INTERMOLECULAR FORCES

CHEMICAL BONDS

Recall that there are three fundamental types of bonding.

1) Ionic bonding
2) ____________________ bonding
3) Metallic bonding

Because ionic and covalent bonding uses electrostatic attractions between areas of full charge, the resulting force of attraction is ___________________.

INTERMOLECULAR FORCES

Intermolecular forces are a secondary method of holding a structure together. As the name implies, these are forces that exist ____________________ molecules. Bonds exist _______________ molecules.

Some elements, such as the _______________ Gases, exist with intermolecular forces and no bonding at all. Intermolecular forces exist in three different levels of strength. The three intermolecular forces (from strongest to weakest) are hydrogen bonding, dipole-dipole forces and _______________ dispersion forces.

INTERMOLECULAR FORCES and POLAR MOLECULES

Polar molecules will have a partially positive side and a partially negative side, or a _______________. The partial positive on one molecule will be attracted to the partial negative on a second molecule. This attraction is an intermolecular force.

Because the molecules are polar, the force is either a dipole-dipole attraction or a ____________________ bond. Because these attractions are between areas of partial charge, they will produce _______________ forces of attraction. It will always break at the weak links – the dipole-dipole forces or Hydrogen bonds. The _________________ bonds will remain intact.

HYDROGEN BONDING

When hydrogen is directly bonded to nitrogen, ________________ or fluorine, then the system will be capable of Hydrogen bonding. In these systems, the difference between the _________________________ values of the bonded atoms will produce fairly large partial charges. As a result, the resulting intermolecular forces will be strong. They will still not be as strong as a true _______________, however.

DIPOLE-DIPOLE FORCE

- Attractions between oppositely charged regions of ________________molecules are called dipole-dipole forces. Dipole-dipole forces ________________ those molecules covered by Hydrogen bonding.
- Hydrogen bonding intermolecular force is about 10 times stronger than dipole-dipole force because it involves large differences in electronegativity, thus creating a ______________ electric dipole.
- Dipole-dipole forces depend on the number of electrons. Bigger molecules result in more electrons, and more electrons mean __________________ forces.

LONDON DISPERSION FORCE

London dispersion forces are weak forces that result from temporary shifts in the density of ___________________ in electron clouds. The electron density around each nucleus is, for a moment, __________________ in one region of each cloud. As a result each molecule forms a _______________________ dipole. Due to the temporary nature of the dipoles, dispersion forces are the ___________________ intermolecular force. Dispersion forces exist between noble gases and compounds that are _________________. Dispersion forces ___________________ as the mass of the molecule increases.

To determine what type of intermolecular force a compound has, ask yourself the following questions.

1) Does the compound contain hydrogen attached to N, O, or F?
   - If yes, the force is hydrogen bonding.

Determine the number of bonds from the Wetter Way and draw the dash-dot diagram.

2) Does the central element of the compound contain any lone pairs of electrons or are different elements attached to the central atom?
   - If yes, the force is dipole-dipole.
   - If no, the force is London dispersion.

1. Determine the type of intermolecular force in each of the following compounds

a) BCl_3 ________________________________ b) Xe ________________________________

c) NH_3 ________________________________ d) CH_4 ________________________________

e) SO_2 ________________________________ f) H_2 ________________________________

g) SO_3 ________________________________ h) CH_3Cl ______________________________

i) HF ________________________________ j) HBr ______________________________