Chemical Bonding

Kossel-Lewis approach
To acquire stable noble gas electronic configuration atoms combine by either losing, sharing or gaining electrons.

Lewis symbol

Lewis provides simple notation for representing this valence electrons called as Lewis symbols. It contains dots surrounding the symbol of given element, indicating number of valence electron present in that element.
Definition
Reason for chemical bond formation
Lewis postulated that atoms combine and form chemical bonds, so that, they can achieve the nearest stable inert gas configuration.

Octet rule
Atoms can combine either by transfer of valence electrons from one atom to another (gaining or losing) or by sharing of valence electrons in order to have an octet or 8 electrons in their valence shells. This is known as octet rule.

Properties of ionic bond
Properties of ionic bond are high melting and boiling points, good conductors of heat and electricity and more solubility in polar solvents.

Formation of covalent bond
When two atoms share electron mutually, they are said to be joined by a covalent bond. Covalent bond is of three types: single bond, double bond and triple bond.

Covalent bond
Covalent bonding occurs when pairs of electrons are shared by atoms. Atoms will covalently bond with other atoms in order to attain the nearest noble gas configuration.

Bond pair

The pair of electrons involved in bond formation is called as bond pair electron and the pair of electron which is not involved in bond formation but remain present on atom, in molecule is called as lone pair of electron. For example: ammonia molecule, it contain 3 bond pair of electrons and 1 lone pair of electrons.

VSEPR theory explaination

VSEPR theory explain the shape of a molecule by number of valence electron present in valence shell of central atom. Charged electrons in valence shell repel each other, electrons occupy such position in space so that repulsion should be minimum.

Importance of valance bond theory

Valence bond theory describes the electronic structure of molecules.

Definition

Valence bond theory

The valence bond theory explains the structure and magnetic properties of a large number of coordination compounds. Valence bond theory was used to explain the structure of coordination compounds and the bond linkages. According to valence bond theory, the metal atom or ion under the influence of ligands can use its (n-1)d, ns, np, nd orbitals for hybridization to yield a set of equivalent orbitals of definite geometry such as octahedral, tetrahedral, square planar etc. The hybridized orbitals can overlap with the ligand orbitals that can donate electron pairs for bonding.

Postulates of valence bond theory

The Heitler-London model of covalent bonds was the basis of the valence-bond theory. The last major step in the evolution of this theory was the suggestion by Linus Pauling that atomic orbitals mix to form hybrid orbitals, such as the sp,sp2,sp3,dsp3,and d2sp3 orbitals.

It is easy to apply the valence-bond theory to some coordination complexes, such as the $Co(NH_3)_6^{3+}$ ion. We start with the electron configuration of the transition-metal ion Co^{3+}:[Ar]d^6 We then look at the valence-shell orbitals and note that the 4s and 4p orbitals are empty.Concentrating the 3d electrons in the dxy,dxz,and dyz orbitals in this subshell gives the following electron configuration. The $3dx^2-y^2$,3dz2,4s,4px,4py and 4pz orbitals are then mixed to form a set of empty d2sp3 orbitals that point toward the corners of an octahedron. Each of these orbitals can accept a pair of non-bonding electrons from a neutral NH_3molecule to form a complex in which the cobalt atom has a filled shell of valence electrons.

Definition

hybridisation VBT Approach

It is the process of mixing and recasting of atomic orbitals of the same atom with slightly different energies to form equal number of new orbitals with equivalent energy , maximum symmetry and definite orientations in space. example, C shows sp3 hybridization in methane.

Important point of Hybridisation

Hybridization involves mixing and recasting of atomic orbitals of same element.

The orbitals involving in this process must have nearly same energy.

only the atomic orbitals not electron undergo hybridization.

Number of hybrid orbitals produced= number of hybrid orbitals involved in hybridization.

Definition

Determination of hybridisation of central atom

For determination of hybridization of central atom following rules can be observed.Start by drawing the Lewis structure. The least electronegative atom

that is not a hydrogen goes in the center (unless you have been given structural arrangement)determine the number of electron domains on the central atom.Determine the electron geometry using VSEPR. Correlate the geometry with the hybridization.

Difference between ionic and covalent compounds

Ionic compounds are mostly crystalline solids, have high melting and boiling points, conduct electricity when melted, and many are soluble in water but not in non-polar liquids. Covalent compounds can exist in solid, liquid or gaseous state, have low melting and boiling points, have poor electrical conductivities in all phases, and are more soluble in non-polar solvents.