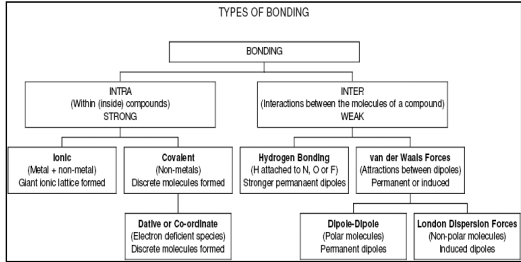


# Forces

# Types of Bonds



# Intramolecular Bonding

- Intra Molecular – Bonding \_\_\_\_\_
  - \_\_\_\_\_ - metal + non metal
  - \_\_\_\_\_ - non metal + non metal
  - \_\_\_\_\_ - metal + metal

# Intermolecular

- Intermolecular bonds – Bonding \_\_\_\_\_
  - Network Covalent bonding
  - Ionic bonding
  - Metallic bonding
  - Hydrogen bonding
  - Dipole – Dipole bonding
  - London Dispersion forces

## Network Covalent

- Continuous network of covalent bonds
- Examples: quartz, diamond, graphite,  $\text{SiO}_2$
- Extremely \_\_\_\_\_ melting points
- Generally \_\_\_\_\_ in all solvents
- \_\_\_\_\_ conductors of electricity

## Ionic

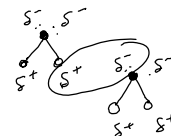
- Strong bonds due to \_\_\_\_\_ forces
- \_\_\_\_\_ melting points
- Good conductors of electricity when \_\_\_\_\_ or in \_\_\_\_\_
- Usually soluble in \_\_\_\_\_ or \_\_\_\_\_ solvents

## Metallic

- \_\_\_\_\_ of valence electrons
- \_\_\_\_\_ melting points
- Electrons free to move around
- \_\_\_\_\_ conductor of electricity

## Hydrogen bonding

- Occurs when H is bonded to \_\_\_\_\_, \_\_\_\_\_, or \_\_\_\_\_
- They are VERY strong leading to
  - High boiling points
  - Viscous



## Polarity

- In order for a substance to be polar, the bonds within the molecule must carry different charges and cannot cancel out due to symmetry

## Polar or non polar

- $\text{CHF}_3$
- $\text{CO}_2$
- $\text{BCl}_3$
- $\text{CH}_4$
- $\text{H}_2\text{O}$

## Rule for solubility

- \_\_\_\_\_ dissolves \_\_\_\_\_
- Polar will dissolve in polar
- Non polar will dissolve in non polar

## Van der Waals Forces

- Dipole – Dipole
  - Dipole - partial \_\_\_\_\_ & a partial \_\_\_\_\_ charges at one end
  - The partial positive and partial negative will \_\_\_\_\_
  - These attractions are called dipole - dipole attractions
  - These come from polar molecules ONLY!!!

### London Dispersion forces

- Small electrostatic forces caused by the \_\_\_\_\_ of the electron in molecules
- In all molecules
- More electrons → stronger LDF because more polarizable

### What type of intermolecular forces are present?

- Ar
- HCl
- HF
- CaCl<sub>2</sub>
- CH<sub>4</sub>
- CO
- NaNO<sub>3</sub>

### Which will have the ...

- Highest boiling point... HBr, Kr, Cl<sub>2</sub>
- Highest freezing point... H<sub>2</sub>O, NaCl, HF
- Lowest freezing point... N<sub>2</sub>, CO, CO<sub>2</sub>
- Lowest boiling point... CH<sub>4</sub>, CH<sub>3</sub>CH<sub>3</sub>, CH<sub>3</sub>CH<sub>2</sub>CH<sub>3</sub>
- Highest boiling point... HF, HCl, HBr

### More examples

- At 25°C ONF is a gas where H<sub>2</sub>O is a liquid. Why?
- At 25°C Br<sub>2</sub> is a liquid when Cl<sub>2</sub> is a liquid. Why?