Notes-Chemistry Honors Name _____
Intermolecular Forces

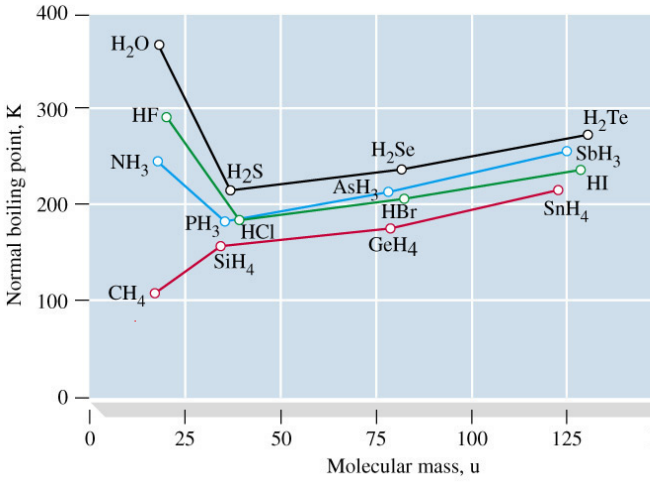
Intermolecular forces vs. Intramolecular forces

a) Intermolecular forces—attractions (bonds) between molecules
b) Intramolecular forces- attractions (bonds) within a molecule

Intermolecular Forces: weak attractions between molecules or atoms.
All intermolecular forces are weaker than covalent bonds (intramolecular bonds), ionic bonds and metallic bonds.

1) Dipole-Dipole Attractions: attraction between **polar molecules** (electrostatic attractions)
   This is an attraction between the partial positive charge (δ+) of one molecule and partial negative charge (δ–) of another molecule.

2) Hydrogen Bonds: Attractions between polar molecules which have particularly strong dipole-dipole attractions. A molecule can only experience hydrogen bonding when it has covalent bonds of **H—F, H−N, H—O**.

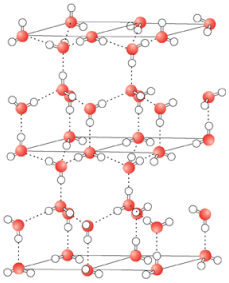


Hydrogen bonds are particularly strong dipole-dipole attractions because….

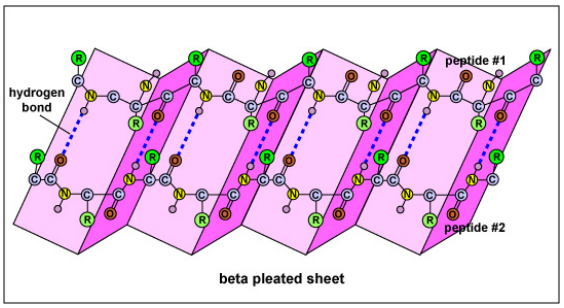
a)

b)

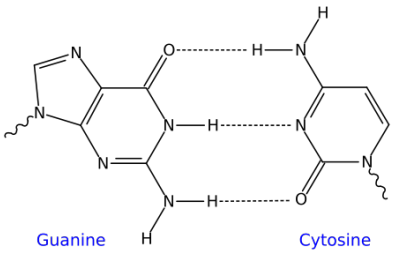
Crystal Structure of Ice

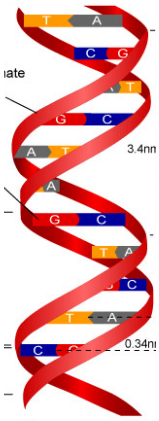


Hydrogen bonds form 3D structures of proteins.
(Forms alpha helixes and beta sheets)



Hydrogen Bonds between amino acids in DNA





3) (London) Dispersion Forces: attractions between neutral atoms or non-polar molecules

a) How dispersion attractions occur:

- The electrons in a roughly symmetrical electron cloud can randomly shift more to one side. (Instantaneous dipole).
- This induces the electron cloud in another atom/molecule, to shift as well. (Induced dipole).
- Now, the instantaneous dipole and the induced dipole attract.

b) **Variations in Strengths**: Dispersion attractions are stronger when molecules are more polarizable. Atoms/molecules with **larger electron clouds** (more electrons) are more polarizable because larger electron clouds can make more significant shifts.

CH_4	mp= −182.5°C
CF_4	mp = −150.0°C
CCl_4	mp = −23.0°C
CBr_4	mp = 90.0°C
CI_4	mp = 171.0°C

Note: Dispersion attraction can comparable or even greater than dipole-dipole attractions.
Ex: bp of CH_3F = −78.4°C bp of CCl_4 = 76.5°C

Note: Officially all atoms/molecules are attracted by dispersion forces—even polar molecules. Thus, since dipole-dipole and dispersion forces can be similar, sometimes it is the dispersion forces of a polar molecule that are actually more significant than its dipole-dipole.