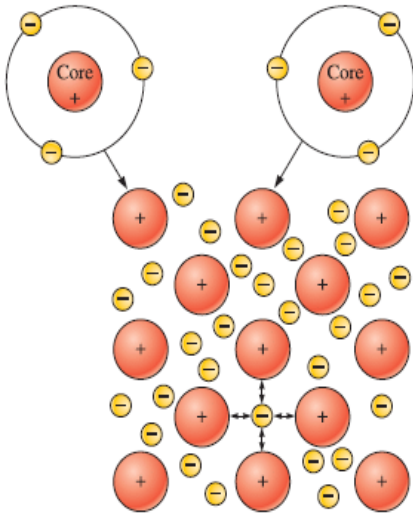
REVIEW 8
CHAPTER 8
AND SOLUBILITY

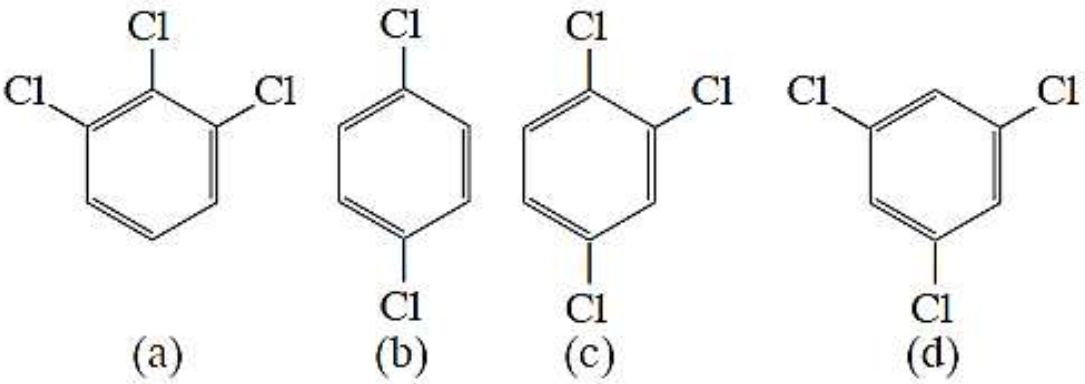
Metallic bonding



- This type of covalent bonding specifically occurs between atoms of metals, in which the valence electrons are free to move through the lattice. This bond is formed via the attraction of the mobile —referred to as sea of electrons—and the fixed positively charged metal ions. Metallic bonds are present in samples of pure elemental metals, such as gold or aluminum, or alloys, like brass or bronze.
- The metal's strength increases as the number of electrons available for bonding increases. For example, the melting point of sodium, with one valence electron, is 97.6C, whereas that of aluminum, with three valence electrons, is 660C.
- The mobility of the delocalized electrons makes metals good conductors of heat and electricity.

problems

- **Arrange these compounds in order of increasing dipole moment:**



Answer: a > c > b=d (non polar)

Problems

1- Arrange the following molecules in order of increasing dipole moment: H_2Te, H_2O, H_2Se, H_2S

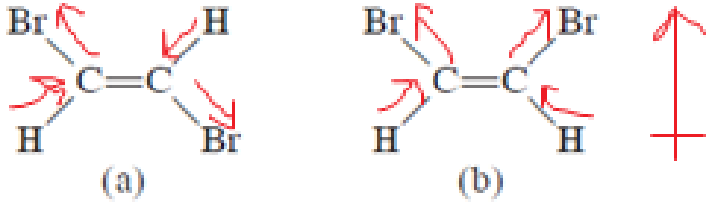
All these molecules have the same no. of bonds and same molecular geometry

The central atoms are in the same group, so from up to down, electronegativity decreases so,

O> S> Se> Te in electronegativity so,

H_2O> H_2S> H_2Se> H_2Te in polarity

2- Which of these molecules has a higher dipole moment? b

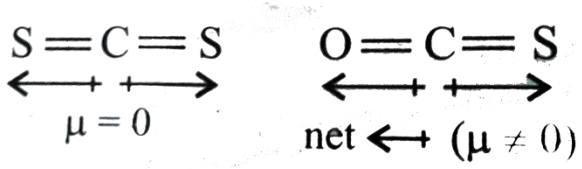


1- List these molecules in order of increasing polarity: PH3, CBr4, NH3, KCl, CO2.

Answer: KCl > NH3 > PH3 > CBr4=CO2 (non polar)

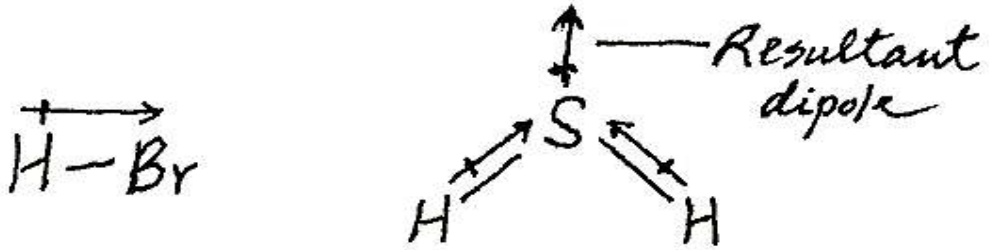
2- Does the molecule OCS have a higher or lower dipole moment than CS2?

Answer: higher



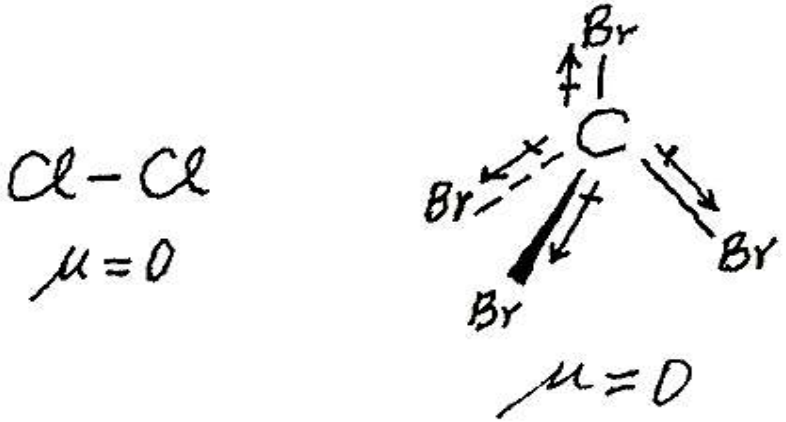
What type(s) of intermolecular forces exist between the following pairs: (a) HBr and H_2S, (b) Cl_2 and CBr_4, (c) I_2 and NO_3^-, (d) NH_3 and C_6H_6?

Solution (a) Both HBr and H_2S are polar molecules.



Therefore, the intermolecular forces present are dipole-dipole forces, as well as dispersion forces.

(b) Both Cl_2 and CBr_4 are nonpolar, so there are only dispersion forces between these molecules.



(c) I_2 is a homonuclear diatomic molecule and therefore nonpolar, so the forces between it and the ion NO_3^- are ion-induced dipole forces and dispersion forces.

(d) NH_3 is polar, and C_6H_6 is nonpolar. The forces are dipole-induced dipole forces and dispersion forces.

- **List the types of intermolecular forces that exist in each of these species: (a) benzene (C_6H_6), (b) CH_3Cl, (c) PF_3, (d) NaCl, (e) CS_2.**

(a) Dispersion forces.

(b) Dispersion and dipole-dipole forces.

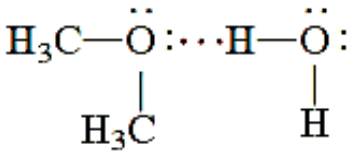
(c) Dispersion and dipole-dipole forces.

(d) Ionic forces.

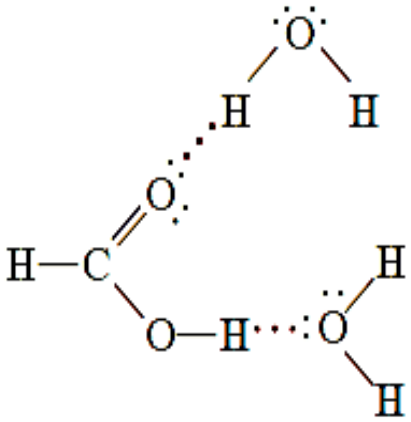
(e) Dispersion forces.

Which of the following can form hydrogen bonds with water: CH_3OCH_3 , CH_4 , HCOOH? Draw if found.

- CH_3OCH_3



- HCOOH



- **The compounds Br2 and ICl have the same molar mass, yet Br2 melts at -7.2C, whereas ICl melts at 27.2C. Explain.**

Answer: Br2 non polar.....dispersion forces

ICl polar.....dipole – dipole forces more strong

- **Arrange the following compounds in order of increasing boiling point: RbF, CO2, CH3I, CH3OH, CH3Br. Explain.**

Answer: RbF > CH3OH > CH3I > CH3Br > CO2

Rb (ionic forces= electrostatic forces between ions have complete charges)

CH3OH make hydrogen bonds stronger than dipole – dipole forces

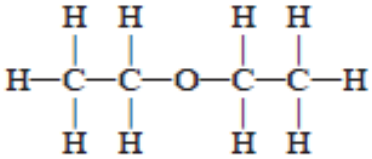
CH3I dipole – dipole forces and molar mass is bigger than CH3Br

CH3Br dipole – dipole forces

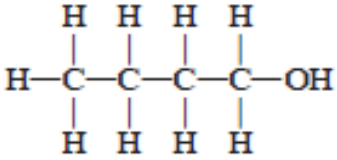
CO2 london forces, in addition its molar mass less than CH3Br

- **Diethyl ether has a boiling point of 34.5C, and**

1 -butanol has a boiling point of 117. explain.



diethyl ether



1-butanol

Answer:

Butanol have OH group So its molecules can form hydrogen bonds between each other. Hydrogen bonds need high energy to be overcome.

- **Arrange according boiling point: methane (CH4), propane (C3H8), or butane (C4H10).**

Answer: Butane > propane > methane

why? As molar mass increases, dispersion forces increases

Predict the relative solubilities in the following cases: (a) Bromine (Br_2) in benzene (C_6H_6, $\mu = 0$ D) and in water ($\mu = 1.87$ D). (b) KCl in carbon tetrachloride (CCl_4, $\mu = 0$ D) and in liquid ammonia (NH_3, $\mu = 1.46$ D). (c) formaldehyde (CH_2O) in carbon disulfide (CS_2, $\mu = 0$) and in water.

Solution (a) Br_2 is a nonpolar molecule and therefore should be more soluble in C_6H_6, which is also nonpolar, than in water. The only intermolecular forces between Br_2 and C_6H_6 are dispersion forces.

(b) KCl is an ionic compound. For it to dissolve, the individual K^+ and Cl^- ions must be stabilized by ion-dipole interaction. Because CCl_4 has no dipole moment, KCl should be more soluble in liquid NH_3, a polar molecule with a large dipole moment.

(c) Because CH_2O is a polar molecule and CS_2 (a linear molecule) is nonpolar, the forces between molecules of CH_2O and CS_2 are dipole-induced dipole and dispersion. On the other hand, CH_2O can form hydrogen bonds with water, so it should be more soluble in that solvent.

- **Arrange the following substances in order of increasing solubility in water.**

(a) CH3CH2CH2CH2CH2CH3

(b) OH-CH2CH2CH2CH2CH2CH2OH

(c) CH3CH2CH2CH2CH2CH2OH

(d) CH3CH2CH2CH2CH2CH2Cl

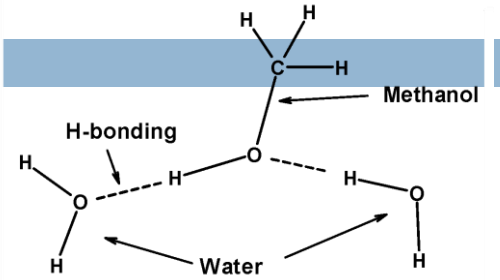
Answer: a < d < c < b

- **Arrange these compounds in order of increasing solubility in water and mention type of intermolecular forces with water:**

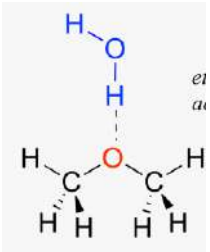
O2, CH3Cl, CH3OH, CH3OCH3

Answer:

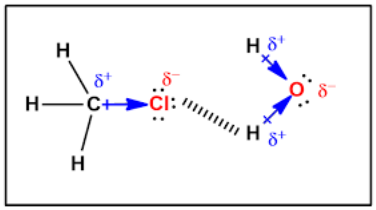
CH3OH (Hydrogen bonds with water from two sites) >



CH3OCH3 (Hydrogen bonds with water from one sites) >



CH3Cl (dipole-dipole forces with water)>



O2 (dipole-induced dipole force with water)