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Polarity of bond

A covalent bond setup by sharining of electrons between two atoms. It is further classified as polar or nonpolar depending upon the fact wether the electron pair is shared equally or unequally between the atoms.

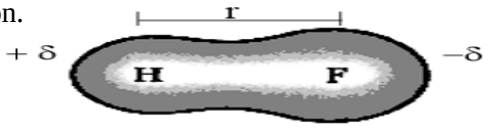
Bond

Polar bond	Nonpolar bond
The distribution of the bonding electrons is unequal between the two atom/nuclei known as polarbond(due to the higher electronegativity) F>O>N>Cl>Br>C>H HF,NO,CO	The distribution of the bonding electyrons is equal between the two atom known as non polar bond N2,O2,H2,F2,Cl2,I2,Br2 homo diatomic molecules are nonpolar

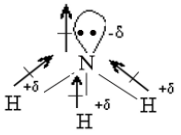
Dipole moment

• The asymmetrical distribution of electron clouds between two atoms involved in a chemical bond due to the difference in electronegativities of the two atoms concerned or due to another external influence is known as polarization.

Example :



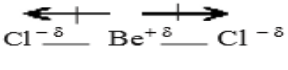
• The product of the charge (δ) present on individual atoms in such a molecule and the length of the bond between the atoms is called the dipole moment ($\mu = \delta \times r$) of the bond. In polyatomic molecules, the dipole moment is considered for each bond. Their resultant is taken as the dipole moment of the molecule.

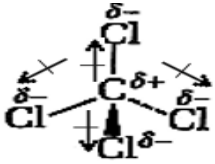


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• The resultant of the dipole moments of all the N- H bonds gives the dipole moment of the NH_3 molecule. • For some symmetric molecules the dipole moment is zero.

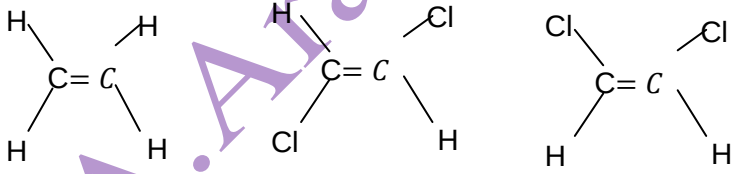
Example:





Dipole moment

μ= o non polar molecules All diatomic homogenus molecules # Requlershape molecules with same surrounding elements. linear Trigonal pyramid Tetrahedral Trigonal pyramid Octrahedral Squareplanner Pentagonalbipyramid	μǂ o poloarmolecules All diatomic heterogenousn molecules HF,HBr,HCl,NO,CO Requllar shape molecules with different surrounding element BeClF,$CHCl_3$,PCl_4Br,SF_5Cl Irreqular shape molecules with lone pairs Bent,Trigonal pyramid, seesaw



1. Which one of the following molecules will not be polar?

1. NH3 2. HCl 3.CO2 4.SO2 5.H2S

2. Which one of the following exhibits the strongest inter-molecular attrction?

1.NH32.PH3 3.SiH4 4.GeH4 5. AsH3

3. Which one of the following exhibits the weakest inter-molecular attrction?

1. NH3 2. H2S 3.CH4 4.CH3Cl5.HI

4. . Which one of the following exhibits the weakest inter-molecular attrction?

1. NH3 2. H2S 3.PH3 4.CH3Cl5.HI

5. Which one of the following molecules is most polar?

1. NH3 2. H2O 3.H2Te 4.CF4 5.H2S

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6.Which one of the following molecules is least dipolarnature?

1. H2S 2. PH3 3.AsH3 4.H2S 5.BF3

7. . Which one of the following molecules is nonpolar?

1.BeCl2 2.NH3 3.CO 4.H2O 5.CHCl3

8. Which one of the following molecules compounds has the largest dipole moment?

1. CisClCH=CHCl 2.CO2 3.Cl2C=CCl2 4.CCl4

5. Trans ClCH=CHCl

9. . Which one of the following molecules compounds has the largest dipole moment?

1.CisCHCl=CHCl 2.TrasnsCHCl=CHCl 3.CCl2=CCl2

4.CClBr=CClBr 5.CisClBrC=CClBr

10. Which one of the following molecules compounds has the largest dipole moment?

1.O3 2.NH3 3.NO2+ 4.AlCl3 5.ICl4-

11.. Which one of the following molecules is nonpolar?

(1) SF_2(2) PCl_4F (3) SF_4 (4) PCl_3 (5) SF_6

Polarization-Polarizing power of a cation and polarizability of an anion

- When an ideal ionic compound is considered, the anion and cation which are its components are regarded as existing in the form of regular solid spheres. But depending on the nature of the cation and the anion which are the constituents of the ionic compound, the cation attracts the electron cloud (polarizing power of the cation) of the anion and at the same time repels the nucleus thus distorting or polarizing the anion and as a result distortion occurs in the electron cloud of the anion (polarizability and tendency to undergo polarization). If the degree of polarization is insignificant the bond remains ionic whereas if it significant electron cloud will be pulled towards the cation resulting in a considerable degree of covalent character.

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Example : Complete ionic bond



No Polarization

Distortion

Increase in polarization of the anion

Showing Covalent character to a considerable extent.

- Cation : Smaller in size, Highly charged or both } Polarizing power is high.

- Anion : Larger in size, Highly charged or both } Polarizability is high (Tends to distort or polarize)

Examples :

In AgF, AgCl, AgBr and AgI the ionic properties vary as follows.

$$AgF > AgCl > AgBr > AgI$$

When the anion becomes larger the polarizability increases with the resulting increase of covalent character.

$$CsI > KI > NaI > LiI$$

When the cation becomes smaller the polarizing power increases with the resulting increase of covalent character.

$$MCO_3 \xrightarrow{\Delta} MO + CO_2$$

Breaking up of the CO_3^{2-} group into O^{2-} and CO_2 is influenced by the polarizing power of the M^{2+} ion. The polarizing power of the cations in Group II varies in the order, Be>Mg>Ca. Therefore the thermal decomposition temperatures of group two carbonates vary in the order $BeCO_3 < MgCO_3 < CaCO_3$.

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