ONE PAGE NOTES

Class 10: Science
C4 : Carbon and Its Compounds

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• CARBON COMPOUNDS •

• CARBON & IT'S PROPERTIES :

→ Carbon forms covalent bonds. It is a non-metal. It's symbol is C.

→ Electronic configuration :- K L
2 4 → C(6).

• Carbon is tetravalent in nature. Carbon forms bond by sharing of its electron with electrons of other carbon atom or with other element & attain noble gas configuration.

• Atoms of other elements like hydrogen, oxygen, nitrogen & chlorine also form bonds by sharing of electrons

• Bond formed by sharing of electrons between same or different atoms is covalent bond.

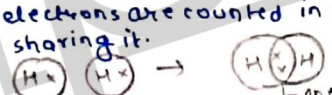
• Conditions for formation of a covalent bond :-

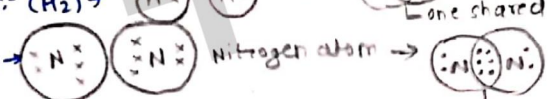
(i). Combining atoms should have 4-7 electrons in their valence shell.
(ii). Combining atoms should not lose electrons easily.
(iii). Combining atoms should gain electrons readily.
(iv). Difference in electronegativity of 2 bonded atoms should be low.

Properties of covalent compounds : (i). Physical states :- generally liquids or gases.
(ii). Solubility :- generally insoluble in water, but soluble in organic solvents like benzene etc.
(iii). M.P. & B.P. :- Generally have low m.p. & B.P.
(iv). Electrical Conductivity :- Do not conduct current.

• STEPS FOR WRITING LEWIS DOT STRUCTURE •

(i). Write elec. configuration for all atoms present in molecule
(ii). Identify how many elec. are needed by each atom to attain noble gas configuration.
(iii). Share elec. b/w atoms in such a way that all the atoms in a molecule have noble gas configuration.
(iv). Shared electrons are counted in valence shell of both atoms sharing it.

Ex :- (H_2) → 
one shared pair of elec

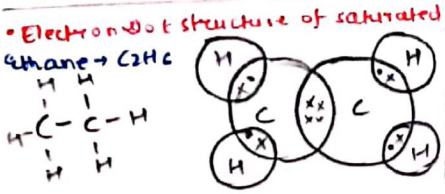
(N_2) → 
Nitrogen atom →
3 shared pair of elec

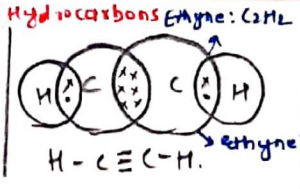
• Compounds made up of hydrogen & carbon are called Hydrocarbon. They can be saturated or unsaturated

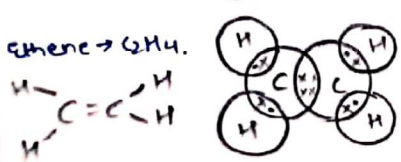
• Saturated → single bond b/w C atoms. $-\overset{|}{\underset{|}{C}}-\overset{|}{\underset{|}{C}}-$.
Alkanes : C_nH_{2n+2} → general formulae.

• Unsaturated → Double or triple bond b/w carbon atoms
Alkenes C_nH_{2n} ← $C=C$ $C\equiv C$ → Alkynes : C_nH_{2n-2}.

• Electron dot structure of saturated Hydrocarbons

Ethane → C_2H_6


Ethyne : C_2H_2

$H-C\equiv C-H$.

Ethene → C_2H_4.


Cyclic / Closed chain Hydrocarbons : Have C-C closed chain further, classified as : (i). Alicyclic :- Hydrocarbons which do not have benzene ring in their structures.
(ii). Aromatic :- Hydrocarbons which have benzene ring in their structures.

• Benzene :- An aromatic hydrocarbon which has molecular formula C_6H_6. Has alternating C-C single & double bonds.

• IUPAC name of hydrocarbons :
(i). Word Root :- No. of carbons in longest carbon chain.
(ii). Suffix :- single bond, suffix → ane, double → ene, triple → yne.

• Molecular formula → Involves actual no. of each type of atom present in the compound.
• Structural -"- → Actual arrangements of atoms written in structural formula.
• Condensed -"- → shortened form of structural formula.

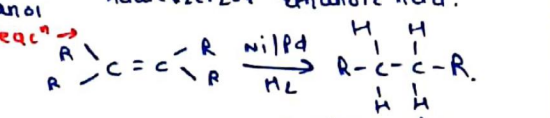
Hetero Atom	Functional group	Formula of func. group
Cl, Br, oxygen.	Halo (Chloro / Bromo)	-Cl, Br.
	1). Alcohol.	-OH.
	2). Aldehyde	-CHO.
	3). Ketone	$-\overset{|}{\underset{|}{C}}-$ (=O)
	4). Carboxylic acid	$-\overset{O}{\overset{\|}{C}}-OH$.
Double bond	1). Alkene group	$>C=C<$
Triple bond	• Alkyne group.	$-C\equiv C-$

• Homologous Series :- series of organic compounds in which every succeeding member differs from previous one by $-CH_2$ or 14 amu. Alkanes → C_nH_{2n+2}, Alkenes → C_nH_{2n}, Alkynes → C_nH_{2n-2}.

• Chemical Properties of Carbon compounds :-
(a). Combustion → $CH_4 + 2O_2 \xrightarrow{\text{Combustion}} CO_2 + 2H_2O$ + Heat + light.
• Carbon & it's compounds are used as fuels because they burn in air releasing a lot of heat energy.
• Saturated Hydrocarbons generally burn in air with blue & non-sooty flame.
• Unsaturated -"- burn in air with yellow sooty flame because % of carbon is higher than saturated hydrocarbon which does not get completely oxidized in air.

(b). oxidation → Alcohols can be converted to carboxylic acid in presence of oxidizing agent alkaline $KMnO_4$ or acidic potassium dichromate.

CH_3CH_2OH (Ethanol) $\xrightarrow[\text{Acidic } K_2Cr_2O_7]{\text{Alk. } KMnO_4}$ CH_3COOH. Ethanoic Acid.

(c). Addition Reac^n →


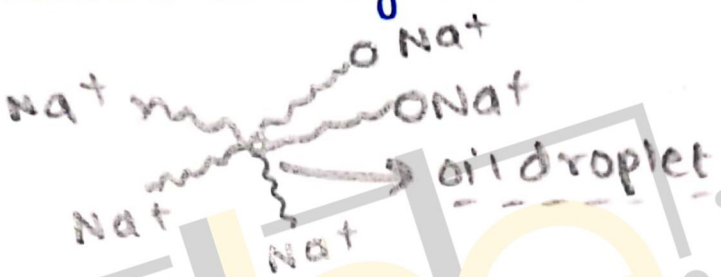
• Vegetable oils are converted into vegetable ghee using this process. It's called hydrogenation of vegetable oil.

(d). Substitution Reac^n → $CH_4 + Cl_2 \xrightarrow{\text{sun light}} CH_3Cl + HCl$.

SOAPS & DETERGENTS

• Soaps is sodium or potassium salt of long chain carboxylic acid. Eg $C_{17}H_{35}COONa^+$. They are effective only in soft water.
• Detergents are ammonium / sulphonate salt of long chain of carboxylic acid.
• Detergents are effective in both hard or soft water.

- Soap molecule has a ionic (hydrophilic) part & long hydrocarbon chain (hydrophobic).
- Cleansing Action of soap → Hydrophobic end of soap molecule attatches itself with dirt & ionic end is surrounded with molecule of water. This forms micelles.
- Micelles help to dissolve dirt & grease in water & cloth gets cleaned.



- Hard water contains magnesium & calcium salts which react with soap molecule to form insoluble product called scum.
- By use of detergent, insoluble scum is not formed with hard water & clothes get cleaned effectively.

- Esterification Reaction :- when an organic acid reacts with an alchohol in presence of acid catalyst. It produces a sweet smelling (fruity smell) substance called Ester.
- Saponification Reaction :- Esters react in the presence of an acid or base to give back the alchohol & the carboxylic acid.