

Section-I: Aldehydes and Ketones

12.1 INTRODUCTION

Aldehydes and ketones are carbonyl compounds, as they contain carbonyl ($>C=O$) group. General formula of aldehydes and ketones is $C_nH_{2n}O$.

Definitions:

- Aldehydes:** These are first oxidative products of primary alcohols, in which carbonyl carbon atom is attached to, at least one H-atom. These are represented as $R-CHO$.
e.g. $H-CHO$ CH_3-CHO
formaldehyde acetaldehyde
- Ketones:** These are first oxidative products of secondary alcohols, in which carbonyl carbon atom is attached to two same or different alkyl groups. These are represented as, $R-CO-R$.
e.g. $CH_3-CO-CH_3$ $CH_3-CO-C_2H_5$
acetone ethyl methyl ketone

12.2 ISOMERISM IN ALIPHATIC ALDEHYDES AND KETONES:

Aldehydes : They show chain, tautomerism, optical isomerism themselves and functional isomerism with ketones.

Ketones: They show chain, tautomerism, optical isomerism, metamerism themselves and functional isomerism with aldehydes.

e.g. i) C_3H_6O

- CH_3CH_2CHO propanal
 - CH_3COCH_3 propanone
- C_4H_8O
 - $CH_3CH_2CH_2CHO$ butanal
 - $CH_3CH(CH_3)CHO$ 2-methyl propanal
 - $CH_3COCH_2CH_3$ 2-butanone
- $C_5H_{10}O$
 - $CH_3CH_2CH_2CH_2CHO$ pentanal
 - $CH_3CH_2CH(CH_3)CHO$ 2-methyl butanal
 - $CH_3CH(CH_3)CH_2CHO$ 3-methyl butanal
 - $(CH_3)_2CCHO$ 2,2-dimethyl propanal
 - $CH_3CH_2COCH_2CH_3$ 3-pentanone
 - $CH_3COCH_2CH_2CH_3$ 2-pentanone

g) $CH_3COCH(CH_3)_2$ 3-methyl 2-butanone

Metamerism:

Metamerism is present in same class of compounds. It is shown by the compounds which have different alkyl groups (nature or type) attached to either side of polyvalent functional group.

e.g. pentan-2-one and pentan-3-one are metamers, not position isomers.

$CH_3CH_2COCH_2CH_3$ diethyl ketone

$CH_3COCH_2CH_2CH_3$ methyl n-propyl ketone
pentan-2-one and 3-methyl butan-2-one are metamers not chain isomers

$CH_3COCH_2CH_2CH_3$ 2-pentanone

$CH_3COCH(CH_3)_2$ 3-methyl, 2-butanone

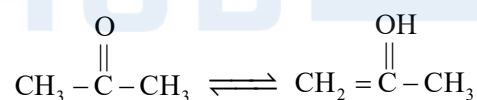
Note : Metamers are either chain or position isomers. If metamerism is mentioned then never write chain or position isomerism.

Tautomerism:

Definition: It is one type of functional isomerism, in which a single compound exists in two or more readily interconvertible structures that differ in the relative position of hydrogen.

Only α -H atom involved in tautomerism

e.g. Acetone and prop-1-en-2-ol are tautomers

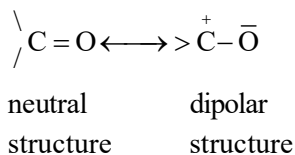


12.3 STRUCTURE OF CARBONYL GROUP

- Carbonyl group ($>C=O$) consists of one sigma and one π bond.
- In carbonyl group carbonyl carbon atom is in sp^2 hybridised state.
- The sigma bond is formed by sp^2 hybrid orbital of carbon and p-orbital of oxygen i.e. sp^2 -p overlapping.
- The π bond is formed by sideways overlapping of unhybridised p-orbital of carbon and p-orbital of oxygen i.e. p-p overlapping.
- Carbonyl carbon atom is joined to three atoms of sigma bond making a bond angle 120° , therefore,

carbonyl group has trigonal planer structure.

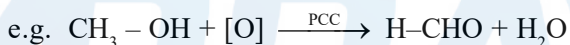
- 6) In carbonyl group, oxygen is more electronegative than carbon hence oxygen carries partial negative charge (nucleophilic or Lewis base centre) and carbon carries partial positive charge (electrophilic or Lewis acid centre).
- 7) The high polarity of carbonyl group is explained on the basis of resonance structure.



12.4 PREPARATION OF ALDEHYDES AND KETONES

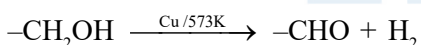
1. **By oxidation of primary and secondary alcohols by using pyridinium chloro chromate(PCC) or pyridinium dichromate (PDC):**

It oxidises only primary alcohol to aldehyde and secondary alcohol to ketones. PCC is the mixture pyridine, CrO_3 and HCl in 1 : 1 : 1 ratio. This reagent does not attack $>\text{C}=\text{C}<$ bond. It is also known as Collin's reagent.

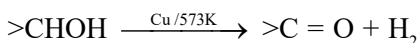


2. **By dehydrogenation of primary and secondary alcohols by using Cu or Fe or Ag metals at 573 K.**

- a) Vapours of primary alcohols are passed over Cu or Fe metal at 573 K undergo dehydrogenation gives aldehydes. These are a-a elimination reactions.



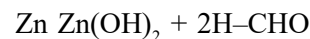
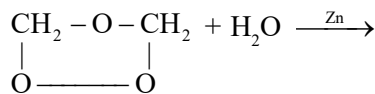
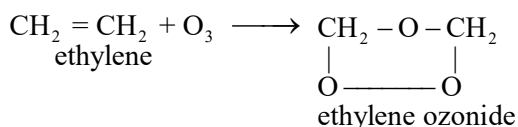
- b) Vapours of secondary alcohols are passed over Cu or Fe metal at 573 K undergo dehydrogenation gives ketones.



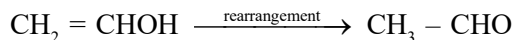
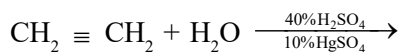
Note: Tertiary alcohols are heated with copper metal at 573 K undergoes dehydration to give alkenes and water.

3. **From hydrocarbon**

- a) **Ozonolysis of alkene:**



- b) **Hydration of alkyne**

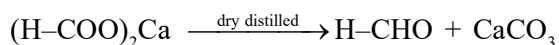


vinyl alcohol

acetaldehyde

4. **From dry distillation (pyrolysis or decarboxylation) of calcium salt of acids**

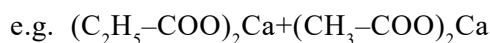
- a) **Aldehydes :**



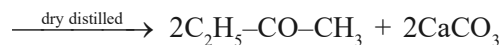
cal. formate

formaldehyde

- b) **Ketones:**



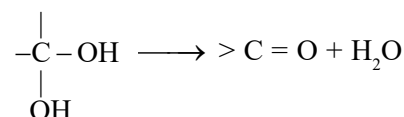
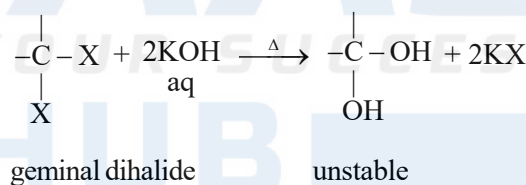
cal. propionate cal. acetate



ethyl methyl ketone

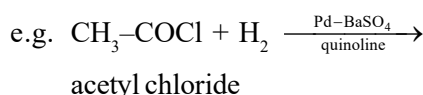
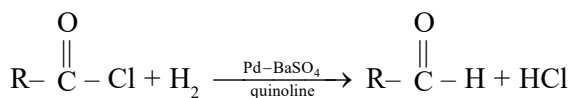
5. **From alkaline hydrolysis of geminal dihalide :**

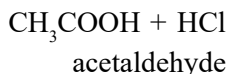
The geminal dihalides are boiled with aqueous KOH or NaOH. It produces aldehydes and ketones.



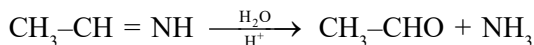
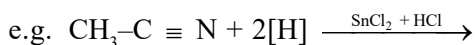
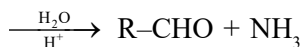
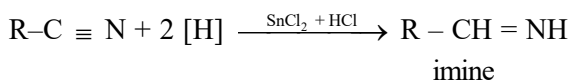
12.5 PREPARATION OF ONLY ALDEHYDES

1. **Rosenmund reduction (Reduction of acyl chloride):** Acid chloride is reduced by Lindlar catalyst to give aldehyde. Function of BaSO_4 is to poison the catalyst at aldehyde stage.



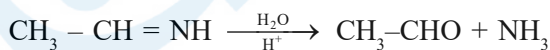
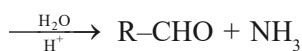
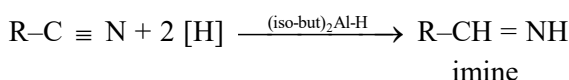


2] Stephen's reduction (Reduction of cyanide by $\text{SnCl}_2 + \text{HCl}$)



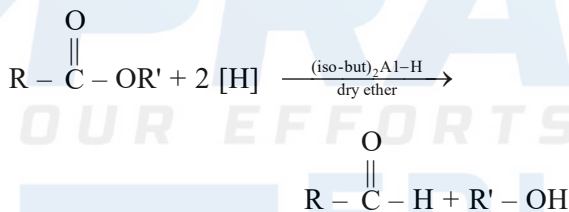
acetaldimine acetaldehyde

3] Reduction of cyanide by di-isobutyl aluminium hydride (iso-but) $_2$ -Al-H or $[(\text{CH}_3)_2\text{CHCH}_2]_2\text{Al-H}$ or Di-iso-but-Al-H

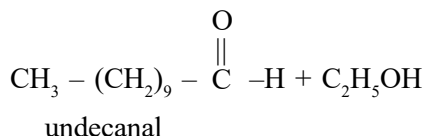
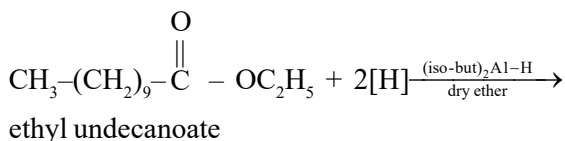


acetaldimine acetaldehyde

4] Reduction of ester by (Iso-but) $_2$ -Al-H



e.g.



5] From hydrocarbon :

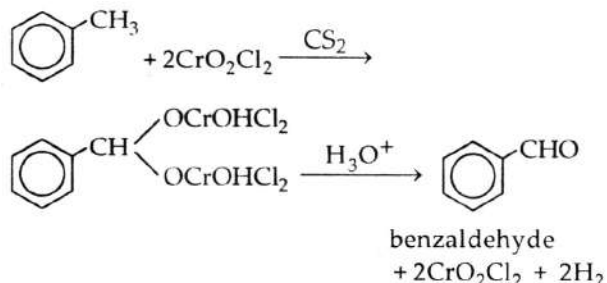
Aromatic aldehydes and its derivatives are prepared from aromatic hydrocarbon by following methods.

Strong oxidising agent oxidises hydrocarbon into acids. It is possible to stop the oxidation at aldehyde stage using suitable reagent, that convert

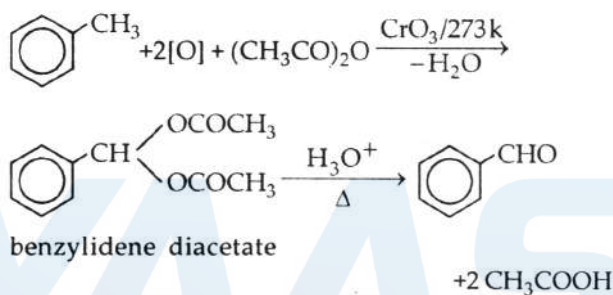
methyl group into intermediate which is difficult to oxidised further.

i) Etard reaction (oxidation of toluene by chromyl chloride (CrO_2Cl_2))

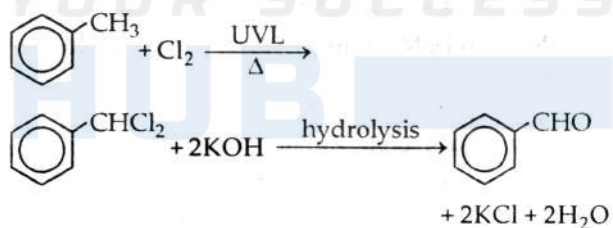
When toluene is oxidised by CrO_2Cl_2 first give chromium complex which on acid hydrolysis gives benzaldehyde



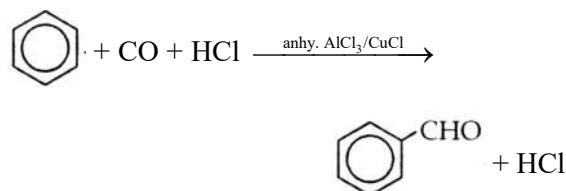
ii) Oxidation of toluene by CrO_3 (chromium oxide) in acetic anhydride



iii) By side chain chlorination followed by hydrolysis (commercial method).



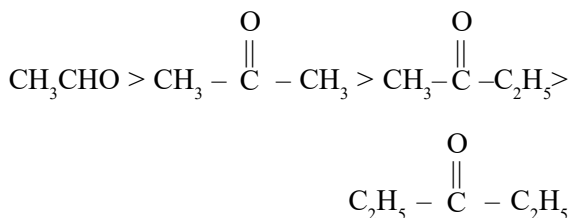
iv) By Gatterman - Koch reaction : In this reaction - H in benzene ring is converted into -CHO



12.6 PREPARATION OF ONLY KETONES:

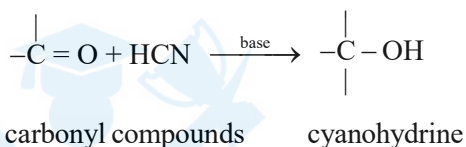
1. From acyl chloride and dialkyl cadmium :

Recently dialkyl cadmium is used for preparation of ketones from acyl halide in the presence of

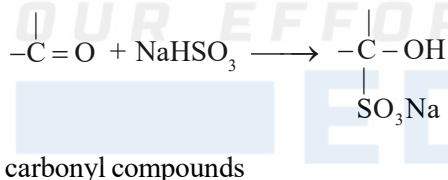
**I] Addition reactions:**

1. **Addition of HCN (Prude add) :** When aldehydes and ketones are reacted with HCN in presence of base gives corresponding cyanohydrins. In this reaction oxygen atom in carbonyl group is changed to OH group.

Practically, HCN need for the reaction is generated in situ from dil. HCl and NaCN. The amount of acid is insufficient to react whole NaCN. Hence, solution remain alkaline and which catalysed the reaction.

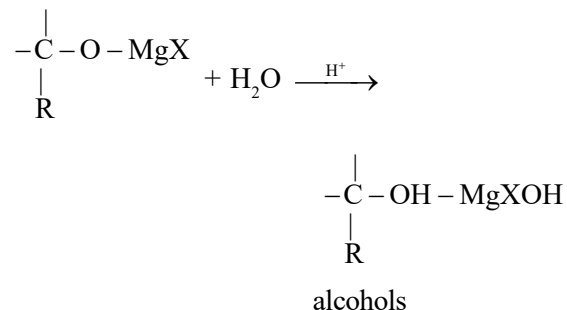
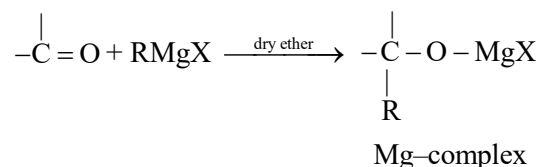


2. **Addition of sodium bisulphite (NaHSO₃) :** When aldehydes and ketones are reacted with 40 % aqueous saturated solution of NaHSO₃, gives corresponding crystalline bisulphite addition compounds. The reaction involves the nucleophilic attack of sulphite ion (SO₃²⁻).

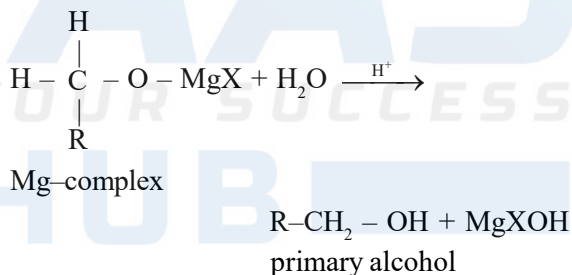
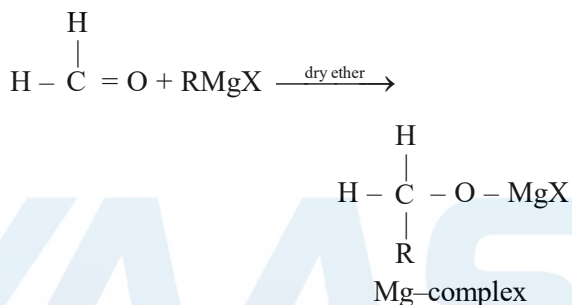
**Note:**

- Some ketones like diethyl ketone, acetophenone do not undergo this reaction.
 - The bisulphite addition product of aldehyde and ketone are crystalline solid and therefore this reaction is used in the separation of aldehydes and ketones from non carbonyl compounds.
 - As the reaction is reversible the addition product can be dissolved by dilute mineral acid or aqueous alkalies to regenerate original aldehydes and ketones. Hence this reaction used to purification of aldehydes and ketones.
3. **Addition of RMgX :** When carbonyl compounds are reacted with Grignards reagent in the presence of dry ether give addition product which

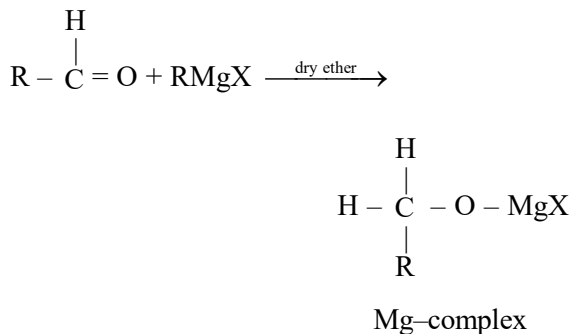
on acid hydrolysis gives alcohols (may be 1° or 2° or 3° alcohols).

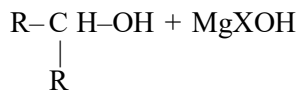
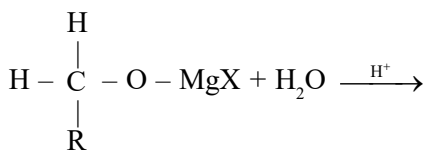


- a) **On formaldehyde:** (In this reaction >C=O group is converted into -CH₂OH primary alcohol)



- b) **On aldehyde (RCHO) :** When aldehydes (except HCHO) are reacted with RMgX in the presence of dry ether, gives Mg complex. Which on acid hydrolysis, gives secondary alcohols. (In this reaction >C=O group is converted into >CH-OH sec. alcohol.)

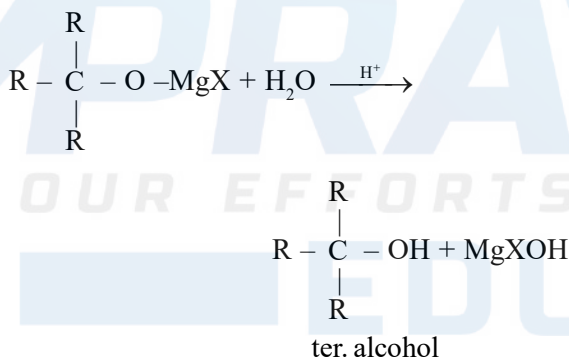
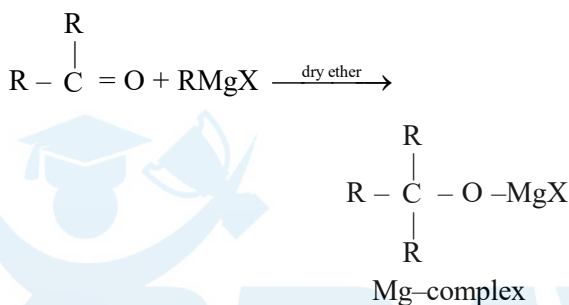




secondary alcohol

- c) **On ketone:** When ketones are reacted with RMgX in the presence of dry ether, gives Mg complex. Which on acid hydrolysis, gives tertiary alcohols.

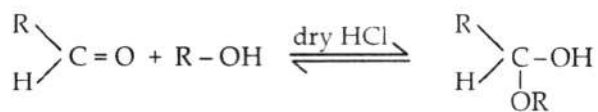
(In this reaction $>\text{C}=\text{O}$ group is converted into $\text{C}-\text{OH}$ tertiary alcohol.)



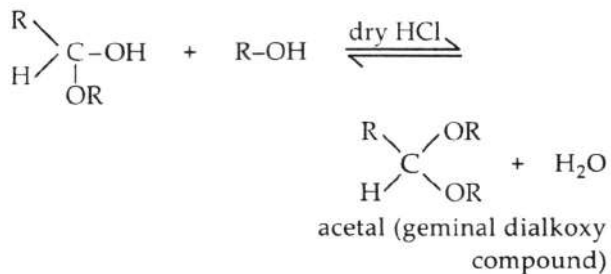
Note: Using RMgX carbonyl compounds are convert into following.

- 1) Formaldehyde into $-\text{CH}_2-\text{OH}$ (primary alcohols)
- 2) Aldehyde into $>\text{CH}-\text{OH}$ (secondary alcohols)
- 3) Ketone into $\text{C}-\text{OH}$ (tertiary alcohols)
4. **Addition of $\text{R}-\text{OH}$:** Aldehydes or ketones are reacts with alcohols to form acetal or ketals. The acetal is used as table sugar, wooden shop, cotton fibrics etc

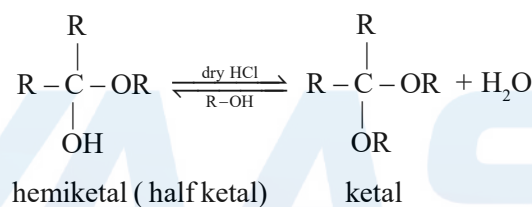
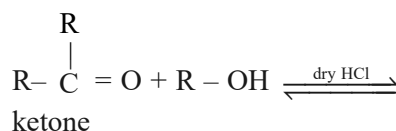
- a) **Aldehyde :** Aldehyde reacts with alcohol in the presence of presence of dry HCl gas to give alkoxy alcohol (hemiacetal) or half acetal, which reacts with another molecule to form acetal.



alkoxy alcohol (hemiacetal) or half acetal



- b) **Ketones :** Ketones reacts with alcohol in the presence of presence of dry HCl gas to give hemiketal or half ketal, which reacts with another molecule to form ketal.

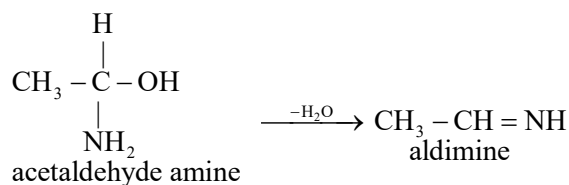
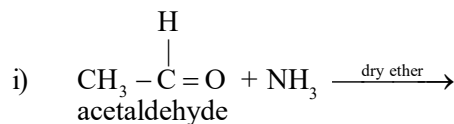


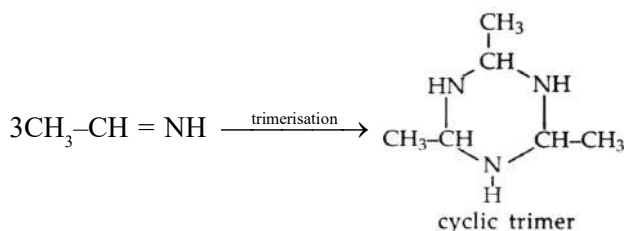
Note:

- i) Dry hydrogen chloride protonates the oxygen of carbonyl compound and increase the electrophilicity of carbonyl carbon atom and increase the rate of reaction.
- ii) Acetal and ketal are hydrolysed by ag. HCl to give corresponding aldehydes and ketones.

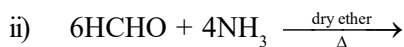
5. **Addition of ammonia :** Ammonia reacts differently with formaldehyde, acetaldehyde and acetone forming.

e.g.

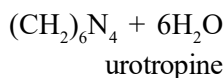




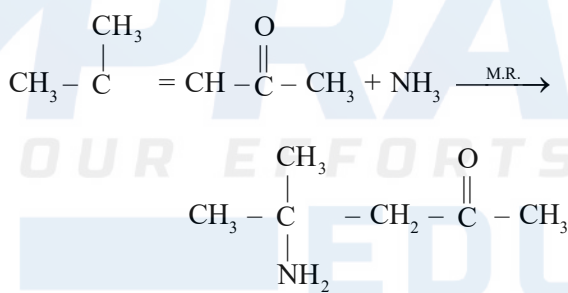
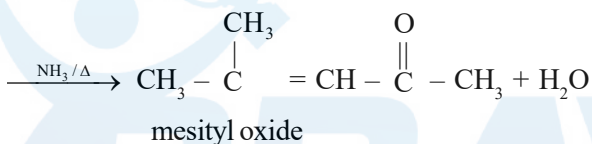
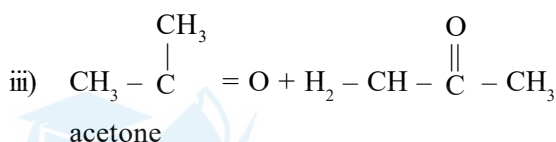
aldimine



methanal

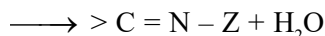
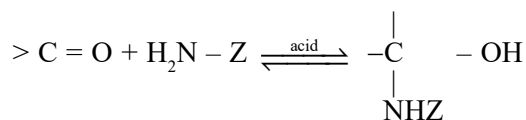


Note: Urotropine is condensation product of methanal and ammonia, it is not addition product.

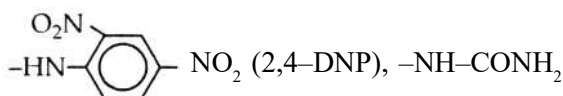


diacetone amine

II] CONDENSATION REACTIONS OR ADDITION FOLLOWED BY ELIMINATION OR REPLACEMENT OXYGEN:

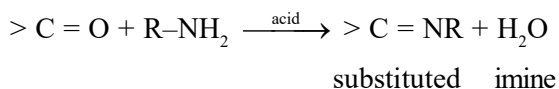


Where Z = R-, C₆H₅-, -OH-, -NH₂-, C₆H₅NH-,

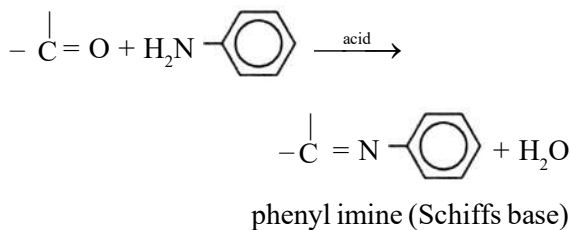


(semicarbazide).

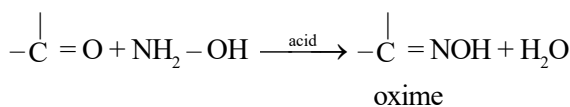
1. Reaction with R-NH₂ :



2. Reaction with Ph-NH₂



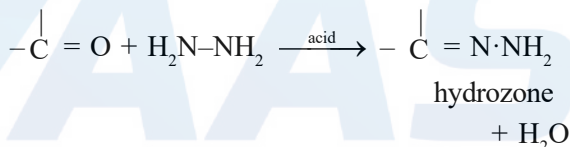
3. Reaction with hydroxyl amine:



4. Reaction with hydrazine:

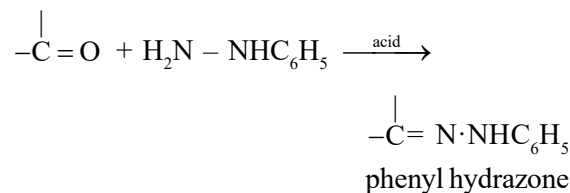
When aldehydes and ketones are heated with hydrazine in the presence of dilute acid undergoes condensation, gives corresponding crystalline red or orange colour hydrazone.

In this reaction >C=O group is converted into >C=NNH₂.

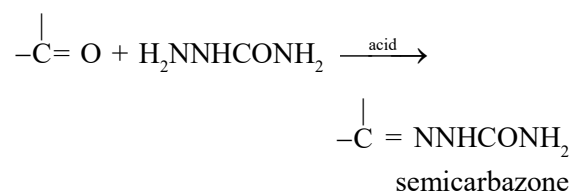


5. Reaction with phenyl hydrazine:

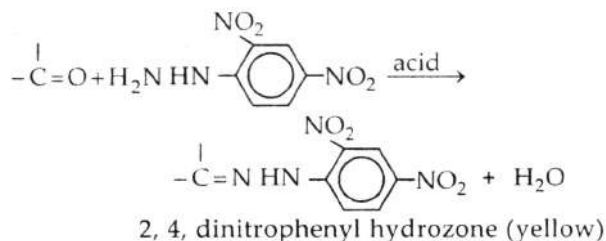
When aldehydes and ketones are heated with phenyl hydrazine in the presence of dilute acid undergoes condensation, gives corresponding crystalline red or orange colour phenyl hydrazone. In this reaction >C=O group is converted into >C=NNHC₆H₅.



6. Reaction with H₂NNH-CO-NH₂ (semicarbazide)



7. Reaction with 2, 4-dinitrophenyl hydrazine (2,4-DNP)

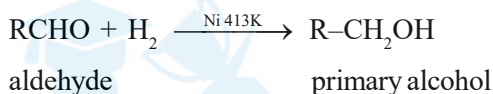


III] REDUCTION:

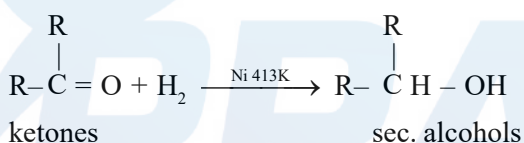
Catalytic hydrogenation or reduction by using NaBH_4 or LiAlH_4 OR $\text{Na.Hg} + \text{H}_2\text{O}$:

- Catalytic hydrogenation:** When aldehydes and ketones are reduced by passing hydrogen gas in the presence of Ni or Pt. or Pd. at 413K to 453K, gives 1° or 2° alcohols.

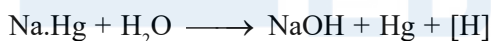
- Aldehydes on reduction gives primary alcohols.



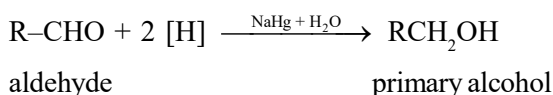
- Ketones on reduction gives secondary alcohols.



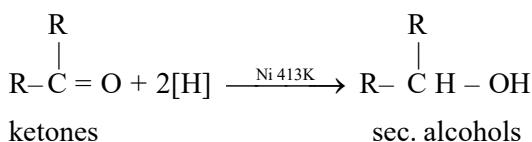
- Reduction by using $\text{Na.Hg} + \text{H}_2\text{O}$:** When aldehydes and ketones are reduced by $\text{Na.Hg} + \text{H}_2\text{O}$ or $\text{Zn.Hg} + \text{CH}_3\text{COOH}$ or LiAlH_4 , NaBH_4 gives 1° or 2° alcohols. Note that NaBH_4 does not reduce ketone group.



- Aldehydes on reduction gives primary alcohols.



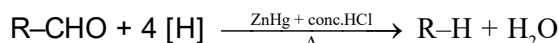
- Ketones on reduction gives secondary alcohols.



Note: Unsaturated aldehydes or ketones can be reduced to unsaturated alcohols without affecting $>\text{C}=\text{C}<$ by using LiAlH_4 or NaBH_4 .

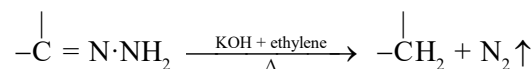
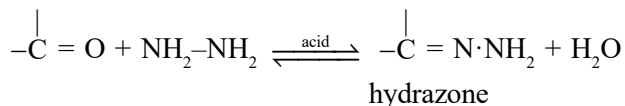
- Clemmenson reduction (deoxygenation):** In this reaction $>\text{C}=\text{O}$ group is converted into $>\text{CH}_2$ (methylene) group.

e.g. When methanal is reduced by $\text{Zn.Hg} + \text{conc. HCl}$ gives methane.

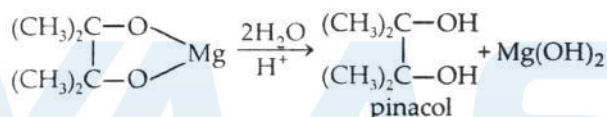
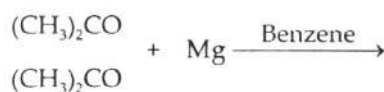


aldehyde alkane

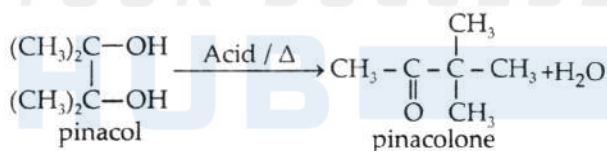
- Wolf – Kishner reduction:** In this reaction $>\text{C}=\text{O}$ group is reduced to $>\text{CH}_2$ group.



- Reduction by Mg metal only ketone (Only for ketones):** Only ketone give this reaction. When acetone is reacted with Mg metal in the presence of benzene gives Mg-complex, which on acid hydrolysis produces pinacol (2, 3-dimethyl butane 2, 3-diol).

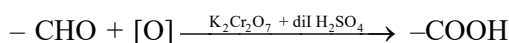


When pinacol is heated with acid undergoes rearrangement gives pinacolone. This is known as pinacol-pinacolone rearrangement.

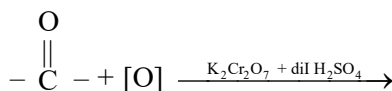


IV] Oxidation reactions:

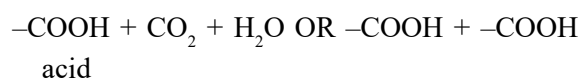
- Oxidation by strong oxidising agent like $\text{K}_2\text{Cr}_2\text{O}_7$ + dil. H_2SO_4



aldehyde acid



ketone

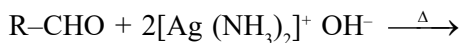


- Oxidation by mild oxidising agents like Tollen's reagent, Fehling solution, Schiffs

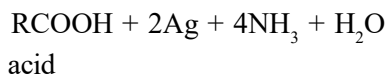
'reagent. or Reducing properties of aldehydes or characteristic test of aldehydes or distinction test of aldehydes from ketones or reducing reaction of aldehydes.

Aldehydes and ketones are distinguished by Tollen's reagent, Fehling solution, Schiff's reagent.

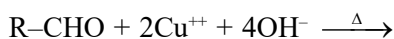
i) **Reaction with Tollens reagent:**



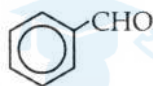
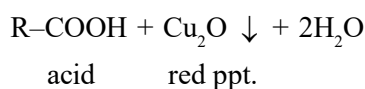
aldehyde



ii) **Reaction with Fehling solution:**



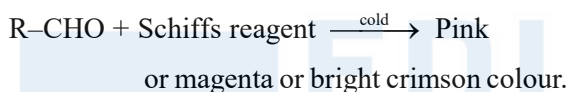
aldehyde



reaction

benzaldehyde

iii) **Reaction with Schiff's reagent:** Schiff's reagent (colourless) is prepared by passing SO_2 gas in magenta or pink dye of para-rosaniline hydrochloride (Fuschin). When decolourised Schiff's reagent is treated with aldehyde in cold original pink or magenta colour is developed.

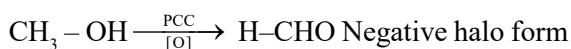


Note : Ketones does not give these reactions because of absence of H-atom on carbonyl carbon atom. Glucose, formic acid and enolic form of fructose gives above test.

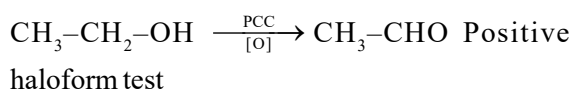
3. **Oxidation of methyl ketone by haloform reaction (Haloform test) :**

Haloform test means preparation of haloform i.e. $CHCl_3$ (colourless liquid), CHI_3 (yellow solid) and $CHBr_3$ (brown liquid). This test is given by some alcohols, some aldehydes and some ketones.

Alcohols: Alcohols that produces CH_3-CO group (methyl ketone or 2-one group) on oxidation gives haloform test or oxidative product of alcohols contain 3- α -H atoms on single carbon atom gives haloform test.



test



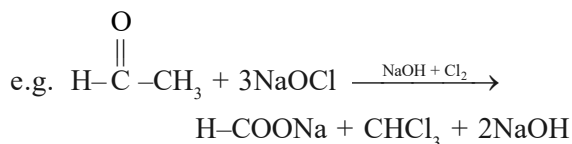
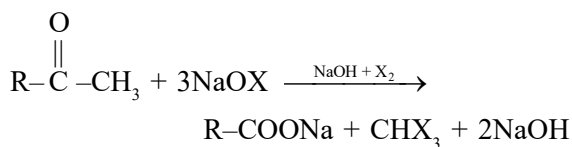
Aldehydes and ketones: They contain CH_3-CO group (methyl ketone or 2-one group) or 3- α -H atoms on single carbon atom.

$H-CHO$ Negative haloform test

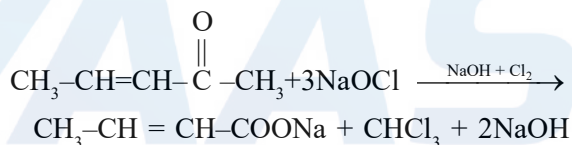
CH_3-CHO Positive haloform test

CH_3CH_2-CHO Negative haloform test

$CH_3-CH_2-CO-CH_2-CH_3$ Negative haloform test



Note: The importance of this reaction is, if $>C=C<$ present in molecule is not attacked by $NaOX$.

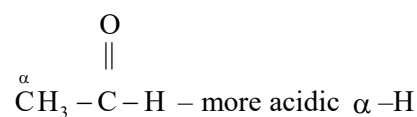


V] **Reaction due to α -H atom**

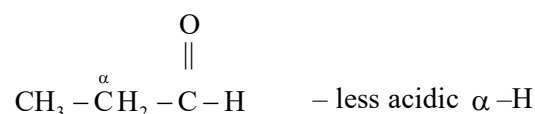
1) **Acidity of α -H atom in aldehydes and ketones:**

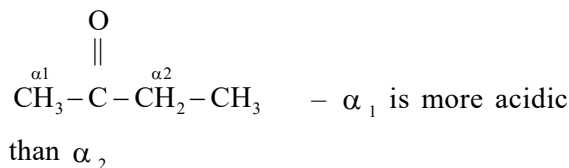
Aldehydes and ketones undergoes number of reactions due to acidic nature of α -H atom. The acidity of α -H depends upon electron withdrawing group ($-I$ effect) of carbonyl group and resonance stabilisation of conjugate base.

When α -H atom is attached to only carbonyl group, then more acidic is α -H atom.



When α -H atom is attached to carbonyl group and alkyl group, then less acidic will be the α -H atom.





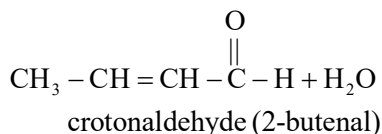
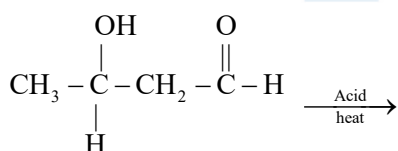
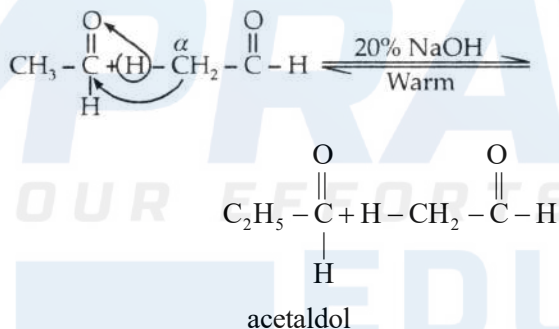
Note: In aldol condensation reaction more acidic $\alpha - \text{H}$ atom involved in condensation reaction.

VI] Aldol condensation reaction or self condensation or reaction with dilute alkali or 10% alkali or weak alkali :

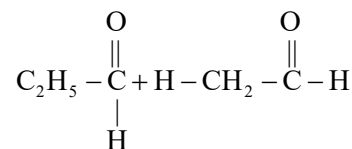
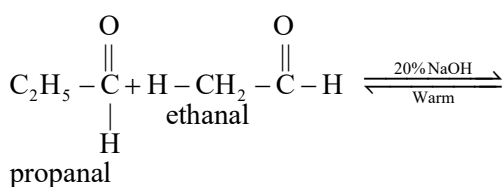
1. **Simple aldol condensation reaction :** It is the reaction between two same aldehydes or two same ketones.

e.g. When acetaldehyde is warmed with dil. (10%) NaOH, gives acetaldol (3-hydroxy butanal).

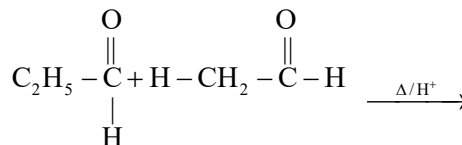
e.g. Which on heating with acid loses water molecule and gives crotonaldehyde ($\alpha - \beta$ unsaturated aldehyde).



2. **Cross aldol condensation reactions:**



3-hydroxy pentanal

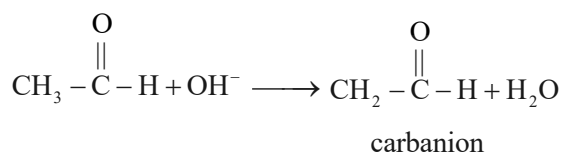


3-hydroxy pentanal

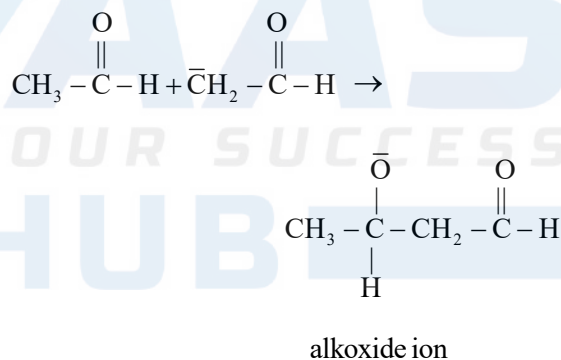


Mechanism of aldol condensation reaction:

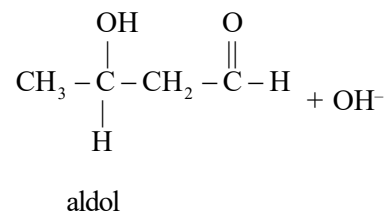
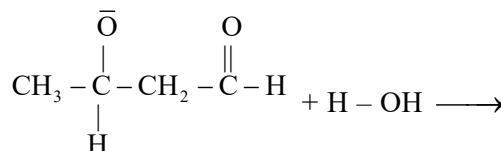
Step-I: Base OH^- takes $\alpha - \text{H}$ -atom from aldehyde to form carbanion(enolate ion).



Step-II: The carbanion attack electrophilic carbonyl carbon of second aldehyde molecule to form alkoxide ion.



Step-III: Alkoxide ion takes hydrogen ion from water to form aldol. Base OH^- ion is generated.



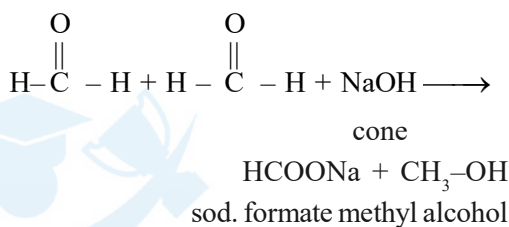
Note: Formaldehyde, benzaldehyde, trimethyl acetaldehyde, benzoquinone, chloral, iodal etc does not give this reaction because of absence of α -hydrogen atoms.

VII] CANNIZZARO'S REACTION OR SELF REDOX REACTION OR BASE CATALYSED SELF OXIDATION REDUCTION REACTION:

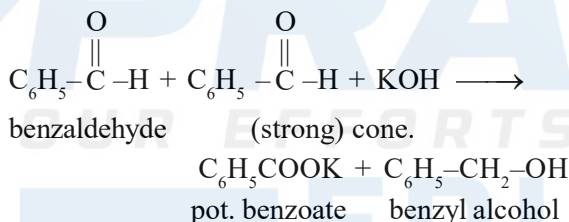
Condition : It is a characteristics reaction of aldehydes and ketones which does not contain α -H atom. It is carried by strong alkali.

e.g.

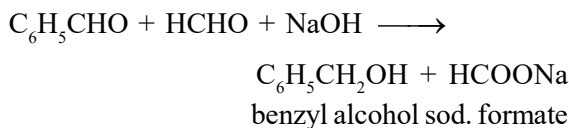
- i) When formaldehyde is heated with cone, (50%) NaOH, gives sodium formate and methyl alcohol.



- ii) When benzaldehyde (benzene carbaldehyde) is heated with strong KOH, gives pot. benzoate and benzyl alcohol.

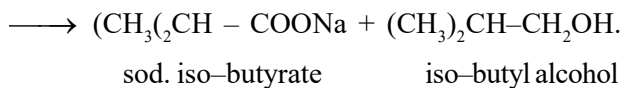


- iii) **Cross Cannizzaro's reaction:** When benzaldehyde and formaldehyde are heated with strong NaOH e.g gives benzyl alcohol and sodium formate. In this reaction more reactive aldehydes give oxidative product in crossed Cannizzaro's reaction.



Note : Isobutyraldehyde gives Cannizzaro's reaction eventhough presence of α -H atom. The exception behavior of isobutyraldehyde is due to +I effect of two alkyl groups.

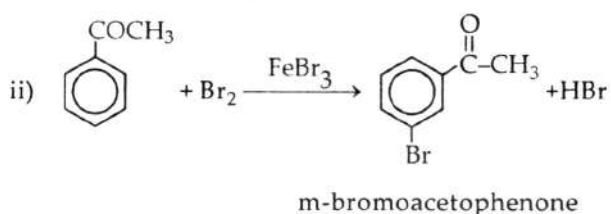
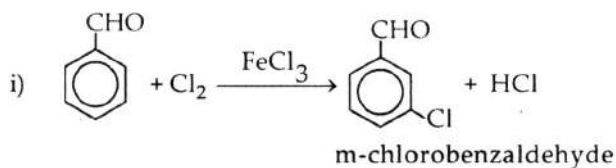
e.g. $(\text{CH}_3)_2\text{CH}-\text{CHO} + (\text{CH}_3)_2\text{CH}-\text{CHO} + \text{NaOH}$
conc.



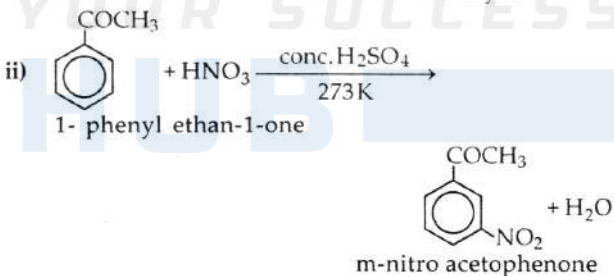
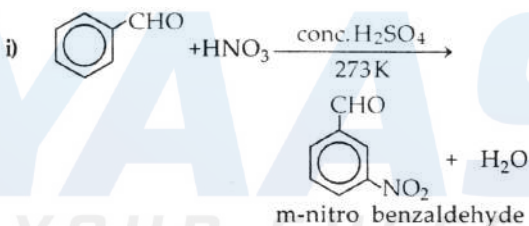
VIII] ELECTROPHILIC SUBSTITUTION REACTION OF AROMATIC ALDEHYDES AND KETONES:

Note that $-\text{CHO}$ and $>\text{C}=\text{O}$ group are meta directing

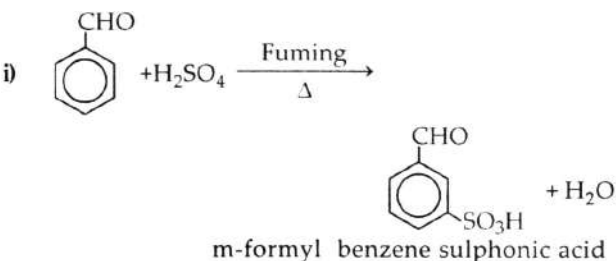
1. Halogenation:

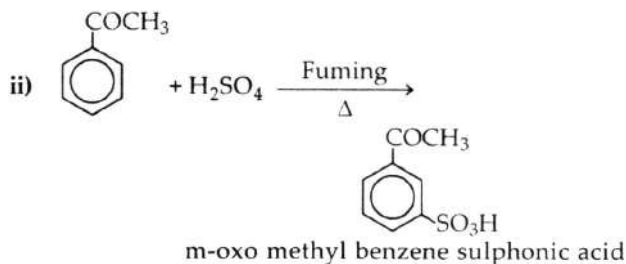


2. Nitration



3. Suiphonation :





Section-II: Carboxylic Acids

12.1 INTRODUCTION

Definition : These are carboxyl derivatives of alkane obtained by replacing hydrogen atom from alkane by carboxyl ($-\text{COOH}$) group.

12.2 ISOMERISM

Carboxylic acids : They show chain, optical isomerism themselves and functional isomerism with esters. Total number of isomeric acids can be calculated by formula, $I = 2^{n-3}$.

Esters : They show chain, metamerism, optical isomerism themselves and functional isomerism with carboxylic acids.

Total number of isomeric esters can be calculated by formula, $I = 2^{n-1} - (n - 2) - 2^{n-3}$ from C_3 onwards.

Total number of isomeric acids and esters can be calculated by formula, $I = 2^{n-1} - (n - 2)$.

e.g. i) $\text{C}_2\text{H}_4\text{O}_2$ (2-isomers)

- a) CH_3COOH acetic acid
b) HCOOCH_3 methyl formate

ii) $\text{C}_3\text{H}_6\text{O}_2$ (3-isomers. 1 acid, 2 esters)

- a) $\text{CH}_3\text{CH}_2\text{COOH}$ propionic acid
b) HCOOC_2H_5 ethyl formate
c) $\text{CH}_3\text{COOCH}_3$ methyl acetate

iii) $\text{C}_4\text{H}_8\text{O}_2$ (6-isomers. 2 acids, 4 esters)

Acids-

- a) $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ n-butyric acid
b) $(\text{CH}_3)_2\text{CHCOOH}$ isobutyric acid

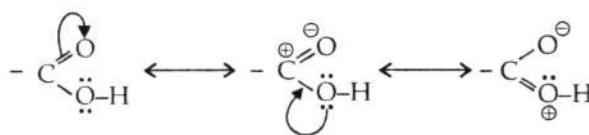
Esters-

- a) $\text{HCOOCH}_2\text{CH}_2\text{CH}_3$ n-propyl formate
b) $\text{HCOOCH}(\text{CH}_3)_2$ isopropyl formate
c) $\text{CH}_3\text{COOCH}_2\text{CH}_3$ ethyl acetate
d) $\text{C}_2\text{H}_5\text{COOCH}_3$ methyl propionate

12.3 STRUCTURE OF $-\text{COOH}$ GROUP

The carboxylic carbon is less electrophilic than carbonyl carbon atom in aldehydes and ketones because of resonance stabilisation of

COOH group.

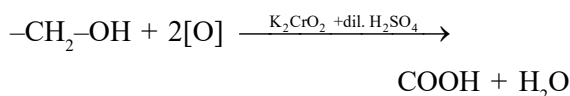


The carbon atom is sp^2 hybridised state. The $\text{O}-\text{C}-\text{O}$ bond angle is 120° .

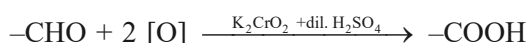
12.4 PREPARATION METHODS

- From oxidation of 1° alcohols, aldehydes and ketones.

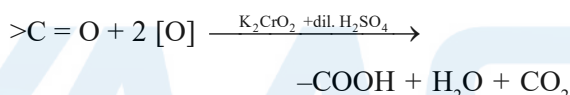
a) **From primary alcohols :** Primary alcohols on controlled oxidation by acidified $\text{K}_2\text{Cr}_2\text{O}_7$ gives carboxylic acid.



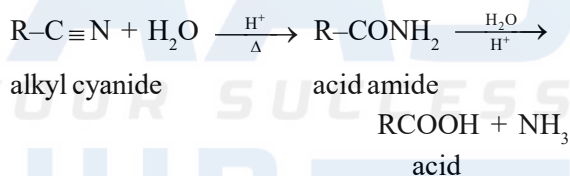
b) **From aldehydes :** Aldehydes on oxidation by acidified $\text{K}_2\text{Cr}_2\text{O}_7$ gives carboxylic acid.



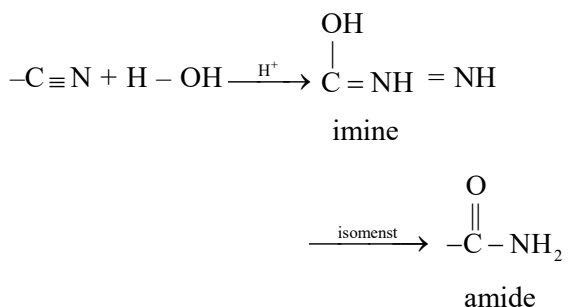
c) **From ketones :** Ketones on controlled oxidation by acidified $\text{K}_2\text{Cr}_2\text{O}_7$ gives carboxylic acid.



- From acid hydrolysis of cyanide or nitrile:

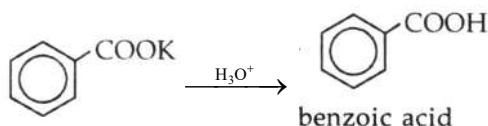
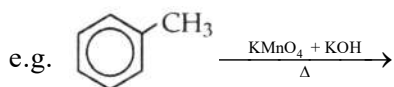


Note: Mild reaction conditions are used to stop reaction at amide stage.

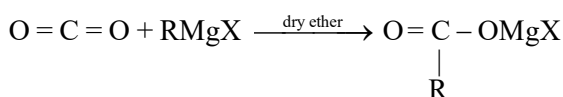


- From oxidation of alkyl benzene or phenyl alkene: Alkyl benzene are oxidised by strong oxidising agent like chromic acid or acidic KMnO_4 or alkaline KMnO_4 . The entire side chain is converted into carboxyl group irrespective of length of the side chain. Tertiary alkyl group donot

under goes oxidation because of absence of benzylic hydrogen atom.

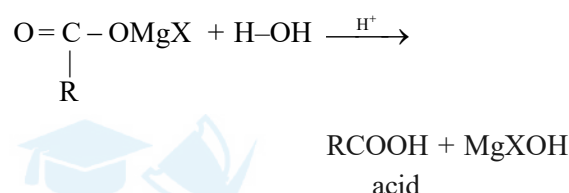


4. From dry ice and R-MgX :



dry ice

addition product



5. From hydrolysis of acid halide and acid anhydride :

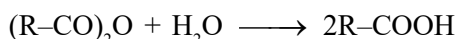
- a) Acid halide is hydrolysed with water gives corresponding acids.



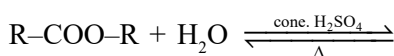
Note: Acid chloride are more readily hydrolysed by aqueous base to give carboxylate ion, which on acidification gives corresponding acids.



- b) Acid anhydride is hydrolysed by water gives acids



6. Acid hydrolysis of esters by using dil. HCl or dil. H₂SO₄ :

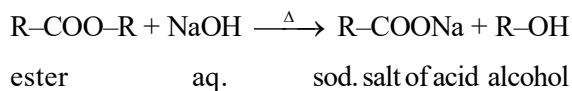


ester

R-COOH + R-OH
acid alcohol

Note: These are reverse of esterification reaction. It is auto catalysed reaction because acid formed in this reaction acts as catalyst.

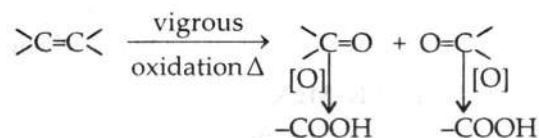
7. Alkaline hydrolysis of ester (Saponification):



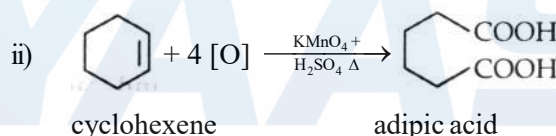
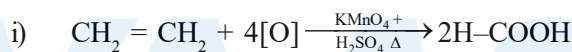
Note:

- Acid hydrolysis and alkaline hydrolysis of esters are nucleophilic substitution reaction.
- Hydrolysis of ester by dilute alkali is irreversible and faster reaction than acid hydrolysis.
- Alkaline hydrolysis of ester is preferred over acid hydrolysis because the acid salt formed can not force backward reaction.
- Reactions of ester with RMgX are nucleophilic addition reactions.

8. Oxidation of alkene by strong oxidising agent (vigrous oxidation) :



e.g.

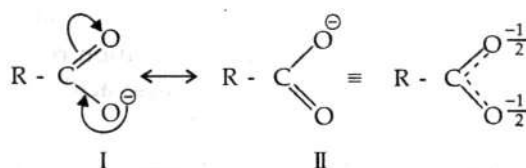


12.5 ACIDIC NATURE OF ALIPHATIC ACID

- Acidic nature of carboxylic acid can be best explained on the basis of resonance and Lowry Bronsted theory.
- Carboxylic acid are weak acids and turns blue litmus to red. In water they are partially dissociated and equilibrium is shifted in left side. Thus, aqueous solution of carboxylic acid contains more undissociated acid molecules. Carboxylic acids are stronger acid than R-OH, C₆H₅-OH water and weaker than mineral acids.



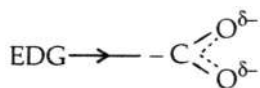
- Carboxylate ion is best stabilised by resonance hence these are acidic in nature.



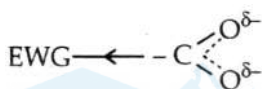
4. Acidic strength can also be explained on the basis of K_a and pK_a values. More the K_a value or less the pK_a value, more the acidic strength and vice versa.

Acidic nature

1. Electron donating groups (+I) effect i.e. $NH_2 > OH > OCH_3 > CH_3$ destabilize the anion, by intensify negative charge and thus decrease the acidity of acid.



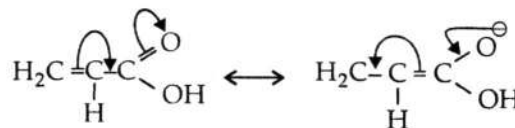
2. Electron withdrawing groups (-I) effect. i.e. $CF_3 > NO_2 > CN > F > Cl > Br > I > C_6H_5$ stabilize the anion, by dispersing negative charge and thus increase the acidity of acid.



Which is depends up on following factors:

- The number of electron attracting groups or atoms (-I effect) increases, the strength of acid increases. The order of acidity
e.g. $CCl_3COOH > CHCl_2COOH > CH_2ClCOOH > CH_3COOH$
- The power electron attracting groups or atoms increases, the acidity increases.
e.g. $CH_2FCOOH > CH_2ClCOOH > CH_2BrCOOH$
- The distance of electron attracting groups or atoms from carboxylic group increases, acidity decreases. Therefore, decreasing acidity order in n-butyric acid is $\alpha > \beta > \gamma > \delta$. Inductive effect is stronger at α -position than β -position, similarly at β -position it is more stronger than γ -position.
 $\gamma \quad \beta \quad \alpha$
e.g. $CH_3CH_2CHClCOOH > CH_3CHClCH_2COOH > CH_2ClCH_2CH_2COOH > CH_3CH_2CH_2COOH$
- More the power of electron withdrawing group, strength of carboxylic acid increases.
e.g. $CH_3-CH_2-COOH < H-CH_2-COOH < C_6H_5CH_2-COOH < HO-CH_2-COOH < Cl-CH_2-COOH$
- Direct attachment of groups such as phenyl (C_6H_5-) or vinyl ($CH_2=CH-$) or acetylenic ($CH \equiv C-$) to $-COOH$ group, increases the

acidity of corresponding carboxylic acid. This is due to more electronegative sp^2 - and sp -hybridised carbon atom to which $-COOH$ group is attached.

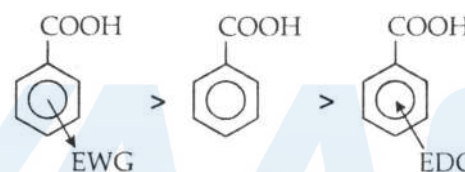


e.g.

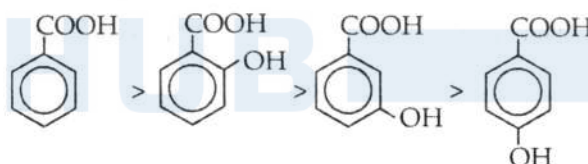
- $H-COOH > C_6H_5-COOH > C_6H_5CH_2COOH > CH_3COOH > C_2H_5COOH$
- $CH \equiv C-COOH > C_6H_5COOH > CH_2=CH-COOH$ (C_6H_5 group is more electron withdrawing than $CH_2=CH-$).

12.6 ACIDIC NATURE IN AROMATIC ACID

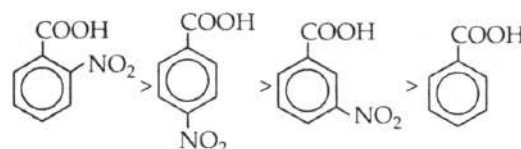
In aromatic carboxylic acid electron donating group decrease the acidic strength while electron withdrawing group increase the acidic strength



- Electron donating groups decrease the acidic strength of acids by destabilizing benzoate ion. It follows the order, $Ph-COOH > o > m > p$



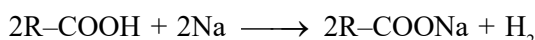
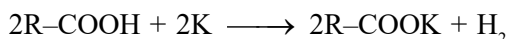
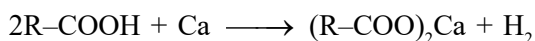
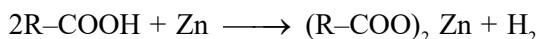
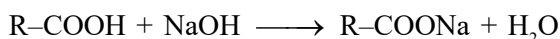
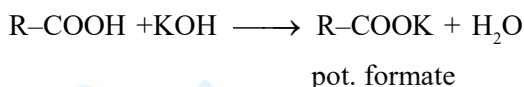
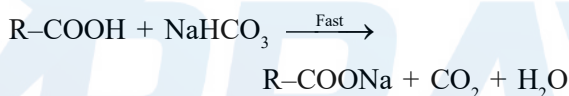
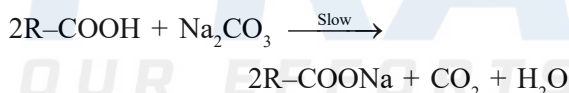
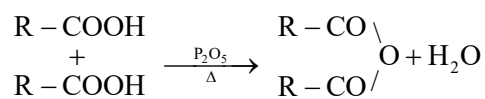
- Electron withdrawing groups increase the acidic strength of acids by stabilizing benzoate ion. It follows the order, $o > p > m > Ph-COOH$



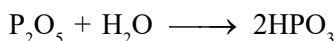
pK_a values 2.16 3.41 3.47 4.19

12.7 REACTION SHOWS THE ACIDIC NATURE OF CARBOXYLIC ACIDS

- Reaction with metal: (Na, K, Ca, Zn)

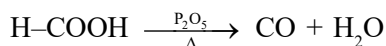
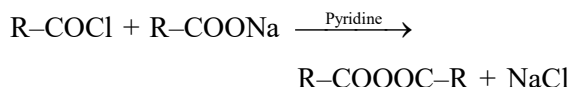
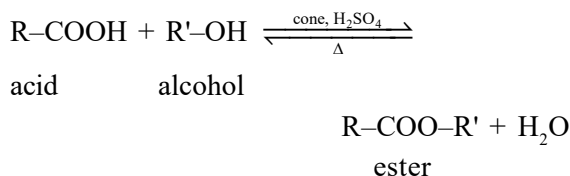
a) **Reaction with Na metal:**b) **Reaction with potassium metal:**c) **Reaction with calcium metal:**d) **Reaction with Zn metal:**2. **Reaction with strong alkali (NaOH, KOH)**a) **Reaction with NaOH :**b) **Reaction with KOH :**3. **Reaction with weak alkali (NaHCO₃, Na₂CO₃, NH₄OH) :**a) **Reaction with NaHCO₃ (sodium bicarbonate or baking soda) :**b) **Reaction with Na₂CO₃ (Sodium carbonate):**c) **Reaction with NH₄OH (ammonium hydroxide) :**4. **Reaction involving breaking of C–O bond (Nu–SR)**a) **Formation of anhydride (Reaction with cone. H₂SO₄ or P₂O₅)**1) **From P₂O₅ :**

acid



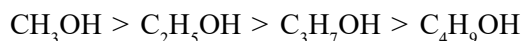
meta phosphoric acid

Note : Formic acid does not form formic anhydride (H–CO)₂O. When it is heated with P₂O₅, undergoes dehydration forming CO.

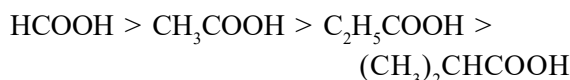
2) **From acyl chloride and sodium salt of carboxylic acids:**b) **Esterification (Fischer esterification) OR Alcoholysis of acids OR Acylation of alcohols.****Note:**

- These reactions are reversible in nature.
- The yield of ester may be increased by using excess of alcohol or removal of water by distillation or excess of acid. Water may be removed by using concentrated H₂SO₄ or dry HCl or anhydrous ZnCl₂.
- The concentrated H₂SO₄ or dry HCl or anhydrous ZnCl₂ acts as mainly dehydrating agent and it also acts as catalyst in the esterification reaction.
- These are nucleophilic substitution reactions.
- The reaction is shifted to the right by using excess of alcohol or removal of water by distillation.
- The greater the bulk of the substituents near the OH group of alcohol and –COOH group of acid, the slower is the rate of esterification due to steric hindrance.

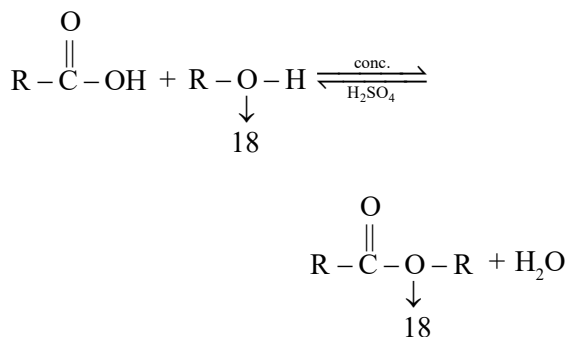
Thus, the reactivity of alcohol towards esterification is –



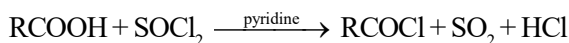
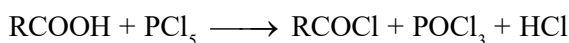
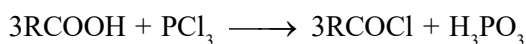
Similarly the reactivity of carboxylic acid increases as –



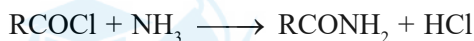
- The reverse of esterification is known as hydrolysis which may be effected by acids or alkalis.
- The mechanism of esterification is detected by tracer technique by taking isotopic oxygen in alcohol. After esterification isotopic oxygen becomes in ester. This indicates that during esterification the cleavage of C–O bond of carboxylic acid and O–H bond of alcohol.



c) **Reaction with PCl_3 , PCl_5 and SOCl_2**



When acid chloride is heated with ammonia gives acid amide.



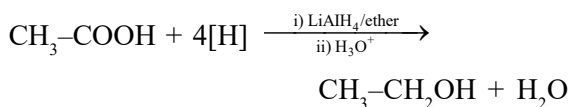
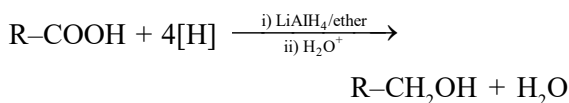
d) **Reaction with ammonia :**

When carboxylic acid is reacted with ammonia, gives ammonium salt of acid. Which on heating loses water molecule and gives amide.



3) **Reaction involving $-\text{COOH}$ group**

Reduction by using LiAlH_4 or diborane (B_2H_6) as reducing agent or hydrogen in the presence of copper chromite (CuO , CuCr_2O_4) as catalyst: Carboxylic acid are reduced by using LiAlH_4 as catalyst gives primary alcohols. The $>\text{C}=\text{O}$ group is reduced to $>\text{CH}_2$ group.

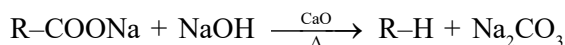


Note:

Sodium borohydride (NaBH_4) does not reduce carboxyl group.

ii) **Decarboxylation :**

a) **Decarboxylation by using soda lime:** Sodium salt of carboxylic acid is heated with soda lime ($\text{NaOH} + \text{CaO}$ 3 : 1 ratio) gives alkane

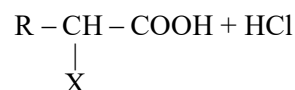


4) **Halogenation (Hell-Vohland-Zelinsky reaction) or HVZ reaction:**

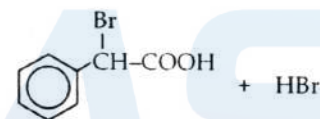
Carboxylic acids having α -H atom undergoes halogenation at only α -position in the presence of red phosphorus to give α -halo carboxylic acids.



$\text{X} = \text{Cl}, \text{Br}$



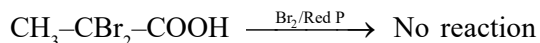
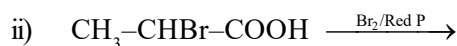
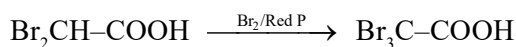
α -halo carboxylic acid



1-bromo 1-phenyl ethanoic acid

The importance of this reaction is that only α -H atom is substituted.

e.g.



12.8 ELECTROPHILIC SUBSTITUTION REACTION OF CARBOXYLIC ACIDS

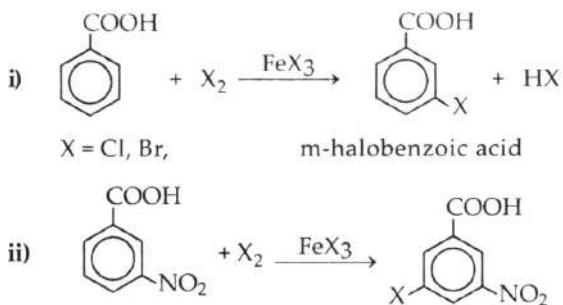
Aromatic carboxylic acid undergoes electrophilic substitution reaction. Carboxyl group is meta directing.

Note: Aromatic carboxylic acid never undergoes Friedel-Craft reaction because only, AlCl_3 ,

(Lewis acid) get bonded to carboxyl group. Other Lewis acid does not bonded to carboxyl group.

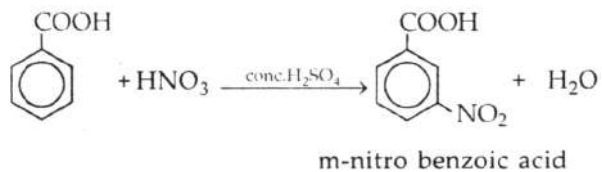
1. Halogenation

e.g.



2. Nitration

e.g.



○○○



MULTIPLE CHOICE QUESTIONS

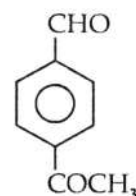
SECTION – I : ALDEHYDES AND KETONES

INTRODUCTION, CLASSIFICATION, NOMENCLATURE, ISOMERISM, STRUCTURE OF $>C=O$ GROUP

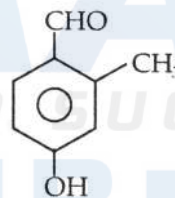
- Aldehydes are characterised by the general formula
 - $C_nH_{2n}O$
 - C_nH_{2n}
 - $C_nH_{2n} + OH$
 - $C_nH_{2n+2}O$
- Hybridisation of carbon in $-CHO$ group is
 - sp
 - sp^2
 - sp^3
 - none of these
- Formalin is a
 - 100% solution of $HCHO$
 - 40% solution of $HCHO$
 - 60% solution of $HCHO$
 - 40% solution of CH_3COOH
- An aldehyde group can be present
 - in between carbon chain
 - at any position in carbon atom
 - only at the end of carbon chain
 - at the second carbon atom of the carbon chain
- Butanal is an example of
 - primary alcohol
 - secondary alcohol
 - aliphatic aldehyde
 - aliphatic ketone
- In IUPAC system aldehydes are called
 - alkanes
 - alkenes
 - alkanals
 - alkanols
- IUPAC name of mesityl oxide is
 - 4-methyl penta-3-none
 - 4-methyl penta-3-none
 - 4-methyl pent-3-en-2-one
 - 4-methyl pent-3-en-1-one
- IUPAC name of pinacol is
 - 2,3-dimethyl butan-2,3-diol
 - 2,3-dimethyl butane-2,3-diol
 - 2,3-dimethyl 2-butanol
 - 2,3-dimethyl 3-butanol
- IUPAC name of diacetone amine is
 - 2-methyl 4-keto 2-pentanamine
 - 4-amino 4-methyl 2-pentanone
 - 4-amino 2-pentanone
 - 4-amino 3-pentanone
- The IUPAC name of crotonaldehyde is

- pentenal
- but-2-enal
- but-2-enal
- but-2-enol

- IUPAC name of the following compound is



- 4-formyl acetophenone
 - 4-ketomethyl benzaldehyde
 - 1-formyl 4-ketomethyl benzene
 - 4-formyl 1-ketomethyl benzene
- IUPAC name of ketone is
 - alkanol
 - alkanal
 - alkanone
 - alkyl alkanoate
 - Tautomerism is possible in
 - CH_3-CHO
 - $CH_3-CO-CH_3$
 - $H-CHO$
 - $(CH_3)_3C-CHO$
 - 1, 2
 - 2, 3
 - 3, 4
 - 1, 2, 4
 - IUPAC name of following compound will be

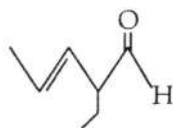


- 4-formyl 3-methyl 1-hydroxy benzene
 - 4-formyl 3-methyl phenol
 - 4-hydroxy 2-methyl benzaldehyde
 - 4-hydroxy 2-methyl carbaldehyde
- IUPAC name following compound is

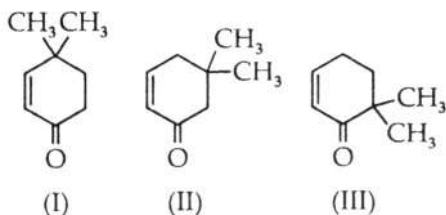


- 4-oxo pent-2-ene
 - pent-2-en-4-one
 - 2-oxo-pent-3-ene
 - pent-3-en-2-one
- Which of the following is 3-phenylprop-2-en-1-al?
 - $C_6H_5-CH=CH-CH_2-CHO$
 - $C_6H_5-CH=CH-CHO$
 - $C_6H_5-CH_2-CHO$
 - $C_6H_5-CH=CH-CH_2-CH_2-CHO$

17. IUPAC name of benzophenone is
 a) 2-phenyl propenal
 b) 3-phenyl butenal
 c) diphenyl methanone
 d) diphenyl ethanone
18. IUPAC name of the following compound is



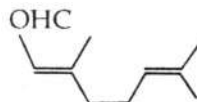
- a) 2-(2-propenyl) butanal
 b) 2-(1-propenyl) butanal
 c) 4-formyl 4-ethyl but-2-ene
 d) 2-ethyl pent-3-enal
19. Aldehyde group can occur,
 a) any where in carbon chain
 b) in the middle of carbon chain
 c) at only second carbon atom of carbon chain
 d) only at end of the carbon chain
20. The carbon atom of carbonyl group is
 a) sp^3 -hybridised b) sp^2 -hybridised
 c) sp -hybridised d) sp^3 -d-hybridised
21. $C_nH_{2n}O$ is general formula for
 a) aldehydes
 b) ketones
 c) all carbonyl compounds
 d) aldehyde and ketones
22. IUPAC name of β -methyl butyraldehyde
 a) 2-methyl butanal b) 3-methyl butanal
 c) 2-methyl propanal d) 3-methyl pentanal
23. Given:



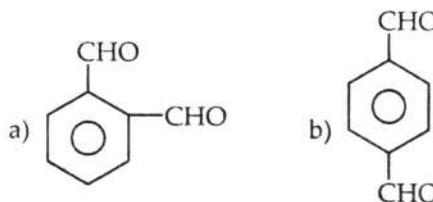
Which of the given compounds can exhibit tautomerism?

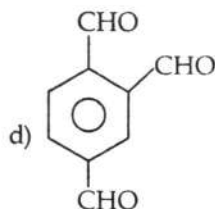
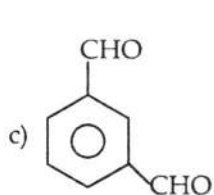
- a) I and II b) I and III
 c) II and III d) I, II and III
24. IUPAC name of isobutyraldehyde is
 a) 2-methyl propanone
 b) 2-methyl propanal
 c) 2-methyl propanone

- d) methyl ethanoate
25. Which of the following is trimethyl acetaldehyde?
 a) $(CH_3)_3C-CH_2-CHO$
 b) $(CH_3)_3C-CH_2-CH_2-CHO$
 c) $(CH_3)_3C-CHO$
 d) $(CH_3)_2CH-CH(CH_3)CHO$
26. IUPAC name of the following compound is

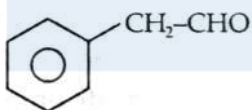


- a) 2-methyl nona 2,6-dien-1-al
 b) 3-methyl nona 2,6-dien-1-al
 c) 4,6-dimethyl hepta 3,5-dien-1-al
 d) 3,7-dimethyl octa 2,6-dien-1-al
27. Aldehyde shows functional isomerism with
 a) aliphatic ether
 b) ketones
 c) dimer of ethanoic acid
 d) thio cyclic ether
28. Pentan-2-one and 3-methyl butan-2-one are
 a) chain isomers b) position isomers
 c) metamers d) tautomers
29. Tautomer of ethyl methyl ketone is
 a) but-2-en-2-ol
 b) but-2-en-1-ol
 c) but-2-en-1-oic acid
 d) prop-1-en-2-ol
30. Which of the following is acrolein?
 a) $CH_3-CH=CH-CHO$
 b) $CH_2=CH-CHO$
 c) $CH_2=CH-CH_2-CHO$
 d) $CH_2=CH-CH_2-CH_2-CHO$
31. What is the IUPAC name of compound when $-CHO$ group is attached to neoamyl group?
 a) 2-methyl propanal
 b) 3-methyl propanal
 c) 2,2-dimethyl butanal
 d) 3,3-dimethyl butanal
32. Which of the following is isophthalaldehyde?

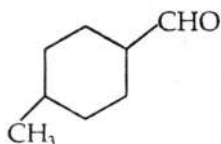




33. What is the IUPAC name of compound when carbonyl carbon atom is attached to phenyl group and ethyl group
 a) propanone benzene
 b) 1-phenyl propan-1-one
 c) 2-phenyl propan-1-one
 d) propiophenone
34. What is IUPAC name of compound when ketone group is attached to one isopropyl group and one t-butyl group?
 a) 2, 4, 4-trimethyl 3-pentanone
 b) 2, 2, 4-trimethyl 3-pentanone
 c) 2, 4-dimethyl 3-pentanone
 d) 2, 2-dimethyl 3-pentanone
35. IUPAC name of ethyl isopropyl ketone is
 a) 4-methyl pent-3-one
 b) 2-methyl pent-3-one
 c) 4-methyl pent-2-one
 d) 2-methyl pent-2-one
36. IUPAC name of acrolein is
 a) but-2-enal
 b) prop-2-enal
 c) pentanal
 d) 2-methyl propanal
37. IUPAC name of the following compound is



- a) Phenyl acetaldehyde
 b) 1-Phenyl formyl methane
 c) 2-Phenyl ethanal
 d) 1-Phenyl methanal
38. Following compound is named as



- a) 4-methyl cyclohexane carbaldehyde
 b) δ -methyl cyclohexane carbaldehyde
 c) γ -methyl cyclohexane carbaldehyde
 d) both a and b

39. Keto-enol tautomerism is observed in
 a) CH_3OH
 b) CH_3COCH_3
 c) CH_3COOH
 d) $\text{CH}_3\text{COOCH}_3$
40. Ketones are isomeric with
 a) alcohols
 b) aldehydes
 c) ester
 d) acetic acid
41. The structural formula of the compound isomeric with acetone is
 a) $\text{CH}_3\text{CH}_2\text{CHO}$
 b) CH_3CHO
 c) $\text{CH}_3\text{CH}_2\text{OH}$
 d) none of these
42. $\text{CH}_3 - \text{CO} - \text{CH}_3$ and $\text{CH}_2 = \text{COH} - \text{CH}_3$ are
 a) metamers
 b) tautomers
 c) geometrical isomers
 d) optical isomers
43. Aldehydes and ketone are
 a) tautomers
 b) chain isomers
 c) functional isomers
 d) position isomers
44. Total number of isomeric aldehydes can be calculated by formula
 a) $I = 2^{n-2}$
 b) $I = 2^{n-3}$
 c) $I = 2^{n-2} - 1$
 d) $I = 2^n$
45. Total number of isomeric ketones can be calculated by formula
 a) $I = 2^{n-3} - 1$
 b) $I = 2^{n-2}$
 c) $I = 2^{n-2} - 1$
 d) $I = 2^n$
46. Molecular formula $\text{C}_3\text{H}_6\text{O}$ represents
 a) aldehydes
 b) ketones
 c) both 'a' and 'b'
 d) aldehydes and alcohols
47. $\text{C}_3\text{H}_6\text{O}$ shows
 a) chain isomerism
 b) position isomerism
 c) metamerism
 d) functional isomerism
48. How many aldehydes are possible for molecular formula $\text{C}_4\text{H}_8\text{O}$?
 a) 2
 b) 3
 c) 4
 d) 5
49. How many ketones are possible for molecular formula $\text{C}_4\text{H}_8\text{O}$?
 a) 1
 b) 2
 c) 3
 d) 4
50. 2-pentanone and 3-pentanone are
 a) chain isomers
 b) position isomers
 c) metamers
 d) functional isomers
51. Ketone never show

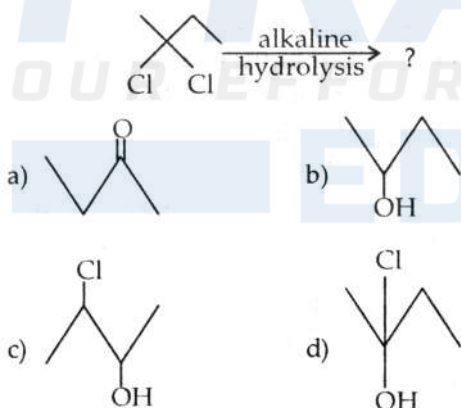
- a) chain isomerism
b) position isomerism
c) geometrical isomerism
d) optical isomerism
52. In $>C=O$ group sigma bond is formed by
a) sp^2 -p-overlapping b) sp^3 -p-overlapping
c) sp -p-overlapping d) s -p-overlapping
53. The π -bond in carbonyl group is formed by
a) s - s -overlapping b) p - p -overlapping
c) s - p -overlapping d) p - d -overlapping
54. IUPAC name of following compound is



- a) heptane 2,6-dione b) octan-6-one
c) octane 2,7-dione d) hexane-2,5-dione
55. Butanone and butanal are
a) chain isomers b) position isomers
c) functional isomers d) tautomers
56. Metamerism is present in
a) CH_3-O-CH_3 b) $CH_3-CO-CH_3$
c) $CH_3-CO-C_2H_5$ d) $CH_3-CO-C_3H_7$

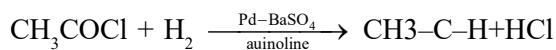
PREPARATION METHODS

57. Product of following reaction is



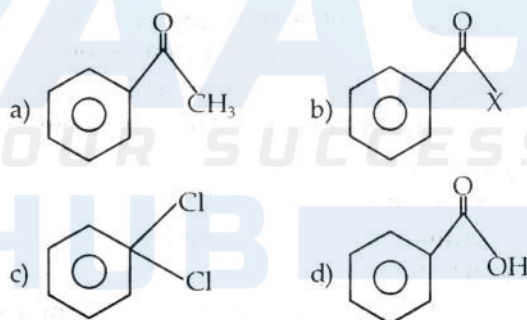
58. Calcium formate, on dry heating, produces
a) acetone b) acetic acid
c) acetaldehyde d) formaldehyde
59. The reaction of RCN with $RMgX$ followed by hydrolysis gives
a) an aldehydes b) an ketones
c) 20 alcohols d) 30 alcohols
60. An isomer of $C_3H_6Cl_2$ on boiling with aq. KOH give acetone. Hence, the isomer is,
a) 2,2-dichloro propane

- b) 1,2-dichloro propane
c) 1,1-dichloro propane
d) 1,3-dichloro propane
61. 2,2-dichloro butane on boiling with aq. potash gives,
a) butanal b) 2-butanone
c) 2-butanol d) butanoic acid
62. Propanone can be obtained from oxidation of what?
a) 2-propanol b) 1-propanol
c) 2-butanol d) 2 methyl, 1-butanol
63. The reaction

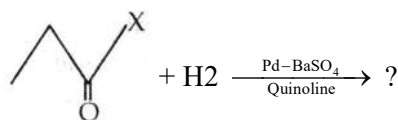


is called

- a) Cannizzaro's reaction
b) Stephen's reduction
c) Haloform reaction
d) Rosenmund's reduction
64. Rosenmund's reduction is used to prepare
a) alcohol b) carboxylic acid
c) aldehyde d) ketones
65. Benzaldehyde is obtained from Rosenmund's reduction of

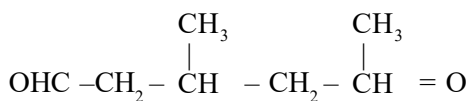


66. 1,1-dichlorocyclohexane on alkaline hydrolysis gives
a) cyclohexane carbaldehyde
b) cyclohexanone
c) benzophenone
d) cyclohexane carboxylic acid
67. Product of the following reaction is IYx

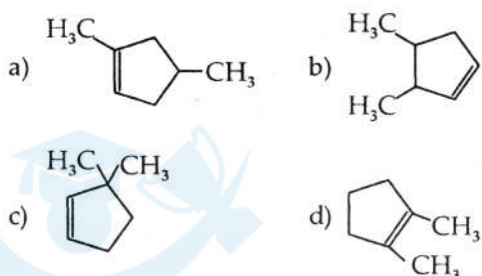


- a) propanone b) propanal
c) propionic acid d) propane
68. Rosenmund's reduction convert



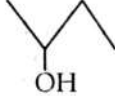
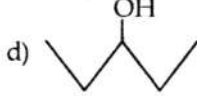
- a) carboxylic acid to aldehyde
 b) ketone to 2°-alcohol
 c) acyl halide to ketone
 d) acyl halide to aldehyde
69. An optical active alcohol of formula $C_4H_{10}O$ on oxidation gives which of the following compound?
 a) $(CH_3)_2CHCHO$ b) $(CH_3)_2C=CH_2$
 c) $CH_3COC_2H_5$ d) $CH_3CH_2CH_2CHO$
70. A single compound of the structure

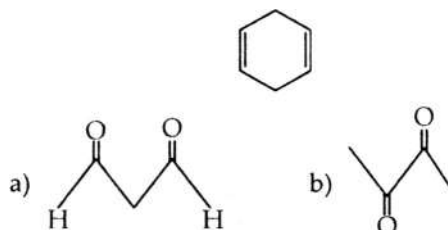


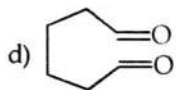
is obtainable from ozonolysis of which of the following cyclic compounds?



71. 2-methyl propanal is formed from isopropyl magnesium halide and what?
 a) CH_3CN b) $HCHO$
 c) HCN d) CH_3COC
72. Calcium acetate on heating gives
 a) acetone b) formic acid
 c) acetaldehyde d) methane
73. Which of the following is Collin's reagent?
 a) pyridine
 b) chromium oxide
 c) pyridinium chlorochromate
 d) $KOH + KMnO_4$
74. Dry distillation of a mixture of calcium acetate and calcium formate can form
 a) formaldehyde b) acetaldehyde
 c) acetone d) all of these
75. Which of the following is not used in the preparation of ketone?
 a) Oxidation of secondary alcohols
 b) Dehydrogenation of 2° alcohol
 c) Pyrolysis of calcium acetate
 d) Acid hydrolysis of alkyl cyanide
76. Which of the following compounds is oxidised to prepare ethyl methyl ketone?

- a) 1-butanol b) t-butyl alcohol
 c) 2-butanol d) 2-propanol
77. Product formed when but-1-yne is reacted with $dil.H_2SO_4$ and $HgSO_4$
- a)  b) 
 c)  d) 
78. Isopropyl alcohol on oxidation forms
 a) acetone b) ether
 c) acetaldehyde d) ester
79. Ethylidene chloride on hydrolysis with aq. $NaOH$ gives
 a) CH_3CHO b) $CH_3COC_2H_5$
 c) C_2H_5OH d) $CH_3CH(OH)_2$
80. Acetone is prepared by
 a) oxidation of acetic acid
 b) pyrolysis of acetic acid
 c) pyrolysis of calcium acetate
 d) oxidation of n-propyl alcohol
81. Formation of acetaldehyde from ethanol is known as
 a) oxidation b) substitution
 c) addition d) reduction
82. Ketones can be obtained in one step by,
 a) hydrolysis of esters
 b) oxidation of primary alcohols
 c) oxidation of secondary alcohols
 d) reaction of acid anhydride and alcohol.
83. 2-butanone can be obtained by heating a mixture of calcium salt of
 a) formic acid and butyric acid
 b) propionic acid and formic acid
 c) propionic acid and acetic acid
 d) acetic acid and formic acid
84. Ozonolysis following compound in the presence of Zn gives

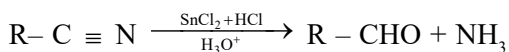




85. On heating calcium acetate and calcium formate, the product formed is
 a) CH_3COCH_3 b) CH_3CHO
 c) $\text{HCHO} + \text{CaCO}_3$ d) $\text{CH}_3\text{CHO} + \text{CaCO}_3$
86. Which of the following compound gives a ketone with Grignard reagent?
 a) Formaldehyde b) Ethyl alcohol
 c) Methyl cyanide d) Methyl iodide
87. Which one is not synthesized by Grignard reagent?
 a) Primary alcohol b) Secondary alcohol
 c) A ketone d) An ester
88. Ethylidene chloride on treatment with aqueous KOH gives?
 a) Acetaldehyde b) Ethylene glycol
 c) Formaldehyde d) None
89. Find out reducing agent in following conversion.



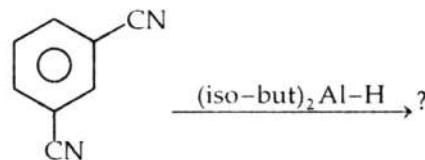
- a) $\text{Na.Hg} + \text{H}_2\text{O}$
 b) $\text{H}_2 + \text{Ni}$
 c) $\text{Pd.BaSO}_4 + \text{quinoline}$
 d) $\text{SnCl}_2 + \text{HCl}$
90. Which poison the catalyst (Pd) at aldehyde stage in the reduction of acyl halide
 a) PCC b) BaSO_4
 c) SnCl_2 d) CuSO_4
91. Cyclohexanoyl chloride on reduction by poisoned catalyst gives
 a) benzaldehyde b) cyclohexanol
 c) cyclohexanone d) cyclohexyl methanal
92. Stephen's reduction convert
 a) acyl chloride to aldehyde
 b) cyanide to aldehyde
 c) cyanide to carboxylic acid
 d) cyanide to ketones
93. The reaction



- a) Rosenmund's reduction
 b) Stephen's reduction

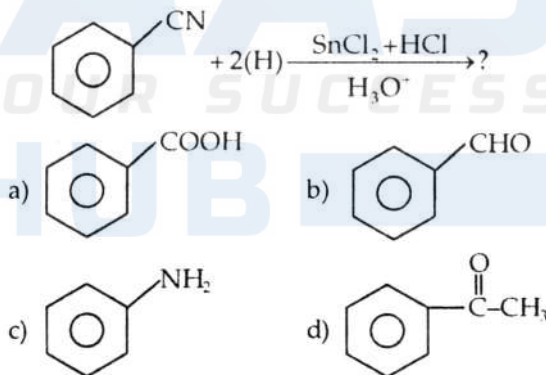
- c) Clemmenson's reduction
 d) Cannizzaro's reaction

94. Formonitrile is reduced by $\text{SnCl}_2 + \text{HCl}$ and product on acid hydrolysis gives
 a) formic acid b) methanal
 c) acetic acid d) acetone
95. Product of the following reaction is

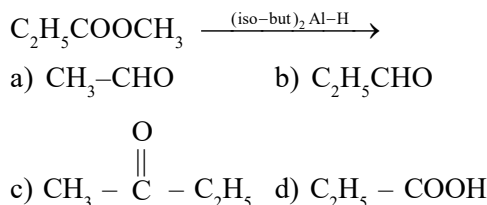


- a)
- b)
- c)
- d)

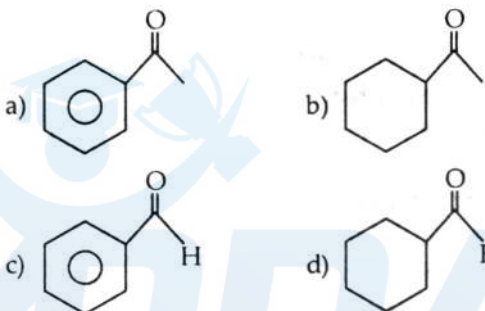
96. Rosenmund's reduction carried out by using
 a) H_2/Ni b) $\text{Na.Hg} + \text{H}_2\text{O}$
 c) LiAlH_4 d) $\text{Pd-BaSO}_4 + \text{quinoline}$
97. Product of the following reaction is



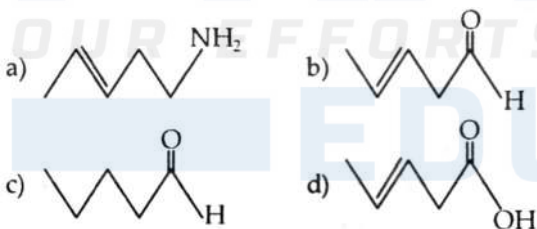
- a)
- b)
- c)
- d)
98. Conversion of ester to aldehyde which of the following reagent is used?
 a) $\text{SnCl}_2 + \text{HCl}$ b) $\text{Pd.BaSO}_4 + \text{quinoline}$
 c) Cr_2O_3 d) $(\text{isobut})_2\text{Al}-\text{H}$
99. The product of following reaction is



100. Compound A is reacted with KCN and followed by reduction using $\text{SnCl}_2 + \text{HCl}$ and successive hydrolysis gives propanal. The compound A is
 a) $\text{C}_2\text{H}_5-\text{X}$ b) $\text{C}_2\text{H}_5-\text{OH}$
 c) $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{X}$ d) $\text{C}_2\text{H}_5-\text{CN}$
101. Acetaldehyde is
 a) oxidising agent
 b) reducing agent
 c) both oxidising and reducing agent
 d) none of these
102. Ethyl cyanide is reduced by di-isobutyl aluminium hydride gives
 a) propanal b) propanoic acid
 c) propan-1-amine d) propane
103. Methyl benzoate is reduced by di-isobutyl aluminium hydride gives



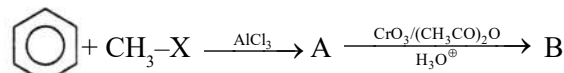
104. Pent-3-ene-1-nitrile on reduction by di-isobutyl aluminium hydride gives



105. Etard oxidation convert toluene to
 a) benzoic acid b) acetophenone
 c) benzaldehyde d) benzoyl chloride
106. Oxidising agent in Etard oxidation is
 a) $\text{K}_2\text{Cr}_2\text{O}_7 + \text{dil. H}_2\text{SO}_4$
 b) $\text{KOH} + \text{KMnO}_4$
 c) dil. HNO_3
 d) CrO_2Cl_2 in CS_2
107. Oxidation of toluene by chromium oxide in acetic anhydride gives
 a) benzaldehyde b) benzoic acid
 c) benzophenone d) acetophenone
108. p-nitro toluene convert p-nitro benzaldehyde by using

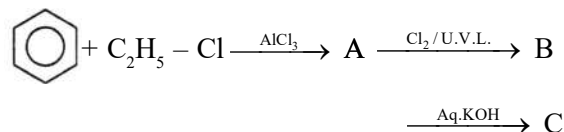
- a) $\text{KOH} + \text{KMnO}_4$
 b) CrO_3 in $(\text{CH}_3\text{CO})_2\text{O}$
 c) $\text{SnCl}_2 + \text{HCl}$
 d) $\text{Pd} - \text{BaSO}_4 + \text{guinoline}$

109. Find out B in the reaction



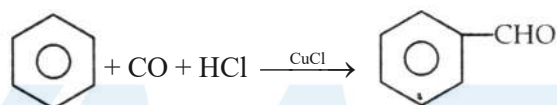
- a) Acetophenone
 b) benzaldehyde
 c) cyclohexyl carbaldehyde
 d) benzoic acid

110. Find out C in the following reaction



- a) benzaldehyde b) 1-phenyl ethanal
 c) Acetophenone d) benzophenone

111. The reaction

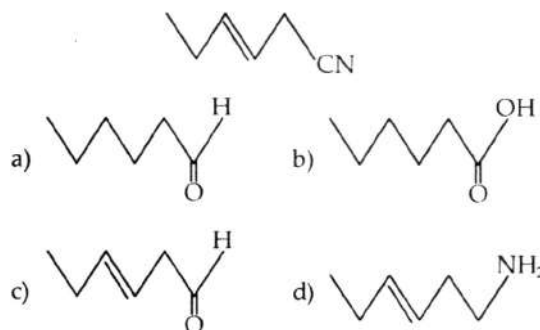


- a) Rosenmund's reaction
 b) Stephen's reaction
 c) Cannizzaro's reaction
 d) Gatterman-Koch reaction

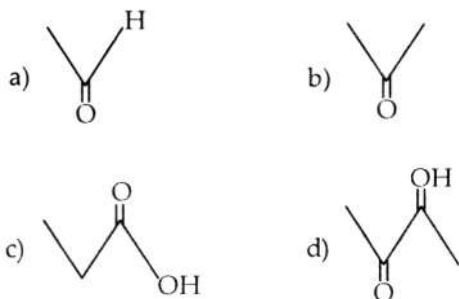
112. Toluene is subjected to Gatterman-Koch reaction produces

- a) benzaldehyde
 b) benzoic acid
 c) 2-methyl benzaldehyde
 d) acetophenone

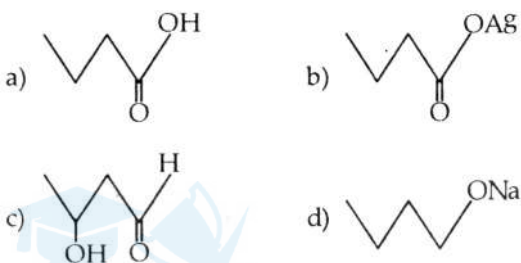
113. Following compound on reduction by using $(\text{iso-but})_2\text{Al-H}$ gives



114. Ethyl acetate is reduced by di-isobutyl aluminium hydride gives



115. Compound A is reacted with C_2H_5-X gives B. The compound B is reduced by di-isobutyl aluminium hydride gives butanal. The compound A is



116. Benzal chloride on hydrolysis gives
 a) benzoic acid b) benzaldehyde
 c) benzo chloride d) benzyl chloride
117. Toluene on side chain chlorination and followed by hydrolysis gives
 a) Tolly chloride b) benzaldehyde
 c) p-chloro toluene d) acetophenone
118. Side chain chlorination of alkyl benzene followed by hydrolysis gives
 a) aromatic aldehyde
 b) aromatic ketones
 c) aromatic carboxylic acid
 d) both a and b

PROPERTIES AND USES

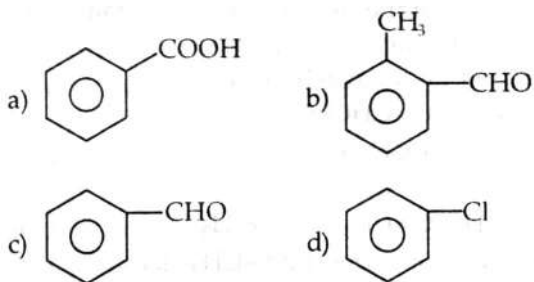
119. A reagent which reacts differently with CH_2O , C_2H_4O , C_3H_6O is
 a) NH_2OH b) $C_6H_5NHNH_2$
 c) HCN d) NH_3
120. Which of the following has maximum reactivity towards HCN ?
 a) $HCHO$ b) CH_3CHO
 c) CH_3COCH_3 d) $CH_3COC_2H_5$
121. Consider the following substances
 1) $HCHO$ 2) CH_3CHO
 3) CH_3COCH_3 4) $CH_3COC_2H_5$
 The correct order of reactivity towards

nucleophilic addition reaction is

- a) $1 > 2 > 3 > 4$ b) $1 > 3 > 2 > 4$
 c) $1 > 2 > 4 > 3$ d) $1 > 4 > 2 > 3$

122. The reagent with which both acetaldehyde and ketone react easily is
 a) Fehling solution
 b) Grignard's reagent
 c) Schiff's reagent
 d) Tollen's reagent
123. In presence of cone. alkali formaldehyde undergoes
 a) Aldol condensation
 b) Cannizzaro's reaction
 c) Esterification
 d) Wurtz reaction
124. The Cannizzaro's reaction is not given by
 a) benzaldehyde b) chloral
 c) methanal d) ethanal
125. Treatment of butanal with dilute $NaOH$ solution gives
 a) $CH_3CH_2CH_2COOCH_2CH_2CH_2CH_3$
 b) $CH_3CH_2CH_2CHOHCH_2CH_2CH_2CHO$
 c) $CH_3CH_2CH_2CHOHCH(C_2H_5)CHO$
 d) $CH_3CH_2CH_2COCH_2CH_2CH_2CHO$
126. The products of the reaction of two molecules of $HCHO$ with strong potash is
 a) CH_3OH and $HCOOH$
 b) CH_3OH and $HCOONa$
 c) CH_3OH and $HCOOK$
 d) C_2H_5OH
127. In the reaction of $NaHSO_3$ with carbonyl compounds to form bisulphite product, the nucleophile is
 a) HSO_3^- b) SO_3Na
 c) SO_3^{--} d) none of the above
128. The formation of cyanohydrin from a ketone is an example of
 a) electrophilic addition
 b) nucleophilic addition
 c) electrophilic substitution
 d) nucleophilic substitution
129. Acetone on treatment with CH_3MgI on further hydrolysis gives,
 a) $(CH_3)_2CHCH_2OH$
 b) $(CH_3)_3COH$
 c) $CH_3CH(OH)CH_2CH_3$
 d) $CH_3CH_2CH(OH)CH_2CH_3$

130. Base catalysed aldol condensation occurs with
 a) propanal b) butanal
 c) ethanal d) all of these
131. Treatment of propanal with dilute NaOH solution gives
 a) $\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_3$
 b) $\text{CH}_3\text{CH}_2\text{CHOHCH}(\text{CH}_3)\text{CHO}$
 c) $\text{CH}_3\text{CH}_2\text{CHOHCH}_2\text{CH}_2\text{CHO}$
 d) $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_2\text{CHO}$
132. Ethanal and propanone undergoes aldol condensation reaction in presence of dilute alkali to form
 a) $\text{CH}_3\text{C}(\text{OH})(\text{CH}_3)\text{CH}_2\text{CHO}$
 b) $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{COCH}_3$
 c) $\text{CH}_3\text{COC}(\text{OH})(\text{CH}_3)_2$
 d) $\text{CH}_3\text{COCH}(\text{CH}_3)\text{CH}_2\text{OH}$
133. Iodoform test is not given by
 a) ethanol b) ethanal
 c) acetone d) 3-pentanone
134. Methyl ketones are usually characterised through
 a) the Tollen's reagent
 b) the Schiff's reagent
 c) the iodoform test
 d) Cannizzaro's reaction
135. Grignard's reagent adds to
 a) $\text{>C}=\text{O}$ b) $\text{>C}=\text{S}$
 c) $\text{—C}\equiv\text{N}$ d) all of the above
136. An organic compound of formula, $\text{C}_3\text{H}_6\text{O}$ forms phenyl hydrazone, but gives negative Tollen's test. The compound is
 a) $\text{CH}_2=\text{CHOCH}_3$ b) $\text{CH}_3\text{CH}_2\text{CHO}$
 c) CH_3COCH_3 d) $\text{CH}_2=\text{CHCH}_2\text{OH}$
137. Which does not react with Fehling solution?
 a) Ethanal b) Glucose
 c) Formic acid d) Benzaldehyde
138. The reaction of RMgX with a ketone, followed by treatment with H_3O^+ forms
 a) 1° alcohol b) 2° alcohol
 c) 3° alcohol d) alkane.
139. When acetone is heated with ammonia gives diacetone amine, the intermediate compound formed in this reaction is,
 a) $(\text{CH}_3)_2\text{C}=\text{CHCOCH}_3$
 b) $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2\text{COCH}_3$
 c) $(\text{CH}_3)_2\text{C}=\text{CHCH}_2\text{CHO}$
 d) $(\text{CH}_3)_2\text{C}=\text{CH}_2\text{CH}_2\text{COCH}_3$
140. $\text{>C}=\text{O}$ is converted into $\text{—CH}_2\text{—}$ by
 a) Clemmenson reduction
 b) H_2/Ni
 c) Mendius reduction
 d) $\text{NaHg} + \text{H}_2\text{O}$ reaction.
141. Which of the following give self redox reaction?
 a) Methanal b) Ethanal
 c) Butanal d) Methanol
142. Which of the following reagent react with CH_2O forming urotropine ?
 a) NH_2OH b) NH_3
 c) HCN d) RMgX
143. Propanal and prop an one undergoes condensation reaction in presence of dil. KOH to form,
 a) $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{COCH}_3$
 b) $\text{CH}_3\text{C}(\text{OH})(\text{CH}_3)\text{CH}(\text{CH}_3)\text{CHO}$
 c) $\text{CH}_3\text{CH}(\text{OH})(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CHO}$
 d) none of these
144. Which one of the following reaction yield diacetone alcohol from carbonyl compound?
 a) Cannizzaro's reaction
 b) Catalytic hydrogenation
 c) Aldol condensation
 d) Oxidation
145. When H—CHO reacts with NH_3 , urotropin is formed. In this molecule how many C—C bonds are present?
 a) 4 b) 2
 c) 0 d) 6
146. Acetone shows similarity with acetaldehyde in reacting to
 a) Tollen's reagent
 b) Schiff's reagent
 c) Fehling solution
 d) Grignard reagent
147. Cyanohydrine of the following compound on hydrolysis give optically active compound.
 a) $\text{CH}_3\text{—COCH}_3$ b) H—CHO
 c) $\text{CH}_3\text{—CHO}$ d) All of these
148. When ethanal is heated with Fehling's solution, it gives a precipitate of
 a) Cu b) CuO
 c) Cu_2O d) $\text{Cu}_2\text{O} + \text{CuO}$
149. Benzene is reacted with carbon monoxide in HCl in the presence of catalyst, cupric chloride gives



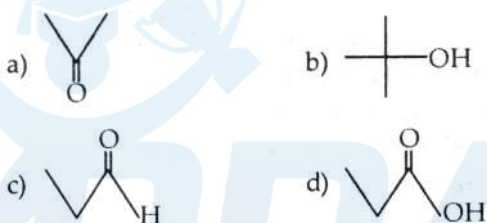
150. Which of the following is used to prepare ketone from acyl chloride

- a) $R-MgX$ b) R_2Cd
c) $CO + HCl$ d) CrO_3

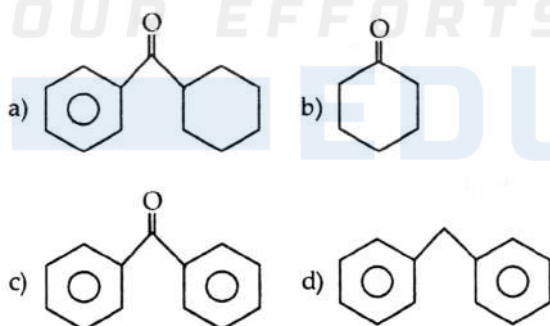
151. Dimethyl cadmium and acetyl chloride produces

- a) acetone b) t-butyl alcohol
c) 2°-propyl alcohol d) n-propyl alcohol

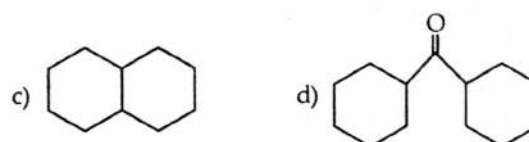
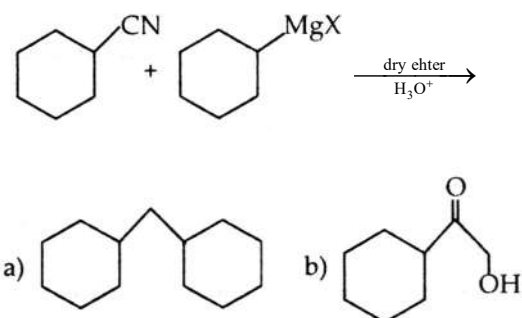
152. Product of the following reaction is



153. Benzonitrile and phenyl magnesium bromide produces



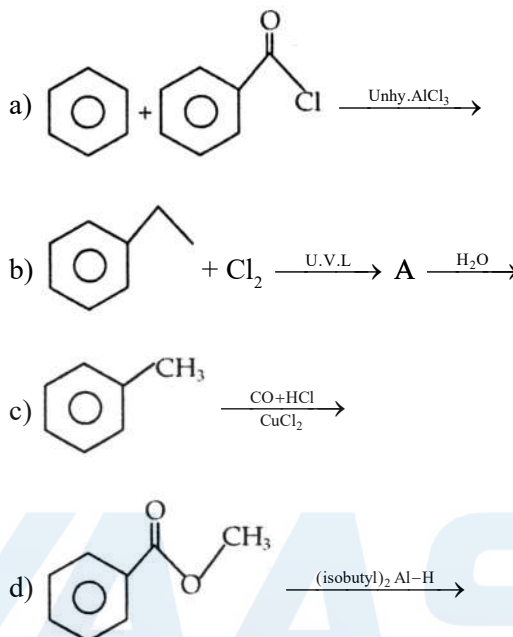
154. Product of the following reaction is



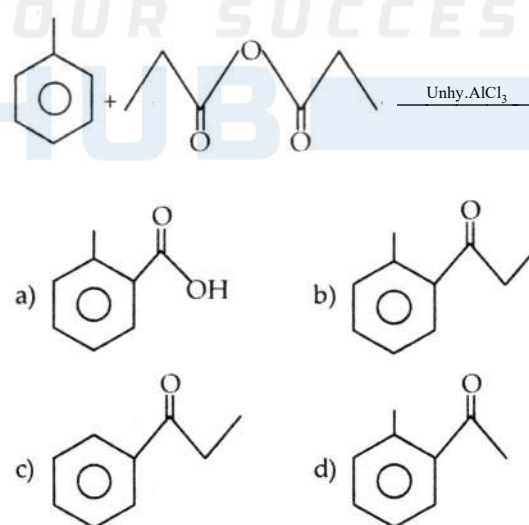
155. Friedel Craft acetylation of benzene gives

- a) benzophenone b) acetophenone
c) alkyl benzene d) diphenyl

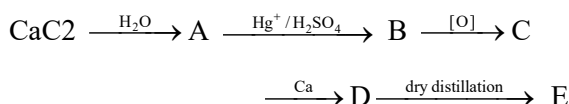
156. Diphenyl methanone is obtained from



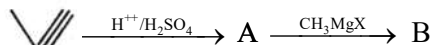
157. Product of the following reaction is







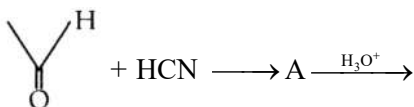
158. In the following sequence of reaction end product is.







- a) acetaldehyde b) propanone
c) methanal d) ethanoic acid
159. In the following sequence of reaction end product is

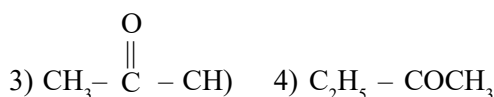


- a)  b) 
c)  d) 
160. The product 'B' in the following reaction...



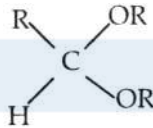
- a)  b) 
c)  d) 
161. The correct order of solubility of following compound is
- 1) $\text{H}-\text{CHO}$ 2) CH_3-CHO
3) $\text{CH}_3-\text{CH}_2-\text{CHO}$ 4) $\text{CH}_3-\text{COCH}_3$
a) $4 > 3 > 2 > 1$ b) $1 > 2 > 4 > 3$
c) $1 > 2 > 3 > 4$ d) $1 > 4 > 2 > 3$
162. Acetylene on hydration gives compound A, which on Clemmenson's reduction gives?
- a) Ethane b) Ethyl alcohol
c) Acetaldehyde d) Ethene
163. Compound 'A' has molecular formula $\text{C}_5\text{H}_{10}\text{O}$ reduce Tollen's reagent on oxidation gives monocarboxylic acid with same number of carbon atoms. The compound 'A' is
- a) $\text{CH}_3\text{COCH}(\text{CH}_3)_2$ b) $\text{CH}_3(\text{CH}_2)_3-\text{CHO}$
c) $\text{C}_2\text{H}_5\text{COC}_2\text{H}_5$ d) $\text{CH}_3\text{COCH}_2\text{CH}_2\text{CH}_3$
164. Wolf-Kishner reduction is
- a) reduction of carbonyl compound in to alcohol
b) reduction of carbonyl compound in to alkene
c) reduction of carboxyl compound in to alkane
d) reduction of nitro compound into aniline
165. Among the following compound the reactivity order is

- 1) $\text{H}-\text{CHO}$ 2) CH_3-CHO

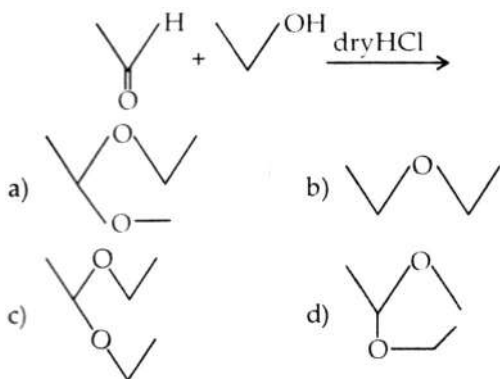


- a) $1 > 2 > 4 > 3$ b) $4 > 3 > 2 > 1$
c) $1 > 2 > 3 > 4$ d) $1 > 3 > 4 > 2$

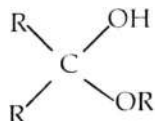
166. Less reactivity of ketone is due to
- a) +I inductive effect decrease positive charge on carbonyl carbon atom
b) steric effect of two bulky alkyl groups
c) sp^2 hybridised carbon atom of carbonyl carbon atom
d) both a and b
167. To distinguish between acetone and iso-propyl alcohol, which of the following reagent can help
- a) NaCl b) NaOH
c) Na_2CO_3 d) NaHSO_3
168. Which of the following statement is wrong?
- a) aldehyde and ketones are reducing agents
b) aldehyde and ketones are nonpolar compounds
c) aldehydes are more reactive than ketones
d) aldehydes and ketones are reduced to alcohol
169. Which of the following statement is correct regarding the aldol condensation?
- a) All aldehydes give this reaction
b) Ketones do not give this reaction
c) This reaction proceeds in presence of strong alkali
d) Ketones, in which α -hydrogen atom is present, give this reaction
170. If formaldehyde and KOH are heated then we get
- a) methane b) acetylene
c) ethyl formate d) methyl alcohol
171. Benzaldehyde is converted to benzyl alcohol by
- a) Wurtz reaction
b) Fitting reaction
c) Wurtz fittings reaction
d) Cannizzaro's reaction
172. Aldehydes are oxidised to acids by
- a) potassium dicromate
b) Tollen's reagent
c) Fehling's solution
d) all of these
173. Formaldehyde + ammonia \rightarrow Y, the product Y is
- a) methanol

- b) formamide
c) para-formaldehyde
d) hexamethylene tetraamine
174. Acetaldehyde and acetone can be identified by
a) Schiff's test b) Lucas test
c) Iodoform test d) Bromoform test
175. Ethanal reacts with alkali to give 3-hydroxy butanal. The reaction is
a) Aldol condensation
b) Claisen condensation
c) Cannizzaro's reaction
d) Clemmenson reduction
176. Which of the following undergoes haloform reaction?
a) HmO b) $(\text{CH}_3)_2\text{CO}$
c) $\text{C}_2\text{H}_5\text{Cl}$ d) $\text{CH}_3\text{-O-CH}_3$
177. Which of the following cation is involved In Tollens reagent ?
a) $[\text{Ag}(\text{NH}_3)_2]^+$ b) 2OH^-
c) $[\text{Ag}(\text{NH}_3)_3]^+$ d) AgNO_3
178. Diethyl ketone and a dimethyl ketone can be distinguished with
a) Tollen's reagent b) Fehling's solution
c) Schiff's reagent d) Haloform test
179. Tollen's reagent is
a) ammonical CuSO_4
b) ammonical AgO_3
c) alkaline solution containing complex of copper nitrate
d) none of these
180. Reduction of a keto group to a methylene group is converted by using
a) $\text{ZnHg} + \text{cone, HCl}$ b) $\text{NaHg} + \text{water}$
c) $\text{Sn} + \text{cone, HCl}$ d) $\text{Zn} + \text{CH}_3\text{COOH}$
181. Which statement is false regarding acetaldehyde and acetone?
a) Both reduce ammonical silver nitrate to silver mirror
b) Both react with hydroxylamine to form oximes
c) Both react with hydrazine to form hydrazone derivative
d) Both react with sodium bisulphite to form addition product
182. Which of following give haloform test?
a) $\text{CH}_3\text{-CHO}$ b) $\text{C}_2\text{H}_5\text{-CHO}$
c) H-CHO d) $\text{C}_2\text{H}_5\text{-CO-C}_2\text{H}_5$
183. Which of the following compounds does not contain an -OH group?
a) Alcohol b) Phenol
c) Aldehyde d) Carboxylic acid
184. HCHO and CH_3CHO differ from each other towards
a) Schiff's reagent b) Fehling solution
c) ammonia d) ammonical AgNO_3
185. The most active carbonyl compound is
a) HCHO b) CH_3CHO
c) CH_3COCH_3 d) $\text{C}_2\text{H}_5\text{CHO}$
186. Out of
1) butane 2) butan-1-ol
3) butanal 4) butanone.
The decreasing order of their B.P is
a) $1 > 2 > 3 > 4$ b) $2 > 4 > 3 > 1$
c) $2 > 3 > 4 > 1$ d) $4 > 2 > 3 > 1$
187. Acetone is converted into propane by Wolff-Kishner reduction by using reagent
a) LiAlH_4 b) $\text{Zn.Hg} + \text{cone HCl}$
c) $\text{H}_2 + \text{pd} - \text{BaSO}_4$ d) $\text{NH}_2\text{-NH}_2$ and KOH
188. A neutral compound $\text{C}_4\text{H}_8\text{O}_2$, reduce Fehling's solution, and liberate H_2 gas when treated with sodium metal and give positive iodoform test. The compound is
a) $\text{CH}_3\text{-CHOHCH}_2\text{-CHO}$
b) $\text{HO-CH}_2\text{-CH}_2\text{-CHO}$
c) $\text{CH}_3\text{-CO-CH}_2\text{-CHO}$
d) $\text{CH}_3\text{COCH}_2\text{-CH}_2\text{-OH}$
189. Compound of general formula  are called
a) diester b) acid anhydride
c) hemiacetal d) acetal
190. In the reaction
$$\text{CH}_3\text{CH}=\text{O} + \text{A} \xrightarrow{\text{dry HCl}} \text{CH}_3\text{CH}(\text{OC}_2\text{H}_5)_2 + \text{H}_2\text{O}$$

The compound A is
a) propan-1-ol b) ethanol
c) methanol d) $\text{C}_2\text{H}_5\text{-O-C}_2\text{H}_5$
191. During reduction of aldehyde with hydrazine and KOH , the first is the formation of
a) R-CH=NH b) R-CH=N-NH_2
c) RCONH_2 d) R-C=N
192. Product of following reaction will be



193. Compound of general formula are called



- a) acetal b) hemiketal
 c) ketal d) hemiacetal

194. Acetals are

- a) aldehyde b) ketones
 c) ethers d) diether

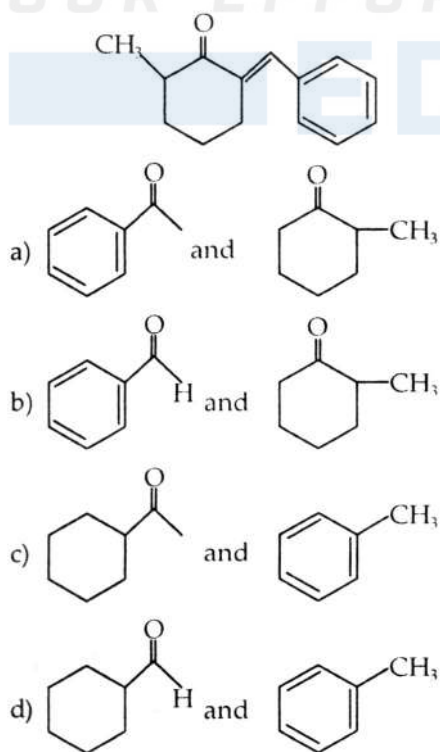
195. Pentan-3-en-2-one is reduced by LiAlH_4 gives

- a) pent-4-en-2-ol b) pent-3-en-1-ol
 c) pent-2-ol d) pent-3-en-2-ol

196. Which is best solvent

- a) $\text{H}-\text{CHO}$ b) CH_3COCH_3
 c) CH_3-CHO d) CH_3COOH

197. What is the structure of carbonyl compounds that will give following compound?



198. Prop 1,3-diphenyl 2-en-1-one is crossed condensation product. Which is obtained from

- a) benzophenone
 b) Acetophenone
 c) benzaldehyde
 d) Acetophenone and benzaldehyde

199. In mechanism of aldol condensation reaction the second step is

- a) abstraction of α -H atom carbon of aldehyde by base to form carbanion
 b) The attack of carbanion on carbonyl carbon atom of another molecule to form alkoxide ion
 c) The attack of carbanion on carbonyl carbon atom of another molecule to form oxocation
 d) Alkoxide ion take proton from water to form β -hydroxy aldehyde

200. Formaldehyde is used as

- a) solvent
 b) antiseptic
 c) disinfectant
 d) disinfectant and preservative

201. Carbonyl group in aromatic aldehyde and ketone is

- a) o-directing b) p-directing
 c) o- and p-directing d) m-directing

202. Benzaldehyde on nitration gives

- a) o-nitrobenzaldehyde
 b) p-nitrobenzaldehyde
 c) mixture of a and b
 d) m-nitrobenzaldehyde

203. Product of the following reaction will be



- a) cyclohexanal
 b) cyclohexanone
 c) cyclohexane carbaldehyde
 d) cyclohexane carboxylic acid

204. But-2-en-1-ol on oxidation by using PCC gives

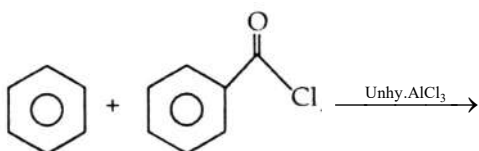
- a) Butan-1-ol b) butanal
 c) but-2-en-al d) butan-2-one

205. Following compound on oxidation by $\text{K}_2\text{Cr}_2\text{O}_7 + \text{dil. H}_2\text{SO}_4$ gives



- a)
- b)
- c)
- d)

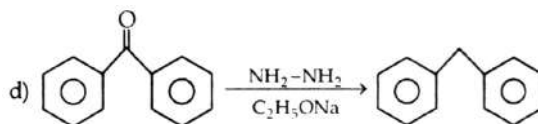
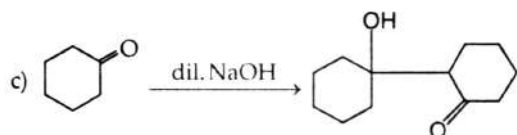
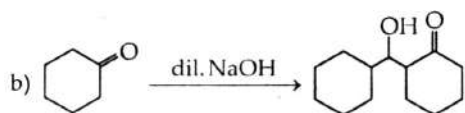
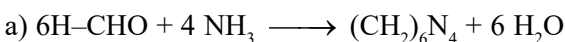
206. Product of the following reaction is



- a) acetophenone
b) diphenyl methanone
c) 2-diphenyl ethanone
d) 1-phenyl ethan one
207. Methyl ketone group is identified by
a) Lucas test b) Haloform test
c) Hinsberg test d) Millon's test
208. Match the List-I and II and select the correct answer

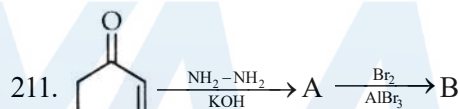
List-I**List-II**

- | | |
|--------------------------|--|
| 1. Cannizzaro's reaction | A) $\text{SnCl}_2 + \text{HCl}$ |
| 2. Stephen's reaction | B) 50% NaOH |
| 3. Clemmenson reduction | C) $\text{Pd-BaSO}_4 + \text{quinoline}$ |
| 4. Rosenmund's reduction | D) $\text{Zn.Hg} + \text{Conc. HCl}$ |
- a) 1-B, 2-D, 3-A, 4-C
b) 1-B, 2-C, 3-D, 4-A
c) 1-B, 2-A, 3-D, 4-C
d) 1-D, 2-A, 3-C, 4-B
209. Which of the following is not correct reaction?



210. What is product formed when cyclohexane carbaldehyde undergoes aldol condensation followed by heating

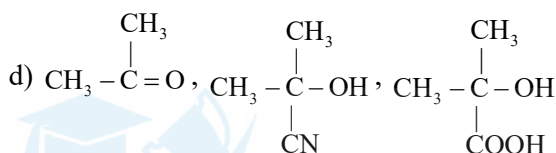
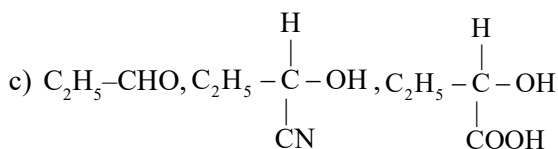
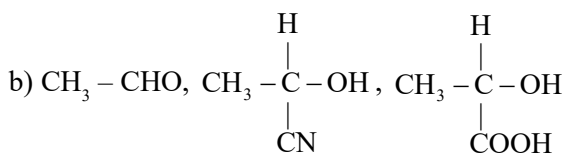
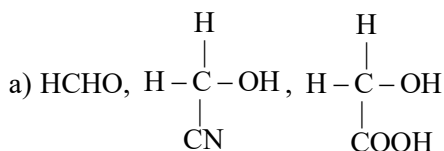
- a)
- b)
- c)
- d)



The product A and B are

- a) and
- b) and
- c) and
- d) and

212. A carbonyl compound 'A' react with hydrogen cyanide to give cyanohydrin 'B' which on acid hydrolysis gives optically active α -hydroxy propanoic acid 'C'. Compounds A, B, C respectively are,



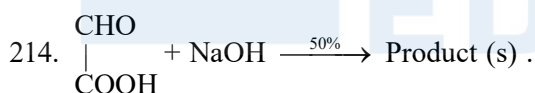
213. Acetone + A \longrightarrow Oxime of acetone

Acetone + B \longrightarrow Propane

Acetone + C \longrightarrow Pinacoi.

A, B and C are

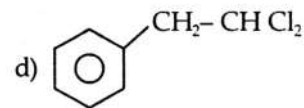
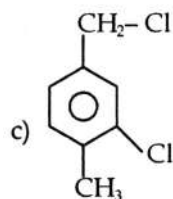
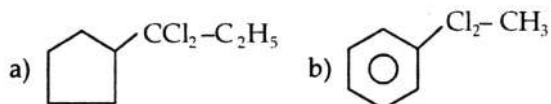
- a) NH_2-OH , Mg, Zn.Hg + conc. HCl
 b) NH_2-OH , Zn.Hg + conc. HCl, Mg
 c) Mg, NH_2-OH , Zn.Hg + cone. HC
 d) NH_2-OH , Na.Hg + H_2O , Mg



Identify the products

- a) $\begin{array}{c} \text{COONa} \\ | \\ \text{COONa} \end{array}$ b) $\begin{array}{c} \text{CH}_2-\text{OH} \\ | \\ \text{COONa} \end{array}$
 c) both a and b d) $\begin{array}{c} \text{CHO} \\ | \\ \text{COONa} \end{array}$

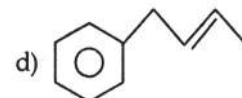
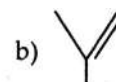
215. Structure $\text{C}_5\text{H}_5\text{Cl}_2$ an alkaline hydrolysis gives a product which does not give iodoform test but give silver mirror test, is



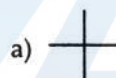
216. Which of the following reagent to get sp^3 -hybridised carbon atom from sp^2 -hybridised carbon atom?

- a) NH_2-NH_2 b) $\text{NH}_2-\text{CO}-\text{NH}-\text{NH}_2$
 c) $\text{NH}_2-\text{NH}_2/\text{KOH}$ d) NH_2OH

217. An alkene (A) on ozonolysis gives (B) as one of the product, (B) can give Cannizzaro's reaction. The compound (A) is



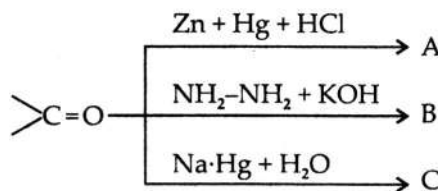
218. Which of the following alkane cannot be prepared by Clemmensen's reduction of ketones?



219. Reaction of aldehyde with NH_2-OH will be fastest at which of the following pH

- a) 1 b) 6
 c) 7 d) 8

220. In the reaction.

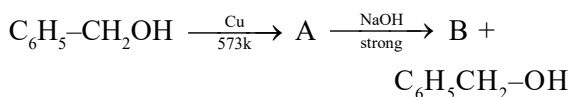


- a) A = aldehyde, B = ketone, C = alcohol
 b) A, B, C are alkene
 c) A, B are alkane and C = alcohol
 d) A, B are alkane, C = alkene

221. In Cannizzaro's reaction of formaldehyde involves an

- a) Intramolecular shift of proton

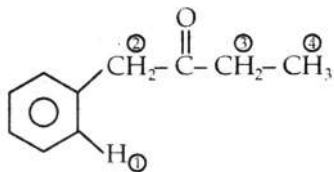
- b) Intramolecular shift of hydride
 c) Intermolecular shift of proton
 d) Intermolecular shift of hydride
222. Consider two aldehydes
 1) $\text{CH}_3\text{-CHO}$ 2) H-CHO
 The correct statement is/are
 a) both undergoes aldol condensation
 b) both do not undergoes aldol condensation
 c) only (1) undergoes aldol condensation
 d) only (2) undergoes aldol condensation
223. Final product 'B' in the following sequence of reaction



- a) benzaldehyde b) acetophenone
 c) sodium phenoxide d) sodium benzoate
224. The final product 'C' in the following reaction.....



- a) $\text{CH}_2 = \underset{\text{CH}_3}{\text{C}}\text{-CHO}$
 b) $\text{CH}_3\text{-}\underset{\text{CH}_3}{\text{CH}}\text{-CH}_2\text{-OH}$
 c) $\text{CH}_2 = \underset{\text{CH}_3}{\text{C}}\text{-CH}_2\text{-OH}$
 d) $\text{CH}_2 = \text{CH-CH}_2\text{-CH}_2\text{-OH}$
225. Which of the following four hydrogens which is most acidic?



- a) 1 b) 2
 c) 3 d) 4
226. Find out A, B, C, D in following reaction
- 1) $\text{CH}_3\text{-CH} = \text{CH-CHO} \xrightarrow{\text{A}} \text{CH}_3\text{-CH} = \text{CH-COOH}$
 2) $\text{CH}_3\text{-CH} = \text{CH-CHO} \xrightarrow{\text{B}}$



- 3) $\text{R-COOH} \xrightarrow{\text{C}} \text{R-CH}_2\text{-OH}$
 4) $\text{R-COCl} \xrightarrow{\text{D}} \text{R-CHO}$
 a) 1 = $\text{H}_2\text{, Pd, BaSO}_4$ 2 = Ammoniacal AgNO_3
 3 = LiAlH_4 4 = LiAlH_4
 b) 1 = LiAlH_4 2 = LiAlH_4
 3 = $\text{H}_2\text{, Pd, BaSO}_4$ 4 = Ammoniacal AgNO_3
 c) 1 = Ammoniacal AgNO_3 2 = LiAlH_4
 3 = LiAlH_4 4 = $\text{H}_2\text{Pd} + \text{BaSO}_4$
 d) 1 = LiAlH_4 2 = LiAlH_4
 3 = Ammoniacal AgNO_3 4 = $\text{H}_2\text{Pd} + \text{BaSO}_4$

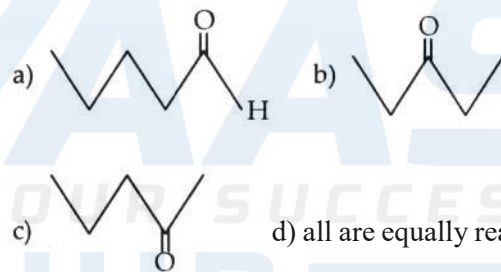
227. Which among the following is most reactive in nucleophilic addition?

- a) $\text{FCH}_2\text{-CHO}$ b) $\text{Cl-CH}_2\text{-CHO}$
 c) $\text{Br-CH}_2\text{-CHO}$ d) $\text{I-CH}_2\text{-CHO}$

228. Which of the following carbonyl compound is most polar?

- a) $\text{CH}_3\text{COC}_2\text{H}_5$ b) CH_3COCH_3
 c) CH_3CHO d) H-CHO

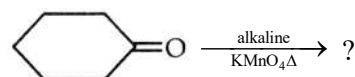
229. Which of the following isomeric compounds is most reactive?



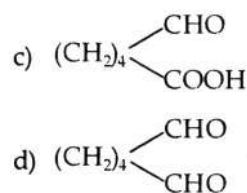
230. The reagent which oxidise aldehyde and ketone is

- a) Tollen's reagent b) Fehling's solution
 c) Schiff's reagent d) $\text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4$

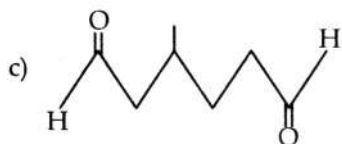
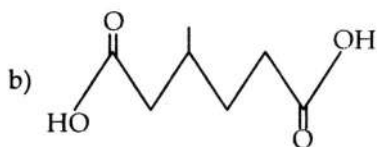
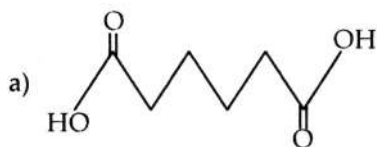
231. The product of given reaction is



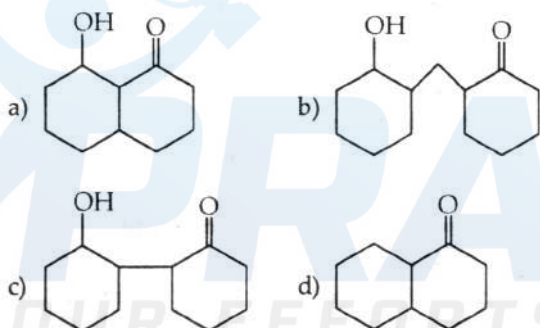
- a) $\text{CH}_2 = \text{CH(CH}_2)_3\text{-COOH}$
 b) $\text{CH}_3\text{-(CH}_2)_4\text{-COOH}$



232. 3-methyl cyclohexene on oxidation will give



233. Cyclohexanone is treated with $\text{Ba}(\text{OH})_2$ gives



234. Mixture of ethanal and propanal is subjected to aldol condensation, the product formed are

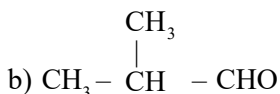
- a) 1 b) 2
c) 3 d) 4

235. Aldehyde which shows Cannizzaro's reaction is

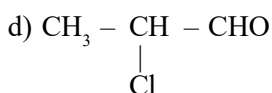
- a) $\text{H}-\text{CHO}$ b) $\text{C}_6\text{H}_5-\text{CHO}$
c) CCl_3-CHO d) all of these

236. The aldehyde having α -H atom gives Cannizzaro's reaction is

- a) $\text{CH}_3 - \text{CH}_2 - \text{CHO}$



- c) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CHO}$



237. Mixture of $\text{H}-\text{CHO}$ and $\text{C}_6\text{H}_5-\text{CHO}$ is treated

with cone. NaOH then self redox reaction involves

- 1) oxidation of $\text{H}-\text{CHO}$
2) oxidation of $\text{C}_6\text{H}_5-\text{CHO}$
3) reduction of $\text{H}-\text{CHO}$
4) reduction of $\text{C}_6\text{H}_5-\text{CHO}$

- a) 1, 3 b) 1, 2
c) 1, 4 d) 2, 3

238. When ethanoyl chloride is reduced with hydrogen using Pd deposited over BaSO_4 catalyst it forms

- a) ethane b) chloro ethane
c) ethanal d) ethanol

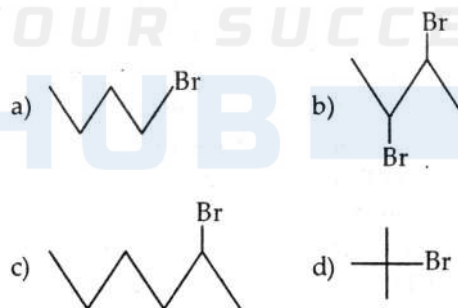
239. Crotonaldehyde is easily oxidised to crotonic acid using

- a) alkaline KMnO_4 b) Tollen's reagent
c) acidic KMnO_4 d) CrO_3

240. Which of the following aldehyde forms stable hydrate?

- a) Trichloroacetaldehyde
b) acetaldehyde
c) formaldehyde
d) prop anal

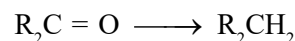
241. An unknown alkyl halide 'A' reacts with alcoholic KOH to produce C_4H_8 . Ozonolysis of the hydrocarbon gives one mole of prop anal and one mole of methanal the correct structure of 'A' is



242. $(\text{CH}_3)_2\text{C} = \text{CHCOCH}_3$ can be oxidised to $(\text{CH}_3)_2\text{C} = \text{CH}-\text{COONa}$ by

- a) $\text{NaOH} + \text{KOH}$ b) NaOH
c) NaOI d) KMnO_4/H^+

243. For the following conversion which can be used

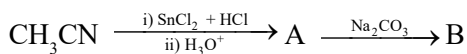


- a) Clemmenson's reaction
b) Wolff Kishner reaction
c) $\text{Zn} + \text{cone. HCl}$
d) both 'a' and 'b'

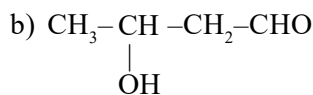
244. Benzaldehyde can be prepared by hydrolysis of
 a) Benzyl chloride b) Benzal chloride
 c) Benzotrichloride d) benzonitrile
245. 1-phenyl ethan-1-ol is prepared by reaction of benzaldehyde with
 a) methyl bromide
 b) ethyl magnesium iodide
 c) methyl magnesium bromide
 d) methyl iodide and zinc metal
246. Oxidation of toluene to benzaldehyde by chromyl chloride is called
 a) Rosenmund reaction
 b) Wurtz reaction
 c) Etard reaction
 d) Fittig reaction
247. Which of the following reagent convert
 $\text{C}_6\text{H}_5\text{CHO} \longrightarrow \text{C}_6\text{H}_5\text{COOH}$
 a) Fehling's solution b) PCC
 c) Tollen's reagent d) $\text{H}_2 + \text{Ni}$
248. The product of following reaction will be



- a) m-hydroxy benzaldehyde
 b) potassium m-chlorobenzoate and benzyl alcohol
 c) potassium m-chlorobenzoate m-chlorobenzyl alcohol
 d) m-cresol
249. Hydrogenation of benzoyl chloride in the presence of Pd on BaSO_4 gives
 a) benzyl alcohol b) benzoic acid
 c) benzaldehyde d) phenol
250. An organic compound does not give a precipitate with 2,4-DNP and does not react with sodium metal. It could be
 a) $\text{CH}_3\text{--CH}_2\text{--CHO}$ b) CH_3COCH_3
 c) $\text{CH}_3\text{--CHO}$ d) $\text{CH}_3\text{OC}_2\text{H}_5$
251. What is 'B' in the following reaction?



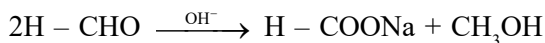
- a) $\text{CH}_3\text{--CH(OH)--CH}_2\text{--CH}_3$



- c) $\text{CH}_3\text{--CH}_2\text{--COONa}$
 d) $\text{CH}_3\text{--CH}_2\text{--ONa}$
252. Under Wolff-Kishner reduction the conversion may be brought about are
 a) benzophenone to diphenyl methane
 b) benzaldehyde to benzyl alcohol
 c) cyclohexanone to cyclohexene
 d) cyclohexanone to cyclohexanol
253. When formaldehyde react with ethyl amine, it gives
 a) formaldehyde imine
 b) formaldehyde ethyl amine
 c) dimethyl amine
 d) diethylamine
254. Imine derivatives of aldehyde and ketone is called as
 a) Schiff's reagent b) Fehling's reagent
 c) Schiff's base d) Schiff's acid
255. Acetone on condensation gives
 a) mesitylene b) mesityl oxide
 c) prop anal d) di-isopropyl ether
256. A carbonyl compound with molecular weight 86, does not reduce Fehling's solution, but form crystalline bisulphite derivatives and gives iodoform test. The possible compound can be
 a) Pentan-2-one and pentan-3-one
 b) Pentan-2-one and 3-methyl butan-2-one
 c) Pentanal
 d) pent-3-one
257. $\text{CH}_3\text{--CH=CH--CHO}$ is oxidised to $\text{CH}_3\text{--CH=CH--COOH}$ using oxidising agent
 a) alkaline KMnO_4
 b) $\text{K}_2\text{Cr}_2\text{O}_7 + \text{conc. H}_2\text{SO}_4$
 c) dil. HNO_3
 d) ammoniacal AgNO_3

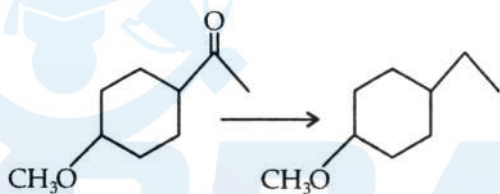
258. Ketones $\text{R--}\overset{\text{O}}{\parallel}\text{C--R'}$ where R = R' alkyl group can be obtained in one step by
 a) oxidation of 1° alcohol
 b) hydrolysis of ester
 c) hydrolysis of acid anhydride
 d) oxidation of 3° alcohol

259. Among the given compound the most susceptible to nucleophilic attack at carbonyl group is
 a) HCHO b) MeCOOMe
 c) MeCHO d) MeCOO CMe
260. The reaction given below is

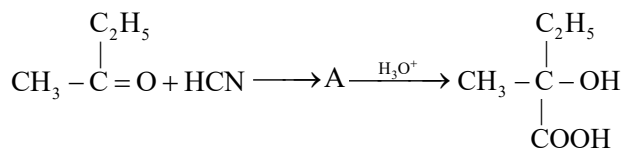


The slowest step is

- a) Wurtz's reaction
 b) Cannizzaro's reaction
 c) Fittig's reaction
 d) Etard oxidation
261. Which of the following does not used to convert ketone to secondary alcohol?
 a) LiAlH_4 b) NaBH_4
 c) $\text{H}_2/\text{Pd}-\text{BaSO}_4$ d) $\text{Na} + \text{C}_2\text{H}_5\text{OH}$
262. The appropriate reagent for following transformation.

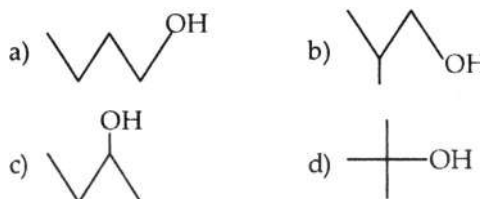


- a) $\text{Zn.Hg} + \text{HCl}$ b) $\text{NH}_2\text{NH}_2, \text{KOH}$
 c) $\text{H}_2 + \text{Ni}$ d) both a and b
263. In the following sequence of reaction,
 $\text{Toluene} \xrightarrow{\text{KMnO}_4} \text{A} \xrightarrow{\text{SOCl}_2} \text{B} \xrightarrow[\text{BaSO}_4]{\text{H}_2 + \text{Pd}} \text{C}$
 The product C is
 a) $\text{C}_6\text{H}_5-\text{COOH}$ b) $\text{C}_6\text{H}_5-\text{CH}_3$
 c) $\text{C}_6\text{H}_5-\text{CHO}$ d) $\text{C}_6\text{H}_5-\text{CH}_2-\text{OH}$
264. Which of the following is correct?
 a) reduction of any aldehyde gives 2° alcohol
 b) reduction of any ketone gives tertiary alcohols
 c) Wolff-Kishner reduction convert $> \text{C} = \text{O}$ to $-\text{CH}_2-\text{OH}$ group
 d) Ozonolysis of alkene in the presence of zinc gives aldehydes or ketones/mixture of aldehyde and ketones
265. Ozonolysis of C_7H_{14} give methanal and 2-methyl pentan-3-one. The C_7H_{14} is
 a) 2-ethyl 3-methyl but-1-ene
 b) 3-ethyl-2-methyl but-3-ene
 c) hept-1-ene
 d) hept-2-ene
266. In the reaction

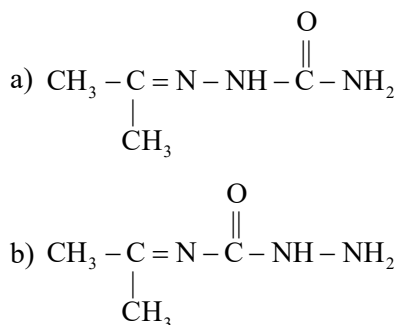


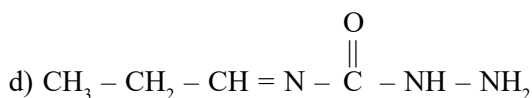
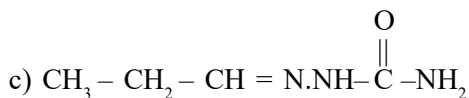
The acid obtained will be

- a) L-isomer
 b) D-isomer
 c) 20% D + 80% L-isomer
 d) 50% D + 50% L-isomer
267. A substance $\text{C}_4\text{H}_{10}\text{O}$ yield on oxidation $\text{C}_4\text{H}_8\text{O}$ which gives oxime and positive iodoform test. The original substance on treatment with conc. H_2SO_4 gives C_4H_5 . The structure of compound is

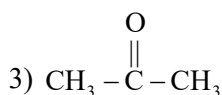
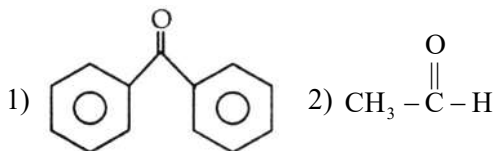


268. Which of the following react with NaOH produces acid and alcohol?
 a) $\text{C}_6\text{H}_5\text{CHO}$ b) CH_3-CHO
 c) CH_3COOH d) $\text{C}_6\text{H}_5\text{COOH}$
269. Which of the following is not correctly matched?
 a) $> \text{C} = \text{O} \xrightarrow[\text{reduction}]{\text{Clemmenson's}} > \text{CH}_2$
 b) $> \text{C} = \text{O} \xrightarrow[\text{reduction}]{\text{Wolff-Kishner}} > \text{CH} - \text{OH}$
 c) $-\text{COCl} \xrightarrow[\text{reduction}]{\text{Rosenmund's}} - \text{CHO}$
 d) $-\text{C} \equiv \text{N} \xrightarrow[\text{reduction}]{\text{Stephen's}} - \text{CHO}$
270. Compound A of formula $\text{C}_3\text{H}_5\text{O}$ is treated with acidic KMnO_4 to form product B of formula $\text{C}_3\text{H}_6\text{O}$, which form shining silver mirror on warming with ammoniacal AgNO_3 , when B is treated with $\text{NH}_2\text{CONHNH}_2$ in HCl and sodium acetate gives the product C. Identity the structure of C.



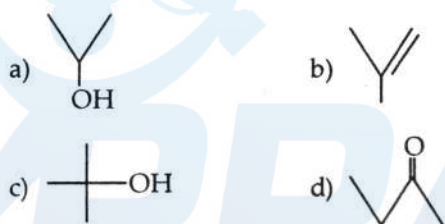


271. The correct order of reactivity of Ph-MgCl with



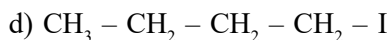
- a) $1 > 2 > 3$ b) $3 > 2 > 1$
c) $2 > 3 > 1$ d) $2 > 1 > 3$

272. Which one of the following oxidised to corresponding carbonyl compound?



273. 2,2-diethoxy butane is obtained from ethanol and what?

- a) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CHO}$
b) $\text{CH}_3 - \text{COCH}_2 - \text{CH}_3$
c) $\text{CH}_3 - \underset{\text{OH}}{\text{CH}} - \text{CH}_2 - \text{CH}_3$



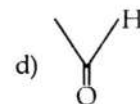
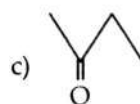
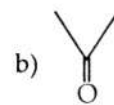
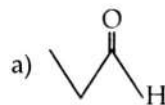
274. Which reagent is used to convert butan-2-one to propionic acid?

- a) Tollen's reagent
b) Fehling's solution
c) acidic KMnO_4
d) PCC

275. The compounds HCHO and CH_3CHO on intermolecular aldol condensation gives.

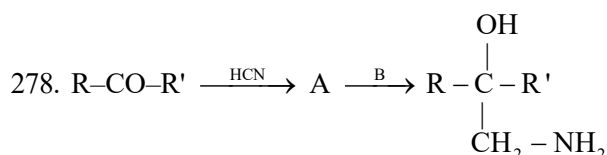
- a) $\text{HO-CH}_2\text{-CH}_2\text{-CHO}$
b) $\text{CH}_3\text{-CHOH-CH}_2\text{OH}$
c) $\text{CH}_3\text{-CHOH-CH}_3$
d) $\text{CH}_3\text{-CHOH-CH}_2\text{-CH}_2\text{OH}$

276. Nucleophilic addition reaction is most favored in

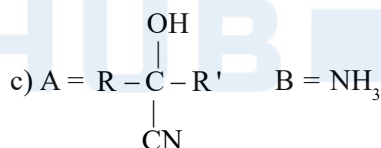
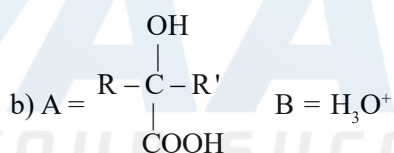
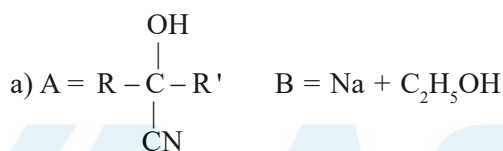


277. The smallest ketone and its functional isomer are treated with $\text{NH}_2\text{-OH}$ to form oxime

- a) two different oxime are formed
b) three different oxime are formed
c) two oximes are optically active
d) all oximes are optically active



A and B are



279. On reaction with ketone with hydroxyl amine give ketoxime which on reduction produces

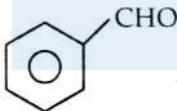
- a) carboxylic acid b) 1° amine
c) 2° -amine d) amide

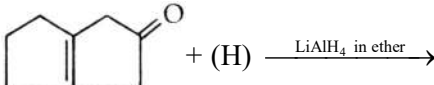
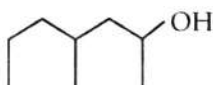
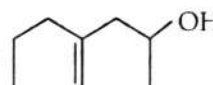

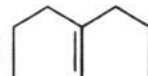
280. Aldehyde with $\text{NH}_2\text{-NH}_2$ forms

- a) aniline b) nitrobenzene
c) hydrazine d) hydrazone

281. $\text{C}_3\text{H}_6\text{O} \xrightarrow[\Delta]{\text{OH}^-} \text{Mesityloxide.}$

The $\text{C}_3\text{H}_6\text{O}$ is

- a) $\text{CH}_3\text{-CH}_2\text{-CHO}$
 b) CH_3COCH_3
 c) $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{OH}$
 d) $\text{CH}_3 - \underset{\text{OH}}{\text{C}} = \text{CH}_2$
282. 3-hydroxy 2-methyl pentanal is formed when X react with Y in dilute Z solution. What are X, Y, Z
- | X | Y | Z |
|--------------------------------------|-----------------------------------|------|
| a) $\text{CH}_3\text{-CHO}$ | $\text{CH}_3\text{-CHO}$ | NaOH |
| b) $\text{C}_2\text{H}_5\text{-CHO}$ | $\text{CH}_3\text{-CHO}$ | NaOH |
| c) $\text{C}_2\text{H}_5\text{-CHO}$ | $\text{C}_2\text{H}_5\text{-CHO}$ | NaOH |
| d) $\text{C}_2\text{H}_5\text{-CHO}$ | $\text{C}_2\text{H}_5\text{-CHO}$ | NaCl |
283. A base can abstract an α - H atom from
- | | |
|--------------------------------|--|
| a) $\text{CH}_2 = \text{CH}_2$ | b) $\text{CH} \equiv \text{CH}$ |
| c) $\text{CH}_3 - \text{CHO}$ | d) $\text{C}_6\text{H}_5 - \text{CHO}$ |
284. Which of the following pathways produces 2-pentanone
1. pent-1-yne is treated with $\text{H}_2\text{SO}_4 + \text{HgSO}_4$ and water
 2. 3-methyl hex-2- ene is treated with O_3 followed by hydrolysis
 3. n-butylmagnesium halide is reacted with formaldehyde
 4. hydroboration oxidation of pent-1-ene
- | | |
|---------|------------|
| a) 1, 3 | b) 1, 2 |
| c) 2, 4 | d) 1, 3, 4 |
285. Which of the following reagent react with same manner with
- 

$\text{H} - \text{CHO}, \text{CH}_3 - \text{CHO},$
 CH_3COCH_3
- | | |
|-----------------------|------------------|
| a) Fehling's solution | b) NH_3 |
| c) HCN | d) NaOH |
286. Which statement is correct with ethanal and propanone
- 1) Both react with NaHSO_3
 - 2) Both gives iodoform test
 - 3) Both can be reduced into alcohols
 - 4) Both undergoes aldol condensation
- | | |
|---------|-----------------|
| a) 1, 3 | b) 2, 3 |
| c) 2, 4 | d) all of these |
287. Which of the following react same manner with H-CHO and $\text{C}_6\text{H}_5\text{-CHO}$?
- | | |
|-----------------------|-----------------------------|
| a) Fehling's solution | b) $\text{CH}_3\text{-MgX}$ |
| c) NH_3 | d) dil. NaOH |
288. Acetone gives addition elimination reaction with
- | | |
|----------------------------|-----------------------------------|
| 1) $\text{NH}_2\text{-OH}$ | 2) $\text{NH}_2\text{-CONH-NH}_2$ |
| 3) NaHSO_3 | 4) $\text{CH}_3\text{-NH}_2$ |
- | | |
|------------|------------|
| a) 2, 4 | b) 3, 4 |
| c) 1, 2, 4 | d) 1, 2, 3 |
289. An carbonyl compounds gives nucleophilic addition reaction with
- | | |
|-------------------|------------------------------|
| 1) HCN | 2) NaSHO_3 |
| 3) R-MgX | 4) $\text{NH}_2\text{-NH}_2$ |
- | | |
|------------|------------|
| a) 1, 2 | b) 2, 3 |
| c) 1, 2, 4 | d) 1, 2, 3 |
290. Product of the following reaction is
- 
- | | |
|---|--|
| a)  | b)  |
| c)  | d)  |
291. The product formed when HCHO is heated with conc. KOH
- | | |
|----------------------------|---------------------------|
| a) CH_3CHO | b) CH_3OH |
| c) C_2H_2 | d) CH_4 |
292. Formaldehyde reacts with NH_3 to form urotropine which has the composition
- | | |
|--------------------------------|--------------------------------|
| a) $(\text{CH}_2)_5\text{N}_5$ | b) $(\text{CH}_2)_5\text{N}_5$ |
| c) $(\text{CH}_2)_4\text{N}_6$ | d) $(\text{CH}_2)_6\text{N}_4$ |
293. Pinacol is converted in to pinacolone by
- | | |
|-----------------|---------------|
| a) rearrangment | b) oxidation |
| c) reduction | d) hydrolysis |
294. Aldehydes with Tollen's reagent are
- | | |
|---------------------|---------------------|
| a) reducing agent | b) oxidising agents |
| c) hydrating agents | d) bleaching agents |
295. Low reactivity of ketones with respect to aldehydes is due to
- greater +I effect of alkyl group
 - greater steric hindrance of alkyl group
 - both 'a' and 'b'
 - less steric hindrance of alkyl group
296. Aldehydes can be distinguished from ketones by using
- | | |
|-----------------------------|---------------------|
| a) dil. NaOH | b) R-MgX |
| c) Na_2CO_3 | d) Schiff's reagent |
297. Which of the following are generally used for

- preparing derivatives of aldehydes and ketones?
 a) Hydrocyanic acid b) Hydroxylamine
 c) Phenyl hydrazine d) All of these
298. Which of the following is an example of aldol condensation?
 a) $2\text{CH}_3\text{CHO} \xrightarrow{\text{OH}^-} \text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CHO}$
 b) $\text{C}_6\text{H}_5\text{CHO} \xrightarrow{\text{OH}^-} \text{C}_6\text{H}_5\text{CH}_2\text{OH}$
 c) $\text{HCHO} \xrightarrow{\text{OH}^-} \text{HCH}_2\text{OH}$
 d) $\text{C}_6\text{H}_5\text{CHO} + \text{HCHO} \xrightarrow{\text{OH}^-} \text{C}_6\text{H}_5\text{CH}_2\text{OH}$
299. Which of the following can be used to differentiate between acetaldehyde and propional ?
 a) Ammonical AgNO_3
 b) $\text{CuSO}_4 + \text{Na-K tartarate}$ in NaOH
 c) I_2 in the presence of base
 d) Decolourised Fuchin
300. Molecular formula 'A' ($\text{C}_4\text{H}_8\text{O}$) reacts with CH_3MgI gives 3-methyl 2-butanol. The structure of A is
 a) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$ b) $\text{C}_2\text{H}_5\text{COCH}_3$
 c) $(\text{CH}_3)_2\text{CHCHO}$ d) $\text{C}_2\text{H}_5\text{OCH}_3$
301. When acetone reacts with $\text{Ba}(\text{OH})_2$ it gives
 a) acetoxime b) urotropine
 c) t-butyl alcohol d) diacetone alcohol
302. Which of the following aldehydes does not reduce Fehling solution readily?
 a) Acetaldehyde b) Formaldehyde
 c) Propanal d) Benzaldehyde
303. 1-propanol is obtained from $\text{C}_2\text{H}_5\text{MgI}$ and what?
 a) CH_3CHO b) HCHO
 c) HCN d) $\text{C}_2\text{H}_5\text{CHO}$
304. Treatment of propionaldehyde with dil. NaOH solution gives
 a) $\text{CH}_3\text{CH}_2\text{COOCH}_2\text{C}_2\text{H}_5$
 b) $\text{CH}_3\text{CH}_2\text{CHOHCH}_2\text{CH}_2\text{CHO}$
 c) $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}(\text{CH}_3)\text{CHO}$
 d) $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_2\text{CHO}$
305. Oxidation number of carbon in HCHO is,
 a) 0 b) 2
 c) 3 d) 4
306. Which of the following compound does not undergo aldol condensation?
 a) Acetaldehyde b) Prop anal
 c) Ethyl methyl ketone d) Benzaldehyde
307. Which of the following compound undergoes aldol condensation?
 a) CH_3CHO b) $\text{C}_2\text{H}_5\text{CHO}$
 c) CH_3COCH_3 d) All
308. The reaction,

$$\text{CH}_3\text{CHO} + \text{CH}_3\text{CHO} \xrightarrow{\text{alkali}} \text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CHO}$$
 represents
 a) Cannizzaro reaction
 b) Aldol condensation
 c) Wurtz reaction
 d) Mendius reaction
309. Mesityl oxide is formed by the condensation of
 a) acetaldehyde b) acetone
 c) prop anal d) formaldehyde
310. The most probable compound whose molecular formula is $\text{C}_3\text{H}_6\text{O}$ and which can give Tollen's reagent test
 a) $\text{CH}_3\text{CH}_2\text{CHO}$ b) CH_3COCH_3
 c) $\text{CH}_3\text{OCH}_2\text{CH}_3$ d) $\text{CH}_2 = \text{CHCH}_2\text{PH}$
311. When two molecules of HCHO react in presence of base to produce CH_3OH and HCOONa , the reaction is called
 a) Wurtz reaction b) Cannizzaro reaction
 c) Aldol condensation d) Hoffman reaction
312. Aldol condensation of acetaldehyde results in the formation of
 a) $\text{CH}_3\text{COCHOHCH}_3$
 b) $\text{CH}_3\text{CHOHCH}_2\text{CHO}$
 c) $\text{CH}_3\text{CH}_2\text{CHOHCHO}$
 d) $\text{CH}_3\text{CH}_2\text{OH} + \text{CH}_3\text{COOH}$
313. Which of the following reagents can not be used to distinguish between pentanal and 2-pentanone?
 a) I_2 in NaOH b) Fehling solution
 c) Na metal d) Tollen's reagent
314. Acetaldehyde reacts with NH_2OH to give
 a) acetal amine b) acetal oxide
 c) acetaldoxime d) amino acetal
315. Which of the following statement is true?
 a) Aldehydes are less susceptible to oxidation than ketones
 b) All aldehydes undergo Cannizzaro reaction
 c) Aldehydes are more susceptible to oxidation than ketones
 d) Formaldehyde does not react with ammonia
316. Silver mirror test is given by

- a) aldehyde b) ketones
c) amines d) ethers
317. Which of the following reagent is used to convert $>C=O$ to $>CH_2$?
a) $ZnHg + H_2O$ b) $ZnHg + \text{conc. HCl}$
c) $NaHg + H_2O$ d) $Sn + \text{conc. HCl}$
318. The formation of acetone sodium bisulphite from a acetone is an example of
a) electrophilic addition
b) nucleophilic addition
c) nucleophilic substitution
d) electrophilic substitution
319. In which reaction new C–C bond does not form
a) Aldol b) Cannizzaro's
c) Wurtz d) $HCN + RMgX$
320. Mesityl oxide is
a) ketone b) aldehyde
c) ester d) ethers
321. Schiff's reagent is obtained by passing
a) SO_2 gas in aq. solution of rosaniline
b) NO_2 gas in aq. solution of rosaniline
c) O_2 gas in aq. solution of rosaniline
d) CO_2 gas in aq. sol. of rosaniline
322. Which of the following can reduce Tollen's reagent but not Fehling solution?
a) C_6H_5CHO b) CH_3CHO
c) C_3H_7CHO d) CH_3COCH_3
323. An aldehyde on oxidation gives
a) an alcohol b) an acid
c) an ether d) a ketone
324. Magenta is
a) ale. phenolphthalein
b) p-rosaniline hydrochloride
c) methyl red
d) red litmus
325. Aldehyde on reaction with Grignard reagent and subsequent hydrolysis yields
a) primary alcohol b) tertiary alcohol
c) secondary alcohol d) dihydroxy alcohol
326. Which of the following does not have alpha hydrogen?
a) Formaldehyde
b) Acetaldehyde
c) Dimethyl acetaldehyde
d) Acetone
327. Rochelle salt is
a) ammonium tartarate b) sodium potassium tartarate
c) potassium ammonium tartarate
d) sodium tartarate
328. Fuschin is,
a) pink dye of para-rosa-aniline hydrochloride
b) Schiff's reagent
c) Tollen's reagent
d) Fehling solution
329. Which of the following is a gas at room temperature?
a) CH_3CHO b) $HCHO$
c) CH_3COCH_3 d) $C_2H_5OC_2H_5$
330. Clemmenson reduction is carried out with
a) H_2/Pd
b) NH_2NH_2 , followed by treatment with glycolic KOH
c) $LiAlH_4$ in ether
d) $Zn(Hg)/HCl$
331. Aldehydes having no α -hydrogen atom undergo
a) Hoffman reaction
b) Aldol condensation
c) Cannizzaro reaction
d) Wurtz reaction
332. Which of the following does not react with phenyl hydrazine ?
a) Ethanol b) Ethanal
c) Acetone d) 2 – pentanone
333. Which of the following compound does not undergo Cannizzaro reaction?
a) Ethanol
b) Methanal
c) Benzaldehyde
d) 2,2,4,4-tetra methyl 3-pentanone
334. Reduction in presence of amalgamated zinc and conc. HCl is known as
a) Mendius reduction
b) Wurtz reaction
c) Hoffmanns reaction
d) Clemmenson's reduction
335. Aldehyde having no α -hydrogen undergo disproportionation in presence of strong potash to give a corresponding salt of acid and alcohol. The reaction is known as,
a) Wurtz reaction
b) Aldol condensation
c) Cannizzaro's reaction
d) Esterification

336. An organic compound contains H_2O and single carbon. It responds positive to Tollen's reagent. The compound is
 a) $HCHO$ b) CH_3OH
 c) CH_3CHO d) none of these
337. Formaldehyde gives an addition product with methyl magnesium iodide which on acid hydrolysis gives
 a) CH_3OH b) C_2H_5OH
 c) $(CH_3)_2CHOH$ d) $CH_3CHOHCH_3$
338. Formaldehyde and formic acid are distinguished by treating with
 a) Tollen's reagent b) $NaHCO_3$
 c) Fehling solution d) Schiff's reagent
339. Pick up the correct statements from the following
 a) both aldehydes and ketones use sp^2 -hybrid carbon atoms for their addition reaction
 b) acetic acid neither reacts with Fehling's solution nor with Tollen's reagent
 c) chloral is aldehyde
 d) all are correct
340. Butanal is heated with ammonical silver nitrate. The product formed is,
 a) $CH_3CH_2CH_2COOH$
 b) $(CH_3)_2CHCOOH$
 c) $CH_3COOH + CH_3OH$
 d) $HCOOH + C_2H_5COOH$
341. Fehling solution is
 a) acidified $CuSO_4$ solution
 b) ammonical $AgNO_3$ solution
 c) copper sulphate, sodium hydroxide and Rochelle salt
 d) none of these
342. Union of two or more molecules of the same or different compound with elimination of water to form a new substance is known as
 a) synthesis b) polymerisation
 c) condensation d) none of these
343. Which of the following compound will undergo self aldol condensation in presence of dilute alkali?
 a) C_6H_5CHO b) $(CH_3)_3CCHO$
 c) C_2H_5CHO d) CCl_3CHO
344. When a ketone is condensed into an ketol, the reagent used is
 a) Na_2CO_3 b) $NaHCO_3$
 c) Br_2 water d) Cl_2
345. Benzaldehyde undergoes auto-oxidation and reduction in presence of
 a) cone, $NaOH$ b) Na_2CO_3
 c) $NaHCO_3$ d) dil. $NaOH$
346. Nucleophilic attack on carbonyl carbon changed its hybridisation from
 a) sp to sp^2 b) sp^2 to sp^3
 c) sp^3 to sp^2 d) sp to sp^3
347. Which of the following reaction is used for detecting the presence of carbonyl group in aldehydes and ketones?
 a) Reaction with hydroxylamine
 b) Reaction with phenyl hydrazine
 c) Reaction with hydrazine
 d) All of these
348. Which of the following reagent form oxime with carbonyl compound?
 a) NH_3OH b) NH_2OH
 c) $NaOH$ d) CH_2N_2
349. Ketonic form of acetone contains,
 a) 8- α bonds and 2- n bonds
 b) 9- α bonds and 1- n bond
 c) 7- α bonds and 3- n bonds
 d) 4- α bonds and 5- n bonds
350. 11-hydroxy butyraldehyde is an example of
 a) aldol b) ketol
 c) ester d) alcohol
351. Which is most difficult to oxidise?
 a) $HCHO$ b) CH_3COCH_3
 c) CH_3CHO d) C_2H_5CHO
352. Aldehydes or ketones having atleast one α -hydrogen undergo condensation reaction in presence of dilute base. This reaction is called
 a) Aldol condensation
 b) Cannizzaro's reaction
 c) Hoffmann's reaction
 d) Mendius reaction
353. The reagent with which both aldehyde and acetone react easily is
 a) Fehling's reagent b) Grignard reagent
 c) Schiff's reagent d) Tollen's reagent
354. When, acetaldehyde is heated with Tollen's reagent, following is obtained
 a) Methyl alcohol b) Silver acetate
 c) Silver mirror d) Formaldehyde
355. Which of the following compounds would undergo Cannizzaro's reaction
 a) Propionaldehyde b) Benzaldehyde
 c) Bromobenzene d) Acetaldehyde

356. Schiff's reagent gives pink colour with
 a) Aldehydes b) Ethers
 c) Ketones d) Carboxylic acid
357. An aldehyde on oxidation gives
 a) An alcohol b) An acid
 c) A ketone d) An ether
358. Schiff's reagent is
 a) Magneta solution decolourised with SO_2
 b) Ammonical cobalt chloride solution
 c) Ammonical manganese sulphate solution
 d) Magneta solution decolourised with chlorine
359. Acetone and acetaldehyde are differentiated by
 a) $\text{NaOH} + \text{I}_2$ b) $\text{Ag}(\text{NH}_3)_2^+$
 c) HNO_2 d) I_2
360. Hexamethylene tetramine is used as
 a) analgesic b) antipyretic
 c) urinary antiseptic d) all the above
361. Benzyl alcohol is obtained from benzaldehyde by
 a) Fittg's reaction b) Cannizaro's reaction
 c) Kolbe's reaction d) Wurtz's reaction
362. Which of the following gives difference between aldehyde and ketone?
 a) Fehling's solution b) Tollen's reagent
 c) Schiff's reagent d) All of the above
363. Formaldehyde gives an additive product with ethyl magnesium iodide which on aqueous hydrolysis gives
 a) isopropyl alcohol b) ethyl alcohol
 c) methyl alcohol d) n-propyl alcohol
364. The reagent which easily reacts with ethanal and propanal is
 a) Fehling solution b) Grignard reagent
 c) Schiff's reagent d) Tollen's reagent
365. Magneta is
 a) alkaline phenolphthalein
 b) methyl red
 c) p-rosaniline hydrochloride
 d) red litmus
366. Grignard reagent on reaction with ketones forms
 a) tertiary alcohol b) secondary alcohol
 c) acetic acid d) acetaldehyde
367. The compound which reacts with Fehling solution is
 a) $\text{C}_6\text{H}_5\text{COOH}$ b) HCOOH
 c) $\text{C}_6\text{H}_5\text{CHO}$ d) CH_2ClCH_3
368. Acetone gives test with
 a) Phenyl hydrazine b) Fehling solution
 c) Schiff's reagent d) All the above
369. An aldehyde can undergo the aldol condensation having
 a) an aromatic ring
 b) no α H atom
 c) atleast one α -H atom
 d) at least one β -H atom
370. An organic compound 'X' having molecular formula $\text{C}_5\text{H}_{10}\text{O}$ yields phenyl hydrazone and gives negative response to the iodoform test and Tollen's test. It produces n-pentane on reduction 'X' could be:
 a) pentanal b) 2-pentanone
 c) 3-pentanone d) n-amy alcohol
371. Aldol condensation will not take place in
 a) HCHO b) CH_3CHO
 c) CH_3COCH_3 d) $\text{CH}_3\text{CH}_2\text{CHO}$
372. CH_3COCH_3 can be converted to $\text{CH}_3\text{CH}_2\text{CH}_3$ by the action of
 a) HIO_3 b) $\text{Zn Hg} + \text{HCl}$
 c) HNO_3 d) H_3PO_3
373. The compound most suitable for the preparation of cyanohydrin is
 a) $\text{C}_2\text{H}_5\text{COOH}$ b) $\text{C}_2\text{H}_5\text{COC}_2\text{H}_5$
 c) $\text{C}_6\text{H}_5\text{NH}_2$ d) $\text{C}_2\text{H}_5-\text{C}_2\text{H}_5$
374. Baking powder is
 a) NaHCO_3 b) $\text{NaHCO}_3 \cdot 6\text{H}_2\text{O}$
 c) Na_2CO_3 d) $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$
375. Which one of the following undergoes reaction with 50% sodium hydroxide solution to give the corresponding alcohol and acid?
 a) Butanal b) Formaldehyde
 c) Phenol d) Benzoic acid
376. Which of the following compounds can be regenerated to carbonyl compounds?
 a) Urotropin b) Bisulphite complex
 c) Cynohydrine d) Diacetone amine
377. What is 'C' in the following reaction?

$$\text{C}_6\text{H}_5\text{CN} + \text{C}_6\text{H}_5\text{MgI} \xrightarrow[\text{ii) } \text{H}_3\text{O}^+]{\text{i) dry ether}}$$

$$\text{A} \xrightarrow{\text{NH}_2\text{OH}} \text{B} \xrightarrow{\text{LiAlH}_4} \text{C}$$
 a) diphenyl methane
 b) diphenyl methanamine
 c) nitrodiphenyl methane
 d) diphenyl

ANSWERS - MCQ'S**SECTION - I : ALDEHYDES AND KETONES**

1. a)	2. b)	3. b)	4. c)	5. c)	6. c)	7. c)	8. b)	9. b)	10. b)
11. b)	12. c)	13. a)	14. c)	15. d)	16. b)	17. c)	18. d)	19. d)	20. b)
21. d)	22. b)	23. d)	24. b)	25. c)	26. d)	27. b)	28. c)	29. a)	30. b)
31. d)	32. c)	33. b)	34. b)	35. b)	36. b)	37. c)	38. d)	39. b)	40. b)
41. a)	42. b)	43. c)	44. b)	45. a)	46. c)	47. d)	48. a)	49. a)	50. c)
51. c)	52. a)	53. b)	54. c)	55. c)	56. d)	57. a)	58. d)	59. b)	60. a)
61. b)	62. a)	63. d)	64. c)	65. b)	66. b)	67. b)	68. d)	69. c)	70. a)
71. c)	72. a)	73. c)	74. b)	75. d)	76. c)	77. b)	78. a)	79. a)	80. c)
81. a)	82. c)	83. c)	84. a)	85. d)	86. c)	87. d)	88. a)	89. c)	90. b)
91. d)	92. b)	93. b)	94. b)	95. d)	96. d)	97. b)	98. d)	99. b)	100. a)
101. c)	102. a)	103. c)	104. b)	105. c)	106. d)	107. a)	108. b)	109. b)	110. c)
111. d)	112. c)	113. c)	114. a)	115. b)	116. b)	117. b)	118. d)	119. d)	120. a)
121. a)	122. b)	123. b)	124. d)	125. c)	126. c)	127. c)	128. b)	129. b)	130. d)
131. b)	132. b)	133. d)	134. c)	135. d)	136. c)	137. d)	138. c)	139. a)	140. a)
141. a)	142. b)	143. a)	144. c)	145. c)	146. d)	147. c)	148. c)	149. c)	150. b)
151. a)	152. b)	153. a)	154. d)	155. b)	156. a)	157. b)	158. b)	159. c)	160. d)
161. c)	162. a)	163. b)	164. c)	165. c)	166. d)	167. d)	168. b)	169. d)	170. d)
171. d)	172. d)	173. d)	174. a)	175. a)	176. b)	177. a)	178. d)	179. b)	180. a)
181. a)	182. a)	183. c)	184. c)	185. a)	186. c)	187. d)	188. a)	189. d)	190. b)
191. b)	192. c)	193. b)	194. d)	195. d)	196. b)	197. b)	198. d)	199. b)	200. d)
201. d)	202. d)	203. b)	204. c)	205. d)	206. b)	207. b)	208. c)	209. b)	210. b)
211. c)	212. b)	213. b)	214. b)	215. d)	216. c)	217. b)	218. a)	219. b)	220. c)
221. b)	222. c)	223. d)	224. c)	225. b)	226. c)	227. a)	228. d)	229. a)	230. d)
231. a)	232. d)	233. c)	234. d)	235. d)	236. b)	237. c)	238. c)	239. b)	240. a)
241. a)	242. c)	243. d)	244. b)	245. c)	246. c)	247. c)	248. c)	249. c)	250. d)
251. b)	252. a)	253. b)	254. c)	255. b)	256. b)	257. d)	258. d)	259. a)	260. b)
261. c)	262. d)	263. c)	264. d)	265. a)	266. d)	267. c)	268. a)	269. b)	270. c)
271. c)	272. a)	273. b)	274. c)	275. a)	276. d)	277. a)	278. a)	279. b)	280. d)
281. b)	282. c)	283. c)	284. b)	285. c)	286. d)	287. b)	288. c)	289. d)	290. b)
291. b)	292. d)	293. a)	294. a)	295. c)	296. d)	297. d)	298. a)	299. c)	300. c)
301. d)	302. d)	303. b)	304. c)	305. a)	306. d)	307. d)	308. b)	309. b)	310. a)
311. b)	312. b)	313. c)	314. c)	315. c)	316. a)	317. b)	318. b)	319. b)	320. a)
321. a)	322. a)	323. b)	324. b)	325. c)	326. a)	327. b)	328. a)	329. b)	330. d)
331. c)	332. a)	333. a)	334. d)	335. c)	336. a)	337. b)	338. b)	339. d)	340. a)
341. c)	342. c)	343. c)	344. a)	345. a)	346. b)	347. d)	348. b)	349. b)	350. a)
351. b)	352. a)	353. b)	354. c)	355. b)	356. a)	357. b)	358. a)	359. b)	360. c)
361. b)	362. d)	363. d)	364. b)	365. c)	366. a)	367. b)	368. a)	369. c)	370. c)
371. a)	372. b)	373. b)	374. a)	375. b)	376. b)	377. b)			

MULTIPLE CHOICE QUESTIONS

SECTION – II : CARBOXYLIC ACIDS

INTRODUCTION, NOMENCLATURE, ISOMERISM

- General formula for carboxylic acid is
a) $C_nH_nO_2$ b) $C_nH_{2n}O_2$
c) $C_nH_{2n}O$ d) $C_nH_{2n+2}O_2$
- The general formula of an ester, where R represents an alkyl group, is
a) ROH b) RCOOH
c) RCOOR d) ROR
- Vinegar contains acetic acid nearly
a) 6–10% b) 30%
c) 12–15% d) 20%
- The bite of honey-bee inject into our body
a) acetic acid b) formic acid
c) butyric acid d) carbolic acid
- Glacial acetic acid at low temperature is a
a) thin liquid b) viscous liquid
c) ice like solid d) semi solid
- The suffix used in carboxylic acid is
a) –oic b) –ane
c) ene d) –al
- Formic acid owes its origin to
a) milk b) butter
c) red ants d) vinegar
- Vinegar obtained from canesugar contains
a) Citric acid b) Lactic acid
c) Acetic acid d) Palmitic acid
- Write the IUPAC name of CH_3CH_2COOH .
a) ethyl formic acid
b) ethyl carboxylic acid
c) ethane methanoic acid
d) propanoic acid
- IUPAC name m-toluic acid is
a) 3-methyl benzoic acid
b) 2-methyl benzoic acid
c) 4-methyl benzoic acid
d) 2,4-dimethyl benzoic acid
- IUPAC name of carboxylic acid is
a) alkinoic acid b) alkanoic acid
c) alkenoic acid d) alkyl alkanoate
- IUPAC name of ester is
a) alkoxy alkane b) alkoxyalkene
c) alkane alkanoate d) alkyl alkanoate
- IUPAC name of isobutyric acid is
a) 3-methyl propionic acid
b) 2-methyl propanoic acid
c) 3-methyl butanoic acid
d) isobutanoic acid
- IUPAC name of following compound is $(CH_3)_2CHCOOC_2H_5$
a) ethyl isobutanoate
b) ethyl isobutyrate
c) ethyl 2-methyl propanoate
d) ethyl 1-methyl ethanoate
- IUPAC name of following compound is $(CH_3)_3C-CH_2-COOH$
a) 2, 2-dimethyl butanoic acid
b) 3, 3-dimethyl butanoic acid
c) 2, 3-dimethyl propanoic acid
d) 2, 3-dimethyl butanoic acid
- IUPAC name of following compound is $C_2H_5-COOCH(CH_3)_2$
a) isopropyl propanoate
b) isopropyl propionate
c) 2-propyl propanoate
d) 2-propyl ethanoate
- Structure of ethyl ethanoate is
a) $CH_3COOC_2H_5$ b) $C_2H_5COOCH_3$
c) $H-COOC_2H_5$ d) $H-COOCH_3$
- An organic compound having the molecular formula $C_2H_4O_2$ is
a) formic acid b) acetic acid
c) ethyl acetate d) propionic acid
- Aliphatic carboxylic acids shows isomer of type,
a) position b) chain
c) functional d) all of these
- Carboxylic acid is isomeric with
a) aldehydes b) alcohols
c) esters d) saturated ketones
- Acids and esters are
a) chain isomers b) position isomers
c) functional isomers d) metamers
- Molecular formula $C_2H_4O_2$ represents
a) acids b) esters
c) aldehydes d) both 'a' and 'b'
- Molecular formula $C_2H_4O_2$ shows

- a) chain isomerism
b) position isomerism
c) functional isomerism
d) metamerism
24. IUPAC name of following compound is
- a) 2-carboxy phenol
b) 2-carboxy benzyl alcohol
c) 2-hydroxy benzoic acid
d) 2-hydroxy benzene carboxylic acid
25. How many carboxylic acids are possible for $C_4H_5O_2$?
- a) 2 b) 3
c) 4 d) 5
26. Total number of isomeric acids can be calculate by formula
- a) $I = 2^{n-1}$ b) $I = 2^{n-3}$
c) $I = 2^n$ d) $I = 2^{n-2} - 1$
27. Citric acid is
- a) monocarboxylic acid
b) dicarboxylic acid
c) tricarboxylic acid
d) fatty acid
28. The following structure is
- a) oxalic acid b) phthalic acid
c) fumaric acid d) succinic acid
29. The acid which is obtained from plant
- a) propionic acid b) valeric acid
c) fumaric acid d) malic acid
30. Lemon is sour due to
- a) oxalic acid b) tartaric acid
c) citric acid d) malic acid
31. Saturated monocarboxylic acid is second oxidative product of
- a) 1° alcohol b) 2° alcohol
c) both a & b d) ketones
32. Monocarboxylic acid shows functional isomerism with
- 1) Ester 2) aldehydes
3) ketones 4) ethers
a) 1, 2 b) 1
c) 2, 3 d) 3, 4
33. IUPAC name of malic acid is
- a) 3-hydroxy butanoic acid
b) 2-hydroxy butanedioic acid
- c) 2-hydroxy butanoic acid
d) 2-hydroxy pentanedioic acid
34. IUPAC name of β -methyl butyric acid is
- a) 3-methyl butanoic acid
b) 4-methyl pentanoic acid
c) 2-methyl butanoic acid
d) 2-methyl propanoic acid
35. IUPAC name of following compound is
- a) 4-methyl cyclohexane 1-carboxylic acid
b) 4-carboxyl 1-methyl cyclohexane
c) m-Toluic acid
d) o-Toluic acid
36. IUPAC name of following compound is
- a) 2-oxo butane dioic acid
b) 2-oxo propane 1, 3-dicarboxylic acid
c) 2-oxo 1, 5-pentane dioic acid
d) Hexane dioic acid
37. The IUPAC name of caproic acid is
- a) pentanoic acid
b) 2-phenyl ethanoic acid
c) 2-phenyl propanoic acid
d) hexanoic acid
38. Which of the following is isobutyric acid
39. Which of the following is 2-phenyl pentanoic acid?
40. n-valeric acid is functional isomer of
- a) methyl propionate b) n-butyl formate
c) propyl isobutyrate d) ethyl isobutyrate
41. Butyric acid and isobutyric acid are
- a) chain isomers b) position isomers
c) metamers d) tautomers
42. Which isomers of $C_5H_{10}O_2$ shows optical isomerism?
- a) 2-methyl butanoic acid
b) valeric acid
c) neo-valeric acid
d) 3-methyl butanoic acid
43. How many carboxylic acids are possible for molecular formula $C_5H_{10}O_2$?
- a) 3 b) 4
c) 5 d) 6
44. Molecular formula $C_4H_5O_2$ shows

- 1) chain isomerism
2) metamerism
3) functional isomerism
4) optical isomerism
a) 1, 2, 3 b) 3, 4
c) 2, 3, 4 d) all of these
45. Common name of the following compound is
a) o-Toluic acid b) m-Toluic acid
c) p-Toluic acid d) Phthalic acid
46. IUPAC name of malonic acid is
a) propane dioic acid b) ethane dioic acid
c) butane dioic acid d) pentane dioic acid
47. Carbon atom in carboxyl group is
a) sp-hybridised state
b) sp² hybridised state
c) sp³ hybridised state
d) sp³ d hybridised state
48. Which of the following is 3-oxo cyclohex-4-ene-1-carboxylic acid
49. Which of the following is not fatty acid?
a) propionic acid b) butyric acid
c) iso-butyric acid d) iso-phthalic acid
50. IUPAC name of following acid is
a) isophthalic acid
b) benzene 1, 3-dicarboxylic acid
c) phenyl 1, 3-dicarboxylic acid
d) terephthalic acid
51. Carboxylic acid donot give characteristic property of
a) R - group b) - COOH group
c) > C = O group d) - O - H group
- PREPARATION METHODS**
52. Consider the following sequence of reactions and identify the final product (Y)
- $$\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} \xrightarrow[\text{dry ether}]{\text{Mg}} \text{X} \xrightarrow[\text{dry ether}]{\text{CO}_2/\text{H}_3\text{O}^+} \text{Y}$$
- a) CH₃CH₂COOH
b) (CH₃)₂CHCOOH
c) CH₃CH₂CH₂CH₂COOH
d) CH₃CH₂CH₂COOH
53. Solid carbondioxide and RMgX produces
a) alkanoic acid b) alkanal
c) alkanone d) alkyl alkanoate
54. Carbonation of CH₃MgI gives an organic compound. This compound is also obtained by
a) hydrolysis of acetonitrile by a mineral acid
b) oxidation of methyl alcohol
c) hydrolysis of isoacetonitrile by a mineral acid
d) hydrolysis of methyl formate with dilute mineral acid
55. Propyl propionate is prepared from which of the following
a) CH₃CH₂CH₂OH, CH₃CH₂COOH
b) CH₃COOH, CH₃(CH₂)₂COOH
c) CH₃CHOHCH₃, CH₃CH₂COOH
d) CH₃CH₂CH₂OH, (CH₃)₂CHCOOH
56. A mixture of carboxylic acid (A) and alcohol (B) on heating give and ester (C) having molecular mass 74. What is (C) ?
a) HCOOC₂H₅ b) CH₃COOCH₃
c) Both a and b d) None of these
57. CH₃-CH₂-COOH is can be obtained in the following synthesis
a) CH₃ - CH₂ - CN $\xrightarrow{\text{OH}^-}$
b) CH₃ - CH₂ - CN $\xrightarrow{\text{H}_3\text{O}^+}$
c) CH₃ - CH₂ - CN $\xrightarrow{\text{N}_2 + \text{Ni}}$
d) CH₃ - CH₂ - CN $\xrightarrow{\text{CH}_3\text{MgX}}$
58. CH₃-C(=O)-CH₃ can be converted to CH₃-COOH by following method.
1) CH₃ - COCH₃ $\xrightarrow{\text{I}_2 + \text{NaOH}}$
2) CH₃ - COCH₃ $\xrightarrow{\text{K}_2\text{Cr}_2\text{O}_7 + \text{H}^+}$
3) CH₃ - COCH₃ $\xrightarrow{\text{Ag}(\text{NH}_3)_2^+}$
a) only 2 b) 1 and 2
c) 2 and 3 d) 1 and 3
59. Which is leaving group in the hydrolysis of CH₃COOC₂H₅ ?
a) C₂H₅⁺ b) C₂H₅O⁻
c) CH₃COO⁻ d) CH₃⁻
60. For the preparation of isopropyl acetate from esterification. The compounds used as,
a) CH₃COOH and CH₃CH₂OH
b) (CH₃)₂CHCOOH and CH₃OH
c) CH₃COOH and (CH₃)₂CHOH
d) C₂H₅COOH and CH₃OH
61. Find out X in the following reaction

- $X + \text{CH}_3\text{OH} \xrightarrow{\text{conc. H}_2\text{SO}_4} \text{C}_2\text{H}_5\text{COOCH}_3 + \text{H}_2\text{O}$
 a) $\text{C}_2\text{H}_5\text{-X}$ b) $(\text{CH}_3\text{CO})_2\text{O}$
 c) CH_3COOH d) $\text{C}_2\text{H}_5\text{COOH}$
62. Ethyl propionate is formed from ethyl iodide and what?
 a) $\text{C}_2\text{H}_5\text{COOH}$ b) $\text{C}_2\text{H}_5\text{COOAg}$
 c) $(\text{C}_2\text{H}_5\text{CO})_2\text{O}$ d) All of these
63. Propanoic acid is the oxidative product of,
 a) ethanol b) 3-pentanone
 c) 1-butanol d) 2-propanol
64. Reaction
 $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$
 is an illustration of
 a) dehydration b) esterification
 c) neutralization d) dehydrogenation
65. $\text{R-CH}_2\text{-CH}_2\text{OH}$ can be converted into RCH_2COOH . The reaction is
 a) reduction b) hydrolysis
 c) oxidation d) decarboxylation
66. If hydrolysis of ester is carried out in presence of an acid, using water containing radioactive oxygen atom, the product most likely to be radioactive is,
 a) alcohol b) ester
 c) acid d) both 'a' and 'c'
67. If acetic acid reacts with methyl alcohol containing labelled oxygen atom. In presence of dry HCl, the labelled oxygen atom, at the complete reaction will be found in
 a) methyl acetate b) water
 c) may be 'a' and 'b' d) not predictable
68. Propionic acid is obtained from dry ice and what?
 a) CH_3MgI b) $\text{C}_2\text{H}_5\text{MgBr}$
 c) $\text{C}_3\text{H}_7\text{MgBr}$ d) None of these
69. Carbonation of Grignard reagent followed by hydrolysis gives
 a) aldehyde b) acid
 c) ketone d) primary alcohol
70. Which of one the esters is formed by esterification of propan-2-ol with acetic acid?
 a) $(\text{CH}_3)_2\text{CHCOOCH}_3$
 b) $\text{CH}_3\text{COOCH}(\text{CH}_3)_2$
 c) $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_3$
 d) $(\text{CH}_3)_2\text{CHCOOCH}_2\text{CH}_3$
71. CH_3COCH_3 can be converted into CH_3COOH by
 a) reduction b) hydrolysis
 c) decarboxylation d) oxidation
72. Which reaction does not have the correct oxidising agent?
 a) $\text{CH}_3\text{-COCH}_3 \xrightarrow{\text{PCC}} \text{CH}_3\text{COOH}$
 b) $\text{CH}_3\text{-CHO} \xrightarrow{\text{Ag}(\text{NH}_3)^+} \text{CH}_3\text{COOH}$
 c) $\text{CH}_3\text{-CHO} \xrightarrow{\text{Cr}_2\text{O}_7^{2-}/\text{H}^+} \text{CH}_3\text{COOH}$
 d) $\text{CH}_3\text{COCH}_3 \xrightarrow{\text{Cr}_2\text{O}_7^{2-}/\text{H}^+} \text{CH}_3\text{COOH}$
73. For the following reaction
 $\text{R-CN} \xrightarrow{\text{H}_3\text{O}^+} \text{R-COOH}$
 a) there is protonation of electronegative nitrogen
 b) an amide is formed as an intermediate
 c) nitrogen atom is expelled as ammonia
 d) all are correct
74. Acetylation is the introduction of
 a) CH_3COOH group b) R-CO group
 c) $\text{CH}_3\text{CH}_2\text{O-}$ d) $\text{CH}_3\text{-CO}$
75. 2-methyl propane nitrile on acid hydrolysis give
 a) butyric acid b) isobutyric acid
 c) propionic acid d) pentanoic acid
76. In esterification reaction the correct order of reactivity of alcohol is,
 a) $1^\circ > 2^\circ > 3^\circ$ b) $3^\circ > 2^\circ > 1^\circ$
 c) $1^\circ > 3^\circ > 2^\circ$ d) $3^\circ > 1^\circ > 2^\circ$
77. Monocarboxylic acid are regarded as oxidation product of aldehyde
 a) first b) second
 c) third d) fourth
78. Formic acid is obtained when
 a) Acetaldehyde is oxidised by acidic KMnO_4
 b) Calcium formate is heated with calcium acetate
 c) Methanol is oxidised by PCC
 d) Methanol is oxidised by acidic dichromate
79. Which of the following acid containing aldehyde group?
 a) $\text{CH}_3\text{-COOH}$ b) H-COOH
 c) HOOC-COOH d) $(\text{CH}_3)_2\text{CH-COOH}$
80. Formic acid is not representative member of carboxylic acid because
 a) it is first member of the series
 b) it does not contain alkyl group
 c) it is a gas
 d) it reduced Tollen's reagent
81. Molecular formula $\text{C}_4\text{H}_8\text{O}$ on oxidation gives

- acetic acid. The structure of $C_4H_5O_2$ will be
82. Mixture of acetic acid and propionic acid is obtained by oxidation of
83. Isobutyric acid is obtained by oxidation of
 a) butanal
 b) 2-methyl propanal
 c) 2-methyl propan-1-ol
 d) both b and c
84. 1-phenyl ethanone on oxidation gives
 a) salicylic acid b) benzoic acid
 c) succinic acid d) phthalic acid
85. Cyclohexane carboxylic acid is obtained by oxidation of
 d) both b and c
86. Following compound on oxidation by acidic $KMnO_4$ gives
 a) Adipic acid b) succinic acid
 c) fumaric acid d) maleic acid
87. Benzoic acid is obtained by oxidation of
 1) benzaldehyde 2) benzyl alcohol
 3) Acetophenone
 a) only 1 b) 2, 3
 c) 1, 3 d) 1, 2, 3
88. Find out A in the following reaction

$$A \xrightarrow{aq.KOH} B \xrightarrow{PCC} \text{propanal}$$
 a) n-propyl alcohol b) n-propyl halide
 c) n-propyl amine d) diethyl ether
89. Acid hydrolysis of cyanide may produces
 a) carboxylic acid b) mineral acid
 c) aldehyde d) amine
90. Molecular formula C_4H_7 on acid hydrolysis gives 2-methyl propanoic acid. The possible structure of C_4H_7 will be
91. Benzoic acid is obtained by acid hydrolysis of
 a) benzonitrile
 b) 2-phenyl ethane nitrile
 c) phenyl isocyanide
 d) 2-phenyl ethane isonitrile
92. Find out final product in following reaction
93. Compound A on hydrohalogenation gives B, which is treated with alc.KCN and followed by acid hydrolysis gives 2-methyl butanoic acid. The compound A will be
94. Hexane dioic acid is obtained by oxidation of
 a) benzene
 b) cyclohexane
 c) cyclohexene
 d) cyclohexane carbaldehyde
95. Find out missing compound in following reaction

$$CO_2 + ? \xrightarrow[H_3O^+]{\text{dry ether}} R - COOH$$
 a) $R-X$ b) $R-Li$
 c) $R-MgX$ d) $R-ONa$
96. Dry ice and benzyl magnesium halide produces
 a) benzoic acid
 b) phthalic acid
 c) 2-phenyl ethanoic acid
 d) 2-phenyl propanoic acid
97. Product of the following reaction is
98. 2-methyl propanoic acid is obtained from dry ice and what
99. Find out final product 'E' in the following reaction series

$$\begin{array}{ccccccc} & \xrightarrow{Zn} & A & \xrightarrow[\text{unhy}AlCl_3]{CH_3-Cl} & B & \xrightarrow{Cl_2/U.V.L} & C \\ & & & & & \xrightarrow{Mg/Ether} & D & \xrightarrow[H_3O^+]{CO_2/Ether} & E \end{array}$$
100. Hydrolysis of acyl halide gives
 a) aldehydes b) ketones
 c) carboxylic acids d) esters
101. Following compound on hydrolysis gives
 $+ H.OH \longrightarrow ?$
102. Benzoic acid is obtained by hydrolysis of
103. 1-phenyl ethanoyl chloride on hydrolysis gives
 a) ethanoic acid
 b) 1-phenyl ethanoic acid
 c) 2-phenyl ethanoic acid
 d) benzoic acid
104. Hydrolysis of acid anhydride gives
 a) aldehydes b) ketones
 c) acid amides d) carboxylic acids

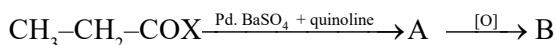
105. Hydrolysis of ethanoic anhydride gives
 a) methanoic acid b) propanoic acid
 c) ethanoic acid d) oxalic acid
106. Following compound on hydrolysis gives

107. Product of the following reaction is

108. Which of the following compound does not gives benzoic acid on oxidation

109. Benzoic acetic anhydride on hydrolysis gives
 a) benzoic acid
 b) acetic acid
 c) mixture of benzoic acid and acetic acid
 d) benzyl alcohol and acetic acid

110. Product 'B' in the following reaction



- a) $\text{CH}_3\text{--CH}_2\text{--COOH}$ b) $\text{CH}_3\text{--COOH}$

- c) $\text{CH}_3\text{--CH}_2\text{--CHO}$ d) $\text{CH}_3\text{--}\overset{\text{O}}{\parallel}\text{C--CH}_3$

111. Acid hydrolysis of ester produces

- a) carboxylic acid
 b) alcohol
 c) carboxylic acid and alcohol
 d) aldehyde and ketone

112. Molecular formula $\text{C}_4\text{H}_8\text{O}_2$ on acid hydrolysis gives acetic acid and ethanol. The structures of $\text{C}_4\text{H}_8\text{O}_2$ will be

113. $\text{A} + \text{H.OH} \xrightleftharpoons{\text{H}^+}$
 The compound A is

114. Molecular formula $\text{C}_3\text{H}_6\text{O}_2$ on acid hydrolysis gives A and B. The compound 'A' reduce Tollens-reagent. The possible structure of $\text{C}_3\text{H}_6\text{O}_2$ will be

- a) $\text{CH}_3\text{--CH}_2\text{--COOH}$ b) $\text{CH}_3\text{--COOCH}_3$
 c) $\text{H--COOC}_2\text{H}_5$ d) $\text{CH}_3\text{--}\overset{\text{O}}{\parallel}\text{C--CH}_3$

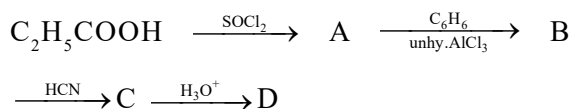
115. Which of the following method cannot be used in the preparation of acid

- a) $\text{R--COCl} + \text{H}_2\text{O} \longrightarrow$
 b)

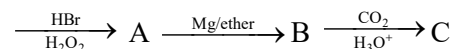


116. Vigorous oxidation by acidic permagnet solution of $(\text{CH}_3)_2\text{C}=\text{CH--CH}_2\text{CH}_3$ gives

117. A set of reaction yielded a product D.



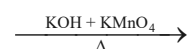
118. Product of the following reaction



119. Alkyl benzene on oxidation by alkaline KMnO_4 gives

- a) aldehyde b) ketone
 c) carboxylic acid d) esters

120. Product of the reaction



121. o-xylene on oxidation gives

- a) phthalic acid b) isophthalic acid
 c) terephthalic acid d) citric acid

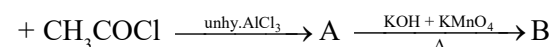
122. Following compound is obtained by oxidation is

- a) 1, 3 b) 2, 3
 c) 2, 4 d) 1, 2, 3, 4

123. Phenyl ethene on oxidation produces

- a) phthalic acid
 b) p-ethenyl benzoic acid
 c) benzoic acid
 d) salicylic acid

124. Find out final product of the reaction



125. Potassium salt of isophthalic acid on acid hydrolysis gives

- a) phthalic acid b) isophthalic acid
 c) terephthalic acid d) benzoic acid

126. Carbonation of organometallic reagent

- a) is a one carbon homologation
 b) involves its carbanionic attacks on electron deficient carbonyl carbon
 c) both are correct

- d) none is correct
127. Hydrolysis of nitriles with alkaline solution gives
a) salt of acid b) amides
c) acid d) esters
128. The mechanism of carbonation of organometallic compound is analogous to that of addition to
a) aldehyde and ketones
b) nitriles
c) alcohols
d) amines
129. Dry ice reacts with n-propyl magnesium iodide to give
a) propyl acetic acid b) propionic acid
c) butanoic acid d) none of these
130. Esterification reaction is
a) nucleophilic substitution
b) electrophilic substitution
c) electrophilic addition
d) dehydration
131. In which case R-COOH is not product?
a) $R-CN + RMgX \rightarrow$
b) $R-CN \xrightarrow{H_3O^+}$
c) $R-MgX \xrightarrow{CO_2}$
d) $RCOR \xrightarrow{\text{oxidation}}$
132. In esterification reaction concentrated H_2SO_4 act as
a) dehydrating agent b) catalyst
c) reducing agent d) oxidising agent
133. After completion of esterification, excess of alcohol is removed by using
a) $CaCl_2$ b) $CaOCl_2$
c) Na_2CO_3 d) NaOH
134. Synthesis of ester involves the reaction of alcohol with
a) a ketone b) an amide
c) CH_3MgBr d) $RCOOH$
135. Which of the following reagent produces 2-methyl propanoic acid with dry ice?
a) CH_3MgI b) C_2H_5MgI
c) $(CH_3)_2CHMgI$ d) C_3H_7MgI
136. 1-propanol on oxidation give
a) propanal b) propionic acid
c) propanone d) ethanal
137. $-CN$ group is converted into $-COOH$ group by,
a) hydrolysis b) oxidation
c) reduction d) esterification
138. Esters are formed from acid by the replacement of
a) non-ionisable H atom by alkyl group
b) ionisable H atom by alkyl group
c) OH group by RO group
d) both 'b' and 'c'
139. Which one of the following correctly represents esterification reaction
a) $RCO \boxed{OH+H} O-R' \rightarrow R-COOR' + H_2O$
b) $RCOO \boxed{H+HO} -R' \rightarrow R-COOR' + H_2O$
c) $RCO \boxed{OH+H} O-R' \rightarrow R'-COOR + H_2O$
d) $RCOO \boxed{H+HO} -R' \rightarrow R'-COOR + H_2O$
140. The compound formed when propyl magnesium bromide is treated with carbon dioxide is
a) C_3H_7COOH b) C_2H_5COOH
c) C_3H_7CHO d) $C_3H_7OCH_3$
141. The alkyl cyanides when hydrolysed to the corresponding acid, the gas evolved is
a) N_2 b) O_2
c) NH_3 d) CO_2
142. In esterification of an acid, the other reagent is
a) Alcohol b) An aldehyde
c) Amine d) Water
143. When methyl cyanide is hydrolysed in presence of alkali and followed by treatment with HCl. The product is
a) Acetamide b) Methane
c) Formic acid d) Acetic acid
144. Which product is formed, when acetonitrile is hydrolysed partially with dil. HCl ?
a) Acetic acid b) Acetamide
c) Methyl cyanide d) Acetic anhydrides
145. Carboxylic acid is formed by the hydrolysis of an addition compound formed by reaction of Grignard's reagent with
a) ethanal b) methanal
c) carbon dioxide d) methyl cyanide
146. Which is formed, when benzonitrile is hydrolysed by dil. HCl ?
a) Benzoic acid b) Benzaldehyde
c) Benzamide d) Benzoic unhydride

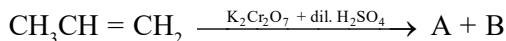
ACIDIC NATURE

147. The acidic nature of carboxylic acid is due to
 a) high degree of ionisation of acid
 b) greater resonance stabilization of the acid
 c) greater resonance stabilization of its anion
 d) all of the above
148. Acidic character of carboxylic acid with an molecular mass increases
 a) sometime increases some time decreases
 b) decreases
 c) increases
 d) none of the above
149. Among the acid
 1) $\text{HC}=\text{C}-\text{COOH}$
 2) $\text{H}_2\text{C}=\text{CH}-\text{COOH}$
 3) $\text{CH}_3-\text{CH}_2-\text{COOH}$
 The acidic strength follows the order
 a) $3 < 2 < 1$ b) $3 = 2 < 1$
 c) $1 < 2 < 3$ d) $1 < 2 = 3$
150. Which of the following it the most stable acid?
 a) $\text{CH}_2(\text{F})\text{COOH}$ b) $\text{CH}_2(\text{Br})\text{COOH}$
 c) $\text{CH}_2(\text{Cl})\text{COOH}$ d) $\text{CH}_2(\text{I})\text{COOH}$
151. Which of the following acid is strongest
 a) CH_3-COOH b) $\text{Cl}_2-\text{CH}_2-\text{COOH}$
 c) $\text{Cl}_2\text{CH}-\text{COOH}$ d) CCl_3-COOH
152. Which of the following is weak acid?
153. Which of the following is strongest acid?
 a) $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$
 b) $\text{CH}_3\text{CH}_2\text{CHBrCOOH}$
 c) $\text{CH}_3\text{CHBrCH}_2\text{COOH}$
 d) $\text{CH}_2\text{BrCH}_2\text{CH}_2\text{COOH}$
154. Which of the following has highest Pka value?
 a) $\text{C}_6\text{H}_5-\text{COOH}$ b) CH_3-OH
 c) $\text{C}_6\text{H}_5-\text{OH}$ d) CH_3-COOH
155. Which of the following is strong acid?
 a) CF_3COOH b) CCl_3COOH
 c) CBr_3COOH d) Cl_3COOH
156. Which of the following is strongest acid?
 a) $\text{H}-\text{COOH}$ b) $\text{C}_6\text{H}_5-\text{COOH}$
 c) CH_3-COOH d) $\text{CH}_3-\text{CH}_2-\text{COOH}$
157. Weakest acid among the following is
 a) $\text{H}-\text{COOH}$
 b) $\text{C}_6\text{H}_5-\text{COOH}$
 c) $\text{o}-\text{NO}_2-\text{C}_6\text{H}_4-\text{COOH}$
 d) CH_3-COOH
158. Benzoic acid is more stronger than all aliphatic carboxylic acid except $\text{H}-\text{COOH}$, why?
 a) $\text{C}_6\text{H}_5-\text{COOH}$ is aromatic acid
 b) In $\text{C}_6\text{H}_5-\text{COOH}$, the $-\text{COOH}$ group is attached to sp^2 -hybridised carbon atom
 c) resonance stabilization of benzene ring
 d) resonance stabilization of benzoate ion.
159. The aqueous solution of RCOOH contains,
 a) $\text{RCOO}^- + \text{H}^+$
 b) $\text{RCO}^+ + \text{OH}^-$
 c) $\text{RCOO}^- + \text{H}_3\text{O}^+$
 d) $\text{RCOOH} + \text{RCOO}^- + \text{H}_3\text{O}^+$
160. Which one of the following would be expected to be most highly ionised in water
 a) $\text{Cl}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{COOH}$
 b) $\text{CH}_3\text{CHClCH}_2-\text{COOH}$
 c) $\text{CH}_3-\text{CH}_2-\text{CHCl}-\text{COOH}$
 d) $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{COOH}$
161. Between CH_3COOH and $\text{H}-\text{COOH}$, the HCOOH will be
 a) less acidic b) more acidic
 c) equally acidic d) non-acidic
162. Formic acid and acetic acid may be distinguished by the reaction with
 a) sodium metal b) Tollen's reagent
 c) sodium ethoxide d) NaOH
163. Which is tribasic acid
 a) adipic acid b) succinic acid
 c) Tartaric acid d) citric acid
164. Consider the following acids
 1) CH_3COOH 2) Cl_2CHCOOH
 3) ClCH_2COOH 4) Cl_3CCOOH
 The correct sequence of acidity is
 a) $1 > 4 > 3 > 2$ b) $1 > 3 > 2 > 4$
 c) $1 > 2 > 3 > 4$ d) $4 > 2 > 3 > 1$
165. Which of the following order of relative strength of acid is correct?
 a) $\text{F}-\text{CH}_2-\text{COOH} > \text{Cl}-\text{CH}_2-\text{COOH} > \text{Br}-\text{CH}_2-\text{COOH} > \text{CH}_3-\text{COOH}$
 b) $\text{CH}_3-\text{COOH} > \text{F}-\text{CH}_2-\text{COOH} > \text{Cl}-\text{CH}_2-\text{COOH} > \text{Br}-\text{CH}_2-\text{COOH}$
 c) $\text{Br}-\text{CH}_2-\text{COOH} > \text{Cl}-\text{CH}_2-\text{COOH} > \text{F}-\text{CH}_2-\text{COOH} > \text{CH}_3-\text{COOH}$
 d) $\text{ClCH}_2\text{COOH} > \text{F}-\text{CH}_2-\text{COOH} > \text{Br}-\text{CH}_2-\text{COOH} > \text{CH}_3-\text{COOH}$
166. Which of the following is weakest acid

181. When propionic acid is heated with ammonia give

- a) CH_3CONH_2 b) $\text{C}_2\text{H}_5\text{COONH}_4$
c) $\text{C}_2\text{H}_5\text{CONH}_2$ d) $\text{CH}_3\text{COONH}_4$

182. Product 'A' and 'B' in the following reaction is



- a) acetone
b) acetaldehyde and formaldehyde
c) propanoic acid
d) acetic acid and formic acid

183. Sodium acetate reacts with acetyl chloride to give

- a) acetic acid b) acetic anhydride
c) methyl acetate d) ethyl acetate

184. Acetic acid react with PCl_5 gives,

- a) CH_3COCl b) $\text{ClCH}_2\text{CH}_2\text{Cl}$
c) CH_3COOCl d) CH_3Cl

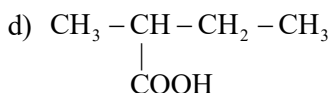
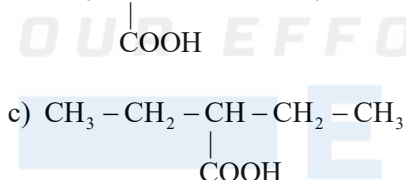
185. Which of the following compound reacts with NaHCO_3 solution to give sodium salt and carbon dioxide?

- a) Phenol b) 1-propanol
c) Acetic acid d) Nitric acid

186. An optically active compound 'X' evolve CO_2 with NaHCO_3 . The 'X' react with LiAlH_4 gives chiral compound. The compound 'X' is

- a) $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{COOH}$

- b) $\text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_3$



187. An propanoyl chloride is formed when PCl_5 reacts with an

- a) propanoic acid b) alcohol
c) acetic acid d) ester

188. Which of the following substance will give amide, when it reacts with NH_3 ?

- a) CH_3X b) CH_3NH_2
c) CH_3COCl d) $(\text{CH}_3\text{CO})_2\text{O}$

189. Formic acid is a stronger acid than acetic acid. This is due to the fact that

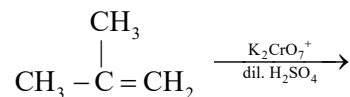
- a) formic acid is reducing agent

b) formic acid molecule is of smaller size

c) there is no alkyl group on α -carbon in formic acid

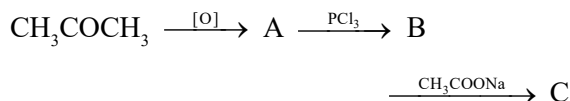
d) formic acid does not undergo association

190. What are the product in the following reaction?



- a) $\text{CH}_3-\text{COCH}_3$ and $\text{H}-\text{COOH}$
b) $\text{CH}_3-\text{CH}_2\text{CHO}$ and CO_2
c) CH_3-COOH and $\text{H}-\text{COOH}$
d) CH_3-CHO and $\text{H}-\text{COOH}$

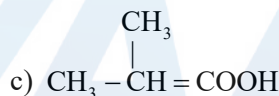
191. Product of the following reaction is



- a) acetic unhydride b) propanoic unhydride
c) ethyl propanoate d) isopropyl alcohol

192. Which of the following does not under go HVZ reaction?

- a) CH_3-COOH
b) $\text{CH}_3-\text{CH}_2-\text{COOH}$



- d) $(\text{CH}_3)_3\text{C}-\text{COOH}$

193. During formation of unhydride from P_2O_5 and acid. The acid molecule under goes

- a) intermolecular dehydration
b) interamolecular dehydration
c) oxidation
d) hydration

194. Acetic anhydride is obtained by the reaction of

- a) sodium and acetic acid
b) ammonia and acetic acid
c) ethanol and acetic acid
d) P_2O_5 and acetic acid.

195. An ester is subjected to hydrolyse. Product of hydrolysis will be tested for

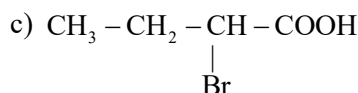
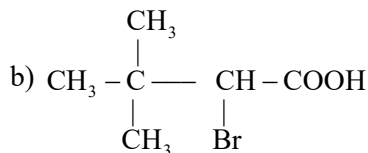
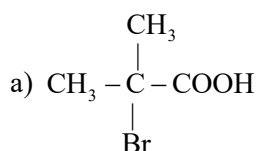
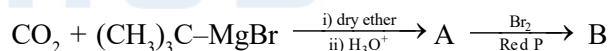
- a) carboxylic acid and alcoholic group
b) carboxylic acid and ketonic group
c) carboxylic acid and aldehyde group
d) aldehyde and ketonic group

196. Carboxylic acid reacts with potassium metal. The amount of potassium used up and hydrogen liberated are in the molar ratio of

- a) 2 : 1 b) 1 : 1
c) 3 : 2 d) 2 : 3
197. HVZ reaction is characteristic reaction of
a) α -H atom b) β -H atom
c) γ -H atom d) δ -H atom
198. Carboxylic acid reacts with calcium metal. The amount of calcium used up and hydrogen liberated are in the molar ratio of
a) 2 : 1 b) 1 : 1
c) 3 : 2 d) 2 : 3
199. Two molecules of acetic acid are heated with P_2O_5 . The product formed is
a) two moles of ethanol
b) two moles of methyl cyanide
c) acetic anhydride
d) formic acid
200. Carboxylic acid can
a) decompose carbonate and evolve CO_2
b) reacts with metal forming H_2 gas
c) neutralise ammonium hydroxide form salt
d) all of the above
201. Which of the following group will increase more acidity of acetic acid?
a) $-NO_2$ b) $-CH_3$
c) CH_3O^- d) $-NH_2$
202. P_2O_5 is anhydride of
a) H_3PO_3 b) HPO_3
c) H_3PO_4 d) $HClO$
203. The solvent that can dissolve all the carboxylic acids is
a) water b) dil. HCl
c) dil. $NaOH$ d) conc. H_2SO_4
204. Acetyl chloride can be prepared
a) by the action of CH_3COOH with chloroform
b) by the action of PCl_3 on acetic acid
c) by the action of Cl_2 on acetic acid
d) by the action of CCl_4 on acetic acid
205. Of the following four reactions, formic and acetic acid differ in which respect?
a) Formation of ester with alcohol
b) Replacement of hydrogen by sodium
c) Reduction of Fehling solution
d) Blue litmus reaction
206. Arrange the following carboxylic acid in their decreasing acidity

- COOH
1) $\begin{array}{c} | \\ COOH \end{array}$ Oxalic acid
- 2) $HOOC-CH_2-COOH$ Malonic acid
- CH₂ - COOH
3) $\begin{array}{c} | \\ CH_2 - COOH \end{array}$ Succinic acid
- a) 3 > 2 > 1 b) 1 > 2 > 3
c) 2 > 3 > 1 d) 2 > 1 > 3

207. Among the following which compound will react with Na_2CO_3 solution to give sodium salt and CO_2 ?
a) Phenol b) 1-hexanol
c) Formic acid d) Ethanal
208. Identify the correct order of boiling point of following compound?
a) 1 > 3 > 2 > 1 b) 2 > 3 > 1 > 4
c) 3 > 1 > 2 > 4 d) 3 > 1 > 4 > 2
209. The compounds formed by the acid hydrolysis of ethyl acetate are
a) formic acid and propanol
b) acetic acid and ethanol
c) acetone and ethanol
d) acetone and methanol
210. $-COOH$ group of a compound does not react with $NaHSO_3$ even though it has $>C=O$ group because of
a) cyclic structure b) acidic character
c) linear structure d) resonance
211. Final product of following reaction is

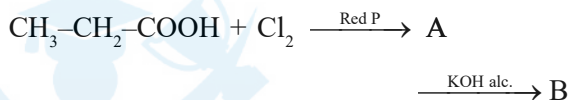


- d) No product will be formed.
212. Acids having higher B.P. than alcohols because of
- intra molecular HB
 - dimerisation of acid
 - dipole-dipole attraction
 - Vander Waals force of attraction

213. Product of the following reaction is

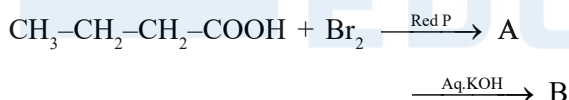


- $\text{CH}_3\text{-COOH} + \text{C}_2\text{H}_5\text{-OH}$
 - $\text{CH}_3\text{-CHO} + \text{C}_2\text{H}_5\text{-OH}$
 - $\text{C}_2\text{H}_5\text{-COOH} + \text{CH}_3\text{-OH}$
 - $\text{C}_2\text{H}_5\text{-COOH} + \text{C}_2\text{H}_5\text{-OH}$
214. Adipic acid is formed by oxidation of
- cyclohexane
 - cyclohexene
 - hex-1-ene
 - hex-2-ene
215. Product 'B' of the following



- $\text{CH}_3\text{-CHCl-COOH}$
 - $\text{CH}_3\text{-CHOH-COOH}$
 - $\text{CH}_2 = \text{CH-COOH}$
 - $\text{CH} = \text{C-COOH}$
216. Which of the following does not give HVZ reaction?
- Acetic acid
 - Propionic acid
 - Isobutyric acid
 - Neovaleric acid

217. Product 'B' of the following



- $\text{CH}_3\text{-CH}_2\text{-CHOH-COOH}$
 - $\text{CH}_3\text{-CHOH-CH}_2\text{-COOH}$
 - $\text{HO-CH}_2\text{-CH}_2\text{-CH}_2\text{-COOH}$
 - $\text{CH}_3\text{-CH} = \text{CH-COOH}$
218. Terephthalic acid is heated with ammonia gives
- phthalamide
 - phthalimide
 - isophthalic
 - ammonium phthalate

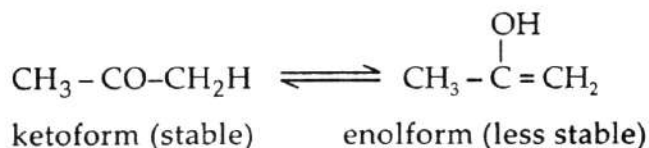
○○○



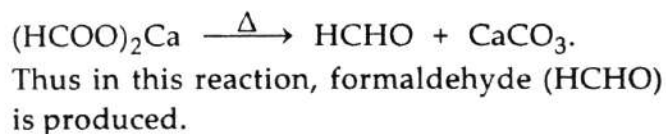


SECTION - I : ALDEHYDES AND KETONES

39. b) Ketone also shows tautomerism by transfer of hydrogen.



58. d) We know that



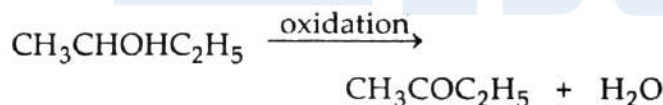
59. b) $\text{RCN} + \text{RMgX} \xrightarrow[\text{H}_3\text{O}^+]{\text{dry ether}} \text{RCOR} + \text{NH}_3 + \text{MgXOH}$

60. a) $\text{CH}_3\text{CCl}_2\text{CH}_3 + 2\text{KOH} \xrightarrow{\text{aq.}} \text{CH}_3\text{COCH}_3 + 2\text{KCl}$

61. b) $\text{CH}_3\text{CCl}_2\text{CH}_2\text{CH}_3 + 2\text{KOH} \xrightarrow{\text{aq.}} \text{CH}_3\text{COCH}_2\text{CH}_3 + 2\text{KCl}$

62. a) $\text{CH}_3\text{CHOHCH}_3 \xrightarrow{\text{oxidation}} \text{CH}_3\text{COCH}_3 + \text{H}_2\text{O}$

69. c) Molecular formula $\text{C}_4\text{H}_{10}\text{O}$ has four isomers i.e. n-butyl alcohol, isobutyl alcohol, sec. butyl alcohol, t-butyl alcohol. Sec. butyl alcohol is optically active and on oxidation gives ethyl methyl ketone.



71. c) $\text{HCN} + (\text{CH}_3)_2\text{CHMgX} \xrightarrow[\text{H}_3\text{O}^+]{\text{dry ether}} (\text{CH}_3)_2\text{CH-CHO} + \text{MgXOH}$

119. d) The reagents a, b, c reacts with the carbonyl compounds in a same manner and only NH_3 react differently. Formaldehyde is reacted with ammonia give urotropine. Acetaldehyde reacts ammonia give acetaldehyde amine and acetone reacts ammonia give diacetone amine.

120. a) Positive charge on carbonyl carbon is maximum in case of HCHO. It is because no alkyl group (+I effect) is attached with it and therefore, positive charge is not dispersed. Hence formaldehyde is more reactive than other aldehydes.

121. a) Aldehydes are more reactive than ketones towards nucleophilic addition reactions, due to the electron repelling inductive effect (+I) of alkyl groups. The alkyl groups at the carbonyl carbon in ketones reduces the positive charge over it and therefore, the tendency of a nucleophilic attack is reduced. The bulky alkyl groups also decrease the reactivity of $>\text{C}=\text{O}$ group, due to steric hindrance.

122. b) Aldehydes and ketones both have carbonyl group $>\text{C}=\text{O}$, which reacts with Grignard's reagent. Fehling's solution gives red precipitate or coloration with aldehydes only, except aromatic aldehydes. Tollen's reagent gives silver mirror only with aldehydes. Only aldehydes turn Schiff's reagent pink.

123. b) Aldehydes lacking an α hydrogen undergoes self oxidation reduction (disproportionation reaction), also known as Cannizzaro's reaction.

124. d) Cannizzaro's reaction is given by those aldehydes which have no α hydrogen atom. Compound (a) has no α hydrogen atoms, so it shows Cannizzaro's reaction. Compound (b) has no α -hydrogen atom but does not show Cannizzaro's reaction, because of -I effect.

125. c) This is aldol condensation reaction
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO} + \text{CH}_3\text{CH}_2\text{CH}_2\text{CHO} \xrightarrow{\text{dil. NaOH}} \text{CH}_3\text{CH}_2\text{CH}_2\text{CHOHCH}(\text{C}_2\text{H}_5)\text{CHO}$
 2-ethyl 3-hydroxy hexanal

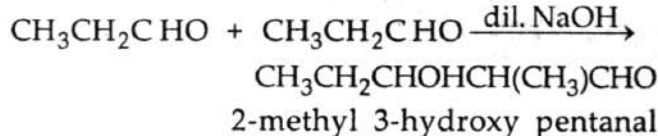
126. d) $2\text{HCHO} + \text{KOH} \longrightarrow \text{CH}_3\text{OH} + \text{HCOOK}$

127. c) The nucleophile is SO_3^{2-} not HSO_3^- , SO_3Na

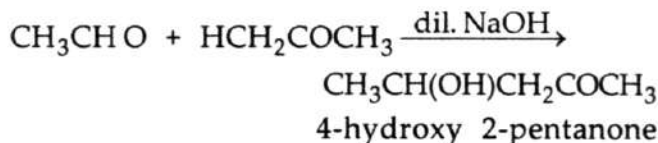
128. b) The nucleophile is CN^- attack on $>\text{C}^{\delta+}$

129. b) $\text{CH}_3\text{COCH}_3 + \text{CH}_3\text{MgI} \xrightarrow[\text{H}_3\text{O}^+]{\text{dry ether}} (\text{CH}_3)_3\text{COH} + \text{MgIOH}$

130. d) Aldol condensation reaction shown by those aldehydes and ketones containing α hydrogen atoms or aldehydes and ketones having methyl or methylene group in α position. Compounds a, b, c have α -hydrogen atoms.



132. b) When aldehydes condenses with ketone, produces four condensation products. It is the α -hydrogen atom of the ketone which is involved in the condensation reaction and produces major product.



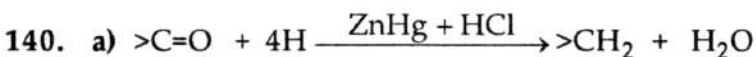
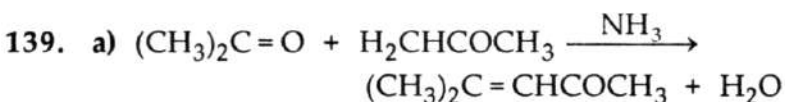
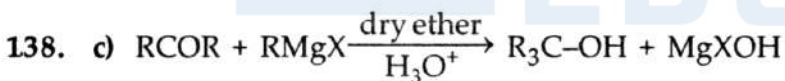
133. d) Iodoform test is given by organic compounds which contains CH_3CO group or CH_3CHOH grouping. 3-pentanone does not contain any one of such grouping.

134. c) Methyl ketones react with iodine and aqueous alkali to form yellow compound, iodoform (CHI_3)

135. d) Compounds a, b, c undergo nucleophilic addition reactions. Hence, RMgX adds in above compounds.

136. c) Ketones do not respond to Tollen's test. Aldehydes respond to Tollen's test.

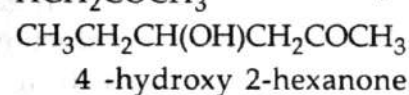
137. d) Fehling solution is weak oxidising agent and benzaldehyde is weak reducing agent. Hence, it does not react with Fehling solution. Formic acid, glucose, ethanal contains CHO -group. Hence, they reduce Fehling solution.



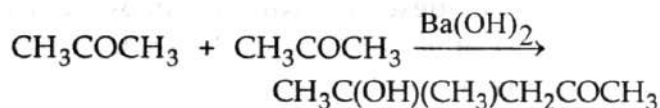
141. a) Self redox reaction is Cannizzaro's not given by those aldehydes which contain α -hydrogen atoms. Methanal does not have α -hydrogen atoms, hence, it gives self redox reaction.



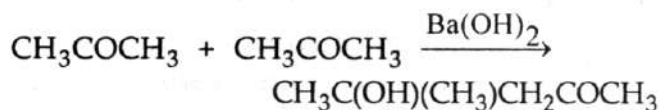
143. a) When aldehydes condense with ketone, gives four condensation products. It is the α -hydrogen atom of the ketone which is involved in the condensation reaction and produces major product.



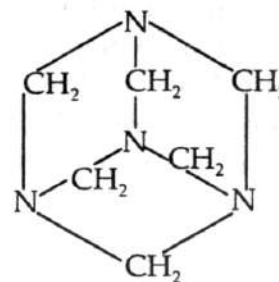
144. c) This is aldol condensation reaction,



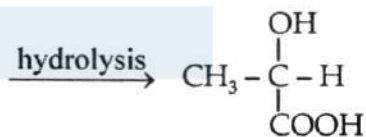
144. c) This is aldol condensation reaction,



145. c) Structure of urotropine is,

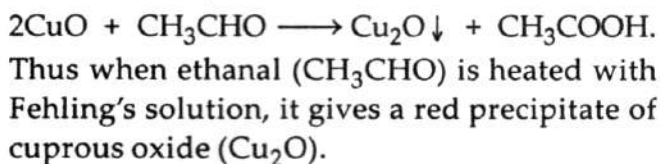


146. d) Acetone and acetaldehyde, both contain $>\text{C}=\text{O}$ group. The Grignard adds in $>\text{C}=\text{O}$ group. These are nucleophilic substitution reactions.



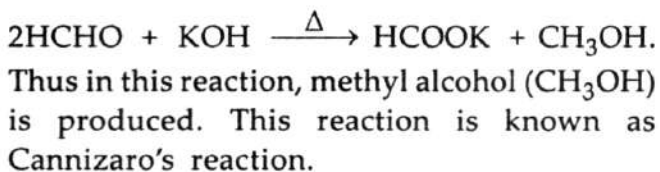
lactic acid (optically active acid)

148. c) We know that,



169. d) We know that in aldol condensation, α -hydrogen atoms undergo self-addition between two molecules to form β -hydroxy ketone. Therefore ketone in which α -hydrogen atom is present, give this reaction.

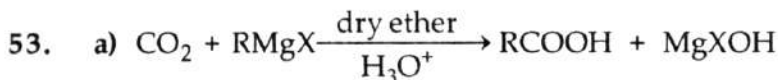
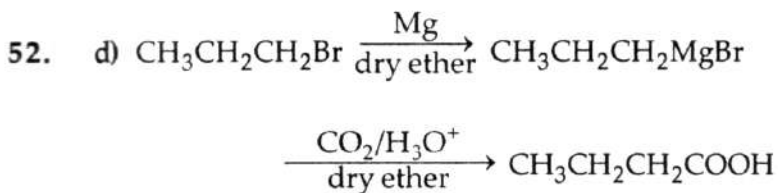
170. d) We know that,



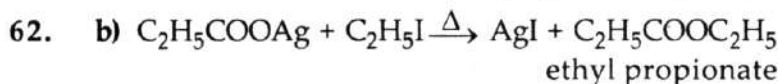
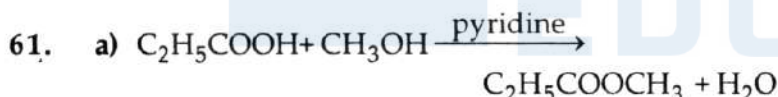
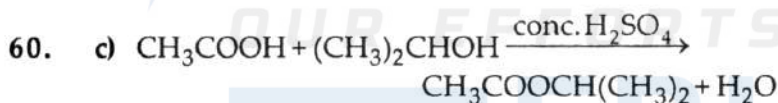
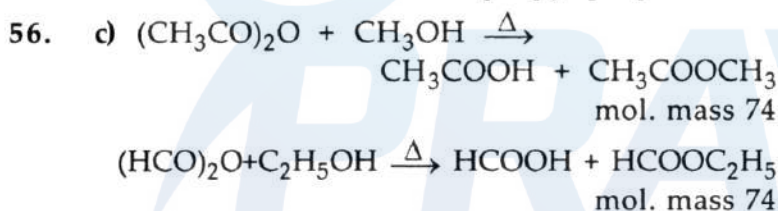
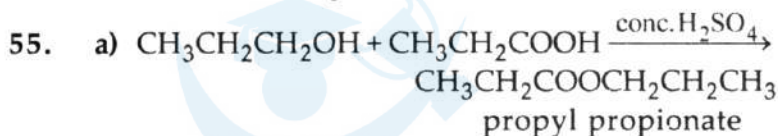
171. d) We know that benzaldehyde which does not contain α -hydrogen atom, undergoes self oxidation-reduction when reacted with 50% aqueous alkali. In the process of converting benzaldehyde to benzyl alcohol, one molecule is oxidised to sodium benzoate at the expense of other which is reduced to benzyl alcohol. This reaction is known as Cannizzaro's reaction.
172. d) We know that aldehyde can be oxidised with potassium dichromate ($K_2Cr_2O_7$) in acidic medium to form carboxylic acid, when Tollens reagent is used to oxidise an aldehyde, the silver ion is reduced to metallic form if the reaction is carried out in a clean test tube. We also know that when Fehling's solution is used to oxidise an aldehyde, the complexed cupric ion is reduced to cuprous oxide. Therefore all of these options are correct.
173. d) We know that,
 $6HCH=O + 4NH_3 \longrightarrow (CH_2)_6N_4 + 6H_2O$.
Formaldehyde Hexamethylene tetramine
Thus in this reaction, the product Y is hexamethylene tetramine $[(CH_2)_6N_4]$
174. a) We know that, aldehyde restores the colour of Schiff's reagent in the cold, while ketones do not give this test.

SECTION - II : CARBOXYLIC ACIDS

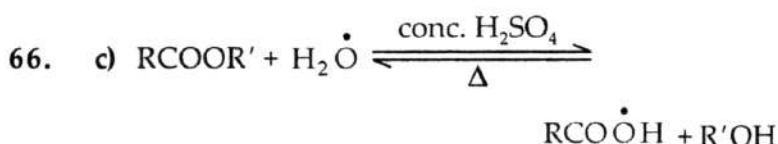
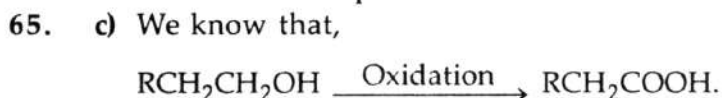
18. b) $C_2H_4O_2$ have two isomers,
i) CH_3COOH , ii) $HCOOCH_3$



54. a) Carbonation of CH_3MgI forms CH_3COOH .
Hydrolysis of acetonitrile by a mineral acid also forms CH_3COOH .



64. b) We know that,
 $CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$.
Thus in this reaction, an ester ($CH_3COOHC_2H_5$) is formed. This process is called esterification.



The radioactive oxygen must be in acid. This technique is known as tracer technique.

150. d) Electron withdrawing groups or atoms increase the strength of acid. More the electron withdrawing power, more the strength of acid.

In halogens electron withdrawing power is,
 $F > Cl > Br > I$.

Hence, CH_2ICOOH is stable acid.

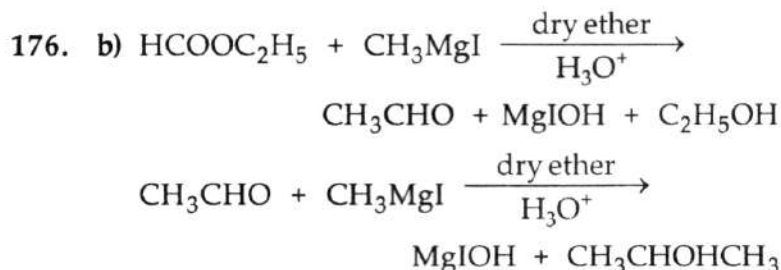
153. b) Strength of acid depends upon distance between electron withdrawing group and $COOH$ group. Distance between electron withdrawing group and $COOH$ group increases, the strength of the acid decreases.

164. d) Inductive effect diminishes with increases in the number of σ -bonds through which the effect operates. This makes $ClCH_2COOH$ more acidic than $ClCH_2CH_2COOH$. An electronegative atom Cl is an electron withdrawing group and acid strengthener. Therefore, $ClCH_2COOH$ is a stronger acid than CH_3COOH . Two chlorine atoms are more electron withdrawing than single Cl atom. So, $Cl_2CHCOOH$ stronger acid than $ClCH_2COOH$.

172. a) Molecular formula $C_4H_8O_2$ is acids and esters. The compound react with CH_3MgI means it must be ester. The ester gives 2-propanol with excess CH_3MgI , it means that ester is formate ester.

174. b) $RCOOH + H_2O \rightarrow RCOO^- + H_3O^+$
Because of resonance stabilization of carboxylate ion, the equilibrium shifts in the forward direction, thereby forming more and more of hydronium ions.

175. a) Formic acid has aldehydic group $H-C=O$, therefore reduces Tollen's reagent to give silver mirror test.



177. d) Carboxylic acids are weak acids, they dissociate lesser extent in water and equilibrium is shifted to left. Hence, aqueous solution of carboxylic acids contains undissociated acid molecules.

178. a) $CH_3-CH_2-COOH + Br_2 \xrightarrow{\text{Red P}} CH_3-CHBr-COOH$
It shows optical isomerism.

- $$\text{C}_2\text{H}_5\text{COONH}_4 \xrightarrow{\Delta} \text{C}_2\text{H}_5\text{CONH}_2 + \text{H}_2\text{O}$$
183. b) $\text{CH}_3\text{COONa} + \text{CH}_3\text{COCl} \longrightarrow$
sod. acetate acetyl chloride

$$(\text{CH}_3\text{CO})_2\text{O} + \text{NaCl}$$
184. a) $\text{CH}_3\text{COOH} + \text{PCl}_5 \longrightarrow$

$$\text{CH}_3\text{COCl} + \text{POCl}_3 + \text{HCl}$$
185. c) We know that,

$$\text{CH}_3\text{COOH} + \text{NaHCO}_3 \longrightarrow$$

$$\text{CH}_3\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}.$$

Thus in this reaction acetic acid (CH_3COOH) reacts with NaHCO_3 to give sodium salt and carbon dioxide.
187. a) We know that,

$$3\text{CH}_3\text{COOH} + \text{PCl}_5 \longrightarrow$$

$$3\text{CH}_3\text{COCl} + \text{POCl}_3 + \text{HCl}.$$

Thus in this reaction PCl_5 react with an acetic acid (CH_3COOH) to produce acetyl chloride.
188. c) We know that,

$$\text{CH}_3\text{COCl} + 2\text{NH}_3 \longrightarrow \text{CH}_3\text{CONH}_2 + \text{HCl}.$$

Thus in this reaction, acetyl chloride (CH_3COCl) when heated with ammonia (NH_3) produces acetamide (CH_3CONH_2).
189. c) Electron donating alkyl groups decrease the strength of acid. That is why formic acid is strongest acid than acetic acid.