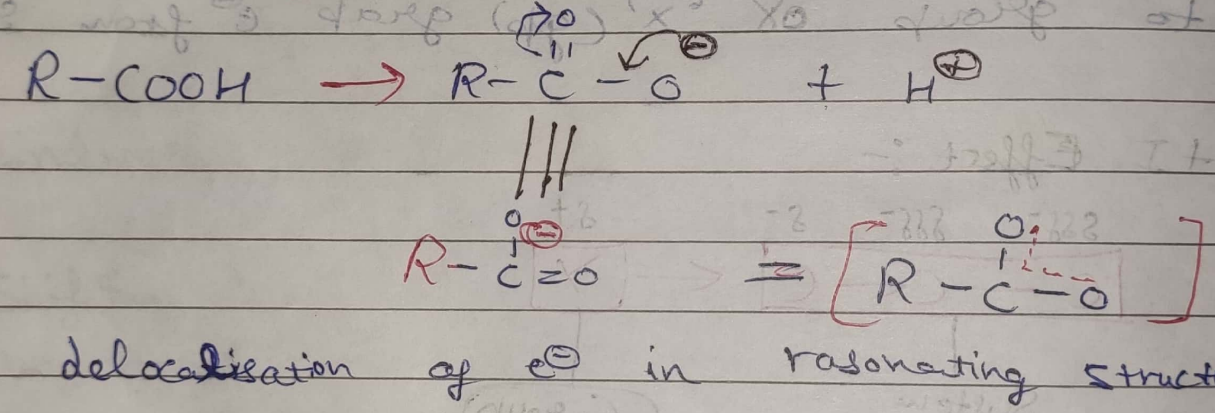
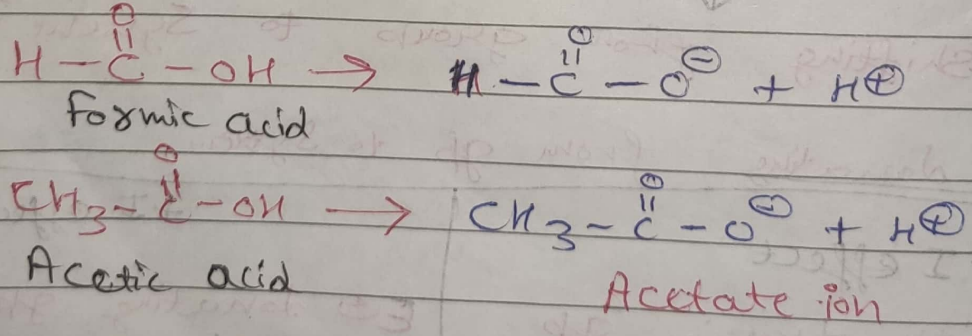
Acidity of Carboxylic Acid



delocalisation of $e^{\ominus}$ in resonating structure

* more resonating structure, more will be the acidity of Carboxylic a

e.g:-



Formic acid

Acetic acid

Acetate ion

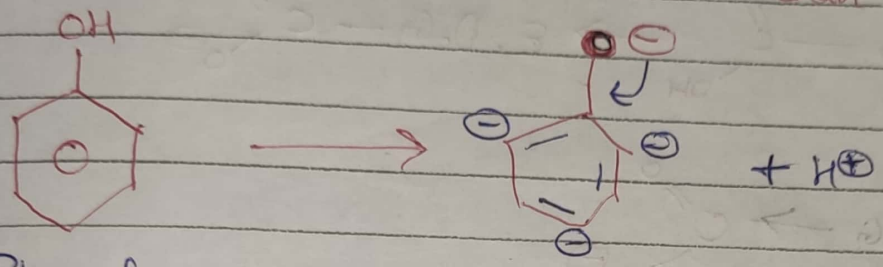
Q Which Acid is more Stable?

In formic acid, formate ion give two resonating structure. where as Acetate ion,

also give two resonating structure. but there is $e^{\ominus}$ donating group in the acetate ion. which disturb the stability of acetate ion. In formic acid, there is no $e^{\ominus}$ donating group so, thats why formic acid is more stable that acetic acid.

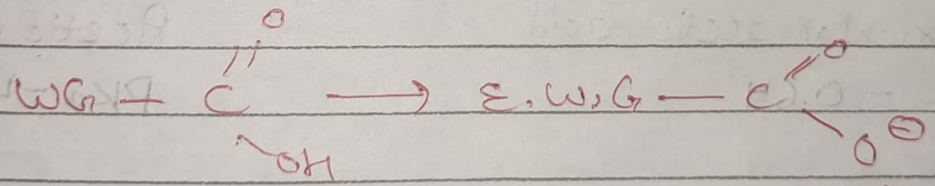
e.g:

⇒ Why Phenolic less acidic than acetic acid.

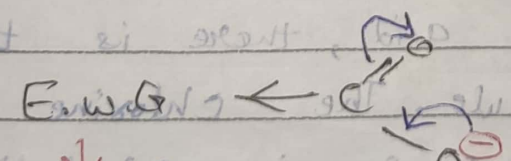


Phenol — Phenoxide ion (4 resonating structure)

In Phenol there is delocalisation of $e^{\ominus}$ on carbon atom. In acetic acid there is delocalisation of $e^{\ominus}$ on oxygen atom. as we ~~know~~ oxygen is more electronegative atom. they have tendency to accept $e^{\ominus}$ towards itself so, ~~Ea~~ Phenol is less stable acidic than acetic acid



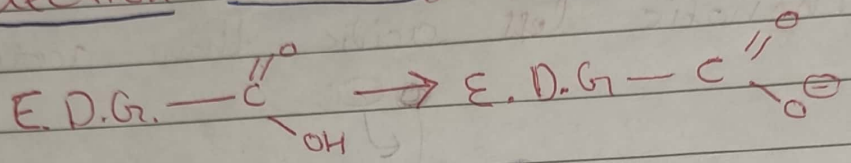
e.g:-

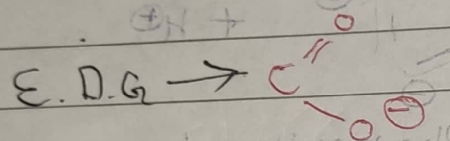


E.W.G is attach to this carboxylic group that is present over here. The negative charge will move toward E.W.G there by stabalising

the carboxylate ion & we can say that it will help in removing the $H^{\oplus}$ from the carboxylic acid. So, E.W.G. will help to inc. the acidity of carboxylic acid.

Electron Donating group





Electron donating g/p (E.D.G) will actually destabilise the carboxylate ion. there by $H^{\oplus}$ will not remove very easily.

⇒ Why trichloro acetic acid is more acidic than acetic acid.

CCl_3-COOH CH_3COOH

Trichloro acetic acid
PKa - 0.64

Acetic acid
PKa - 4.34

In Trichloro acetic acid, there is three chlorine atom in this molecule. The chlorine substituent are basically E.W.G. So, it stabalise the carboxylate ion as there by it help to remove $H^{\oplus}$ ion more easily remove the $H^{\oplus}$ ion more acidic will be the acidi molecule.
In acetic acid, CH_3 is E.D.G that destab due the carboxylate ion.

⇒ The other factor i.e. Acidic strength also depend upon the acidity of Carboxylic acid.

e.g:-

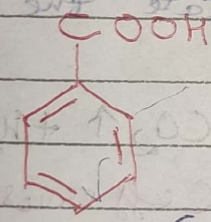
$CH_3-CH_2-\underset{Cl}{\underset{|}{CH}}-COOH$ 2-Chloro-butanoic acid

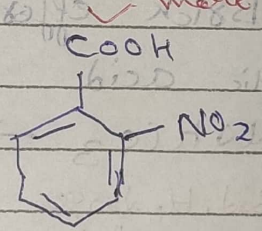
Pka - 2.86

$\underset{Cl}{\underset{|}{CH_2}}-CH_2-CH-COOH$ 4-chlorobutanoic acid

Pka - 4.52

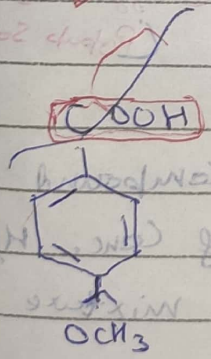
In 2-chloro-butanoic acid the Cl atom is very much closer to Carboxylic gp, it will help to remove $H^{\oplus}$ ion easily where as, 4-chlorobutanoic acid, the Cl atom is very much far to Carbonyl gp. it will not help to remove $H^{\oplus}$ ion easily. So, 2 chlorobutanoic acid is more acidic than 4-chlorobutanoic acid.





✓ more acidic

$= N \rightarrow O$



$e^{\ominus}$ $\xrightarrow{D}$ dec. acidity

$e^{\ominus}$ $\xrightarrow{W}$ inc. acidity

due to $e^{\ominus}$ donation gp they destabalse the resonating → dec the acidity.

Nitro B.A > Benzoic a > p. methoxy benzoic acid

the resonating ~~Stru~~ structure of p-methoxy benzene is destablise due to e⊖ donating gp.

Qualitative test of Carboxylic group

① Litmus Test :- Place a drop of organic compound & moist blue litmus paper.

Observation :- Blue litmus paper changes to red indicate the presence of Carboxylic or phenolic gp.

Rexn :- $R-\overset{O}{\overset{\|}{C}}-OH + H_2O \rightleftharpoons R-\overset{O}{\overset{\|}{C}}-O^{\ominus} + H_3O^{\oplus}$

② Sodium Hydrogen Carbonate Test :- To the organic compound add Pinch of Sodium bicarbonate

Observation :- Brick effervescence indicate the presence of Carboxylic acid

Rexn :- $RCOOH + NaHCO_3 \rightarrow RCOONa + CO_2\uparrow + H_2O$

Carboxylic acid — Sod. Hydrogen Carboxylate — (Effervescence) (Pop up Sound)

③ Ester Test :- To the organic compound & add 1ml of ethyl alcohol and few drop of Conc. H_2SO_4 → heat the mixture → pour the mixture in beaker containg water.

Observation :- fruity Smell indicat the presence of Carboxylic acid.

Rexn :- $RCOOH + C_2H_5OH \xrightarrow{Conc.\ H_2SO_4} \underline{RCOOC_2H_5} + H_2O$

Carboxylic acid

Qualitative Test for Amide

① Alkaline Hydrolysis :- 0.1 gm organic compound + 10 drops of NaOH Sol^n + Boil.

Observation :- Evolution of ammonia which turn turmeric paper red → indicate the presence of Amide.

② Hydroxamic acid Test :- 0.2 gm of Sample + 2 ml Hydroxylamine HCl + boil for 5min + Cool + few drops of $FeCl_3$ (Ferric chloride)

Observation :- Bluish red Colour which indicate the presence of Amide group (Caliphatic amide).

③ Nitrous Acid Test :- 0.2 gm Comp. + 2 ml of HCl (dil.) + 2 ml of $NaNO_2$ Sol^n.

Observation :- Brick effervescence due to evolution of N_2 which indicate the presence of Amide.

④ Hydrogen Peroxide Test :- 0.2 gm Comp. + 1ml of water + 7-8 drops of H_2O_2 + boil + Cool + add drops of $FeCl_3$.

Observation :- Blue Colour which indicate the presence of Amide group. (Aromatic amid)

PAGE No
DATE : / /201

Qualitative Test for Ester.

① Phenolphthalein Test :- 0.1gm Comp. + water + 2 drops of Phenolphthalein + 2ml dil. NaOH.

Observation :- Disappearance of Pink color which indicate the prence of Ester gp.

② Hydroxamic Acid Test :- Mix 0.4 gm comp ē hydroxylamine in ethanol & ethanolic NaOH

↓ Heat

↓ Cool + add Hcl + fecl3

Observation :- Deep red colour which indicatic the presence of Ester group.

Inductive Effect :-

Shifting of $e^{\ominus}$ in covalent bond from low electro-negative atom to high electronegative atom.

e.g:- $H \xrightarrow{} Cl$

Always sigma (σ) $e^{\ominus}$ are displaced (only occure in single bond)

e.g:- C-C ; C-H , H-Cl

Permanent ~~effect~~

It is distance dependent. (decreased when distance is increased).

e.g:- $\overset{\delta\delta I}{C} - \overset{\delta\bar{\delta} J}{C} \rightarrow \overset{+\delta I}{C} \rightarrow F$

It is two types which depends on ~~the~~ type of group attached.

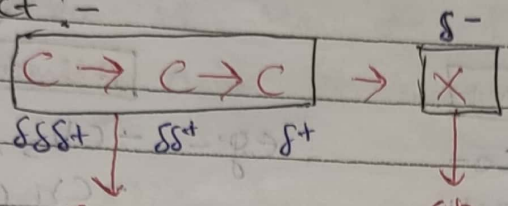
Types of Inductive Effect :-

↓ depend upon gps i.e. functional gp.

$e^{\ominus}$ donating, ⊕ ⊖ withdrawing gp.

① -I Effect :-

e.g.:-



System

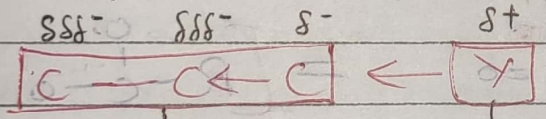
gp

↓

More electronegative than System

-I Effect :- Abstracting of $e^{\ominus}$ System to group or 'x' (gp) grap $e^{\ominus}$ from System.

② +I Effect :-



System

Group

* less electronegative than System *

↓

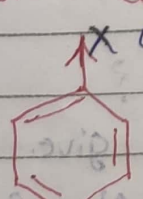
$e^{\ominus}$ shifting from group to System i.e. +I effect

e⊖ donating from gp to System.

-I effect

$e^{\ominus}$ with drawing gp

e.g.:-

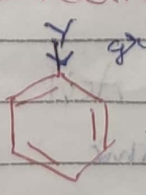


* $e^{\ominus}$ withdraw from system to group.

+I effect.

E⊖ donating gp

e.g.:-



* $e^{\ominus}$ donate from group to System.

⇒ Which types of group that induce inductive effect :-

−I effecting group

↓

All functional group

e.g:- $-CHO$, $-OH$, $-CO-$

$-NH_2$ $-CN$, $-COOH$

* All functional group that cause −I effect

+I effecting

↓

All alkyl group

e.g:- $-CH_3$, $-CH_2CH$

$-CH(CH_3)_2$

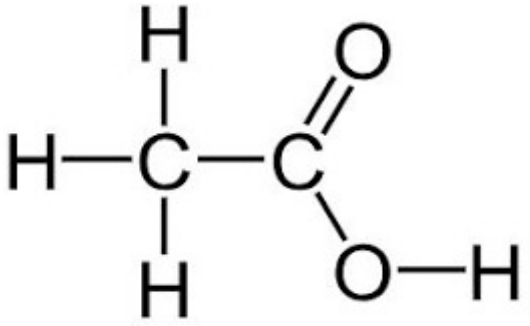
$C(CH_3)_3$

(tert butyl)

ACETIC ACID

Acetic acid is a colourless liquid organic compound with the chemical formula CH3COOH .
When undiluted, it is sometimes called glacial acetic acid.
Vinegar is roughly 3–9% acetic acid by volume, making acetic acid the main component of vinegar apart from water.
Acetic acid has a distinctive sour taste and pungent smell. In addition to household vinegar.
It is miscible in water.

STRUCTURE



Acetic acid

USES OF ACETIC ACID

Industrial chemical, used primarily in the production of cellulose acetate for photographic film, polyvinyl acetate for synthetic fibres and fabrics.

The major esters of acetic acid are commonly used as solvents for inks, paints and coatings.

In households, diluted acetic acid is often used in descaling agents.

In the food industry, acetic acid is used as food additive.

Medicinal Uses:

Acetic acid injection into the tumor has been used to treat cancer since the 1800s.

While diluted acetic acid is used in Iontophoresis.

As a treatment for otitis externa.

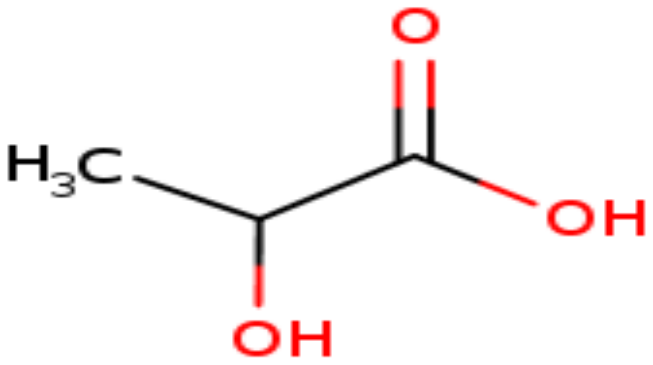
It is an effective antiseptic when used as a 1% solution, with broad spectrum of activity against streptococci, staphylococci, pseudomonas, enterococci etc.

LACTIC ACID

Lactic acid is an organic compound with the formula CH3CH(OH)COOH.
- In its solid state, it is white and water-soluble. In its liquid state, it is colorless crystalline in nature.
It is produced both naturally and synthetically. With a hydroxyl group adjacent to the carboxyl group, lactic acid is classified as an alpha-hydroxy acid (AHA).

In the form of its conjugate base called lactate, it plays a role in several biochemical processes.

STRUCTURE:



2-Hydroxypropanoic acid

•**USES:**

• **In Pharmaceutical and cosmetic:**

• Lactic acid is also employed in pharmaceutical technology to produce water-soluble lactates from otherwise-insoluble active ingredients.

• It is use in topical preparations and cosmetics to adjust acidity and for its disinfectant and keratolytic properties.

•It is also used as buffer

USES

- **In Food uses:**

Lactic acid can be used in meat, poultry and fish in the form of sodium or potassium lactate to extend shelf life, control pathogenic bacteria.

Because of its mild taste, lactic acid is used as an acidity regulator in beverages such as soft drinks and fruit juices.

Lactic acid is effective in preventing the spoilage of onions and other vegetables preserved in brine.

Lactic acid may be also used as a preservative & maintaining stability and safety.

In Detergents:

It is a good descaler and a registered anti-bacterial agent.

commercial products

Name of products	USES
Buffered Lactic acid	***Hard/soft candy***
Calcium Lactate	***Tooth paste and mouth washes ; Chewing gum***
Ethyl Lactate	***Flavours (straw berry and butter); Pesticide; Hair***
Lactic Acid	Wound Dressing; Beer; Ice cream; Gum & jellies; Biscuit/cookies
Zinc Lactate	Oral care(tooth paste and mouth washes)
Sodium/Potassium Lactate	Cakes, breads, rolls; Fresh meat; Pancake bread

TARTARIC ACID

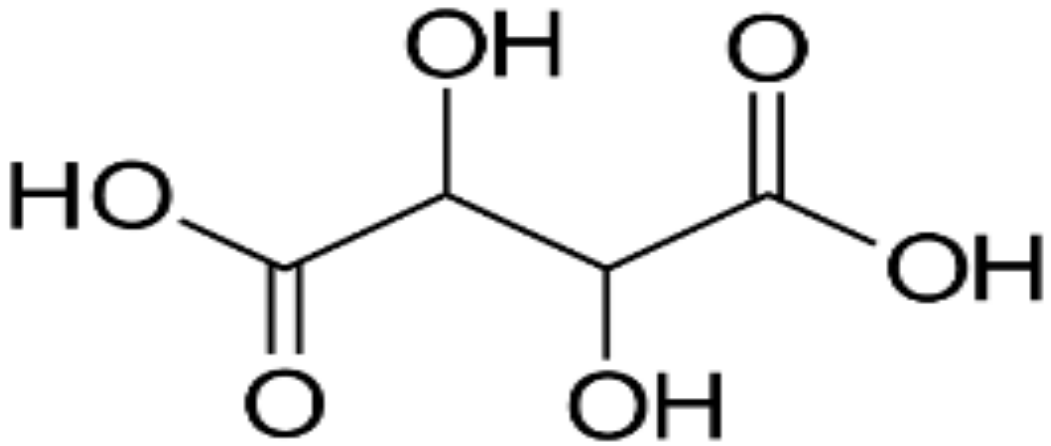
Tartaric acid is a white crystalline organic acid that occurs naturally in many fruits, most notably in grapes, but also in bananas, tamarinds and citrus.

Its salt, potassium bitartrate, commonly known as cream of tartar.

It is commonly mixed with sodium bicarbonate and is sold as baking powder used as a leavening agent in food preparation.

The acid itself is added to foods as an antioxidant and to impart its distinctive sour taste.

STRUCTURE OF TARTARIC ACID



2,3-Dihydroxybutanedioic acid

MEDICINAL USES

Tartaric Acid is used as ***Antiseptic.***

It has been used in combination with citric acid, to improve the taste of oral medications.

Tartaric acid is a great source of ***antioxidants.***

Another health benefit of tartaric acid is that it aids digestion .***It improves intestinal absorption as well which will increase the rate at which healthy nutrients flow into your bloodstream.***

One of the most surprising benefits of tartaric acid is that it significantly improves ***glucose intolerance.***

Salt of Tartaric acid like Potassium sodium tartrate, also known as **Rochelle salt which is used as *Saline (Osmotic) Cathartics.***

CITRIC ACID

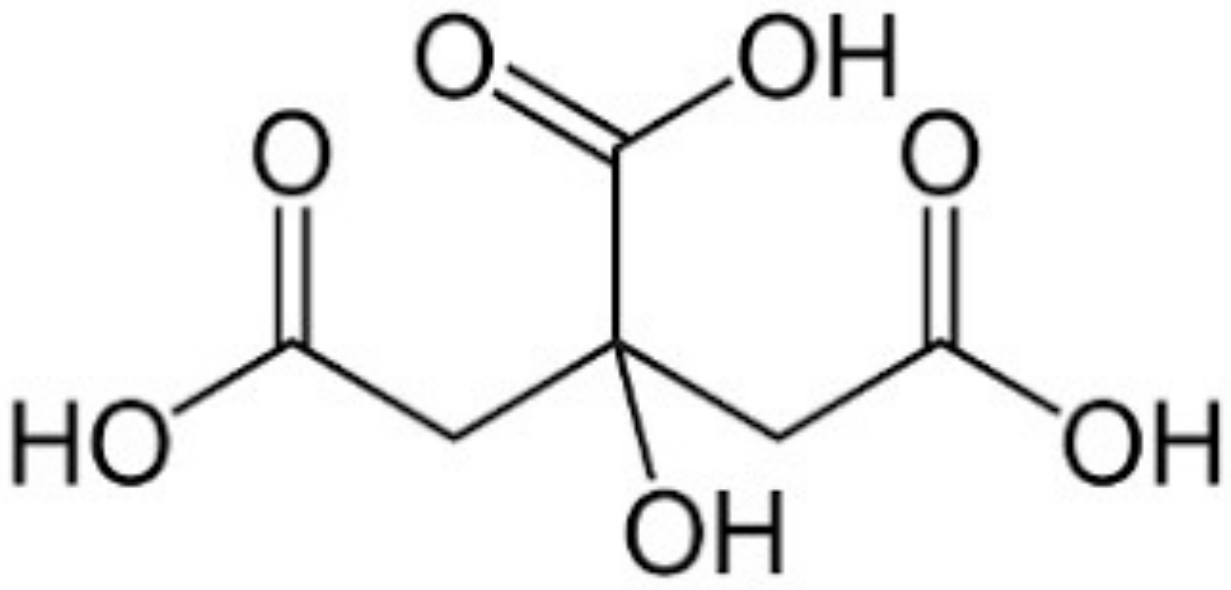
Citric acid is a weak organic acid that has the chemical formula C6H8O7..

- Citric acid is **Polyprotic acids are capable of donating more than one proton**

It occurs naturally in citrus fruits. In biochemistry, it is an intermediate in the **Citric Acid Cycle, which occurs in the metabolism of all aerobic organisms.**

In Citric acid the middle acid group that has the lowest pKa. This is because the hydroxyl group also bonded to the middle carbon is electron-withdrawing by induction, and a negative charge associated with a conjugate base will be stabilized to the greatest extent on the middle carboxylate

STRUCTURE OF CITRIC ACID



2-Hydroxypropane-1,2,3-tricarboxylic acid

USES

Citric acid powder is used as a food preservative, added to beverages and pharmaceutical products.

It is used as a flavouring ingredient for candy and beverages.

It is also an antioxidant, which makes it a favourable product to be used in skin care products.

Citric acid is a type of alpha-hydroxy acid (AHA), making it a good agent to remove dead skin cells and exfoliate the skin.

It is important for producing energy that keeps you active and healthy and is safe for human consumption. Also, its alkaline nature helps to balance the acid levels in the body.

It is used in the canning process as it helps to maintain a healthy pH balance inside the foods and helps to prevent botulism (a harmful form of food poisoning).

Citric acid can also be used as a mouth rinse.

Citric acid combined with other ingredients can make up a very good anti-aging face mask.

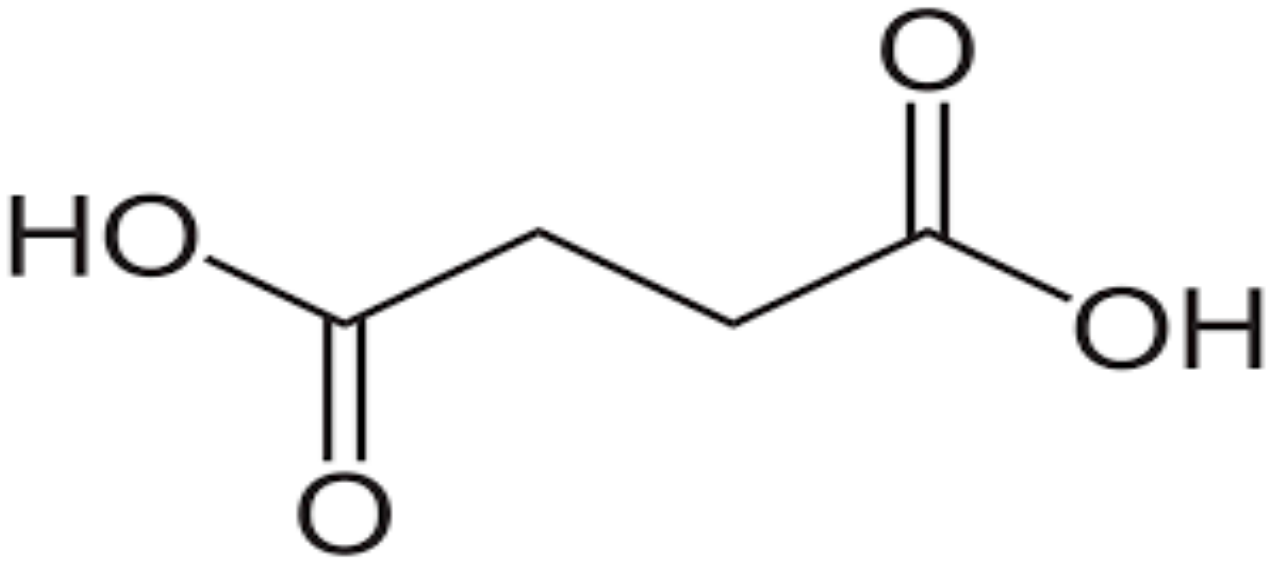
Citric acid has alkalizing properties which help to bind calcium and therefore preventing the formation of kidney stones. It also helps to keep the kidneys in a proper functioning state.

SUCCINIC ACID

Succinic acid is a dicarboxylic acid with the chemical formula (CH 2)2(CO2H)2

- The name derives from Latin ***succinum, meaning amber.***
- Succinate can exit the mitochondrial matrix and function in the cytoplasm as well as the extracellular space, changing gene expression patterns.
- As a diprotic acid, succinic acid undergoes two successive deprotonation reactions and The pKa of these processes are 4.3 and 5.6

STRUCTURE OF SUCCINIC ACID



Butandioic acid

USES

Succinic acid regulates ***cardiomyocyte. It means that it's helps the heart pump blood properly. This is good for people suffering from a cardiovascular disorder.***
Succinic acid has even been known to help prevent heart attacks.
Succinic acid is used as an acidity regulator and pH regulator in food.
Succinic Acid can be used as an excipient.
Succinic Acid can be used as **Masking Buffering in Cosmetics and personal care products.**
succinic acid has played a key role in healing and providing pain relief.

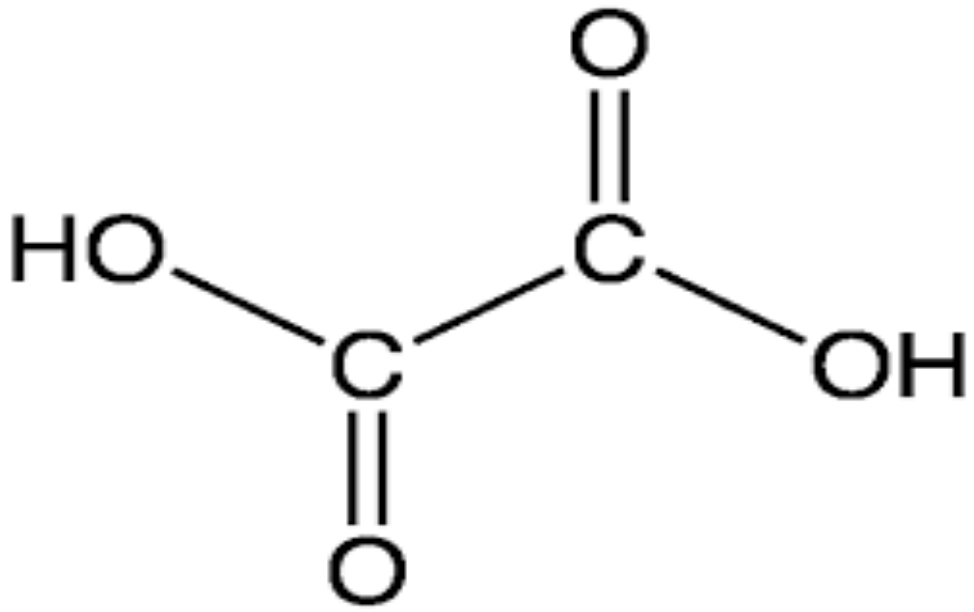
OXALIC ACID

Oxalic acid is an organic compound with the formula $C_2H_2O_4$. Typically, oxalic acid occurs as the dihydrate with the formula $C_2H_2O_4.2H_2O$..

It is a colorless crystalline solid that forms a colorless solution in water. Its condensed formula is HOOCCOOH, reflecting its classification as the simplest dicarboxylic acid.

Its acid strength is much greater than that of acetic acid. Oxalic acid is a reducing agent and its conjugate base, known as oxalate ($C_2O_2^{-4}$), is a chelating agent for metal cations.

STRUCTURE OF OXALIC ACD



Ethanedioic acid

USES

- ***As a Cleaning Agent:***

  The oxalic acid is an ideal chemical for cleaning purposes. Its bleach-like qualities make it perfect for sterilizing household items.

  For Industrial Uses:

  This acid is sometimes used in mineral processing mechanisms. Its bleaching properties can be used to sterilize equipment in a number of corporate environments. Textile mills and factories use it for bleaching in order to color cloths.

- ***Other Uses***

  oxalic acid is also used as a reducing agent in developing photographic film. It is also used in waste water treatment as well since oxalic acid can effectively remove calcium from waste water.

  oxalic acid is also used as a grinding agent when polishing marble.

- ***Medicinal properties:***

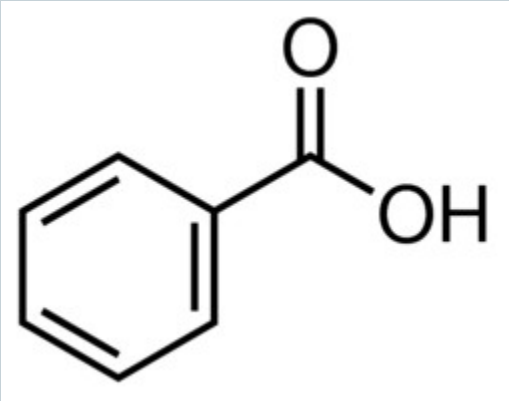
Organic oxalic acid does not present any problem. In its raw form, it is one of the most important minerals needed in the body to maintain peristalsis of the bowel.

BENZOIC ACID

Benzoic acid (C_6H_5COOH), is a colorless crystalline solid and a simple aromatic
carboxylic acid.

The name is derived from gum benzoin.

STRUCTURE:



Benzenecarboxylic acid

USES

Medicinal uses:

Benzoic acid is used for the treatment of fungal skin diseases such as tinea, ringworm, and athlete's foot. Benzoic acid was used as an expectorant, analgesic, and antiseptic in the early 20th century.

- Preservatives:

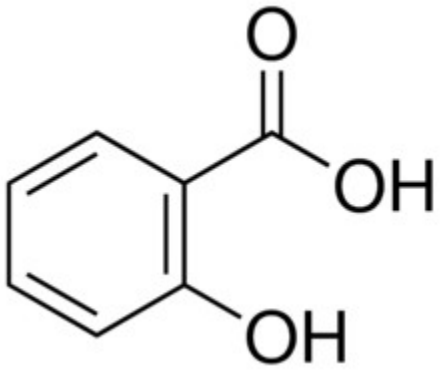
Benzoic acid and its salts are used as food preservatives.

SALICYLIC ACID

✓ Salicylic acid is a lipophilic Monohydroxybenzoic acid, a type of phenolic acid, and a beta hydroxy acid (BHA).

✓Salicylic acid is a compound obtained from the bark of the **white willow.**

STRUCTURE:



2-Hydroxybenzoic acid

USES

It is also used to treatment of,

Acne: ***It is a skin condition characterized by red pimples on the skin, especially on the face, due to inflamed or infected sebaceous glands***

Seborrheic dermatitis: ***It is a common skin condition that mainly affects your scalp. It causes scaly patches, red skin and stubborn dandruff. It can also affect oily areas of the body, such as the face, sides of the nose, eyebrows, ears, eyelids and chest.***

Eczema: ***It is an inflammatory condition of the skin characterized by redness, itching, and oozing vesicular lesions which become scaly, crusted, or hardened.***

Viral warts: It is typically small, rough and hard growths that are similar in color to the rest of the skin.

Ringworm: ***a contagious itching skin disease occurring in small circular patches, caused by any of a number of fungi and affecting chiefly the scalp or the feet. The commonest form is athlete's foot.***

Chemistry:

Salicylic acid used for synthesis of Aspirin (acetylsalicylic acid).

Other Uses:

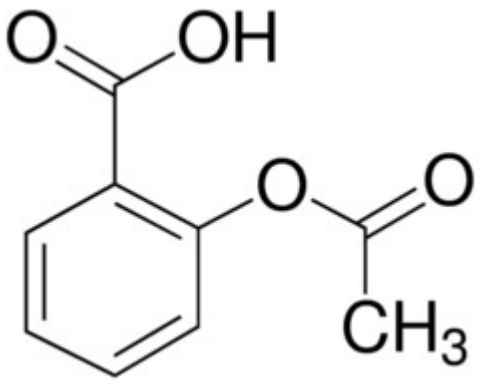
Salicylic acid is used as a food preservative, a bactericidal and an antiseptic

Acetyl Salicylic Acid

Aspirin, also known as acetylsalicylic acid (ASA), is a medication used to treat pain, fever, or inflammation.

Aspirin is also known as Nonsteroidal Anti-Inflammatory Drug (NSAID

STRUCTURE:



2-Acetoxybenzoic acid

USES

Aspirin is used in the treatment of a number of conditions, including fever, pain, rheumatic fever, and inflammatory diseases, such as rheumatoid arthritis, pericarditis, and Kawasaki disease.

It is sometimes used to treat or prevent heart attacks, strokes, and chest pain (angina).

Aspirin is thought to reduce the overall risk of both getting cancer and dying from cancer. This effect is particularly beneficial for **colorectal cancer (CRC).**

METHYL SALICYLATE

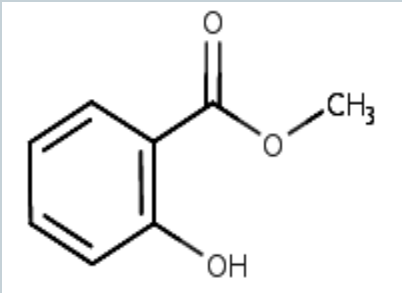
It is the methyl ester of salicylic acid.

It is a colorless, viscous liquid with a sweet odor.

It is produced by many species of plants, particularly wintergreens.

It is also synthetically produced, used as a fragrance, in foods and beverages.

- **STRUCTURE:**



Methyl 2-hydroxybenzoate

USES

It is used in high concentrations as a rubefacient and analgesic in deep heating liniments

It is used in low concentrations (0.04% and under) as a flavouring agent in chewing gum and mints.

Methyl salicylate (oil of wintergreen) is a non-selective COX inhibitor (traditional NSAID), used to treat minor aches and pains of the muscles/joints (e.g., arthritis, backache, sprains).

Used as Anti-inflammatory agent.

Used as Analgesic agent

BENZYL BENZOATE

- Benzyl benzoate is a medication and insect repellent.
- Benzyl benzoate was first studied medically in 1918.
- It is on the World Health Organization's List of Essential Medicines.

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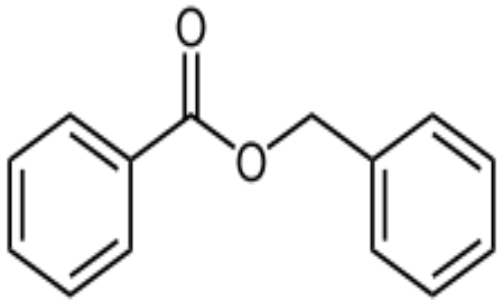


Benzyl benzoate

USES

Medical uses of Benzyl benzoate:

25%W/V Benzyl benzoate used for treating Scabies & Pediculosis (lice infestation of any part of the body).

It has vasodilating and spasmolytic effects and is present in many asthma and whooping cough drugs.

It is also used as an excipient in some testosterone-replacement medications for treating hypogonadism.

Non-medical uses of Benzyl benzoate:

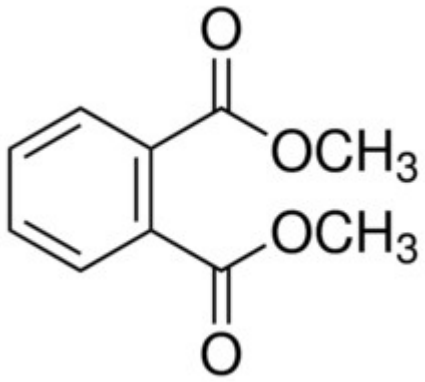
It is used as a repellent for chiggers, ticks, and mosquitoes.

It is also used as a dye carrier, solvent for cellulose derivatives, plasticizer, and fixative in the perfume industry.

DIMETHYL PHTHALATE

✓Dimethyl phthalate is a methyl ester of phthalic acid.
✓ It is Colorless oily liquid with slight aromatic odor
✓ Dimethyl phthalate is Insoluble in Water and Miscible with ethanol, alcohol, chloroform, ether .

STRUCTURE:



Dimethyl benzene-1,2-dicarboxylate

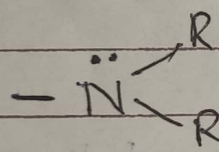
USES

- Dimethyl phthalate is used as an insect repellent for mosquitoes and flies.
- It is also an ectoparasiticide and has many other uses, including in solid rocket propellants, and plastics

Aliphatic Amines

Amines :- organic derivatives of ammonia with one or more alkyl or aryl groups bonded to the nitrogen atom.

Functional group :-

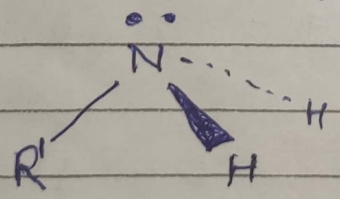


Amine

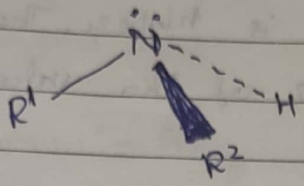
(R = H or Hydrocarbon)

Classification of amines :-

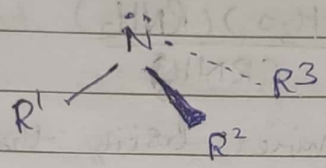
* Primary (1°) amine :- one alkyl or aryl group attached to the nitrogen atom.



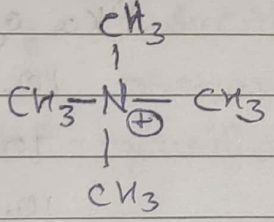
* Secondary (2°) amine :- two alkyl or aryl group attached to the nitrogen atom.



* Tertiary (3°) amine :- three alkyl or alkyl group attached to the nitrogen atom



* Quaternary (4°) amine :- an ion in which nitrogen is bonded to four alkyl or aryl groups and bears a +ve charge



Physical Properties

- Amines are liquid in nature.
- Amines are water insoluble because of N-H bond they are not forming hydrogen bond with water, but soluble in organic solvents.

IR stretch for N-H 3300–3500 cm⁻¹.

Basicity of amines :- Amines are act as Lewis base because it donates lone pair of electron to form a new bond to a hydrogen.

$$R-NH_2 + H_2O \rightleftharpoons RNH_3 + OH^-$$

$$K_b = \frac{(RNH_3)(OH^-)}{(RNH_2)}$$

If the base is strong at that time equilibrium shifted to right and Kb value is higher. The strength of base is measured in terms of pKa value, more pKa value indicates more basic.

$$R\text{-}NH_3 + H_2O \rightleftharpoons H_3O + RNH_2$$

$$K_b = \frac{(H_3O)(RNH_2)}{(RNH_3)}$$

Measurement of amines basity through acidity of conjugate acids. Equilibrium shifted to right and pka value will be greater for conjugated acid.

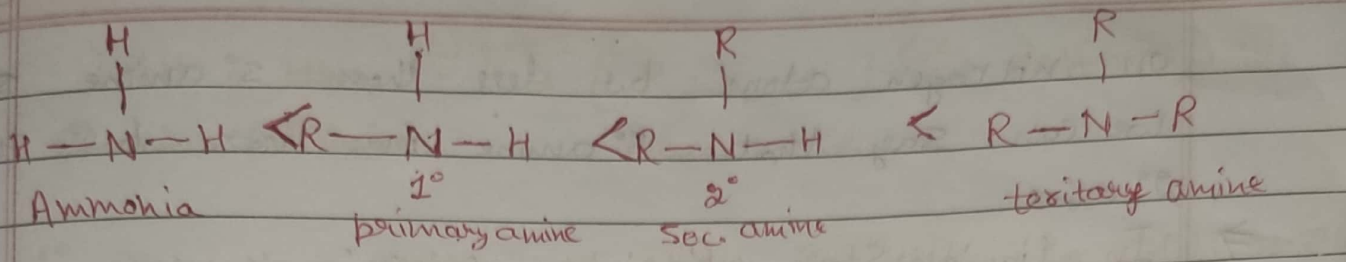
Basity of amines

Sr.No.	name	Pka of conjugate acid
1.	Diethyl amine	10.98
2.	Dimethyl amine	10.64
3.	Ethyl amine	10.63
4.	Triethyl amine	10.65
5.	Methyl amine	10.62
6.	ammonia	9.3

Substituent effect on basicity

Alkylation effect:-

- Any factor that increases electron density on the N atom increases an amine basicity.
- E.g. Ammonia is least basic, alkyl groups having electron density hence alkyl group adds electron density means alkylated ammonia is strong base.



Nature of amine :- Any factor that decreases electron density on N atom, decreases basicity.

E.g:- The amine containing sp^3 hybrid orbital having more electron density but when carbon is sp^2 and sp hybrid at that time electron density on nitrogen decreases hence alkyl cyanide are less basic than imines and amines.

RCH_2NH_2 > RCH=NH > R-C≡N

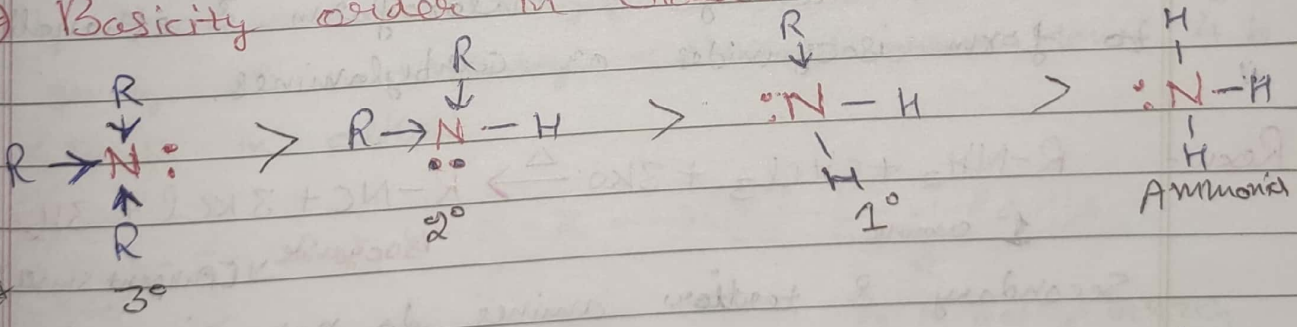
Amine IMINE cyanide

Basicity - Aromatic Amines :- The greater electron-withdrawing inductive effect of the sp^2-hybridized carbon of an aromatic amine compared with that of the sp^3-hybridized carbon of an aliphatic amine.

Basicity of aliphatic amines

Effect of Subsitituent on Basicity of aliphatic amines

⇒ Basicity order in Gaseous State



due to +I effect

In 3° amine, three alkyl group attach to ~~this~~ nitrogen atom, it will inc the density of negative charge on nitrogen atom that will make tertiary amine are more basic.

While in 2° amine, two alkyl group attach to nitrogen atom. it will inc the $e^{\ominus}$ density of -ve charge

on nitrogen atom but less than 3° amine so, we can say that 3° amine are more basic than 2° amine.

⇒ In liquid State, Basicity order :-
2° amine > 3° amine > 1° amine > ammonia.

In 3° alkyl group 3 bulky group attach to nitrogen atom. due to stearic hinderance the HCl would not associate with nitrogen atom so, 3° amine are less basic.

In 2° amine, two alkyl group attach to nitrogen atom, stearic hinderance is less as compared to 3° amine & it is more reactive to HCl that make more basic than 3° amine.

Distinguishing Test B/w 1°, 2°, & 3° Amine

Name of Test

① Carbylamine Rexn :- only aliphatic & aromatic 1° amine on heating ∈ chloroform & ethanolic KOH to form isocyanides or carbylamines.

Rexn :- $R-NH_2 + CHCl_3 + 3KOH \xrightarrow{\Delta} R-NC + 3KCl + 3H_2O$

1° amine — isocyanide → [Pungent smell]

Secondary & tertiary amines do not give the above test.

② Reaction of 1° amine with Nitrous acid
1° aliphatic amine on rexn ∈ HNO_2 to form aliphatic diazonium salt which being unstable decompose to form alcohol & evolve nitrogen.

Rexn $RNH_2 + HNO_2 \xrightarrow{NaNO_2+HCl} [R-N_2^+ Cl^-] \xrightarrow{H_2O} ROH + N_2 + HCl$

1° amine (aliphatic) — Diazonium sol.

1° aromatic amine on rexn ~ HNO_2 in cold (273-278K) to form diazonium salt

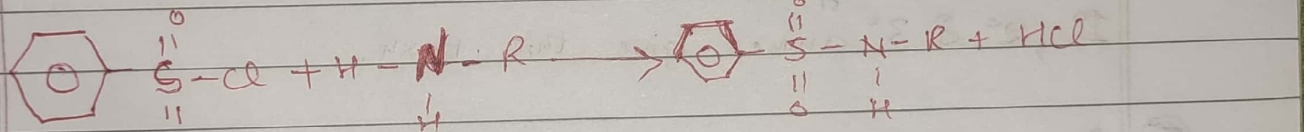
$$C_6H_5-NH_2 \xrightarrow[273-278K]{NaNO_2+2HCl} C_6H_5-\overset{\oplus}{N_2}Cl^{\ominus} + NaCl + 2H_2O$$

Benzenediazonium chloride

* Secondary & tertiary amine do not give this test.

③ Rexn ē Benzene Sulphonyl chloride :-

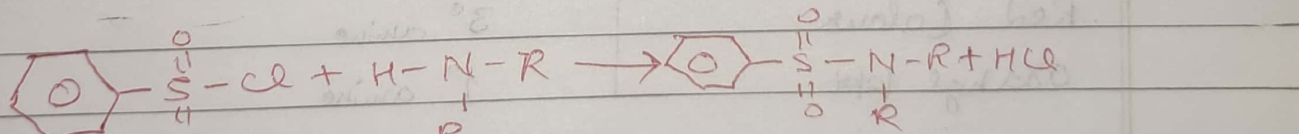
Hinsberg reagent i.e. Benzene sulphenyl chloride ($C_6H_5-SO_2Cl$) react ~ 1° & 2° amines to form Sulphonamides.

Rexn 

1° amine

N-alkylbenzene Sulphonamide (Soluble in alkali)

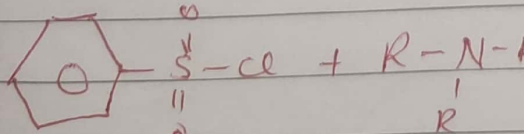
⇒ Hydrogen attached to nitrogen in sulphonamide formed by 1° amine is strongly acidic due to presence of strong $e^{\ominus}$ withdrawing sulphenyl group. Hence it is soluble in alkali.



2° amine

N-N dialkyl benzen Sulphonamide (Insoluble in alkali)

Rexn ~ 3° amine



3° amine

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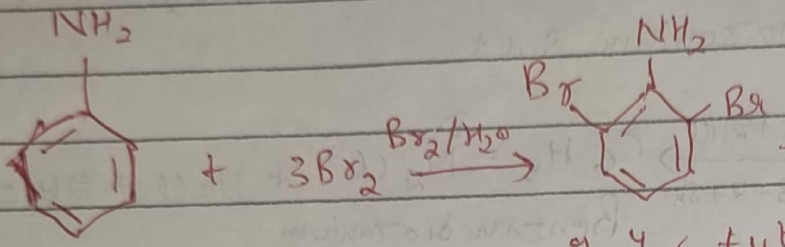
④ Bromine Test :- 1° aromatic amine react ∑ bromine & water at room temp. to give whit bpt. of 2,4,6-tubromoaniline.



Aniline
1° amine

2,4,6 tubromoaniline.

* Secondary & tertiary amine do not give this rexn.

⑤ Salt Test :- 0.1gm of Sample was dissolve in 5ml of 10 + HCl, it give clear soln which indicate the presence of amine.
1°, 2° & 3° amine give this rexn.

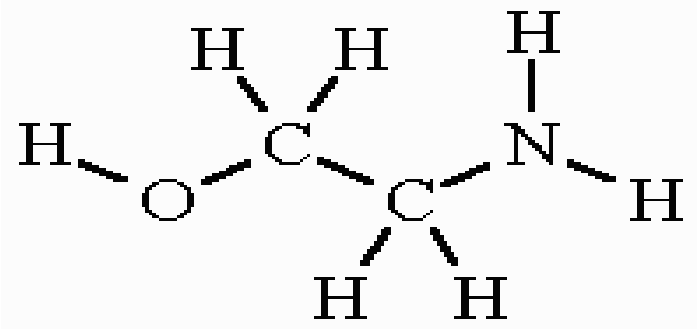
⑥ Diazotization Test :- 0.1gm of Sample + 10 drops of Conc. HCl boil & cool in ice water + 4-5 drops of $NaNO_2$ in water & 2-naphthol in NaOH.

Observation	Inference
Yellow bpt	2° amine
Red Colour	3° amine
Orange bpt	1° amine

ETHANOLAMINE

- It is an organic chemical compound with the formula $HOCH_2CH_2NH_2$ (C_2H_7NO).
- The molecule is bifunctional, containing both a primary amine and a primary alcohol..
- Ethanolamine is a colorless, viscous liquid with an odor reminiscent of ammonia.

STRUCTURE



2-aminoethane-1-ol

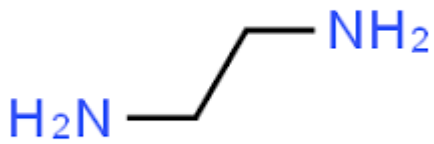
USES OF ETHANOLAMINE

- It is used as feedstock in the production of detergents, emulsifiers, polishes, pharmaceuticals, corrosion inhibitors, and chemical intermediates.
- Ethylenediamine is commonly used as chelating agent,
- MEA is used primarily for buffering or preparation of emulsions.
- Ethanolamine is often used for alkalinization of water in steam cycles of power plants, including nuclear power plants with pressurized water reactors.
- It is also an injectable sclerosant as a treatment option of symptomatic hemorrhoids.

ETHYLENEDIAMINE

- It is the organic compound with the formula $C_2H_4(NH_2)_2$.
- This compound is colorless liquid with an ammonia-like odor & it is a strongly basic amine.
- It is a widely used building block in chemical synthesis.
- Ethylenediamine readily reacts with moisture in humid air to produce a corrosive, toxic and irritating mist, to which even short exposures can cause serious damage to health.

STRUCTURE



Ethane-1,2-diamine

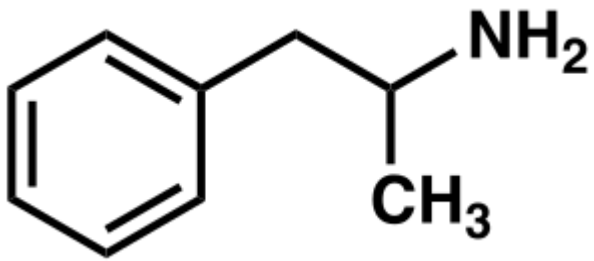
USES OF ETHYLENEDIAMINE

- Ethylenediamine is used in large quantities for production of many industrial chemicals. It forms derivatives with carboxylic acids (including fatty acids), nitriles, alcohols (at elevated temperatures), alkylating agents, carbon disulfide, and aldehydes and ketones. Because of its bifunctional nature, having two amines, it readily forms heterocycles such as imidazolidines.
- Derivative of ethylenediamine is used as chelating agent with EDTA,
- Ethylenediamine is an ingredient in the common bronchodilator drug aminophylline, where it serves to solubilize the active ingredient theophylline.
- Ethylenediamine has also been used in dermatologic preparations.
- It is widely used in the production of polyurethane fibers.
- The bleaching activator tetraacetyl ethylenediamine is generated from ethylenediamine.
- Used as a solvent, it is miscible with polar solvents and is used to solubilize proteins such as albumins and casein.
- It is also used in certain electroplating baths.

AMPHETAMINE

- It is a central nervous system (CNS) stimulant
- Amphetamine belongs to the phenethylamine class.

STRUCTURE



α-methylphenethylamine

USES OF AMPHETAMINE

- It is used in the treatment of attention deficit hyperactivity disorder (ADHD), narcolepsy and obesity.
- Amphetamine is also used as an athletic performance enhancer and cognitive enhancer and recreationally as an aphrodisiac and euphoriant.
- At high dose, Amphetamine can induce effects that severely impair performance, such as rapid muscle breakdown and elevated body temperature.