

Name: _____ Block: _____ Date: _____

CHEMISTRY 11

SOLUTIONS, POLARITY & BONDING

Use pages 198-207 to complete the following.

A. DIPOLE-DIPOLE FORCES

- remember that **van der Waals forces** are weak **intermolecular** forces (between molecules)
- there are two main types of van der Waals forces:

- _____

- _____

- the difference between these two is due to the presence or absence of _____

- a **dipole** is _____

- **London forces** are _____

- **dipole-dipole forces** are _____

- a molecule is **polar** if _____

- if a permanent dipole is absent, only _____ are present

- if a permanent dipole is present, _____ exist

NOTE: London forces are ALWAYS present, even in ionic structures.

- a dipole arises between two atoms with different _____

Q. Which of the following will be polar, and which will be non-polar?

a) H-H b) H-O c) O-Cl d) Cl-Cl

- atoms with very low electronegativities tend to form _____ ions and are said to be _____

- a polar molecule must also be _____ (ends are different)

- if a molecule is symmetrical, it is _____

Do #10, p. 201

- relative strengths of interactions:

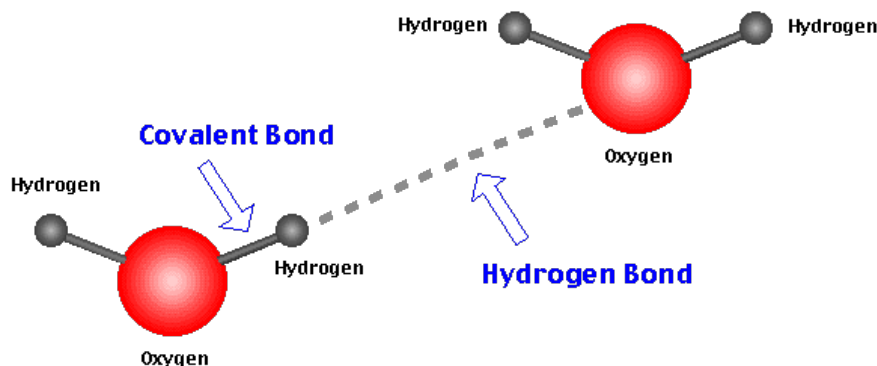
ionic bonds _____ dipole-dipole force _____ London force

Explain:

B. HYDROGEN BONDING

- a relatively strong dipole-dipole attraction exists where _____

- these are called _____
- hydrogen bond is present in molecules containing _____, _____, or _____ bonds



Q. Which of the following substances would you expect to involve hydrogen bonds?

- a) CH₄ b) HCl c) H₂O d) H₂S e) CH₃-NH₂ f) CH₃-SH
 g) CH₃-CH₂-OH h) HF

In summary:

1. Hydrogen bonds are present when molecules contain H-F, O-H, or N-H bonds.
2. When a permanent dipole is present, dipole-dipole forces and London forces are present.
3. When a permanent dipole is not present, only London forces are present
4. Polar molecules have at least one dipole present and are asymmetrical.
5. Non-polar molecules are symmetrical.

POLAR & NONPOLAR SOLVENTS

See page 204 for a list of common solvents used in chemistry.

Classify each of the solvents as polar or nonpolar.

| Solvent | Polar or nonpolar? | Solvent | Polar or nonpolar? | Solvent | Polar or nonpolar? |
|----------|--------------------|--------------|--------------------|----------------------|--------------------|
| water | | ethoxyethane | | carbon tetrachloride | |
| methanol | | acetone | | heptane | |
| ethanol | | acetic acid | | liquid ammonia | |
| benzene | | chloroform | | | |

LIKE DISSOLVES LIKE!

Ionic/Polar solute in Polar solvent will mix
Non-Polar solute in Non-Polar solvent will mix
Polar solute in Non-Polar solventwon't mix

Why? (read p. 205-206)

- Polar & ionic solvents have relatively _____ bonds holding the solid together and only _____ solvents have sufficient attraction to the solute to be able to pull the solute out of a crystal and into solution.
- Nonpolar solutes require solvents with sufficient _____ forces to remove the solid from the crystal and into solution; polar solvents tend to have _____ London forces while non polar solvents have _____ London forces.

How to Distinguish the Most Important Bonds or Forces Holding Substances Together

IONIC BOND - the substance in an ionic crystal (made of metal and nonmetal atoms or recognizable ions) ex. NaCl(s), NH₄NO₃(s)

COVALENT BOND - the bond in question is intramolecular (bond holds to atoms together **IN** a molecule); ex. C-H in CH₄

The remaining types of bonds are all intermolecular (bonds **between** existing molecules)

HYDROGEN BONDS - look for HF or any molecule having OH or NH in its formula
if not present then

DIPOLE-DIPOLE FORCE - look for an asymmetric molecule
if not present then

LONDON FORCE is all that is present

Do # 23, 26 & 27 on page 208.