_2O
17% 3. NH_2Cl, whose shape is trigonal-pyramidal, like that of NH_3
17% 4. OCS, which is a linear molecule, like CO_2
17% 5. All of the above are nonpolar
17% 6. All of the above are polar

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Lecture 14 CH101 A1 (MWF 9 am)

Tuesday, October 11, 2016

- Hydrogen bonding
- Dipole-dipole interaction (polarity)

Next lecture: Dispersion interaction; relative boiling points; solvation in ionic solutions; solubility rules (memorize solubility guidelines fig 6.28 p 181); ionization of molecular solutes; self-ionization of water; precipitation reactions

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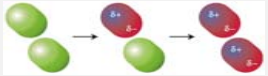
Intermolecular forces: stickiness!

A molecules attract one another, because of the attraction of opposite electrical charges.

Most specific and strongest is "hydrogen bonding": X—H · · · Y

More common and intermediate strength is "dipole-dipole attraction":

Always present and weakest is "temporary dipole attraction" ("dispersion interaction"):



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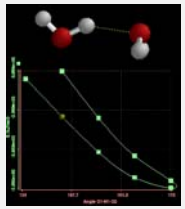
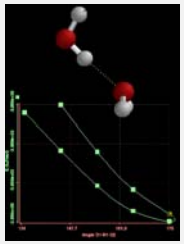
Hydrogen bond angle is 180°

N—H - - - :N—	O—H - - - :N—	F—H - - - :N—
N—H - - - :O—	O—H - - - :O—	F—H - - - :O—
N—H - - - :F—	O—H - - - :F—	F—H - - - :F—





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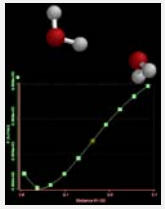
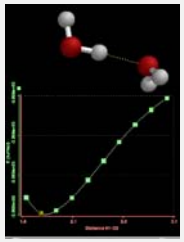
Hydrogen bonds are longer than typical bonds

N—H - - - :N—	O—H - - - :N—	F—H - - - :N—
N—H - - - :O—	O—H - - - :O—	F—H - - - :O—
N—H - - - :F—	O—H - - - :F—	F—H - - - :F—





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Which of the following can form H bonds?

- Ammonia, NH_3
- Methanol, CH_3OH
- Ethanol, CH_3CH_2OH
- Dimethyl ether, CH_3OCH_3

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[Quiz] Which of the following cannot form hydrogen bonds with themselves?

13% 1. Ammonia, NH_3
13% 2. Methanol, CH_3OH
13% 3. Ethanol, CH_3CH_2OH
13% 4. Dimethyl ether, CH_3OCH_3
13% 5. 1 and 3
13% 6. 1 and 4
13% 7. 2 and 4
13% 8. All of the above can form hydrogen bonds with themselves

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Dipole-dipole attraction

Molecules must be "polar"

What makes a molecule polar is unequal sharing of electron clouds.

Sharing tendency is proportional to electronegativity difference.

The greater the difference of electronegativities,
the more unequal the sharing,
the more polar the shared electron cloud.

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Electronegativity χ: Relative pull

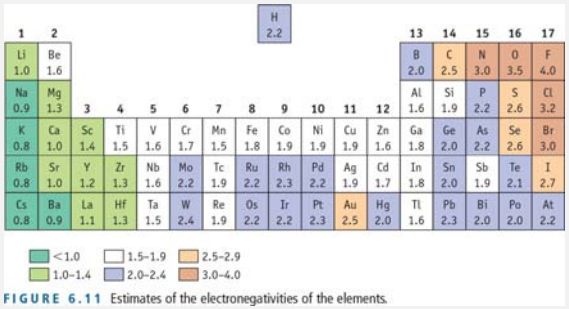
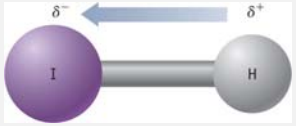


FIGURE 6.11 Estimates of the electronegativities of the elements.

The larger χ the more piggish the atom

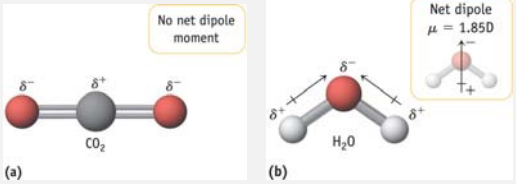
The more different the χ's, the more polar the bond



- If two bonded atoms are different, the one with larger χ gets more of the shared electron cloud
- Atom with larger χ has net negative charge; atom with smaller χ has net positive charge
- The larger the difference in χ, the greater the charge separation (unequal sharing of electron cloud)
- Result is a polar bonds

Molecular polarity

- If bond dipoles cancel, molecule is nonpolar
- If bond dipoles do not cancel, molecule is polar



Let's illustrate, for BF_3 and BH_2F

[TP] Which of the following molecules are not polar?

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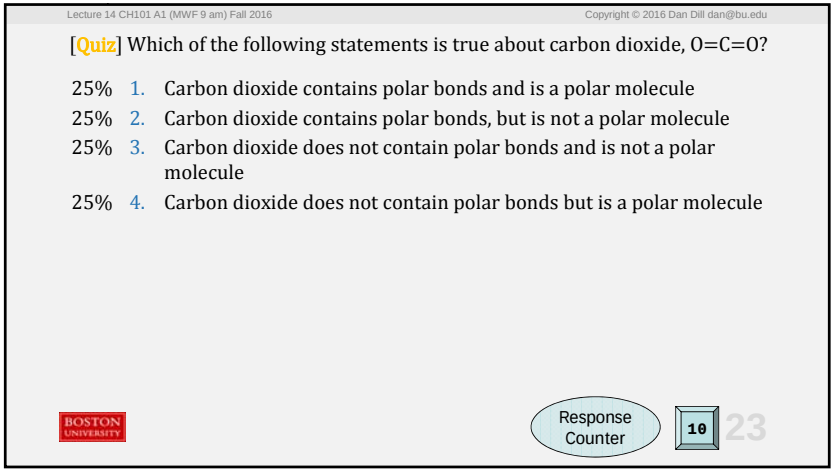
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[Quiz] Which of the following statements is true about carbon dioxide, O=C=O?
25% 1. Carbon dioxide contains polar bonds and is a polar molecule
25% 2. Carbon dioxide contains polar bonds, but is not a polar molecule
25% 3. Carbon dioxide does not contain polar bonds and is not a polar molecule
25% 4. Carbon dioxide does not contain polar bonds but is a polar molecule
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