Date: 02-07-2024

Organic compound

Organic Compounds:

> Organic compounds that are plant and animal origin.

example:- acetic acid (vinger), alcohol (wine), tartaric acid (grapes).

> Organic compounds are hydrocarbons and their derivates.

example: ethane, benzene, carboxylic acid, esters etc.

InOrganic Compounds:-

> Inorganic compounds are mineral origin.

example: salt, marble, CO_2.

> Inorganic compounds are those except hydrocarbons & derivates.

Example: CO_2, $H2O$, $HCO3^{-1}$, CS_2 etc.

Organic Chemistry:-

The branch of chemistry which deals with the study of hydrocarbons and their derivates.

Sources of Organic Compounds:

> main source fossil fuels:-

- coal
- petroleum
- natural gas.

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Fractions of Petroleum:

petroleum gas, Petrol (gasoline), Naphta, Paraffin, diesel, fuel oil, lubricating oil, Bitumen.

Synthesis:

Partial synthesis	Total synthesis
> In this synthesis, an intermediate product of reaction is used to synthesize the required product.	> In this synthesis, the starting material is converted through many steps into target product.
> less complex and challenging.	> more complex & challenging.
> It uses intermediate or existing part of molecule.	> It uses multiple steps to create entire molecule from starting.
> used when functionals groups or structual modification are needed on existing molecule.	> used for creating entirely new molecule that haven't been synthesized.
example:	example:
> $HCHO \xrightarrow{oxid} HCOOH$	> $2NH_3 + CO_2 \longrightarrow NH_2-\overset{\overset{O}{\|}}{C}-ONH_4$
> $CH_3-\overset{\overset{O}{\|}}{C}-H + [O] \longrightarrow CH_3-\overset{\overset{O}{\|}}{C}-OH$	$NH_2-\overset{\overset{O}{\|}}{C}-ONH_4 \xrightarrow{\Delta} NH_2-\overset{\overset{O}{\|}}{C}-NH_2$ (urea)
	> $CH_4 \xrightarrow{oxid} CH_3-OH \xrightarrow{oxid} HCHO \xrightarrow{oxid} HCOOH$

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Date: 03-07-2024

- destruction distillation of coal

coal is produced by decaying trees that are buried under earth crust by influence of temperature and high pressure.

Process :-

> Coal is heated in the absence of air → temp (500-1000°c).

> Then it's converted into different substances like :

• coke • coal gas • coal tar

destructive distillation:

The breakdown or decomposition in absence of air. Also called as Pyrolysis and devolatilization.

Description of Coal Products :-

1- Coke

> It's a solid carbon allotrope.

> Pure form of carbon.

> It's present in solid state.

> Produce 2 gases.

H_2O ← water gas $(CO + H_2)$ Producer gas $(CO + N_2)$ → NH_3

> left Part used as Pitch.

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2- Coal tar

> Black thick Liquid mixtue of 215 organic compound.

> By fractional distillation, it produces.

• benzene • benzole, toluene, napthalene, anthracene, xylene • phenol • cresal.

3- Coal gas

> Mixtue of H_2, CH_4, CO.

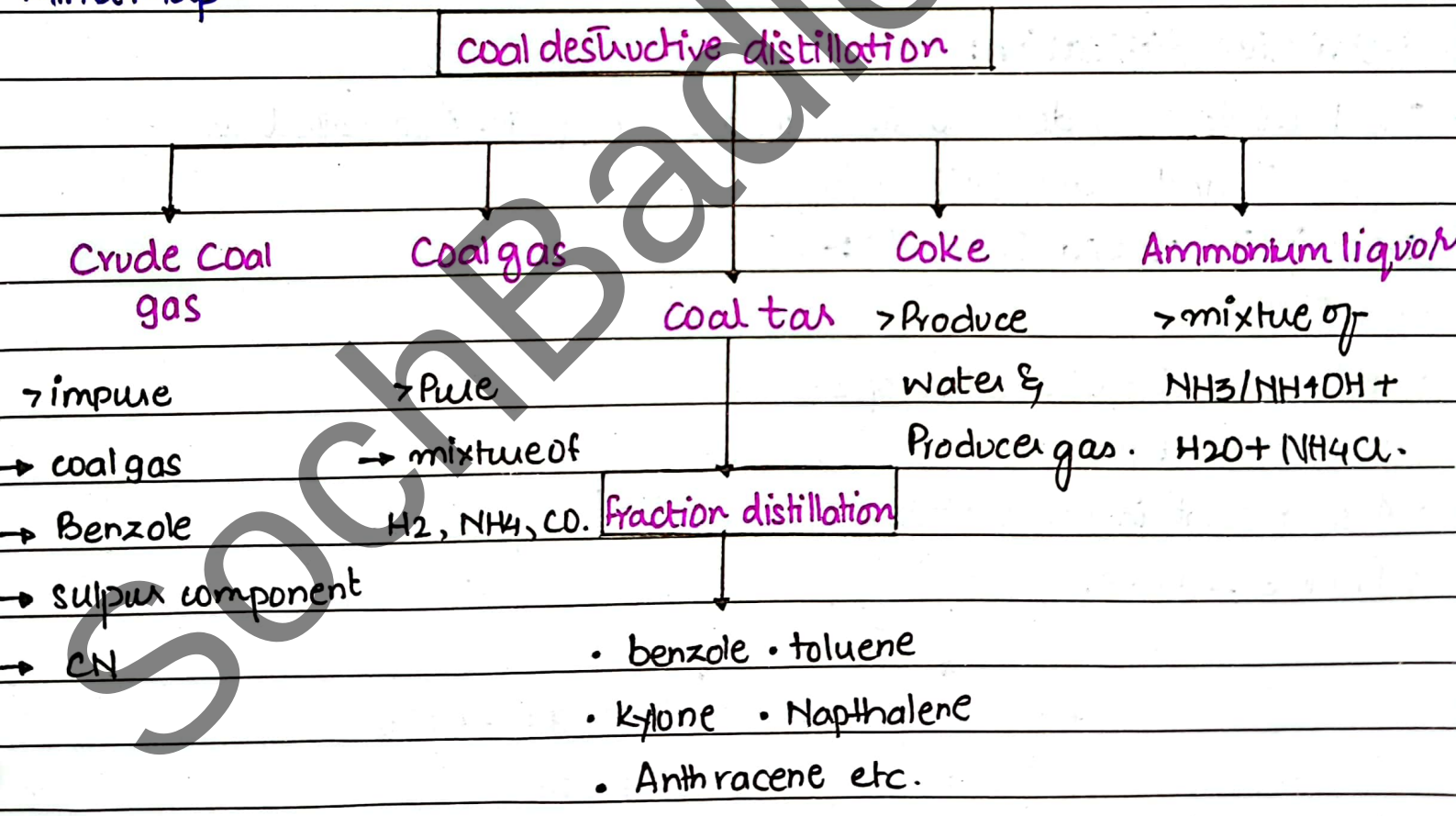
> used as fuel in industries.

4- Ammonical liquor

> Mixtue of NH_3 or NH_4OH + water + NH_4Cl.

> used in fertilizer & medicines.

Mind Map :-



Fractional distillation: sepaation of comp by diff boiling points.

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Date: 5th July-2024

allotropes

Definition:-

Different structual forms of same elements in same physical state.

Reason:-

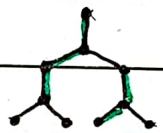
Due to different arrangements of atoms, physical forms of element exists.

> Physical Properties · M.P, B.P, taste, smell, density, evaporation, color, shape, thermal conductivity, electrical conductivity, volume, refractive index.

allotropes of Carbon:

There are 3 allotropes of Carbon:-

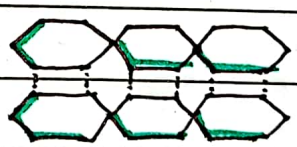
diamond:-



> 1C = 4C

> tetrahedral

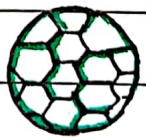
Graphite:-



> 1C = 3C

> hexagonal

Bucky ball:-



> 1C = 3C

> ball shaped or football

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Bucky Ball / Fullerences :-

1- Discovery: discovered in 1985 by Buckminister fullerences.

2- No. of carbon atom: contain C-atom from C40 - C100.
Simplest bucky ball have carbon atom - 60.

3- Structure:- hollow cage like structure.
Pentagon = 12 & hexagon = 20.

4- Bonding : C1 = C3.

5- Uses :- lubricant, semi-conductor, to store hydrogen, serves as drug delievey, imaging agents, performance in solar cells etc.

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Date: 8th July - 2024

Functional group

Definition:- A functional group is an atom or group of atoms in a molecule that gives characteristics properties to the molecule.

> hetero-atoms form functional groups.

> The functional groups causes physical & chemical properties of molecule or compound.

change

double & Triple bonds are also functional groups.

example:- CH_4 (methane) VS CH_3-OH (methanol – IUPAC & methyl alcohol – C.N)

Importance:

Functional groups undergo characteristic reactions. They hold crucial imp.

Basics of nomenclature F.G serves as basis of nomenclature of organic compounds.

Chemical reactivity F.G is a site of chemical reactivity of molecule.

Classes F.G serves to classify O.C into classes.

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Polyfunctional :-

A molecule that contain more than one functional group.

> the properties of each functional group may be modified by presence of others.

example :-

$CH_2 = CH - CH_2 - OH$

double → alcohol

M.P & B.P ∝ No. of carbon atoms.

↳ MDCAT mcq.

Date: 9th July-2024

homologous series

A series of organic compounds in which two successive members of series differ by $-CH_2$ unit or 14amu.

> Each member is called homolog.

→ Tables:

Prefix	Name			Molecular f	condensed f
-	alkane	alkene	alkyne		
Meth	methane	-	-	CH_4	CH_4
Eth	ethane	ethene	ethyne	C_2H_6	$CH_3\bar{C}H_2$
Prop	Propane	Propene	Propyne	C_3H_8	$CH_3\bar{C}H_2\bar{C}H_3$
but	butane	butene	Butyne	C_4H_{10}	$CH_3\bar{C}H_2\bar{C}H_2\bar{C}H_3$
Pent	Pentane	Pentene	Pentyne	C_5H_{12}	$CH_3\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_3$
hex	hexane	hexene	hexyne	C_6H_{14}	$CH_3\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_3$
hept	heptane	heptene	heptyne	C_7H_{16}	$CH_3\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_3$
oct	octane	octene	octyne	C_8H_{18}	$CH_3\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_3$
non	nonane	nonene	nonyne	C_9H_{20}	$CH_3\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_3$
dec	decane	decene	decyne	$C_{10}H_{22}$	$CH_3\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_2\bar{C}H_3$

Teacher's Signature:

Date: 10th July - 24

detection

Carbon is crucial element in all organic compound. Hydrogen is also present in almost all O.C but may be replaced by S, N, O2, P & other metals.

Part a

Carbon and hydrogen

1. Carbon and hydrogen are heated by adding small quantity of O.C.
2. Add some CuO with O.C in a glass test tube.
3. Heat this mixture.
4. Oxidation of Carbon and hydrogen occurs producing carbon dioxide & water.
5. Testing of C by CO_2 & H_2 by H_2O can be done as follows :-

Carbon	Hydrogen
• Take limewater that's transparent in color.	• Take copper anhydrous in solid form & white in color.
• Adding CO_2 will turn lime water color to milky white.	• Water will change its color to blue making copper sulphate hydrated.

Reaction

1. $C + 2CuO \rightarrow CuO_2 + 2Cu$
2. $CO_2 + Ca(OH)_2 \rightarrow CaCO_3 + H_2O$
   Lime water (transparent) — white ppt insoluble

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3. $H_2 + CuO \rightarrow H_2O + Cu$

4. $5H_2O + CuSO_4 \rightarrow CuSO_4.5H_2O$

anhydrous — white solid

hydrated — blue color.

Q# Why don't CO_2 & H_2O form H_2CO_3?

↳ both gases are in gaseous state, gases need high pressure to make react together. Other reason is that H_2O & CO_2 will move from high temp → Low temp towards conical flask where it will detected.

Part b

Preperation of Lassaigne's Solution

1. Cut a small piece of sodium metal with the help of knife.
2. Put these piece of sodium metal in fusion tube.
3. Heat the fusion tube in a flame to melt sodium metal.
4. When sodium metal is melted, add small quantity of O.C.
5. Then again heat, the fusion tube till becomes hot red.
6. Break the fusion tube into china dish that contain $20cm^3$ of distill water.
7. Mix all mixture then boil it & filter the solution.
8. This filterate is called Lassaigne's solution or sodium extract.
9. Divide this filterate into 3 portion to test following.

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Equation

$Na + C + N \rightarrow NaCN$ → Lassaigne containing Na, C, N.

$2Na + S \rightarrow Na_2S$ → Lassaigne containing Na, S.

$Na + N + C + S \rightarrow NaSCN$ → Lassaigne containing, C, N, Na, S.

$Na + X \rightarrow NaX$ → Lassaigne containing Na, X.

↳ Cl, Br, I.

→ Nitrogen test

- Take a portion of Lassaigne's sol or filterate. (NaCN).
- Add few drops of NaOH to make it alkaline.
- Add freshly prepared $FeSO_4$ solution in it.
- Boil the sol.
- Add few drops of $FeCl_3$ & HCl into it.
- blue or greenish blue (Prussion blue) → pproves presence of nitrogen.
- if blood red color is produced it proves presence of sulphur & nitrogen.

Equation of nitrogen

$$6NaCN + FeSO_4 \rightarrow Na_4[Fe(CN)_6] + Na_2SO_4.$$

$$3Na_4[Fe(CN)_6] + 4FeCl_3 \rightarrow \underbrace{Fe_4[Fe(CN)_6]_3}_{\text{prussion blue}} + 12NaCl$$

Equation of nitrogen & Sulfur

$$6NaSCN + FeSO_4 \rightarrow Na_4[Fe(SCN)_6] + Na_2SO_4$$

$$3Na_4[Fe(SCN)_6] + 4FeCl_3 \rightarrow \underbrace{Fe_4[Fe(SCN)_6]_3}_{\text{blood red}} + 12NaCl$$

Date: _____

→ Detection of Sulphur 1

Procedure:

- Take second portion of Lassaigne's solution.
- This sol is acidified by adding acetic acid.
- Boil this sol.
- We need to expel out H_2S gas. This gas is a very rotten bad smell.
- For last verification, we take either lead acetate sol or lead acetate paper.
- By dipping paper or adding sol we get results.

Results:

Black spots on paper & pure black color in H_2S sol.

Equation:

$$Na_2S + 2CH_3COOH \rightarrow 2CH_3COONa + H_2S.$$

$$H_2S + (CH_3COO)_2Pb \rightarrow \underbrace{PbS}_{\text{Black color ppt}} + CH_3COOH$$

The main reagent in Sulphur detection is Lead sulfate.

→ Detection of Sulphur 2 MDCAT imp:

Procedure:

- Taking Lassaigne's solution containing sulphur.
- Add Sodium nitro prosside.
- If violet color appears, it shows presence of sulfur.

Equations:

$$Na_2S + Na_2[Fe(CN)_5NO] \rightarrow Na_4[Fe(CN)_5SNO].$$

↳ violet ppt

Date:

→ Detection of halogen

Procedure:

- Take third portion of Lassaigne's sol.
- It's boiled with conc. HNO_3 to expel the cynide (CN^-) & sulphide ions (S^{-2}).
- Cool this sol.
- Add $AgNO_3$ in it.
- The formation of some ppt with specific ~~results~~ colors which the results.
- Adding NH_4OH with each halogens like Cl & Br & I.

Results:

• Deep yellow (I)	• White ppt (Cl)	• Pale yellow
• AgI	• AgCl	• AgBr
• NH_4OH insoluble ppt	• NH_4OH soluble ppt	• NH_4OH partial soluble.

Equation:

$$NaX + AgNO_3 \rightarrow NaNO_3 + AgX$$

→ $NaCl + AgNO_3 \rightarrow NaNO_3 + AgCl$

→ $NaBr + AgNO_3 \rightarrow NaNO_3 + AgBr$

→ $NaI + AgNO_3 \rightarrow NaNO_3 + AgI$.

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Date: 15-07-2024

Alkaloid

Any class of nitrogenous O.C of plant origin which have pronounced physiological action on human.

e.g:- quinine, morphine, nicotine.

Solo Question

Q#1: What is water gas?

- Water gas is a type of synthetic natural gas (SNG) that is produced from water.
- It is produced by a process called Gasification, where H_2O is converted into CO_2, H_2, CH_4 by reaction under 800°C.
- The resulting gas is colorless, odorless, tasteless and non-toxic.
- Used for industrial process, vechiles etc.

Q#2: What is coal gas, how it is obtained?

- Coal gas also known as town gas is widely used as fuel.
- It is produced by heating coal in absence of air at high temp.
- It can be obtained by:-

1- Coal selection:- ↑ carbon & ↓ S.
2- Washing and cleaning: rid of impurities.
3- Gasification: heated at 800°C - 900°C. producing numerous products.
4- Purification: rid of S, NO etc.

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Q#3. difference between Partial & Total synthesis?

Partial Synthesis	Total Synthesis
Definition	
• In this synthesis, an intermediate product of reaction is used to synthesis required product.	In this synthesis, the starting material is converted through many steps into targeted product.
Source	
• Compounds are isolated from natural sources.	Compounds are synthesized from cheap & available source.
Steps	
• limited steps must be followed.	Proper max steps must be followed.
intermediate	
• intermediate is formed.	intermediate is not formed.
favourable	
• less favourable as it's not economical.	more favourable becoz it's economical.
examples	
• Preparation of soap or ghee.	• Preparation of Urea.
$CH \equiv CH + H_2 \xrightarrow[200-300^\circ C]{Ni} CH_2 = CH_2$	$2NH_3 + CO_2 \rightarrow NH_2-\underset{\underset{O}{\|}}{C}-ONH_4$.
$CH_2 = CH_2 + H_2 \rightarrow CH_3-CH_3$ (ghee)	$NH_2-\underset{\underset{O}{\|}}{C}-ONH_4 \xrightarrow{\Delta} NH_2-\underset{\underset{O}{\|}}{C}-NH_2$.
• $HCHO \xrightarrow{oxid} HCOOH$	• $CH_4 \xrightarrow{oxid} CH_3-OH \xrightarrow{oxid} HCHO \xrightarrow{oxid}$ $HCOOH$.
• $CH_3-\underset{\underset{O}{\|}}{C}-H + [OA] \rightarrow CH_3-\underset{\underset{O}{\|}}{C}-OH$.	

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Q#4: Difference b/w destructive & fractional distillation.

destructive distilla	fractional distillati
— definition —	
• A process that involve decomposition of a solid by heating it in a closed container.	A process that separate hydrocarbon components on different boiling points.
— Separation —	
• Separation of components via decomposition of solid.	separation of components to difference in boiling point.
— Material —	
• for coal.	for coal gas, crude oil.
— Gases —	
No involvment of gases.	involvment of gas.

Q#5 Products ~~Products~~ produced by hydrolysis of coal.

Liquid Product:

• Coal tar • Coal oil • heavy oil

Solid Product:

• Coke • CHAR

Chemical:

• Phenol • benzol • benzene • toluene • Xylene etc.