A level organic chemistry notes pdf

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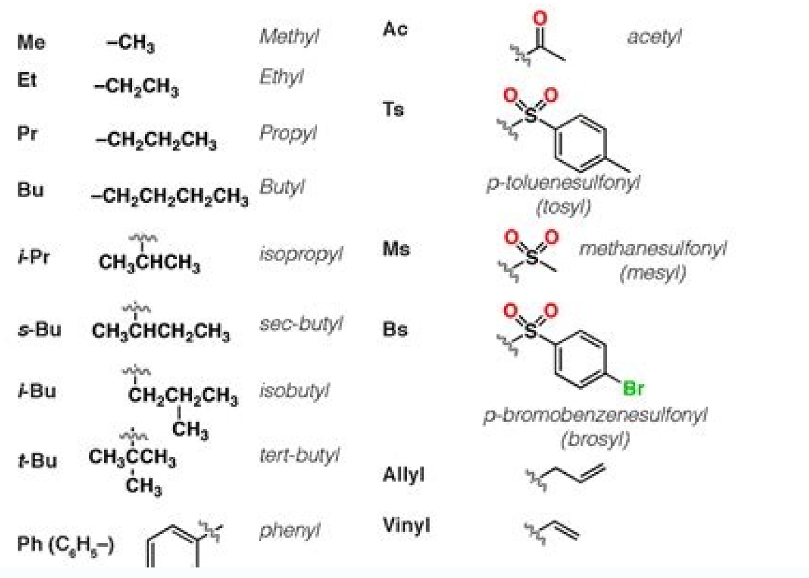
Common Abbreviations and Terms



(ii) nucleus of one atom and electron of other atom i.e., $N_A - e_B$, $N_B - e_A$.

Similarly repulsive forces arise between (i) electrons of two atoms like $e_A - e_B$, (ii) nuclei of two atoms $N_A - N_B$.

Attractive forces tend to bring the two atoms close to each other whereas repulsive forces tend to push them apart (Fig. 4.7).

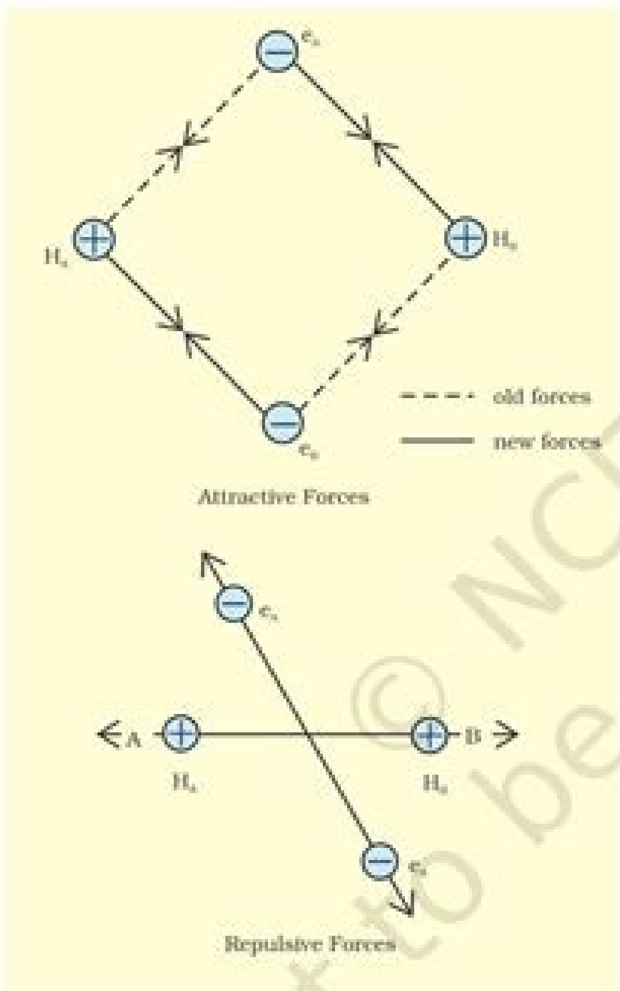


Fig. 4.7 *Forces of attraction and repulsion during the formation of H_2 molecule.*

Experimentally it has been found that the magnitude of new attractive force is more than the new repulsive forces. As a result, two atoms approach each other and potential energy decreases. Ultimately a stage is reached where the net force of attraction balances the force of repulsion and system acquires minimum energy. At this stage two hydrogen atoms are said to be bonded together to form a stable molecule having the bond length of 74 pm.

Since the energy gets released when the bond is formed between two hydrogen atoms, the hydrogen molecule is more stable than that of isolated hydrogen atoms. The energy so released is called as **bond enthalpy**, which is corresponding to minimum in the curve depicted in Fig. 4.8. Conversely, 435.8 kJ of energy is required to dissociate one mole of H_2 molecule.

$$H_2(g) + 435.8 \text{ kJ mol}^{-1} \rightarrow H(g) + H(g)$$

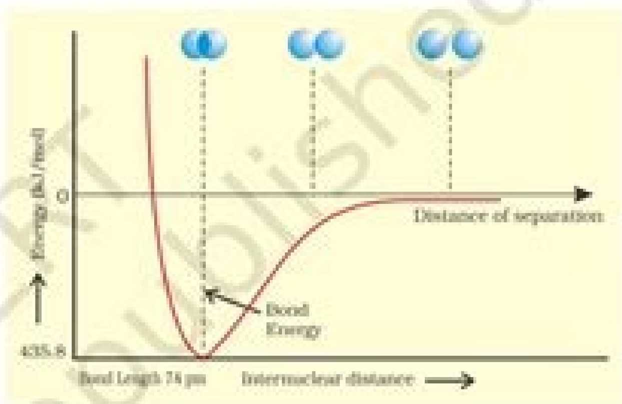
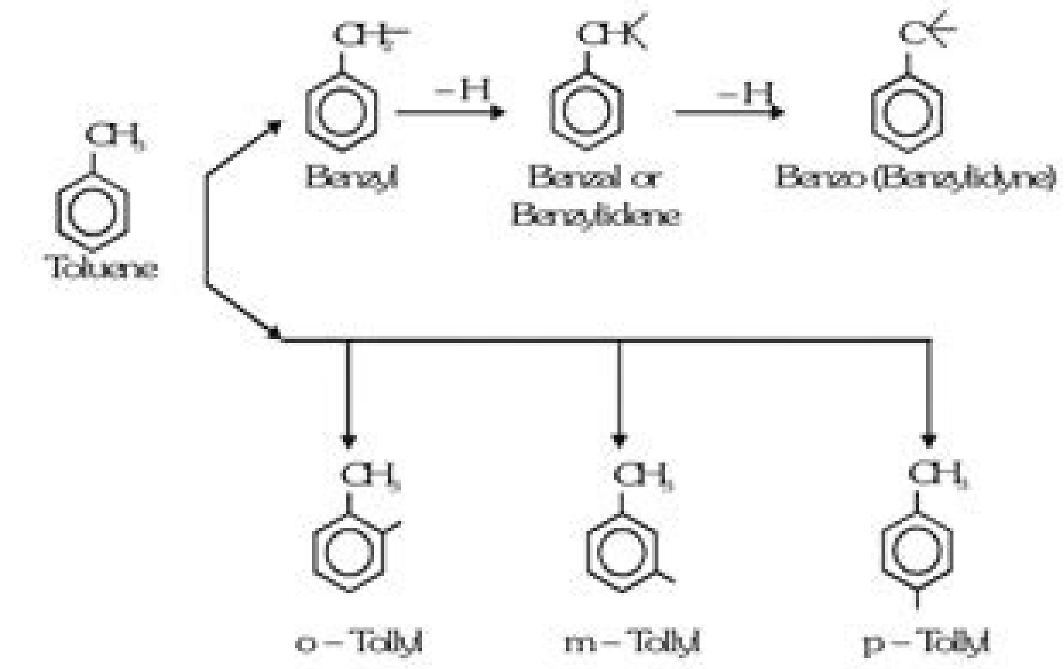


Fig. 4.8 *The potential energy curve for the formation of H_2 molecule as a function of internuclear distance of the H atoms. The minimum in the curve corresponds to the most stable state of H_2.*

4.5.1 Orbital Overlap Concept

In the formation of hydrogen molecule, there is a minimum energy state when two hydrogen atoms are so near that their atomic orbitals undergo partial interpenetration. This partial merging of atomic orbitals is called overlapping of atomic orbitals which results in the pairing of electrons. The extent of overlap decides the strength of a covalent bond. In general, greater the overlap the stronger is the bond formed between two atoms. Therefore, according to orbital overlap concept, the formation of a covalent bond between two atoms results by pairing of electrons present in the valence shell having opposite spins.

(ii)



Ex.

❑ **NOMENCLATURE :**

Mainly three systems are adopted for naming an organic compound -

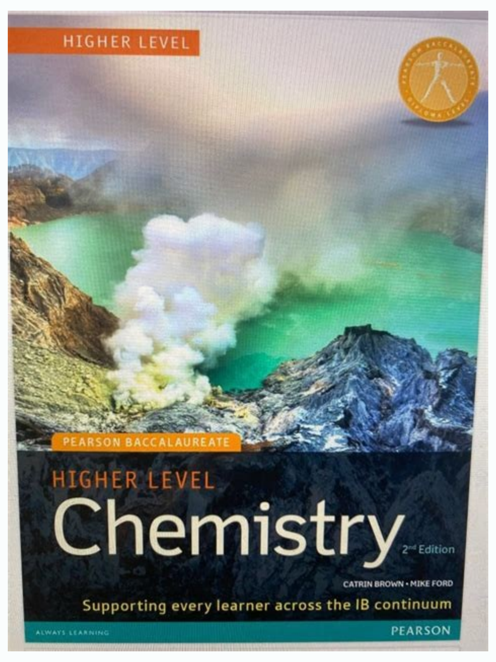
(i) Common names or Trivial system

(ii) Derived system

(ii) IUPAC system or Jeneva system

Trivial System :Initially organic compounds are named on the basis of source from which they were obtained for

S. No.	Organic Compound	Trivial Name	Source
1	CH_3OH	Wood spirit or Methyl spirit	Obtained by destructive distillation of wood
2	NH_2CONH_2	Urea	Obtained from urine
3	CH_4	Marsh gas (fire damp)	It was produced in marshy places
4	CH_3COOH	Vinegar	Obtained from Acetum –i.e. Vinegar
5	COOH | COOH	Oxalic acid	Obtained from oxalis plant
6	HCOOH	Formic acid	Obtained from formicus [Red ant]
7	$CH_3-CH-COOH$ with OH on CH	Lactic acid	Obtained from sour milk
8	CH_2-COOH | $CH(OH)COOH$	Malic acid	Obtaied from apples
9	$CH_3CH_2CH_2COOH$	Butyric acid	Obtained from butter
10	$CH_3(CH_2)_4COOH$	Caproic acid	Obtained from goats



The following topics are included in AS-level Paper 2, A-Level Paper 2 and Paper 3 for AQA Chemistry. Detailed Notes Notes from Knockhardy Science3.1. Definitions, Functional Groups, Nomenclature, Formulae and Yield3.1. Hybridisation in Carbon and Bond Formation3.2. Alkanes, Pollution, Cracking and Petrochemical Industry3.3. Halogenoalkanes, Nucleophilic Substitution, Elimination Reactions, Uses and CFC Problems3.4. Alkenes - Isomerism, Electrophilic Addition, Polymerisation and Polymers3.5. Alcohols, Oxidation, IR Spec, Biofuels and Industrial Preparation of Ethanol3.6. IR Spectroscopy and Global Warming3.6. Identifying Ions - Isotopes and Mass Spec3.6. Mass Spectrometry All Notes Chemistry Developing fuels Made with ❤by snaprevise.co.uk Nomenclature Hydrocarbons can be:Aliphatic- carbon atoms form straight or branched chainsAlicyclic- carbon atoms form a ringAromatic - carbon atoms form a ring and have a delocalised electron systemHomologous series are compounds with the same functional group and similar chemical and physical properties. They differ by the number of repeating units they containA functional group is the group of atoms responsible for the characteristic reactions of a compound.To name a compound:The stem is the main part of the name derived from the longest carbon chain.The suffix after the stem, comes from the most significant functional groupThe prefix before the stem comes from functional groups attached to the main carbon chainNumbers and hyphens indicating the position of functional groups on the carbon chainFunctional groups are prioritised alphabetically Carbon Atoms in alkyl group Prefix 1 Methyl 2 Ethyl 3 Propyl 4 Butyl 5 Pentyl 6 Hexyl Compound Prefix Suffix Alkanes - -ane Alkenes - -ene Alcohols Hydroxy- -ol Carboxylic Acids - -oic acid Haloalkanes Fluoro-Chloro-Bromo-Iodo- - Aldehydes - -al Ketones - -one FormulaeGeneral formula- the simplest algebraic formula for a homologous seriesStructural formula gives the minimum detail on the arrangement of atoms in a molecule, without drawing any bondsMolecular formula shows the number and types of atoms of each element in a compound. However, it does not give any information on how the molecule is bonded together.Skeletal formula is a simplified formula used to represent organic molecules. Lines represent bonds between atoms, junctions are carbon atoms. Other labels are omitted.Displayed formula shows the relative positioning of atoms and the bonds between them. All atoms and bonds are shownEmpirical formula the simplest whole-number ratio of each element present in a compound. Reaction Mechanisms Bond fission can be homolytic or heterolytic Homolytic FissionWhen the bond breaks, each electron in the bond goes to a different atom. This results in the formation of highly reactive free radicals, each with an unpaired electron, represented by a dot. Heterolytic FissionWhen the bond breaks, both the electrons in the bond go to the same atom This results in the formation of a positively charged cation and a negatively charged anion. Bonds are formed on the collision of:Two free radials with unpaired electronsOppositely charged ions Isomerism Isomers are compounds with the same molecular formula but a different arrangement of atomsStructural isomers are compounds with the same molecular formula but a different structural formulaChain isomers- These are molecules with the same molecular formula but a different arrangement of the carbon chain. Chains can be straight or branchedPosition isomers- These are molecules with the same functional group attached to a different position on the carbon chainFunctional group isomers- These are molecules with the same molecular formula but different functional groupsStereoisomers are organic compounds with the same molecular and structural formulae but a different arrangement of atoms in spaceE/Z isomerism is a type of stereoisomerism that can arise in alkenes due to the restricted rotation around the C=C bond.If a carbon atom has two of the same substituent attached, it will not show E/Z isomerismSubstituents can be assigned priorities based on atomic mass using Cahn-Ingold-Prelog rules to name E/Z isomers. The greater the atomic mass, the higher the priorityWhen the highest priority groups are on different sides of the double bond, the isomer is an E-isomer.When the highest priority groups are on the same side of the double bond, the isomer is a Z-isomer Organic chemistry is the study of the structure, properties, composition, reactions, and preparation of carbon-containing compounds. Covalent bonding is a chemical bond that involves the sharing of electron pairs between atoms. Lewis model are diagrams that show the bonding between atoms of a molecule and the lone pairs of electrons that may exist in the molecule. A molecular orbital (MO) can be used to represent the regions in a molecule where an electron occupying that orbital is likely to be found. Resonance structures: when more than one Lewis structure may be written for a molecule, a single structure is not sufficient to describe it. Conjugated systems: system where electrons are delocalized in a molecule. Functional groups: the portion of the structure that controls the reactivity of the entire molecule and much of its physical properties. Organic chemistry is the study of the structure, properties, composition, reactions, and preparation of carbon-containing compounds, which include not only hydrocarbons but also compounds with any number of other elements, including hydrogen, nitrogen, oxygen, halogens, phosphorus, silicon, and sulphur. The range of application of organic compounds is enormous and also includes, but is not limited to, pharmaceuticals, petrochemicals, food, explosives, paints, and cosmetics. Covalent bonding A covalent bond, also called a molecular bond, is a chemical bond that involves the sharing of electron pairs between atoms. These electron pairs are known as shared pairs or bonding pairs. The stable balance of attractive and repulsive forces between atoms, when they share electrons, is known as covalent bonding. There are three types of covalent bonds: single, double, and triple bonds. A single bond is composed of 2 bonded electrons. Naturally, a double bond has 4 electrons, and a triple bond has 6 bonded electrons. Polar Covalent Bonding Polar covalent bonding is the process of unequal sharing of electrons. It happens due to the differing electronegativity values of the two atoms. Because of this, the more electronegative atom will attract and have a stronger pulling force on the electrons. Thus, the electrons will spend more time around this atom. Lewis model Lewis structures are diagrams that show the bonding between atoms of a molecule and the lone pairs of electrons that may exist in the molecule. A Lewis structure can be drawn for any covalently bonded molecule. Lewis structures show each atom and its position in the structure of the molecule using its chemical symbol. Lines are drawn between atoms that are bonded to one another (pairs of dots can be used instead of lines). Excess electrons that form lone pairs are represented as pairs of dots and are placed next to the atoms. The Lewis model limits second-row elements (Li, Be, B, C, N, O, F, Ne) to a total of 8 electrons (shared plus unshared). This means that one atom of carbon can combine with up to four other atoms. Therefore, organic compounds usually are large and can have several atoms and molecules bonded together. In their outer shells, carbon atoms have four electrons that can bond with other atoms. When carbon is bonded to hydrogen (which is common in organic molecules), the carbon atom shares an electron with hydrogen, and hydrogen likewise shares an electron with carbon. Carbon-hydrogen molecules are referred to as hydrocarbons. Resonance Sometimes more than one Lewis structure can be written for a molecule, especially those that contain multiple bonds. An example is ozone (O3). The structure of ozone requires that the central oxygen must be identically bonded to both terminal oxygens. In order to deal with circumstances such as the bonding in ozone, the notion of resonance between Lewis structures was developed. According to the resonance concept, when more than one Lewis structure may be written for a molecule, a single structure is not sufficient to describe it. Rather, the true structure has an electron distribution that is a “hybrid” of all the possible Lewis structures that can be written for the molecule. In the case of ozone, two equivalent Lewis structures may be written. We use a double-headed arrow to represent resonance between these two Lewis structures. This sometimes means that a pair of electrons is delocalized, or shared by several nuclei. Molecular orbitals A molecular orbital is a region of space within the molecule where there is a high probability of finding a particular pair of electrons. A molecular orbital (MO) can be used to represent the regions in a molecule where an electron occupying that orbital is likely to be found. Molecular orbitals are obtained from the combination of atomic orbitals, which predict the location of an electron in an atom. For methane, the molecular orbital is called sp3 and has a tetrahedral shape. The strongest type of covalent chemical bond is done by sigma bonds (σ bonds). pi bonds (π bonds) are covalent chemical bonds where two lobes of an orbital on one atom overlap two lobes of an orbital on another atom. Each of these atomic orbitals has zero electron density at a shared nodal plane, passing through the two bonded nuclei. The same plane is also a nodal plane for the molecular orbital of the pi bond. σ bond between two atoms: localization of electron density Two p-orbitals forming a π-bond Conjugated systems. In chemistry, a conjugated system is a system delocalized electrons in a molecule, which in general increases the stability of the molecule. It is conventionally represented as having alternating single and multiple bonds. The largest conjugated systems are found in graphene, graphite, conductive polymers, and carbon nanotubes. Functional groups When an alkane carbon chain is modified in any way is said to be functionalized. In other words, a functional group has been introduced and a new class of organic substances has been created. A functional group is a specific arrangement of certain atoms in an organic molecule that becomes the centre of reactivity. That is, it is the portion of the structure that controls the reactivity of the entire molecule and much of its physical properties. An entire classification system of functional groups is based on atom hybridization. Isomers An isomer of a molecule has the same number of atoms of each element but has a different arrangement of the atoms. It has the same molecular formula as the other molecule, but with a different chemical structure. Isomers do not necessarily share similar properties unless they also have the same functional groups. There are two main forms of isomerism: structural isomerism (or constitutional isomerism) and stereoisomerism (or spatial isomerism). In stereoisomers, the bond structure is the same, but the geometrical positioning of atoms and functional groups in space differs. This class includes enantiomers which are non-superposable mirror-images of each other, and diastereomers, which are not. Read more about Analysis of Organic Compounds References and further readings: Chemical bonding (general): Covalent bonds: harding/IGOC/A/atomic_orbital.html Petrucci, Ralph H. General Chemistry: Principles and Modern Applications. Upper Saddle River, NJ: Pearson/Prentice Hall, 2007. Print.

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