

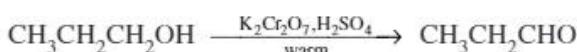
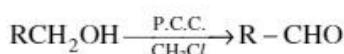
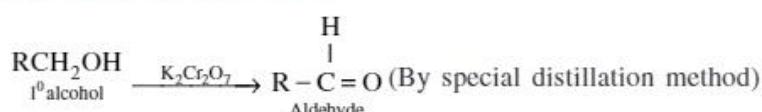
3. ALDEHYDES AND KETONES

SYNOPSIS

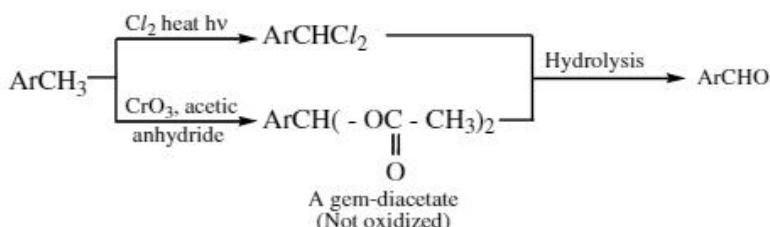
CARBONYL COMPOUNDS

PREPARATION OF ALDEHYDES

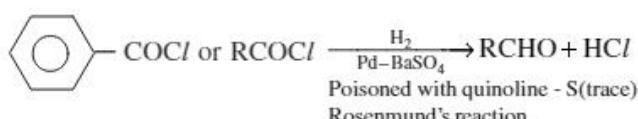
Oxidation of primary alcohols



Oxidation of methyl benzenes



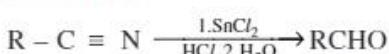
Reduction of acid chlorides



By heating a mixture of the calcium salts of formic acid and any one of its homologues.



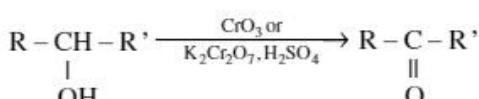
Stephen's Method



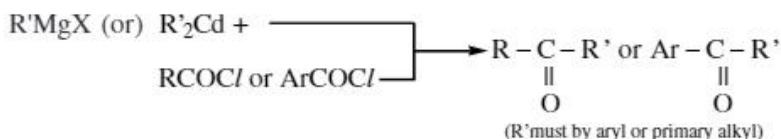
H_2O (Hydrolysis of intermediate) $\text{RCH} = \text{NH}$ to RCHO and NH_3

Preparation of Ketones

Oxidation of Secondary alcohols



Reaction of acid chlorides with organocadmium compounds



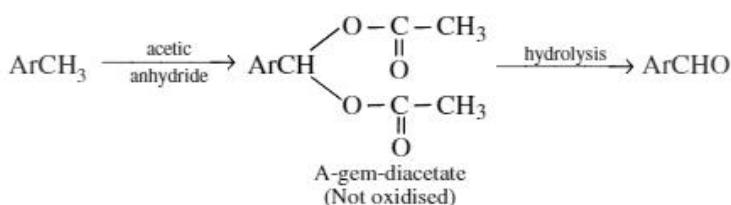
By heating the calcium salt of any monocarboxylic acid other than formic acid



Preparation of aldehydes by oxidation methods

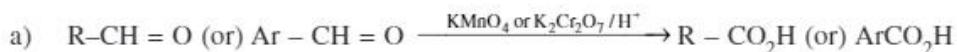
Aldehydes are easily oxidised to carboxylic acids by the same reagent acidic dichromate, in their syntheses. Hence, removal of aldehyde as fast as it is formed is to be accomplished. So it is best to use P.C.C. in CH_3Cl a selective reagent that does not further oxidise the aldehydes to the acids.

In the case of toluene, oxidation of the side chain can be interrupted by trapping the aldehyde in the form a non-oxidisable derivative, the gem-diacetate, which can be isolated and then hydrolysed.



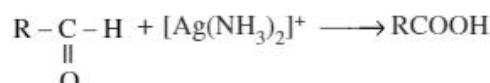
Reactions of Aldehydes and Ketones

Oxidation



b) Tollen's Reagent

A specific oxidant for RCHO is $[\text{Ag}(\text{NH}_3)_2]^+$

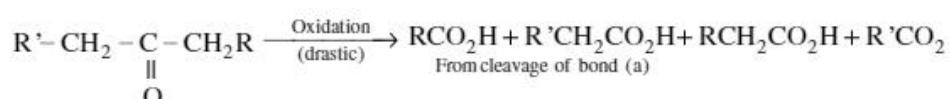


Tollen's test chiefly is used for the detection of aldehydes.

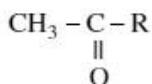
Tollen's reagent does not attack carbon-carbon double bonds.

c) Strong Oxidants

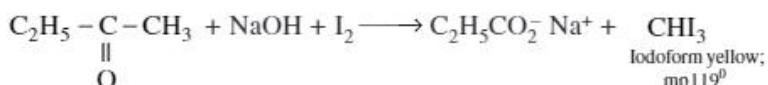
Ketones resist mild oxidation, but with strong oxidants at high temperature they undergo cleavage of $\text{C}-\text{C}$ bonds on either sides of the carbonyl group.



d) Haloform Reaction

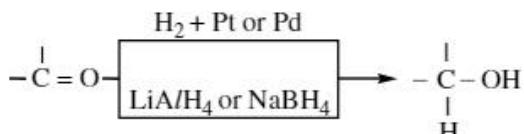


are readily oxidised by NaOI (NaOH + I₂) to iodoform, CHI₃, and RCO₂Na



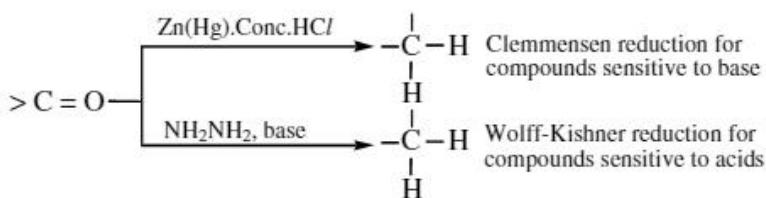
Reduction

a) Reduction to alcohols



Aldehydes → 1° alcohols; Ketones → 2° alcohols

b) Reduction to hydrocarbons



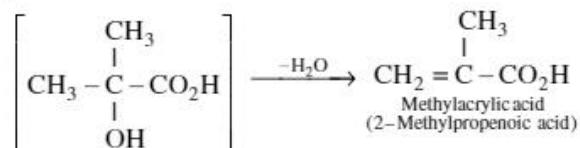
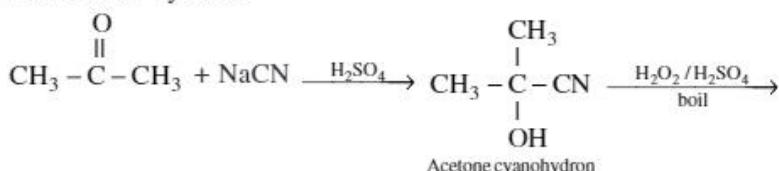
Addition reactions of Carbonyl Compounds

The C of the carbonyl group is electrophilic

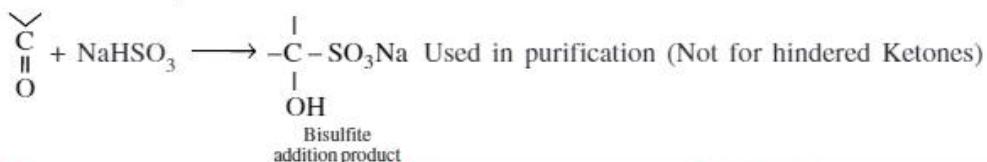


and initially forms a bond with the nucleophile

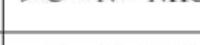
a) Addition of cyanide



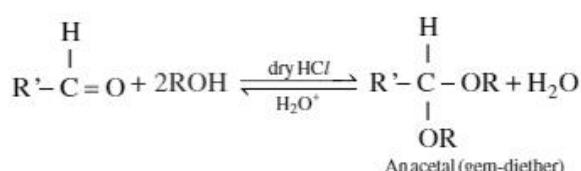
b) Addition of bisulphite



c) Addition of derivative of ammonia

	H ₂ N – G	Product	
H ₂ NOH	Hydroxylamine	> C = N – OH	Oxime
H ₂ N – NH ₂	Hydrazine	> C = N – NH ₂	Hydrazone
H ₂ N – NH – C ₆ H ₅	Phenylhydrazine	> C = N – NHC ₆ H ₅	Phenylhydrazone
H ₂ N – NH – C – NH ₂ O	Semicarbazide	> C = N – NHCONH ₂	Semicarbazone
	2, 4-Dinitrophenylhydrazine		2, 4-dinitrophenylhydrazone (bright orange or yellow precipitate used for identifying aldehydes and ketones)

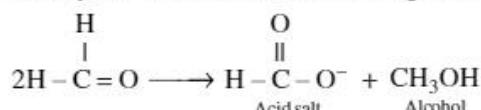
d) Addition of Alcohols: Acetal Formation



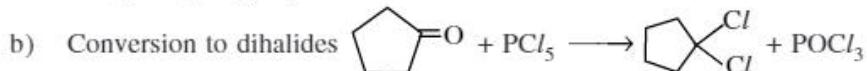
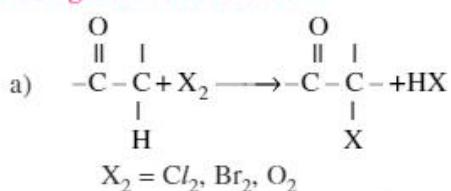
In H_3O^+ , RCHO is regenerated because acetals undergo acid catalyzed cleavage much more easily than ethers do. Since acetals are stable in neutral or basic media, they are used to protect the $-\text{CH} = \text{O}$ group.

Disproportionation; Cannizzaro Reaction

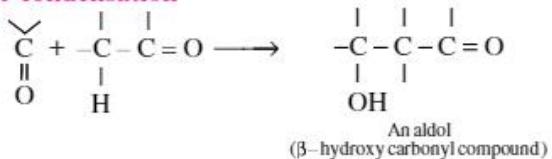
Aldehydes with no H on C undergo self-redox reaction in hot concentrated alkali:

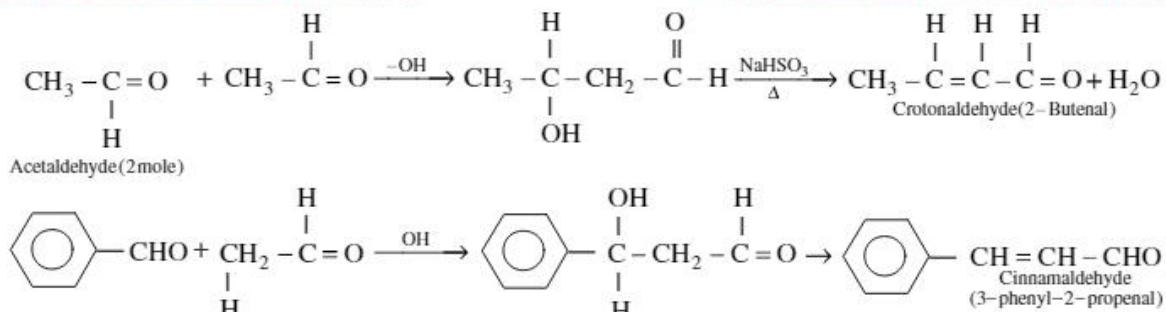


Halogenation of ketones

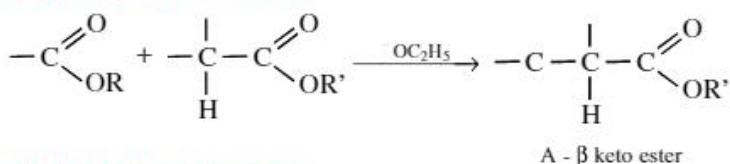


Aldol condensation





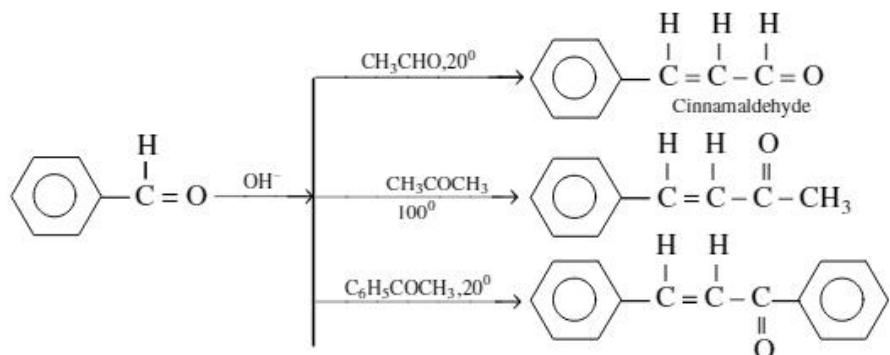
Claisen (Ester) Condensation:



Crossed Aldol Condensation

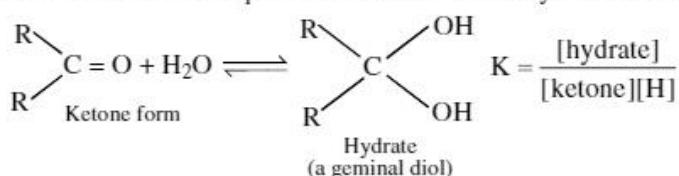
An aldol condensation between two different carbonyl compounds so called crossed aldol condensation – is not always useful as a mixture of four different possible products may be obtained.

Under certain condition, a good yield of a single product can be obtained from a crossed aldol condensation. One reactant contains no α -hydrogens and therefore is incapable of condensing with itself (eg. Aromatic aldehydes or formaldehyde).



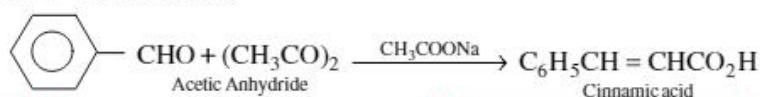
Nucleophilic Addition of water: Hydrogen of Ketones and aldehydes

In an aqueous solution, a ketone or an aldehyde is in equilibrium with its hydrate, a geminal diol. With most ketones the equilibrium favors the unhydrated keto form of the carbonyl.

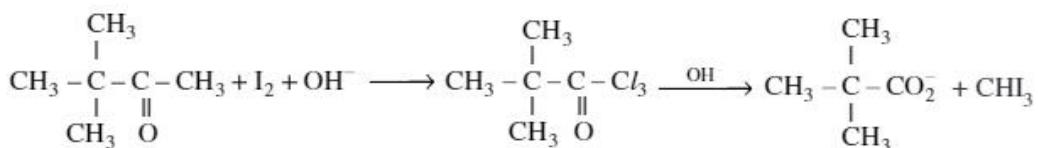
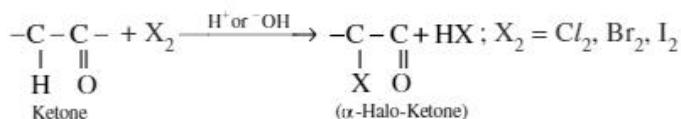


Reactions related to the Aldol Condensation

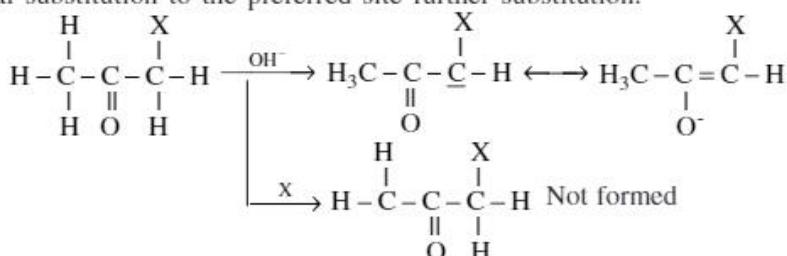
A Perkin Condensation



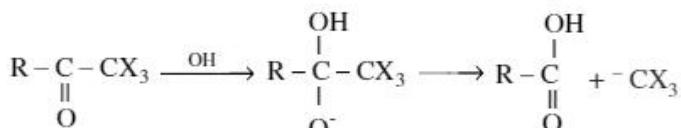
Halogenation of Ketones



The Haloform Test depends upon the fact that the three hydrogens on the same carbon atom are successively replaced by halogen. Taking acetone as an example we see that the carbon that suffers the initial substitution to the preferred site further substitution.



Electron withdrawal by halogen makes hydrogens on the carbon to which halogen has already become attached more acidic and hence more ready removed by base to give further substitution.



Electron withdrawal by three halogens makes CX_3^- comparatively weakly basic (for a carbanion) and hence a good leaving group.

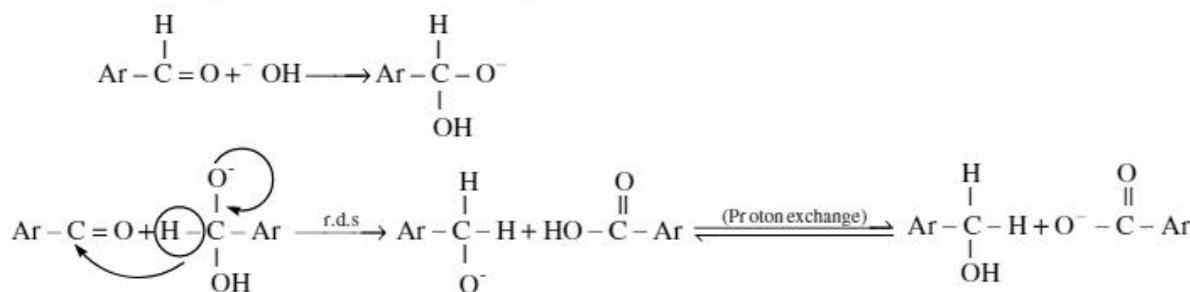
Thus both essential aspects of the haloform reaction — regiospecificity of halogenation and cleavage — are controlled by the same factor; stabilization of a carbanion through electron withdrawal.

Cannizzaro Reaction

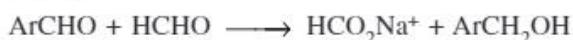
In the presence of concentrated alkali, aldehydes containing no α -hydrogens undergo self-oxidation and reduction to yield a mixture of an alcohol and a salt of a carboxylic acid. This reaction is known as Cannizzaro-reaction.

Two successive additions are involved.

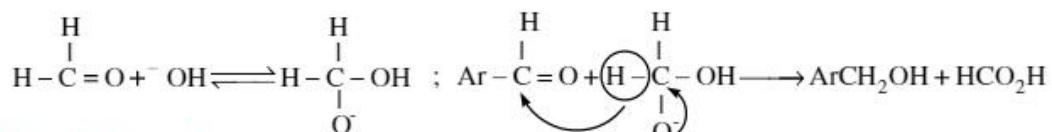
- Addition by hydroxide ion in first step
- Addition of hydride ion in the next step



This explains the Crossed Cannizzario reaction involving formaldehyde to take place in the way that it does.

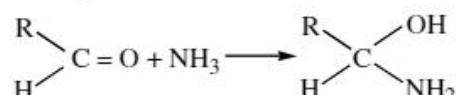


On both electronic and steric grounds, the step 1 is faster for HCHO. Hence becomes the hydride donor in the next step.



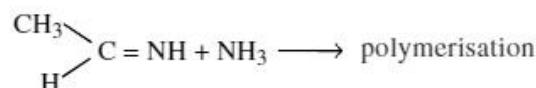
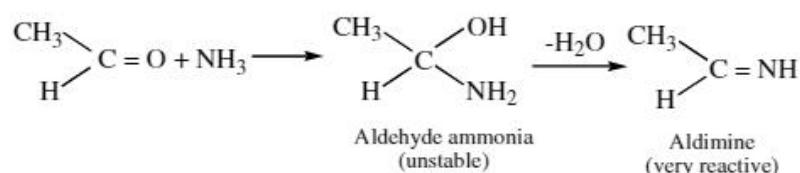
Addition of Ammonia

Aldehydes react with ammonia to form aldehyde ammonia

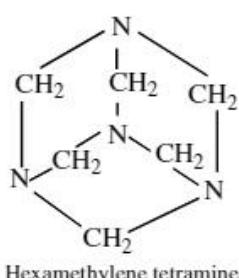
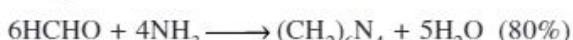


Aldehyde ammonia

The aldehyde amounts as unstable and lose water immediately to form aldimine. The dehydration product is not usually obtained because, in most cases, it immediately polymerises to form cyclic trimers.



When treated with ammonia, formaldehyde does not form an aldehyde – ammonia, but gives instead hexamethylenetetramine, used in medicine as an urinary antiseptic under the name Urotropine.

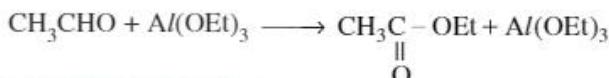


Hexamethylene tetramine

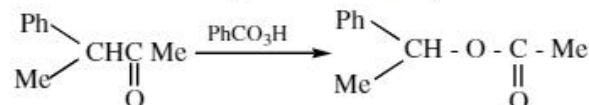
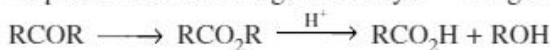
Ketones also give ketone-ammonia but these cannot be isolated. Acetone reacts slowly with ammonia to form acetone ammonia and then a complex compound.

Tischenko Reactions

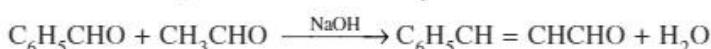
All aldehydes can be made to undergo the Cannizzaro reaction by treatment with *aluminium ethoxide*. Under these conditions the acids and alcohols are combined as the ester, and the reaction is then known as the Tischenko reaction; eg, acetaldehyde gives ethyl acetate, and propionaldehyde gives propyl propionate.

**Baeyer-Villiger oxidations**

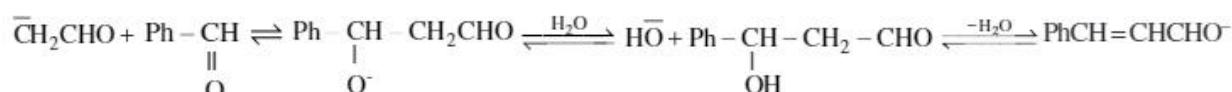
Aliphatic ketone undergo the baeyer – villiger oxidation to form esters or their hydrolysed products.

**Claisen Schmidt reaction**

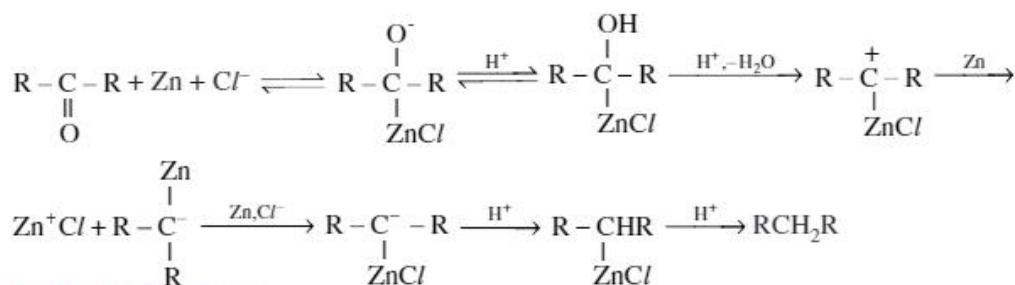
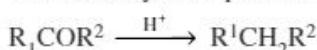
It is condensation between an aromatic aldehyde and an aliphatic aldehyde in presence of dilute alkali to form an A, B unsaturated compound.



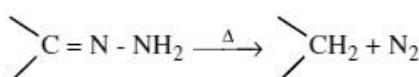
The Mechanism is Given Below

**Clemensen reduction**

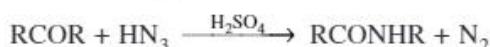
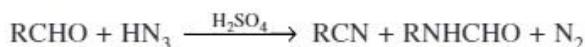
The carbonyl compounds are reduced with amalgamated zinc and conc. HCl

**Wolff kishner reduction**

When hydrazones (or semicarbazones) are heated with o^- et at 180°C nitrogen is eliminated and a hydrocarbon is obtained i.e. By this means carbonyl group is converted into methylene group.

**Schmidt reaction**

This is the reaction between a carbonyl compound and hydrazoic acid in presence of concentrated H_2SO_4 . Aldehydes gives a mixture of cyanide and formyl derivatives of primary amine whereas ketone gives amides.

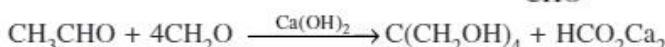
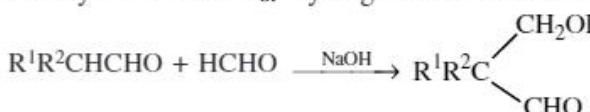


Condensation Reactions of Formaldehyde

Formaldehyde can participate in a crossed cannizzaro reaction.



Aldehydes with one α -hydrogen atom reacts as follow:

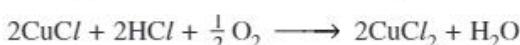


Acetaldehyde (ethanal) is prepared industrially:

- i) By the dehydrogenation or air oxidation of ethanol in the presence of silver catalyst at 300°C .



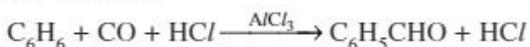
- ii) By passing a mixture of ethylene and oxygen, under pressure, into an aqueous solution of Pd and cupric chlorides at 50°C



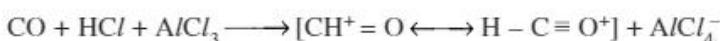
Acetaldehyde is a colourless, pungent smelling liquid, b.p, 21°C .

Gatterman-Koch Aldehyde Synthesis:

Benzaldehyde may be synthesized by bubbling a mixture of carbon-monoxide and hydrogen chloride through a solution of nitrobenzene or either containing benzene and a catalyst of AlCl_3 and small amount of cuprous chloride.



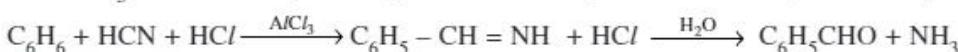
The mechanism of this reaction is uncertain, but it appears likely that the formyl cation is the active species.



It also appears likely that the cuprous chloride forms a complex with the CO, thereby increasing its local concentration.

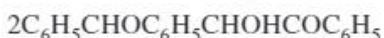
The Gatterman - Koch aldehyde synthesis is not applicable to phenols and their ethers, or when the substituent is strongly deactivating eg. nitrobenzene.

Gattermann Aldehyde Synthesis: When benzene is treated with a mixture of HCN and HCl in the presence of AlCl_3 , and the complex so produced decomposed with water, benzaldehyde is produced.



Benzoin Condensation:

When refluxed with aqueous ethanolic potassium cyanide benzaldehyde forms benzoin.



Analysis of aldehydes and ketones

Aldehydes and ketones are characterized through the addition to the carbonyl group of nucleophilic reagents, especially derivatives of ammonia. All aldehyde or ketone will, for example react with 2,4-dinitrophenylhydrazine to form an insoluble yellow or red solid.

Aldehydes are characterized, and in particular are differentiated from ketones through their ease of oxidation: aldehydes give a positive test with Tollen's reagent; ketones do not.

Aldehydes are also, of course, oxidized by many other oxidizing agents: by cold, dilute, neutral KMnO_4 and by CrO_3 in H_2SO_4 .

A highly sensitive test for aldehydes the Schiff test. An aldehyde reacts with the fuachin aldehyde reagent to form a characteristic magenta colour.

Aldehydes and ketones are generally identified through the melting points of derivatives like 2,4-dinitrophenylhydrazones, oximes, and semicarbazones.

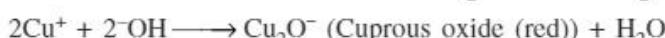
Methyl Ketone are characterized through the iodoform test.

Aldehydes can be oxidised by Fehling's solution.

Fehling's solution, an alkaline solution of cupric ion complexed with tartarate ion (or *Benedict's solution*, in which complexing is with citrate ion); the deep-blue color of the solution is discharged, and red cuprous oxide precipitates.

Fehling's solution is made by mixing, Fehling A solution, which contains copper sulphate,

Fehling B solution, which contains sodium hydroxide and Rochelle salt (Sodium Potassium Tartarate). During the oxidation of aldehydes to acids, the cupric ions are reduced to cuprous ions which are precipitated as red cuprous oxide.



LECTURE SHEET

EXERCISE-I

(*Nomenclature, Isomerism, General Methods of Preparation of Aldehyde, Ketones*)

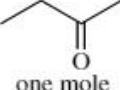
LEVEL-I (MAIN)

Straight Objective Type Questions

1. Which of the following is not a mono valent group?
1) Aldehydic 2) Ketonic 3) Carboxylic 4) Hydroxy
2. IUPAC name of a hydroxybutyraldehyde
1) 1-hydroxy butanal 2) 2-hydroxy butanol
3) 2-hydroxy butanal 4) 2-hydroxy butyraldehyde
3. $\text{CH}_3 - \text{CHO}$ and $\text{CH}_2 = \text{CHOH}$ are a pair of
1) Position isomers 2) Chain isomers 3) tautomers 4) metamers
4. Compound formed when a mixture of vapours of formic and acetic acid is passed over 'MnO' at 300°C is
1) Acetone 2) Acetaldehyde 3) Acetic anhydride 4) Aldol
5. The final product obtained when toluene is subjected to side chain chlorination followed by hydrolysis at 737 K is
1) Phenol 2) Benzaldehyde 3) Acetophenone 4) Chlorobenzene

6. The product formed in Gattermann-Koch benzal chloride reaction from benzene is
 1) Chlorobenzene 2) Benzal chloride 3) Benzaldehyde 4) Acetophenone
7. When ethyl alcohol is passed over red hot copper at 300°C the formula of the product formed is
 1) CH_3CHO 2) CH_3COCH_3 3) C_2H_4 4) CH_3COOH

Numerical Value Type Questions

8.  $\xrightarrow[\text{(ii)} \text{y moles NaNH}_2]{\text{(i)} \text{x moles PCl}_5}$ $\text{CH}_3 - \text{C} \equiv \text{C} - \text{CH}_3$, the sum, $x + y$ is
 one mole
9. How many of the following compounds will give haloform reaction.
 a) $\text{CH}_3\text{COOCH}_3$ b) CH_3CHO c) $\text{CH}_3\text{CH(OH)CH}_2\text{CH}_3$
 d) $\text{CH}_3\text{CH}_2\text{OH}$ e) $\text{C}_6\text{H}_5\text{COCH}_3$ f) $\text{CH}_3\text{COCOCH}_3$
 g) $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_3$ h)  i) CH_3COOH j) $\text{CH}_3\text{COCH}_2\text{COCH}_3$

LEVEL-II (ADVANCED)Straight Objective Type Questions

1. Rosemund's reduction is used for the preparation of
 a) Carboxylic acid b) aldehydes c) Esters d) Carbohydrates
2. CH_3CHO is obtained by the dehydrogenation of
 a) $\text{C}_2\text{H}_5\text{OH}$ b) CH_3Cl c) CH_3OH d) CH_3COCl
3. Acetyl chloride is reduced to Acetaldehyde by
 a) $\text{Na/C}_2\text{H}_5\text{OH}$ b) LiAlH_4 c) H_2/Ni d) $\text{H}_2/\text{Pd-BaSO}_4$
4. $(\text{CH}_3)_2\text{C} = \text{CHCOCH}_3 \xrightarrow[\text{HCl}]{(\text{CH}_3)_2\text{CO}}$ 'X'. Here 'X' is
 a) Mesityl oxide b) Phorone c) Acetic acid d) Mesitylene
5. Clemmenson reduction of aldehydes and ketones produce
 a) Alkenes b) Tertiary alcohols c) Alkanes d) Primary alcohols
6. Acetaldehyde reacts with chlorine to form
 a) Chloral b) Acetyl chloride c) Chloric acid d) Chloretone

More than One correct answer Type Questions

7. Consider the following reaction, $\xrightarrow{\text{NaIO}_4} \xrightarrow[\text{H}_2\text{O}]{\text{H}^+}$

The correct statement(s) regarding the above reaction is/are

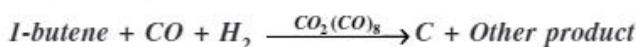
- a) It involves cleavage of sigma C – C bond
 b) Product is a dialdehyde
 c) Reaction proceeds via cyclic intermediate
 d) Optically active diastereomers of the above mentioned reactant behaves similarly in the same reaction

8. Consider the following reaction, $\text{CH}_3\text{CH}_2\text{CH}_2\text{COCl} \xrightarrow{?} \text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$. Reagent(s) that can bring about the above reaction successfully is/are
- Pd/BaSO₄
 - $[(\text{CH}_3)_2\text{CHO}]_3\text{AlI}$
 - $\text{Li}[(\text{CH}_3)_3\text{CO}]_3\text{Al/H}$ at -80°C
 - CuO/Heat
9. Preparation of benzaldehyde by Etard's reaction is not from
- Toluene
 - Ethylbenzene
 - Benzoyl chloride
 - Sodium benzoate

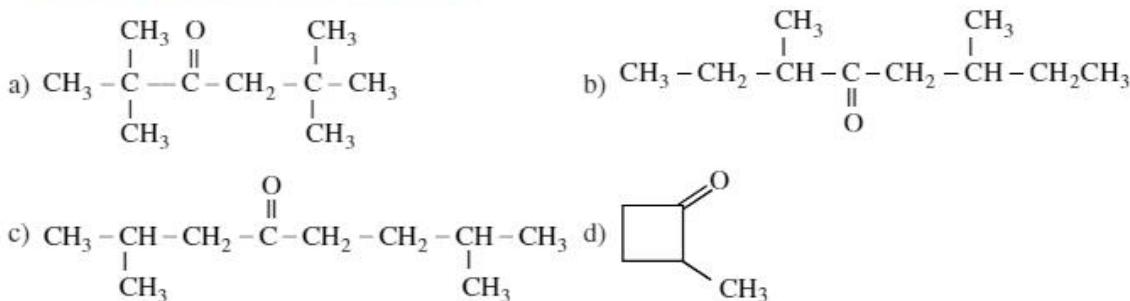
Linked Comprehension Type Questions*Passage :*

A hydrocarbon A($\text{C}_{10}\text{H}_{18}$) is capable of showing both enantiomerism as well as diastereomerism. Treatment of A either with $\text{HgSO}_4/\text{H}_2\text{SO}_4$ or $\text{B}_2\text{H}_6/\text{H}_2\text{O}_2 - \text{NaOH}$ results in the same carbonyl compound B.

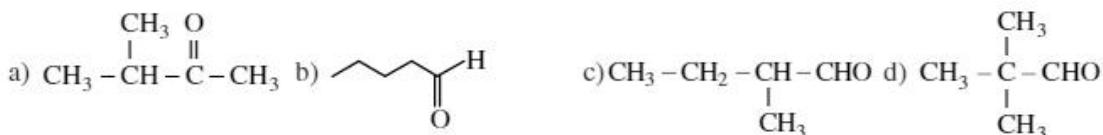
Also, $\text{A} \xrightarrow[\text{C}_2\text{H}_5\text{OH}(\text{dry})]{\text{Na}} \text{B} \xrightarrow[\text{Zn-H}_2\text{O}]{\text{O}_3} \text{C} (\text{C}_5\text{H}_{10}\text{O})$. C can also be obtained as one of the product in the following reaction.



10. What is the most likely structure of B?



11. What is the structure of compound C?



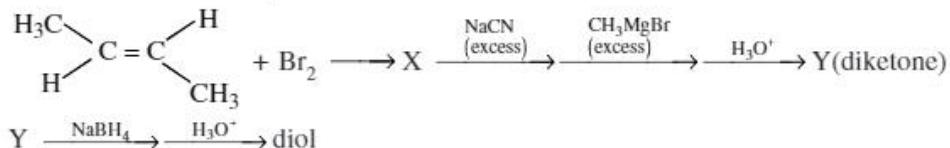
12. Consider the reaction given below, $\text{C} + \text{CH}_3\text{MgBr} \xrightarrow{\text{Et}_2\text{O}} \xrightarrow{\text{H}^+ \text{ H}_2\text{O}} \text{Alcohols}$. How many different alcohols are expected?

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

Integer Type Questions

13. How many different aldehyde isomers exist for $\text{C}_5\text{H}_{10}\text{O}$?
14. How many different ketones isomer exist for $\text{C}_6\text{H}_{12}\text{O}$?
15. If all the ketone isomers of $\text{C}_6\text{H}_{10}\text{O}$ are reduced independently with NaBH_4 . How many of them will produce racemic mixture of alcohols?

16. Consider the following reaction.



How many different diols are expected at the end of the above reaction?

EXERCISE-II

(General Characteristics - Physical Properties, Chemical Properties, Addition Reactions and Addition-elimination reactions)

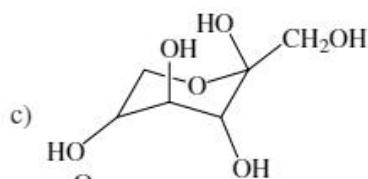
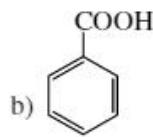
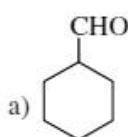
LEVEL-I (MAIN)

Straight Objective Type Questions

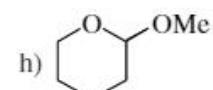
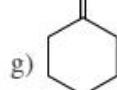
1. $(\text{CH}_3)_2\text{C} = \text{O} \xrightarrow{\text{Zn-Hg/ConHCl}} \text{X}$; Here 'X' is
 - 1) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2\text{OH}$
 - 2) $\text{CH}_3 - \text{CH}(\text{OH}) - \text{CH}_3$
 - 3) $\text{CH}_3 - \text{CH}_2 - \text{CHO}$
 - 4) $\text{CH}_3 - \text{CH}_2 - \text{CH}_3$
2. Metaldehyde is the product of the following?
 - 1) $4\text{CH}_3 - \text{CHO} \xrightarrow{\text{Conc. H}_2\text{SO}_4, 0^\circ\text{C}}$
 - 2) $\text{CH}_3 - \overset{\text{O}}{\underset{\parallel}{\text{C}}} - \text{CH}_3 \xrightarrow{\text{Conc. H}_2\text{SO}_4, \text{ roomtemp.}}$
 - 3) $3\text{CH}_3 - \text{CHO} \xrightarrow{\text{Conc. H}_2\text{SO}_4, \text{ roomtemp.}}$
 - 4) $\text{C}_6\text{H}_5 - \text{CHO} \xrightarrow{\text{Conc. H}_2\text{SO}_4}$
3. Which one of the following statement is wrong?
 - 1) ketones are good reducing agents
 - 2) aldehydes and ketones are Polar compounds
 - 3) aldehydes are more reactive than ketones
 - 4) aldehydes and ketones are reduced to alcohols
4. On reduction with LiAlH_4 a ketone gives
 - 1) 1° alcohol
 - 2) 2° alcohol
 - 3) 3° alcohol
 - 4) alkane
5. Mesitylene is obtained by the condensation of
 - 1) 3-moles of acetone
 - 2) 3-moles of acetaldehyde
 - 3) 2-moles of acetone
 - 4) 2-moles of acetaldehyde
6. Acetone when treated with chloroform form a condensation compound. It is
 - 1) Ketol
 - 2) Mesitylene
 - 3) Phorone
 - 4) Chloretone

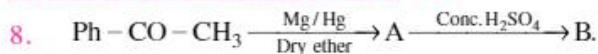
Numerical Value Type Questions

7. Which of the following will give positive Fehling's test



d) HCOOH



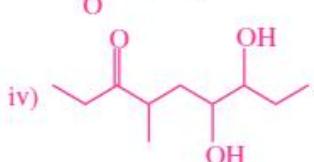
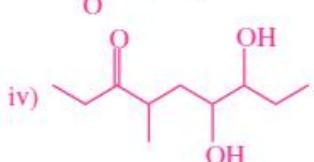
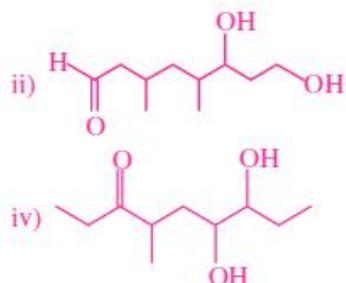
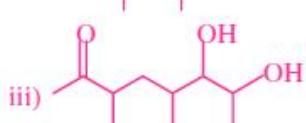
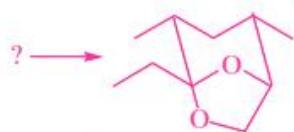


Double bond equivalent in compound 'B' formed is

LEVEL-II (ADVANCED)

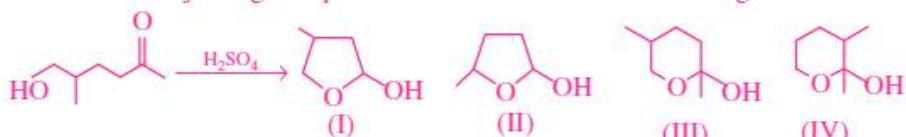
Straight Objective Type Questions

1. Which ketone-diol undergoes cyclisation to form the following acetal?



- a) Only i b) Only ii c) Only iii d) Only iv

2. What is the major organic product obtained from the following reaction?



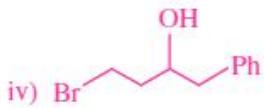
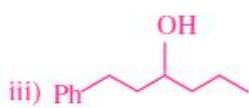
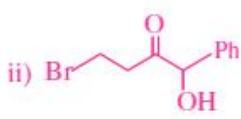
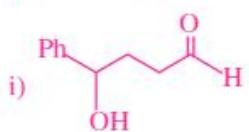
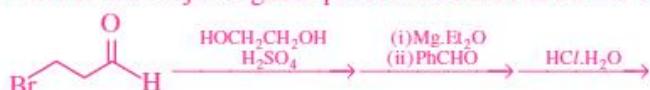
- a) Only I b) Only II c) Only III d) Only IV

3. What is the major organic product obtained from the following reaction?



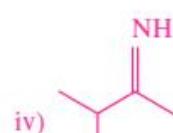
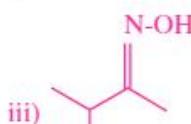
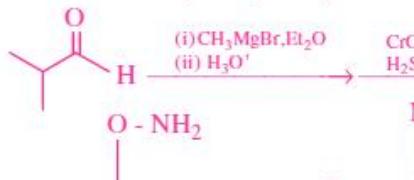
- a) 2-pentanone b) (E)-3-penten-2-ol
c) 2-pentanol d) 4-hydroxy-2-pentanone

4. What is the major organic product obtained from the following sequence of reaction?



- a) Only I b) Only II c) Only III d) Only IV

5. What is the major organic product obtained from the following sequence of reaction?



a) Only I

b) Only II

c) Only III

d) Only IV

6. Which of the following is the best description of the mechanism of the reaction between a ketone and an amine to form an imine?

a) Concerted bimolecular substitution

b) Nucleophilic addition followed by elimination

c) Elimination followed by nucleophilic addition d) Electrophilic addition followed by rearrangement

7. Compound which does not give stereoisomers on treatment with hydroxylamine is

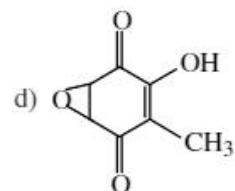
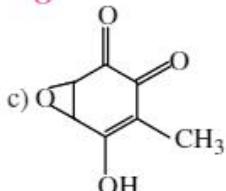
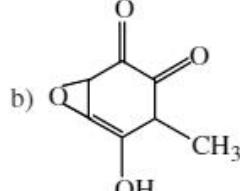
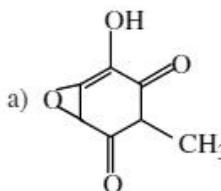
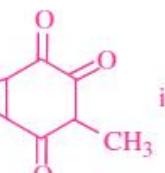
a) benzaldehyde

b) acetophenone

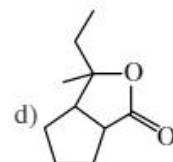
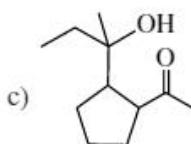
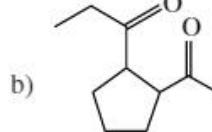
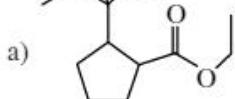
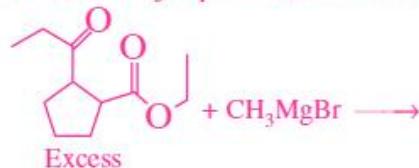
c) benzophenone

d) 2-butanone

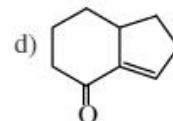
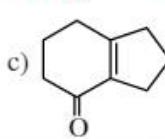
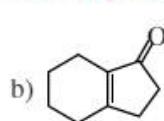
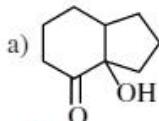
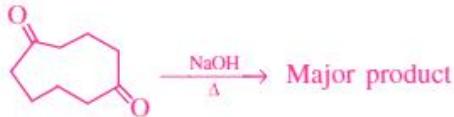
8. The most stable enol form of the compound is



9. Which is major product in the following reaction?



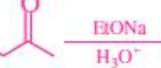
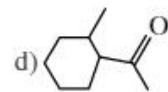
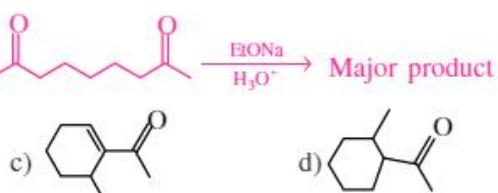
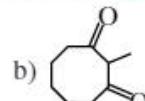
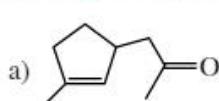
10. Give the product of the following reaction.



11. Which of the following reagent could be used to differentiate the following compounds by a visible change? 2-butanone and propanoic acid

- a) $[\text{Ag}(\text{NH}_3)_2]^+/\text{OH}^-$ b) LiAlH_4 c) $\text{KMnO}_4/\text{H}^+/\text{cold}$ d) NaHCO_3

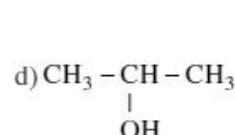
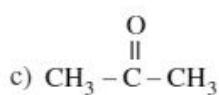
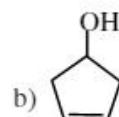
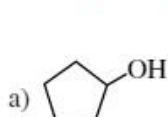
12. The major product of the following reaction is



More than One correct answer Type Questions

13. Consider the following reaction,

The organic product(s) formed above is/are



14. Consider the reaction given below,

The correct observation regarding the above reaction is/are

- a) Precipitate formation takes place
 b) Racemic mixture of salts are formed
 c) Salts on acid hydrolysis gives back the original reactant
 d) If NaHSO_3 is in limited amount, no precipitation occur

15. Consider the following reaction,

The correct deduction(s) regarding mechanism of the above reaction is/are

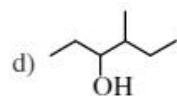
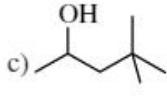
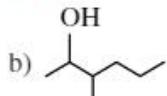
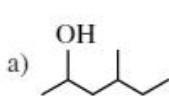
- a) Reaction involves nucleophilic addition at carbonyl carbon
 b) Ketone are more reactive than aldehyde
 c) If carbonyl carbon turns chiral, racemic mixture of products is formed provided no other chiral carbon is present
 d) If the intermediate aluminium salt is hydrolysed with $\text{DCl} - \text{D}_2\text{O}$, deuterated alcohol ($\text{R} - \text{OD}$) is formed.

Linked Comprehension Type Questions

Passage :

An organic compound A($\text{C}_7\text{H}_{16}\text{O}$) shows both enantiomerism and diastereomerism. Treatment of a pure enantiomer of A with $\text{Na}_2\text{CrO}_4/\text{Dil. H}_2\text{SO}_4$ gives B($\text{C}_7\text{H}_{14}\text{O}$). Also A on dehydration with concentrated H_2SO_4 gives a single alkene C(C_7H_{14}). Ozonolysis of C followed by work-up with $\text{Zn-H}_2\text{O}$ gives D($\text{C}_5\text{H}_{10}\text{O}$) as one of the product which gives racemic mixture on reduction with NaBH_4 .

16. The structure of A satisfying the above criteria is



17. If B is reduced with LiAlH_4 followed by acid hydrolysis will give

- a) a pure enantiomer b) a racemic mixture c) a pair of diastereomers d) an achiral alcohol

18. The correct statement regarding the compound D is

- a) With CH_3MgBr followed by acid hydrolysis gives racemic mixture
 b) With $\text{CH}_3\text{CH}_2\text{CH}_2\text{MgBr}$ followed by acid hydrolysis gives racemic mixture
 c) With $\text{CH}_3\text{CH}_2\text{MgBr}$ followed by acid hydrolysis gives racemic mixture
 d) Both (b) and (c) are correct

Integer Type Questions

19. Consider the isomeric aldehydes with molar mass 100, if all the isomers (only structural) are treated independently with NH_2OH , how many of them would give more than two stereomeric oximes?
20. When formaldehyde reacts with ammonia, a typical compound called hexamethylene tetramine is formed. How many six membered rings are present in this compound?
21. The smallest acyclic ketone that gives pair of diastereomers with CH_3NH_2 in slightly acidic medium has how many carbon atoms?

❖ EXERCISE-III ❖

*(Substitution Reactions, Reduction Reactions, Oxidation Reactions,
Test for Aldehydes-Ketones)*

LEVEL-I (MAIN)

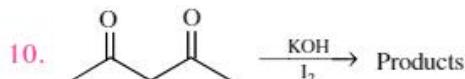
Straight Objective Type Questions

- $\text{R-CHO} + 4[\text{H}] \xrightarrow{\text{Zn-Hg/conc.HCl}} \text{R-CH}_3 + \text{H}_2\text{O}$ is
 - Wurtz's reaction
 - Clemmenson reduction
 - Wolf-Kishner reduction
 - Friedel-Craft's alkylation
- Silver mirror test is for
 - Amines
 - Thioalcohols
 - Ethers
 - Aldehyde
- Fehling's solution is
 - Acidified copper sulphate solution
 - Copper sulphate and sodium hydroxide + Rochelle salt
 - Ammonical cuprous chloride solution
 - Ammonical AgNO_3 solution
- Which statement is incorrect regarding acetaldehyde and acetone?
 - Both reduce ammonical silver nitrate to silver
 - Both react with hydroxylamine to form oximes
 - Both react with hydrazine to form hydrazones
 - Both react with sodium bisulphite to form addition product

5. Which of the following reagent is used to identify carbonyl group from other functional groups?
- Schiff's reagent
 - Fehling solution
 - 2, 4 dinitro phenyl hydrazine
 - Tollen's reagent
6. Ethanal and propanone can be distinguished by
- Hydroxyl amine
 - Tollen's reagent
 - Solubility in water
 - HCN
7. Which one of the following reagents reacts with both acetaldehyde and acetone?
- Fehling's solution
 - Grignard reagent
 - Schiff's reagent
 - Tollen's reagent
8. $\text{C}_2\text{H}_5\text{CHO}$ and CH_3COCH_3 can be distinguished from one another by testing with
- Phenyl hydrazine
 - 2,4-dinitrophenyl hydrazine
 - Fehling solution
 - Sodium bisulphite

Numerical Value Type Questions

9. The number of compounds theoretically possible for the formula $\text{C}_3\text{H}_6\text{O}$ excluding stereo isomers



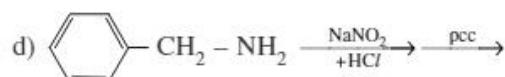
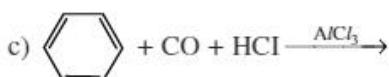
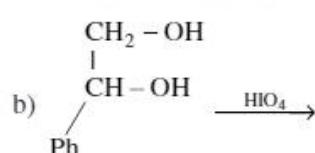
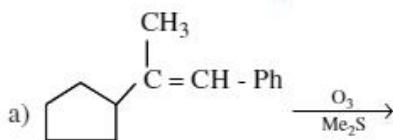
The number of iodoform molecules produced per molecule of the reactant in above reaction is/are

LEVEL-II (ADVANCED)**Straight Objective Type Questions**

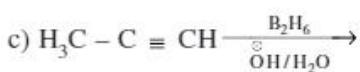
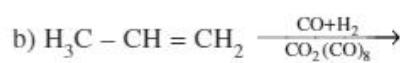
1. Tollen's reagent used for the distinction of aldehydes with ketones is
- $\text{Pb}(\text{NO}_3)_2 - \text{NH}_3\text{(aq)}$
 - $\text{Cu}(\text{NO}_3)_2 - \text{NH}_3\text{(aq)}$
 - $\text{AgNO}_3 - \text{NH}_3\text{(aq)}$
 - Cu (ii) citrate - $\text{NH}_3\text{(aq)}$
2. A hydrocarbon X on treatment with O_3 followed by the reduction of ozonide with $\text{Zn} - \text{H}_2\text{O}$ gives Y. Y gives both Tollen's test as well as yellow precipitate with NaOH/I_2 solution. Which is a possible structure of X?
- a) b) c) d)
3. Which compound given below does not form red precipitate with ammoniacal solution of Cu(ii) tartarate?
- H_2CO
 - $\text{C}_6\text{H}_5\text{CHO}$
 - CH_3CHO
 - $\text{CH}_3 - \text{C} \equiv \text{CH}$
4. Which reagent can differentiate between benzaldehyde and acetophenone?
- $[\text{Ag}(\text{NH}_3)_2]^+$
 - NaOH/I_2
 - $[\text{Cu}(\text{NH}_3)_4]^{2+}$
 - Both (a) and (b)
5. Reagent that can differentiate 2-propanol from acetone is
- NaOH/I_2
 - $[\text{Ag}(\text{NH}_3)_2]^+$
 - $\text{Ce}(\text{NO}_3)_4$
 - $[\text{Cu}(\text{NH}_3)_4]^{2+}$
6. Which reagent given below can differentiate propanal from propanone?
- Schiff's reagent
 - NaHSO_3
 - 2,4-dinitrophenyl hydrazine
 - NaCN/HCN

More than One correct answer Type Questions

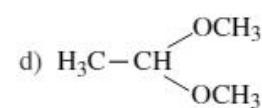
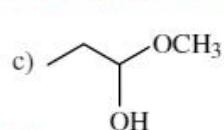
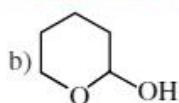
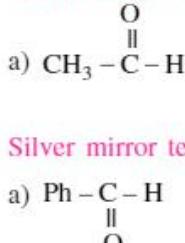
7. Which of the following reactions can produce benzaldehyde as major product?



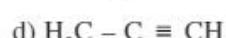
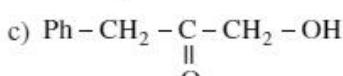
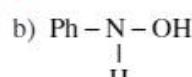
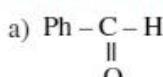
8. Which of the following reactions will produce aldehyde?



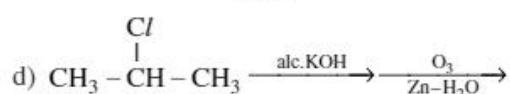
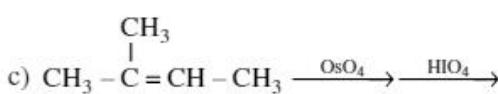
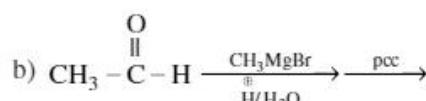
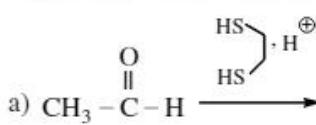
9. Which of the following compounds will give positive Tollen's test?



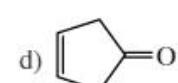
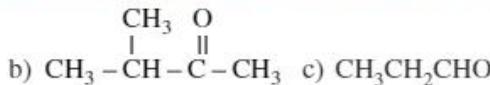
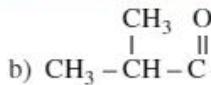
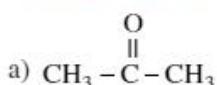
10. Silver mirror test with Tollen's reagent is given by



11. Which of the following reactions would give identical product?



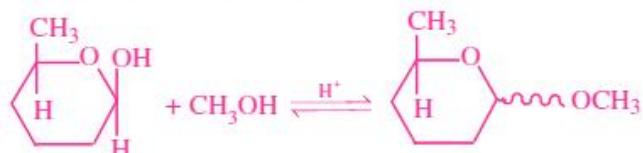
12. Which of the following has (have) more than one enol tautomers?



13. The correct statement(s) regarding hydrates of aldehyde and ketone is/are

- a) Usually hydrates have lower thermodynamic stability than anhydrous form
- b) Hydrate content of acetone is greater in water than in hexane
- c) CH_3CHO when treated with H_2O^{18} in acidic medium, gets converted into $\text{CH}_3\text{CHO}^{18}$
- d) $\text{C}_6\text{H}_5\text{CHO}$ has greater hydrate content than p-nitrobenzaldehyde

14. Consider the reaction below,

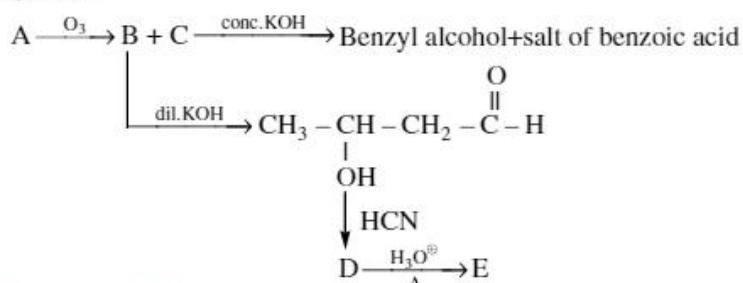


The correct statement(s) regarding the above process is/are

- a) Equilibrium favours product
- b) Pair of enantiomers of acetals are formed
- c) Pair of diastereomers of acetals are formed
- d) Equilibrium favours reactant

Linked Comprehension Type Questions

Passage-I :



15. Structure of A is:

- a) $\text{H}_2\text{C} = \text{CH} - \text{CHO}$
- b) $\text{Ph} - \text{CH} = \text{CH} - \text{CH}_3$
- c) $\text{Ph} - \underset{\substack{| \\ \text{CH}_3}}{\text{C}} = \text{CH}_2$
- d) $\text{Ph} - \underset{\substack{| \\ \text{CH}_3}}{\text{CH}} = \text{C} - \text{CH}_3$

16. Structure of (B) and (C) differentiated by:

- a) Tollen's reagent
- b) Fehling solution
- c) 2,4-DNP
- d) NaHSO_3

17. Structure of E is :



Passage-II :

In general, ketones are less reactive than aldehydes in nucleophilic addition reaction, for both steric and electronic reasons. Hence, if a keto-aldehyde is treated with nucleophilic reagent, reaction occur first at aldehyde group.

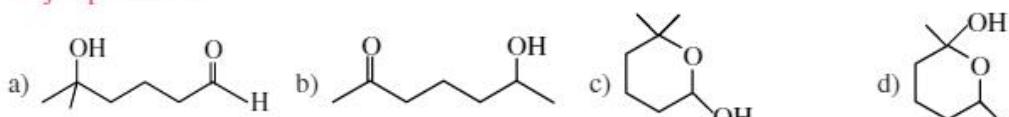
18. The major final product in the following reaction is
-
- a) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
 - b) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$
 - c) $\text{CH}_3\text{CH}_2\text{CH(OH)}\text{CH}_2\text{CHO}$
 - d) Mixture of (b) and (c)

19. How the following transformation can be best brought about?



- a) $\{(\text{CH}_3)_2\text{CHO}\}_3\text{Al}; \text{H}_3\text{O}^+$
- b) $\text{CH}_2 - \underset{\substack{| \\ \text{OH}}}{\text{CH}_2} ; \text{H}^+$ then NaBH_4 followed by H_3O^+
- c) $\text{H}_2/\text{Ni}; \text{high P and T}$
- d) $\text{N}_2\text{H}_4/\text{NaOH}/\text{Heat}$

20. Consider the reaction,  Major product is



Matrix Matching Type Questions

21. Match the reactants from Column I with the reagents and expected outcomes from Column II. Mark the correct option form the codes given below.

Column-I	Column-II
A) 	p) LiAl/H ₄ - racemic mixture of products.
B) 	q) [(CH ₃) ₂ CHO] ₃ Al - racemic mixture of products.
C) 	r) Zn(Hg) - HCl - suitable for selective reduction of carbonyl group
D) 	s) N ₂ H ₄ /NaOH/Heat - suitable for selective reduction of carbonyl group

Integer Type Questions

22. How many different enols exist for 4-methyl-3-hexanone?

23. If all the mono and dienols are considered, how many enols are possible of 2,4-pentanedione?

24. If butanone is treated with D_2O^{18}/DCl , isotopic exchange occur. What maximum gain in molecular mass is possible in the present case?

25. When acetaldehyde is treated with catalytic amount of H_2SO_4 , a stable association product X is formed. How many lone pair of electrons are present in X?

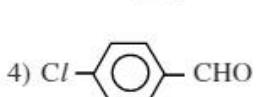
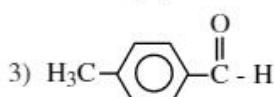
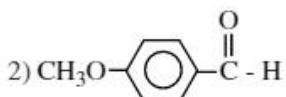
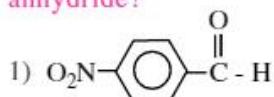
EXERCISE-IV

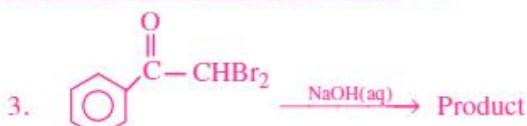
(Condensation reactions, Aldol, Cannizzaro, Beziot)

LEVEL-I (MAIN)

Straight Objective Type Questions

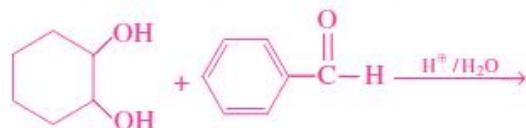
1. Which of the following compound would be most reactive for Perkin condensation with acetic anhydride?

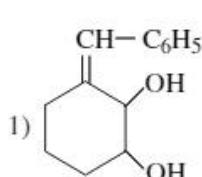
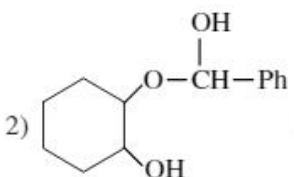
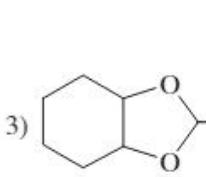


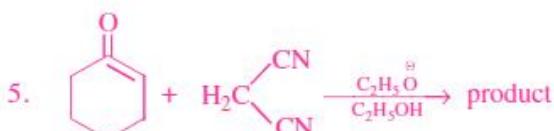


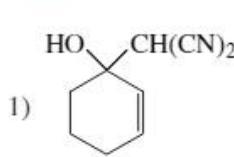
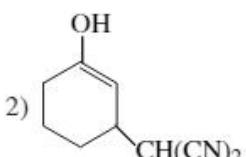
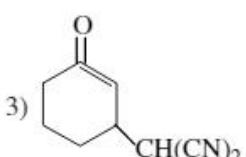
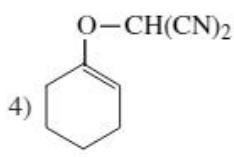
- 1) $\text{Br}_2\text{CH}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{O}^-$ 2) $\text{Ph}-\overset{\text{OH}}{\underset{\mid}{\text{CH}}}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{O}^-$ 3) $\text{Ph}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{H}$ 4) $\text{Ph}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{O}^- + \text{CH}_2\text{Br}_2$

4. What would be the major product of following reaction ?

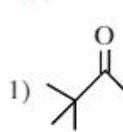
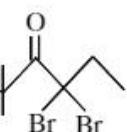
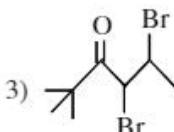
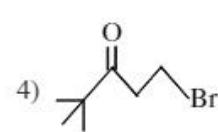


- 1)  2)  3)  4) No reaction



- 1)  2)  3)  4) 



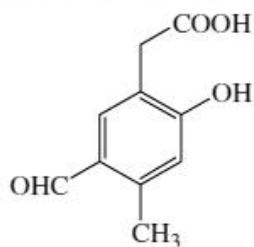
- 1)  + CHBr_3 2)  3)  4) 

Numerical Value Type Questions

7. How many of the following are more reactive than acetaldehyde towards nucleophilic addition?

FCH_2CHO , $\text{O}_2\text{NCH}_2\text{CHO}$, $\text{CH}_3\text{CH}_2\text{CHO}$, CH_3COCH_3 , PhCHO , PhCOCH_3

8. Number of moles of RMgX consumed per molecule with the following reactant is.



LEVEL-II (ADVANCED)

Straight Objective Type Questions

1. Acetone on reaction with chlorine normally gives

a) Mono chloro acetone	b) Dichloro acetone
c) Tri chloro acetone	d) Hexa chloro acetone
2. Which of the following compounds undergo Aldol condensation?

a) CH_3CHO	b) $(\text{CH}_3)_3\text{C-CHO}$	c) CCl_3CHO	d) HCHO
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3. Which of the following reagents can form a phenyl hydrazone with alkanone?

a) $\text{NH}_3^+ \text{OHCl}^-$	b) PhHNHN_2	c) $\text{NH}_2\text{NHCONH}_2$	d) HCN
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4. "Aldol condensation" can be answered by

A) HCHO	B) CH_3CHO	C) CCl_3CHO	D) $\text{C}_6\text{H}_5\text{CHO}$
a) All A,B,C,D	b) A, C, D only	c) B only	d) A and D only
5. An organic compound $\text{CH}_3\text{CH(OH)CH}_3$ on treatment with acidified $\text{K}_2\text{Cr}_2\text{O}_7$ gives compound 'Y' which reacts with I_2 and sodium carbonate to form triiodo methane. The compound 'Y' is

a) CH_3OH	b) CH_3COCH_3	c) CH_3CHO	d) $\text{CH}_3\text{CH(OH)CH}_3$
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6. Which statement is incorrect in the case of acetaldehyde and acetone ?

a) both react with HCN	b) both give Iodoform test
c) both react with NaOH to form polymer	d) both can be reduced into alcohols
7. A sample of acetaldehyde contained some ethyl alcohol as impurity. The reagent useful for the purification of CH_3CHO is

a) NaHCO_3	b) Na_2CO_3	c) NaHSO_3	d) PCl_5
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8. Which of the following types of groups will produce an oxime on reaction with NH_2OH ?

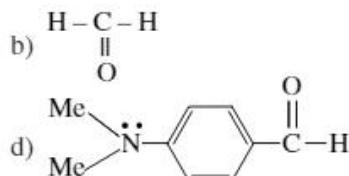
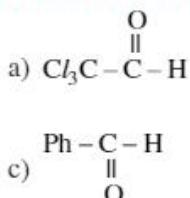
a) $\text{R}-\underset{\text{O}}{\overset{\parallel}{\text{C}}}-\text{OH}$	b) $\text{R}-\underset{\text{O}}{\overset{\parallel}{\text{C}}}-\text{H}$	c) $\text{R}-\underset{\text{O}}{\overset{\parallel}{\text{C}}}-\text{OCH}_3$	d) $\text{R}-\underset{\text{O}}{\overset{\parallel}{\text{C}}}-\text{NH}-\text{CH}_3$
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9. Among the following compounds which will react with acetone to give a product containing $>\text{C}=\text{N}-$

a) $\text{C}_6\text{H}_5\text{NHCOCl}$	b) $(\text{CH}_3)_2\text{N-CH}_3$	c) $\text{C}_6\text{H}_5\text{NNH}_2$	d) $\text{C}_6\text{H}_5\text{NHC}_6\text{H}_5$
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10. Which of the following is the main product formed when $\text{CH}_3\text{CHO}_{(g)}$ reacts with $\text{Cl}_{2(g)}$

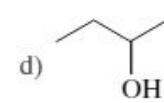
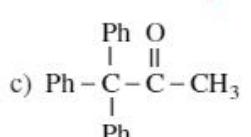
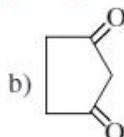
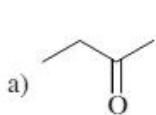
a) $\text{CH}_3-\overset{\text{Cl}}{\underset{\text{O}}{\overset{\parallel}{\text{C}}}}=\text{O}$	b) $\text{CH}_3-\overset{\text{Cl}}{\underset{\text{O}}{\overset{\parallel}{\text{C}}}}=\text{O}$	c) $\text{Cl}_3\text{C.CHO}$	d) CH_3CHCl_2
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More than One correct answer Type Questions

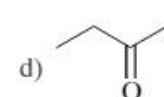
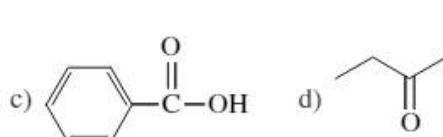
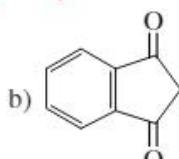
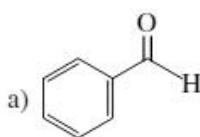
11. Which of the following do not give Cannizzaro reaction?



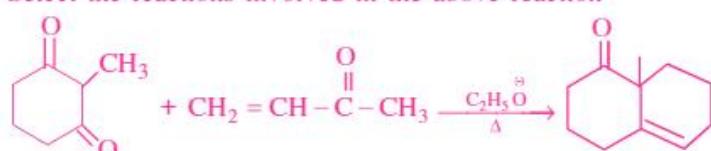
12. Which of the following yield yellow precipitate on reaction with I_2 and NaOH?



13. Which of the following compounds exhibit acid base reaction with NaOH?



14. Select the reactions involved in the above reaction



- a) Michael Addition
c) Dehydration

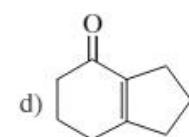
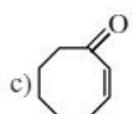
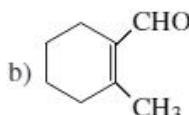
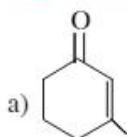
- b) Aldol Condensation
d) Perkin Condensation

15. A new C – C bond formation is possible in

- a) Aldol condensation
c) Clemmensen reduction

- b) Friedel-Crafts alkylation
d) Reimer-Tiemann reaction

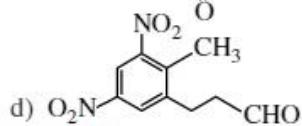
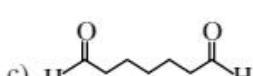
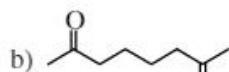
16. Which of the following compounds can be synthesized by intramolecular aldol condensation in very good yield?



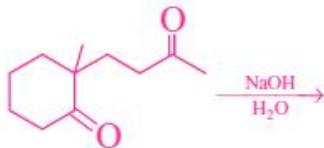
17. Which of the following is/are true regarding aldol condensation?

- a) Both acid and base can act as catalyst
b) A new carbon-carbon bond is always formed
c) CH_3CHO and $D_3C - CHO$ react at same rate if all other conditions are similar
d) Propanal and propanone react at same rate if all other conditions are similar

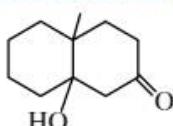
18. Which compound(s) below can react via an intramolecular aldol condensation to give a six membered ring?



19. What is (are) true about the following aldol reaction?



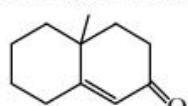
a) The major aldol is



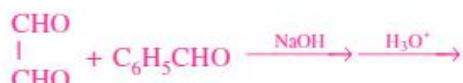
b) If a pure enantiomer of starting compound is taken, the racemic mixture of major aldol would be formed

c) Excluding stereoisomers, a total of three different aldol would be formed

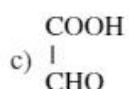
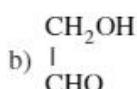
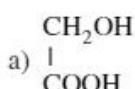
d) Major aldolon dehydration would give



20. Consider the cross Cannizaro reaction given below.

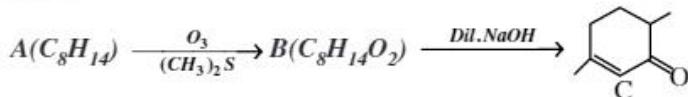


The expected product(s) is/are



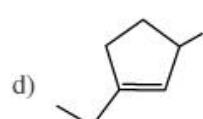
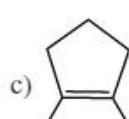
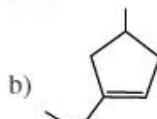
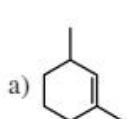
Linked Comprehension Type Questions

Passage :

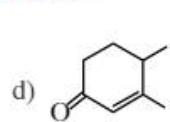
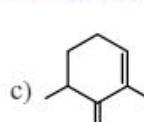
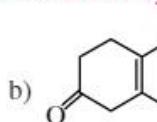
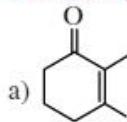


A is optically active and C is one of the several aldol possible in the above reaction.

21. The structure of A satisfying above criteria is



22. Besides C, the other six membered cyclic aldol formed in the above reaction is



23. The product B is stereomeric. If a mixture containing all stereoisomers of B is treated with excess of LiAlH₄ followed by the acidification will give how many different isomeric diols?

a) 2

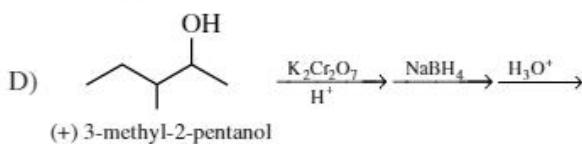
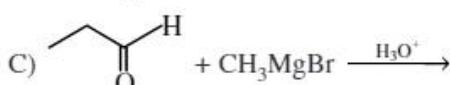
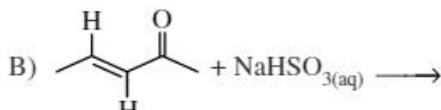
b) 4

c) 6

d) 8

Matrix Matching Type Questions

24. Match the reactions from Column-I with the properties of products form Column-II. Mark the correct option from the codes given below.

Column-I**Column-II**

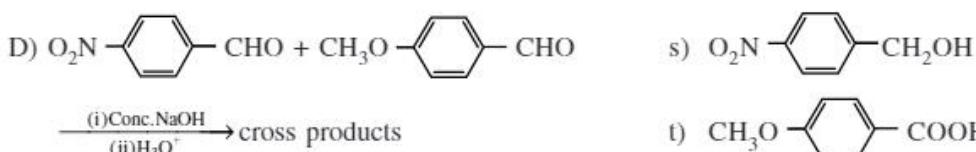
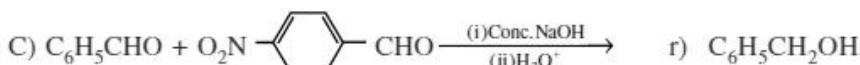
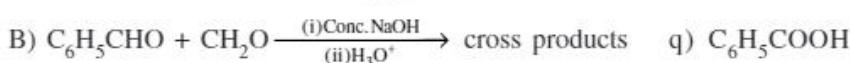
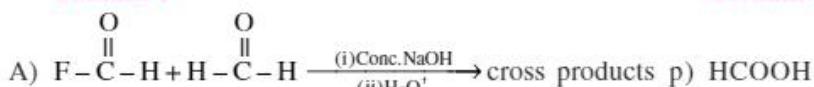
p) Racemic mixture

q) Pair of diastereomers

r) Meso isomer

s) Product mixture can be separated into
two fractions by chromatography

25. Consider the reactions of Column-I and match with the products of Column-II. Mark the correct option from the codes given below.

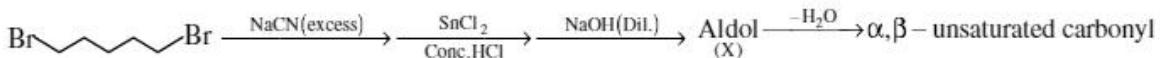
Column-I**Column-II*****Integer Type Questions***

26. Consider the following Cannizaro reaction, H₂CO + D-C-D $\xrightarrow[\text{(ii)} \text{H}_3\text{O}^+]{\text{(i)} \text{Conc. NaOH}}$
How many different products are formed?

27. Consider the following Cannizaro reaction, C₆H₅-C(H)-O + C₆H₅-C(D)-O $\xrightarrow[\text{(ii)} \text{H}_3\text{O}^+]{\text{(i)} \text{Conc. NaOH}}$
How many different products are expected in this reaction ?

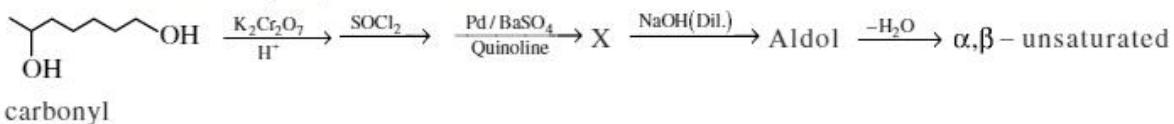
28. Consider the following sequence of reaction, CH₃CHO_(excess) + CH₃NO₂ $\xrightarrow{\text{NaOH}}$
How many ethanol, at the most, will react with one molecule of nitromethane?

29. Consider the following sequence of reaction,



How many different aldol isomers of X are formed?

30. Consider the following sequence of reaction,



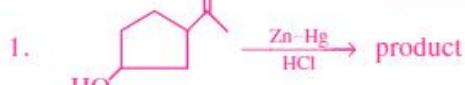
If all undehydrated aldols (X) formed above by intramolecular aldol condensation, are considered, how many pairs of enantiomers are formed?

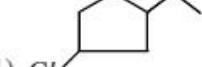
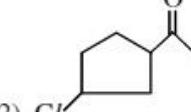
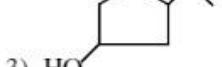
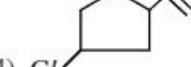
EXERCISE-V

(Polymerisation & other naming reactions - Knoevenagel reaction, Claisen-Schmidt Reaction, Schmidt Reaction, Reformatsky reaction, Tischenko Reaction)

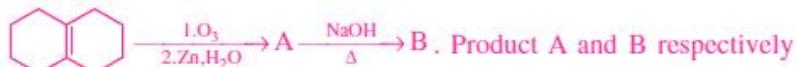
LEVEL-I (MAIN)

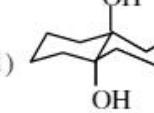
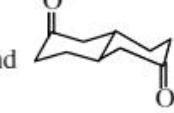
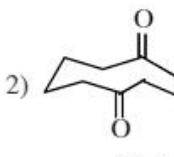
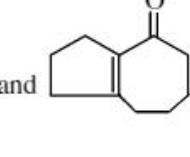
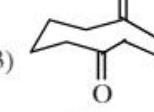
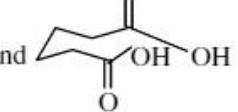
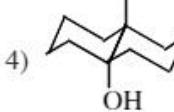
Straight Objective Type Questions

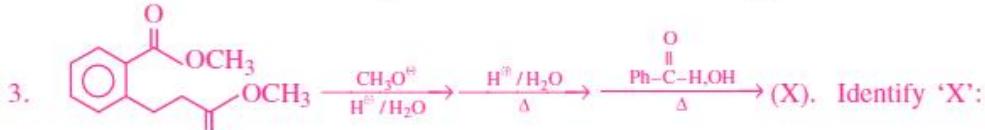


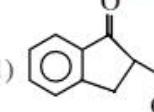
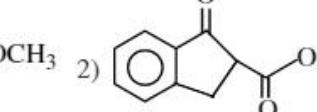
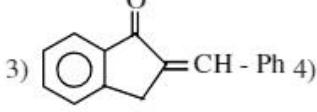
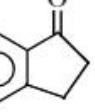
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 2) 
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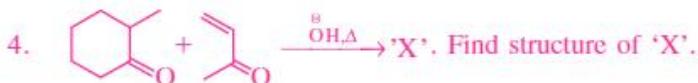
2. Consider the following sequence of reaction.

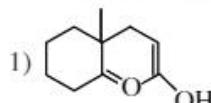
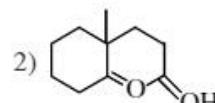
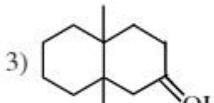
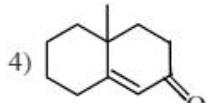


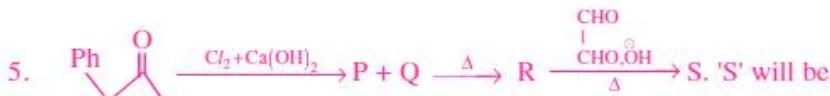
- 1)  and 
 2)  and 
 3)  and 
 4)  and 

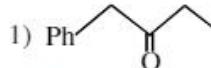
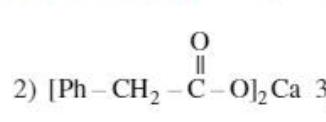
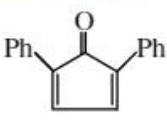
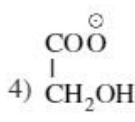


- 1) 
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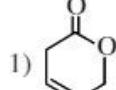
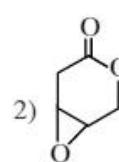
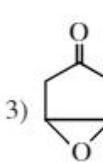
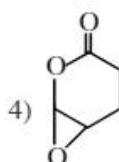


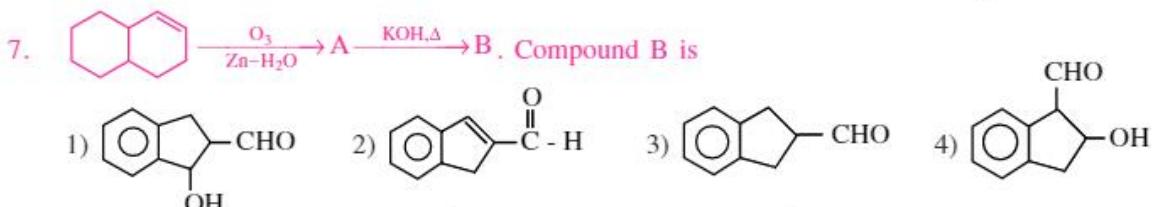
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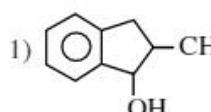
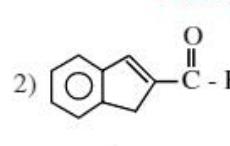
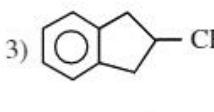
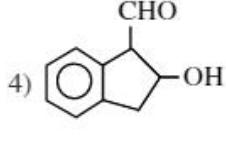


- 1)  2)  3)  4) 



- 1)  2)  3)  4) 

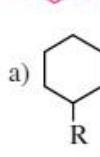
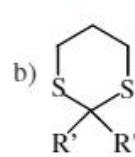
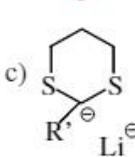
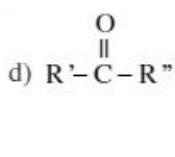


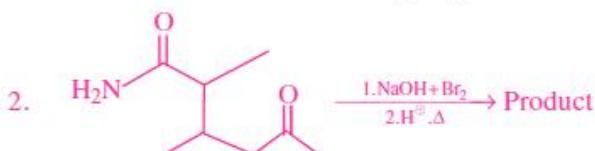
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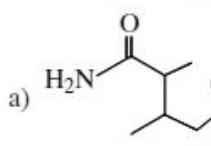
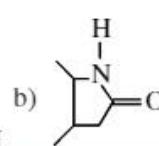
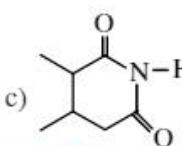
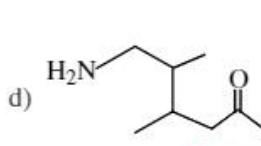
LEVEL-II (ADVANCED)

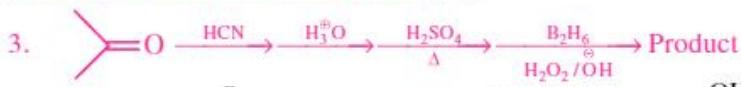
Straight Objective Type Questions

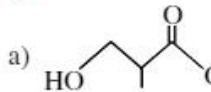
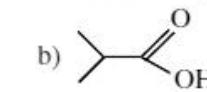
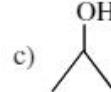
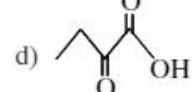


- a)  b)  c)  d) 

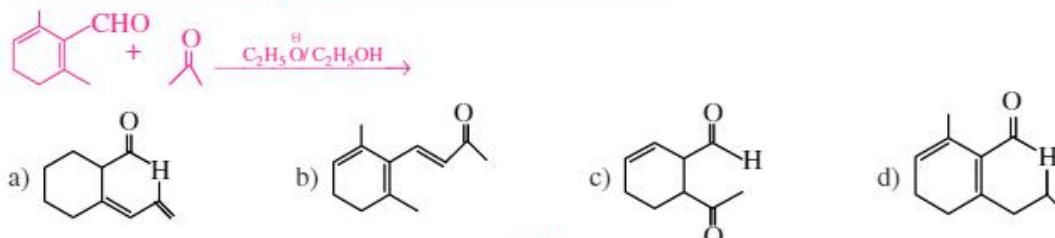


- a)  b)  c)  d) 

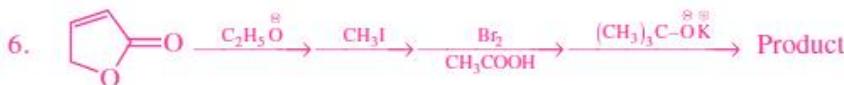
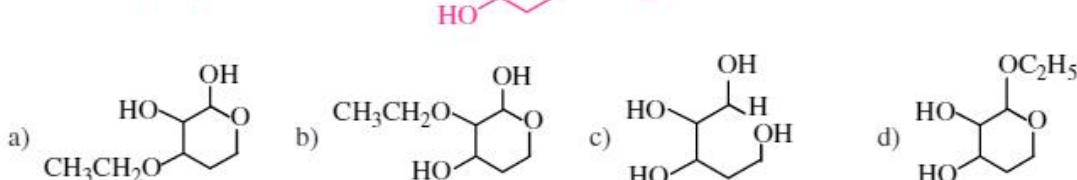


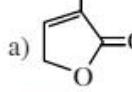
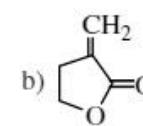
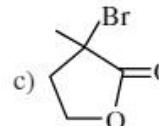
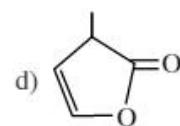
- a)  b)  c)  d) 

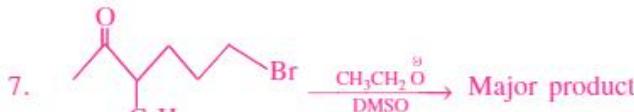
4. The structure of major product of following reaction is

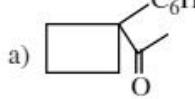
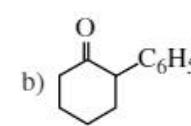
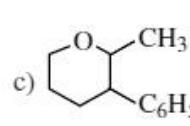
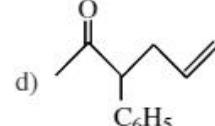


5. Find the major product of reaction:



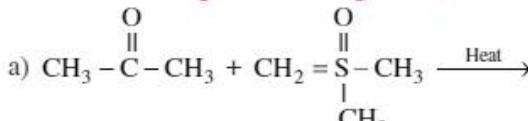
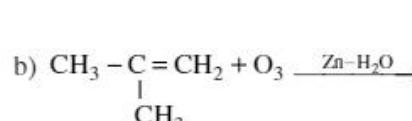
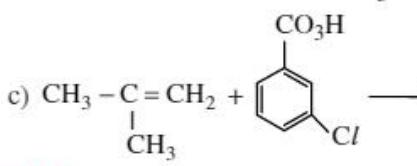
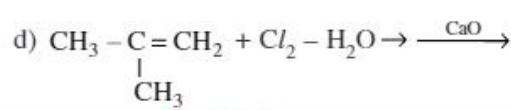
- a)  b)  c)  d) 



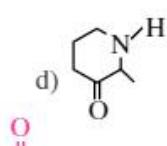
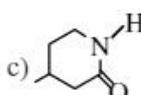
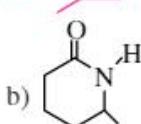
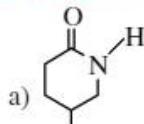
- a)  b)  c)  d) 

More than One correct answer Type Questions

8. Which reaction given below gives 2,2-dimethyl oxirane?

- a)  b) 
- c)  d) 

9. In the reaction given below,  + H₂N - OH $\xrightarrow{\text{Conc. H}_2\text{SO}_4}$ Expected product(S) is/are

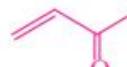
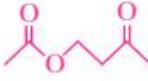


10. The correct statement (S) regarding the following reaction is/arr CH₃ - C = C₆H₅ $\xrightarrow{\text{CF}_3\text{CO}_2\text{H}}$

- a) Product is a benzoic acid ester
- b) Product is an acetic acid ester
- c) Ketone is oxidized
- d) Reaction involves migration of phenyl moiety onto oxygen atom

11. What is/are true about nucleophilic addition reaction at α , β - unsaturated carbonyl compound of type ?

- a) LiAlH₄ brings about addition at carbonyl carbon
- b) (CH₃)₂CuLi brings about addition at conjugate (olefinic) position
- c) CH₃Li brings about conjugate (olefinic) addition
- d) CH₃NH₂ brings about conjugate (olefinic) addition

12. Consider the following reaction,  + CH₃COOH \longrightarrow 

The correct statement(S) regarding mechanism of the above reaction and the reaction outcome is/are

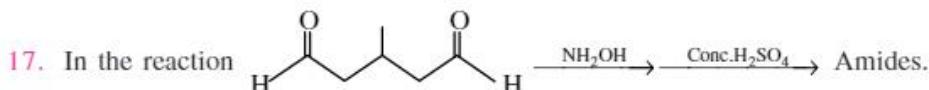
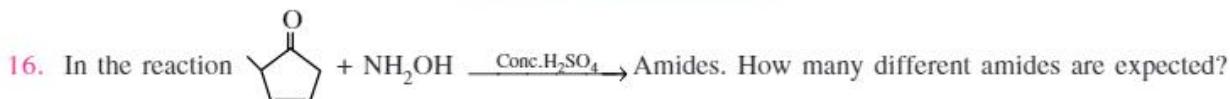
- a) The indicated product is major one
- b) The reaction proceeds by nucleophilic attack of acid at protonated carbonyl at conjugate position
- c) some aldol product is also formed
- d) Some cyclic ester is also formed

Linked Comprehension Type Questions

Passage :

A chemist treated a compound X with NaOH in presence of acetone as solvent. However, it recovered the starting material as such, and instead isolated a small amount of the product A. The product A was shown to have C, H and O and it had a molecular weight of 116 g/mol. It gave a positive iodoform test and was found to be identical with a compound obtained by the aldol self condensation of acetone. Although the product A did not discharge colour of bromine in CCl₄, its dehydration product B with hot sulphuric acid discharged bromine dissolved in CCl₄.

13. What is the molecular weight of a compound that undergoes an aldol self condensation reaction and whose dehydrated product has a molecular weight of 70?
- a) 35
 - b) 44
 - c) 49
 - d) 58
14. The aldol self condensation of acetone is in equilibrium that favours acetone over its corresponding product. Which of the following conditions is most likely to shift the position of equilibrium toward product A?
- a) By using a catalytic amount of NaOH
 - b) By using only a catalytic amount of acetone
 - c) By removing product A as soon as it is formed
 - d) By increasing reaction temperature
15. Which of the following compounds will give a positive iodoform test?
- A) C₂H₅OH
 - B) CH₃CHO
 - C) CH₃OH
 - D) HCHO
- a) Only compound A
 - b) Only compound B
 - c) Both A and B
 - d) Only compound Z

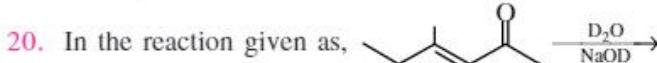
Integer Type Questions

How many different amides are expected?



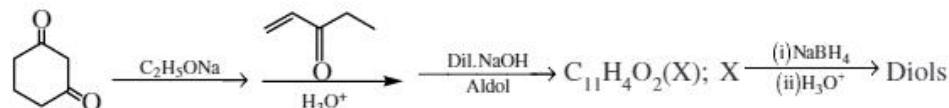
How many lone pair of electrons are present in Y ?

19. In the reaction given below, how many different stereoisomers of major product are possible?



Some of the hydrogen undergo exchange by deuterium, At the most, how many deuterium atoms incorporation are possible per molecule of ketone?

21. Consider the following sequence of reaction,



How many different stereoisomers of diol are formed?

♦♦ KEY SHEET (LECTURE SHEET) ♦♦

EXERCISE-I

LEVEL-I	1) 2	2) 3	3) 3	4) 2	5) 2	6) 3	7) 1	8) 3
	9) 6							

LEVEL-II	1) d	2) a	3) d	4) d	5) b	6) a	7) abc	8) ac
	9) bcd	10) b	11) c	12) d	13) 5	14) 7	15) 5	16) 4

EXERCISE-II

LEVEL-I	1) 4	2) 1	3) 1	4) 2	5) 1	6) 4	7) 4	8) 9
LEVEL-II	1) a	2) c	3) a	4) a	5) c	6) b	7) c	8) d
	9) d	10) c	11) d	12) c	13) bc	14) abcd	15) acd	16) b
	17) c	18) c	19) 3	20) 4	21) 6			

EXERCISE-III**LEVEL-I**

- 1) 2 2) 4 3) 2 4) 1 5) 3 6) 2 7) 2 8) 3
 9) 9 10) 1

LEVEL-II

- 1) c 2) c 3) b 4) b 5) c 6) a 7) abcd 8) bc
 9) abc 10) abcd 11) abc 12) bc 13) abc 14) ac 15) b 16) a
 17) c 18) c 19) b 20) d 21) A-pqrs; B-pqs; C-qs; D-pqrs
 22) 6 23) 8 24) 7 25) 6

EXERCISE-IV**LEVEL-I**

- 1) 1 2) 1 3) 2 4) 3 5) 3 6) 2 7) 2 8) 2

LEVEL-II

- 1) c 2) a 3) b 4) c 5) b 6) c 7) c 8) b
 9) c 10) c 11) ad 12) abcd 13) bcd 14) abc 15) abd 16) ad
 17) abc 18) acd 19) acd 20) acd 21) c 22) d 23) d
 24) A-pqrs; B-qs; C-p; D-qs 25) A-p; B-pr; C-qs; D-st
 26) 6 27) 5 28) 3 29) 4 30) 5

EXERCISE-V**LEVEL-I**

- 1) 1 2) 2 3) 3 4) 4 5) 3 6) 2 7) 2

LEVEL-II

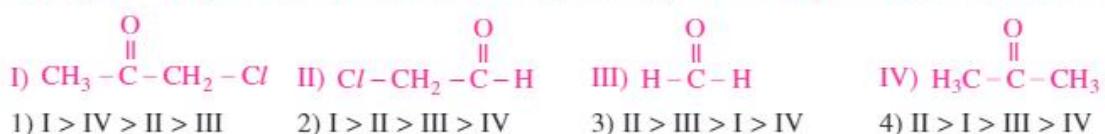
- 1) d 2) b 3) a 4) b 5) d 6) b 7) c 8) acd
 9) ac 10) bcd 11) abd 12) ab 13) b 14) c 15) c 16) 4
 17) 4 18) 6 19) 4 20) 8 21) 8

PRACTICE SHEET**EXERCISE-I**

(Nomenclature, Isomerism, General Methods of Preparation of Aldehyde, Ketones)

LEVEL-I (MAIN)***Straight Objective Type Questions***

- On the dry distillation of calcium acetate, a compound 'X' is formed, the functional isomer of 'x' is
 1) Acetone 2) Acetaldehyde 3) Propionaldehyde 4) Butanone
- Arrange the compounds in order of decreasing reactivity for nucleophilic addition reaction:

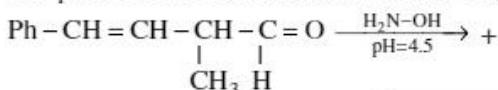


3. The formation of cyanohydrin from a ketone is an example of :
1) electrophilic addition 2) nucleophilic addition
3) nucleophilic substitution 4) electrophilic substitution

4. A compound (A), $C_5H_{10}O$, forms a phenyl hydrazone and gives negative Tollen's and iodoform tests. The compound on reduction gives n-pentane. The compound (A) is
1) pentanal 2) pental-2-one 3) pental-3-one 4) amyl alcohol

Numerical Value Type Questions

5. The possible number of stereoisomers of the product of following reaction would be:



LEVEL-II (ADVANCED)

Straight Objective Type Questions

1. Dialkyl cadmium reacts with a compound to form a ketone. The compound is :
a) an acid b) an acid chloride c) an ester d) carbon monoxide

2. A natural compound (X), $C_4H_8O_2$, reduces Fehling's solution, liberates hydrogen when treated with sodium metal and gives a positive iodoform test. The structure of (X) is :
a) $CH_3CHOHCH_2CHO$ b) $HOCH_2CH_2CHO$ c) CH_3COCH_2CHO d) $CH_3COCH_2CH_2OH$

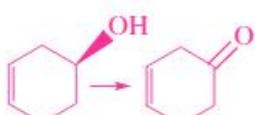
3. Aldol condensation between following compounds, followed by dehydration gives methyl vinyl ketone :
a) formaldehyde and acetone b) formaldehyde and acetaldehyde
c) two molecules of acetaldehyde d) two molecules of acetone

4. Which of the following has the most acidic hydrogen ?
a) Hexan-3-one b) Hexan-2,4-dione c) Hexan-2-one d) Hexan-2,3-dione

5. The increasing order of the rate of HCN addition to compounds A-D is
A) $HCHO$ B) CH_3COCH_3 C) $PhCOCH_3$ D) $PhCOPh$
a) A < B < C < D b) D > B < C < A c) D < C < B < A d) C < D < B < A

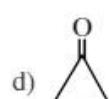
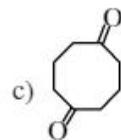
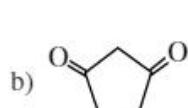
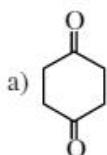
More than One correct answer Type Questions

6. Which of the following reagents can bring about the transformation shown below?

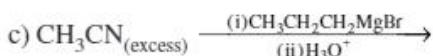


- a) CrO_3/HCl / Pyridine b) $\text{CrO}_3/\text{H}_2\text{SO}_4$ /Acetone
 c) $[(\text{CH}_3)_3\text{CO}]_3\text{Al}$ d) $\text{KMnO}_4/\text{H}_2\text{SO}_4$

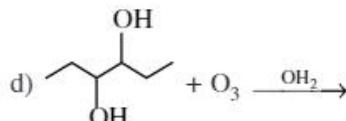
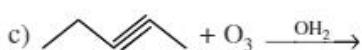
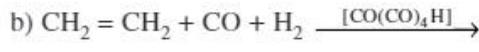
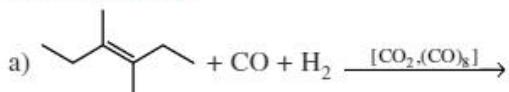
7. Predict the expected product(s) in the following reaction



8. In which of the following reactions the predominant product would be 2-pentanone ?



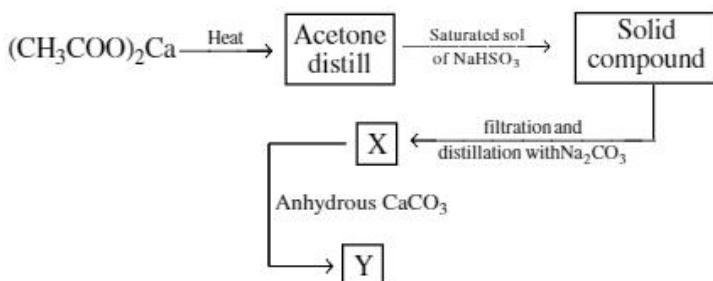
9. In which of the following reaction only one type of aldehyde is produced and no ketone? (Exclude stereoisomers)



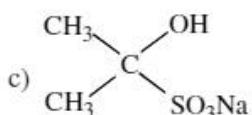
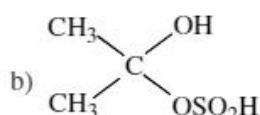
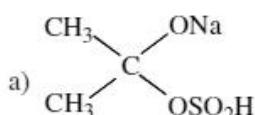
Linked Comprehension Type Questions

Passage :

In laboratory preparation of Acetone



10. The solid compound is



d) None of these

11. X is

- a) Anhydrous acetone
c) Sodium bisulphite adduct

- b) Hydrated acetone
d) None

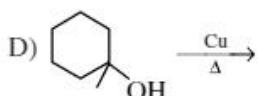
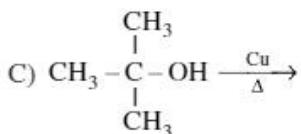
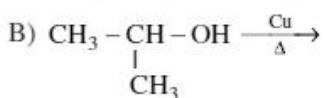
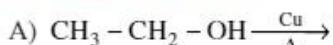
12. Pure acetone is

- a) Solid compound
c) Y

- b) X
d) Distilled acetone in 1st step

Matrix Matching Type Questions

13. Column-I (Reaction)



Column-II (Involves)

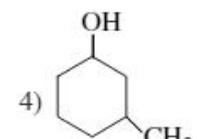
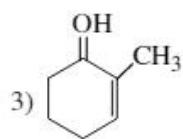
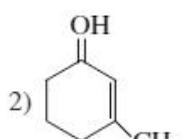
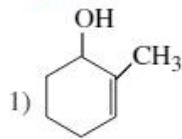
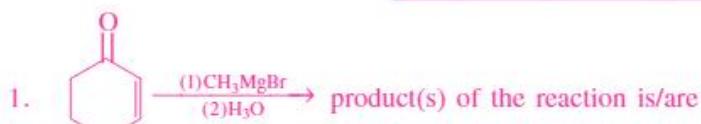
p) Dehydration

q) Elimination

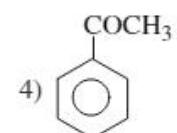
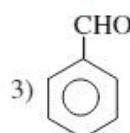
r) Oxidation

s) Dehydrogenation

t) Neither oxidation nor reduction

EXERCISE-II*General Characteristics - Physical Properties, Chemical Properties, Addition Reactions and Addition-elimination reactions***LEVEL-I (MAIN)***Straight Objective Type Questions*

2. Which of the following reacts at a faster rate to form cyanohydrin



3. Acetylene on reaction with hypochlorous acid gives

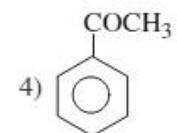
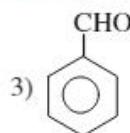
1) Acetone

2) Chloro acetone

3) Dichloro acetaldehyde

4) Dichloro methane

4. Which of the following reacts at a faster rate to form cyanohydrins

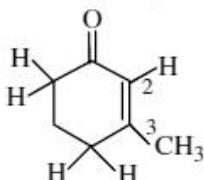


5. Which of the following reaction gives $(\text{CH}_3)_2\text{CHCH}_2\text{COCH}_3$

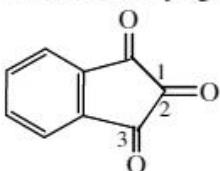
- 1) $(\text{CH}_3)_2\text{CHCH}_2 - \text{C} \equiv \text{CH} \xrightarrow{\text{H}_2\text{O}, \text{HgSO}_4, \text{H}_2\text{SO}_4}$ 2) $(\text{CH}_3)_2\text{CHCH}_2\text{CN} + \text{CH}_3\text{MgI} \longrightarrow$
 3) $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{CN} + \text{CH}_3\text{MgI} \longrightarrow$ 4) $(\text{CH}_3)_2\text{CHCH}_2\text{CHOHCH}_3 \xrightarrow{\text{KMnO}_4} \longrightarrow$

Numerical Value Type Questions

6. Which hydrogen of the given compound is least acidic in nature?



7. Which carbonyl group of the given compound is most reactive for nucleophilic addition reaction?



LEVEL-II (ADVANCED)

Straight Objective Type Questions

1. Which one of the following compounds would form most stable hydrate?

- a) $\text{Cl}_3\text{C}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{H}$ b) $\text{Cl}_3\text{C}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{H}$ c) $\text{F}_3\text{C}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{CF}_3$ d) $\text{H}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{H}$

2. $\text{H}_3\text{C}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{H} + \begin{matrix} \text{HS} \\ \text{HS} \end{matrix} \xrightarrow{\text{H}^+} \text{A} \xrightarrow{\begin{matrix} 1.\text{BuLi} \\ 2.\text{H}_3\text{C}-\text{Br} \\ 3.\text{HgCl}_2/\text{H}_3\text{O}^+ \end{matrix}} \text{B}; \text{ Identify structure of B}$

- a) b) c) d)

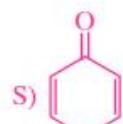
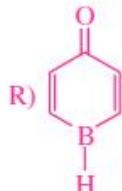
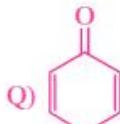
3. $\xrightarrow{\text{Me}_2\text{CuLi}, \text{H}_3\text{O}^+}$ Product, Product will be

- a) b) c) d)

4. $\xrightarrow{\text{Me}_2\text{CuLi}, \text{H}_3\text{O}^+}$ Product.

- a) b) c) d)

5. Consider the following carbonyl compounds,

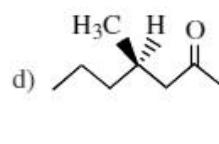
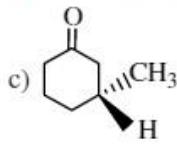
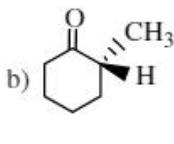
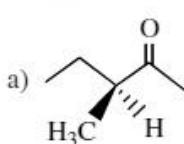


Which of the following is correct decreasing order of their dipole moment?

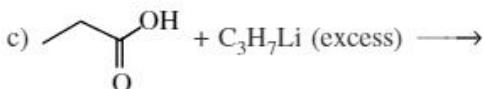
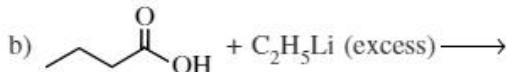
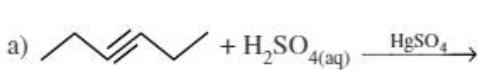
- a) P > R > Q > S b) S > R > Q > P c) S > Q > R > P d) Q > S > R > P

More than One correct answer Type Questions

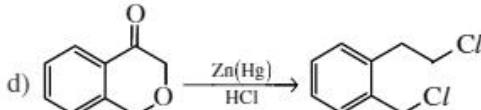
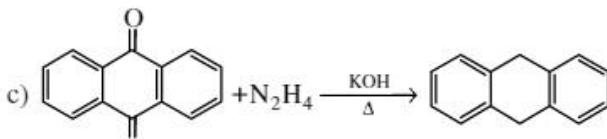
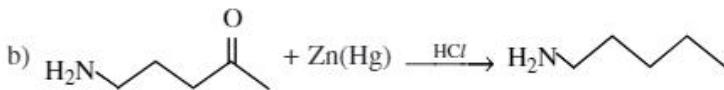
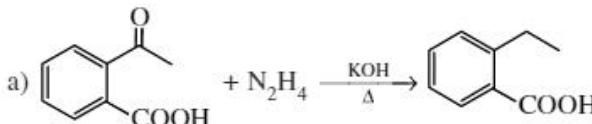
6. Compound that recemizes on treatment with strong base is (are)



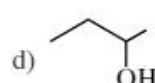
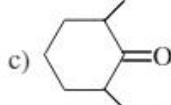
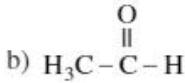
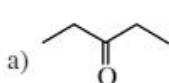
7. In which of the following reaction, the major organic product would be 3-hexanone?



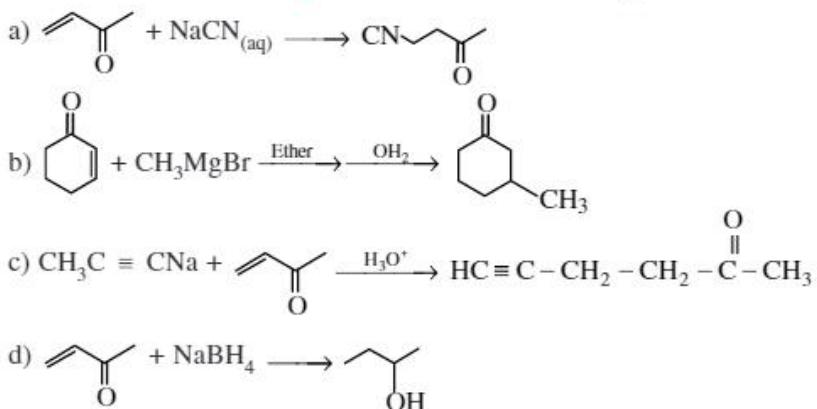
8. In which of the following reaction, reactant and products are correctly matched?



9. Which of the following produces a yellow precipitate when treated with alkaline solution of I₂?

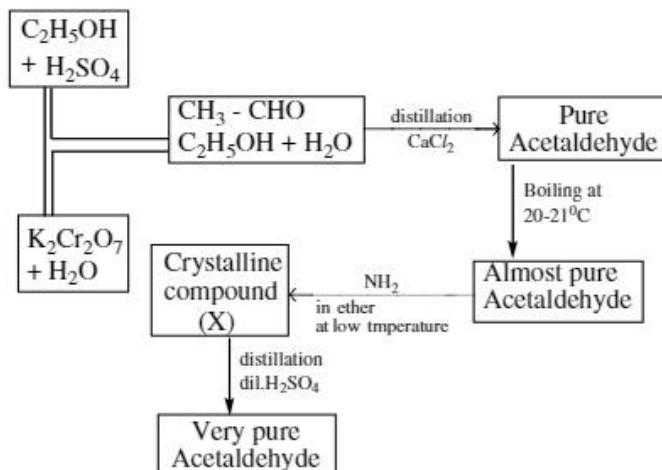


10. In which of the following reaction(s), reactants and products are correctly matched?



Linked Comprehension Type Questions

Passage :



11. Crystalline compound is

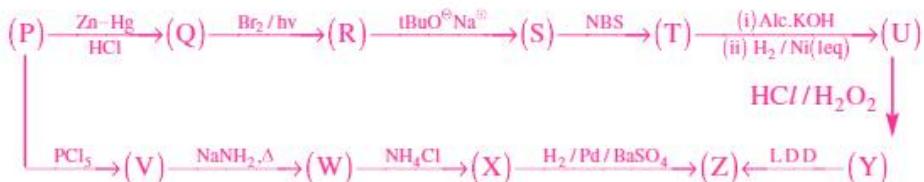
- a) $\text{CH}_3 - \text{CH}_2 - \text{NH}_2$ b) $\text{CH}_3 - \text{CH} = \text{NH}$ c) $\text{CH}_3 - \text{C} \equiv \text{N}$ d) $\text{CH}_3 - \underset{\substack{| \\ \text{OH}}}{\text{CH}} - \text{NH}_2$

12. Boiling point of acetaldehyde is approx

- a) 20°C b) 40°C c) 72°C d) 100°C

Matrix Matching Type Questions

13. For the given reaction sequence.



If 'P' has molecular formula ' C_4H_8O ', produces oxime with NH_2OH which shows G.I. and can also produce racemic product on reaction with LAH.

Column-I

- A) Substitution reaction
 B) Electrophilic addition reaction
 C) Decrease in double bond equivalent
 (Consider overall reaction)
 D) 6 member cyclic transition state involve

Column-II

- p) (Q) \rightarrow (R), (S) \rightarrow (T)
 q) (X) \rightarrow (Z)
 r) (T) \rightarrow (U)
 s) (U) \rightarrow (Y)
 t) (P) \rightarrow (V)

EXERCISE-III

**Substitution Reactions, Reduction Reactions, Oxidation Reactions,
Test for Aldehydes-Ketones**

LEVEL-I (MAIN)**Straight Objective Type Questions**

1. 3-Hydroxy butanal is formed when (X) reacts with (Y) in dilute (Z) solution. What are (X), (Y) and (Z) ?

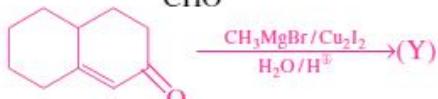
- 1) CH₃CHO; (CH₃)₂CO; NaOH
 (X) (Y) (Z)
 2) CH₃CHO; CH₃CHO; NaCl
 (X) (Y) (Z)
 3) (CH₃)₂CO; (CH₃)₂CO; HCl
 (X) (Y) (Z)
 4) CH₃CHO; CH₃CHO; NaOH
 (X) (Y) (Z)

2. Compound 'X' (C₉H₁₀O) does not add on Br₂ in CCl₄. Vigorous oxidation of 'X' gives benzoic acid and reacts with 2,4-D N P which of the following is the structure of X.

- 1) C₆H₅COCH₂CH₃ 2) C₆H₅CH₂COCH₃

- 3) C₆H₅CH₂CH₂CHO 4) C₆H₅—CH—CHO
 CHO

3. In the given reaction the main product will be

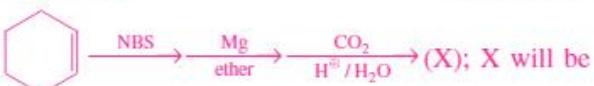


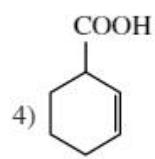
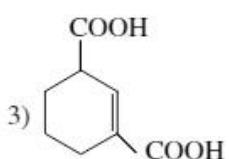
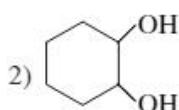
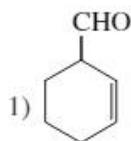
- 1) 2) 3) 4)

4. In the given reaction (X) will be

- 1) 2)

- 3) 4)

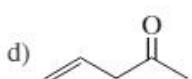
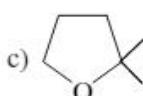
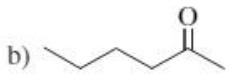
5. In the given reaction  (X); X will be

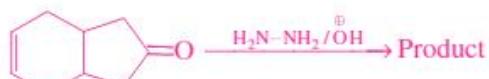


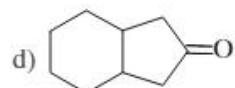
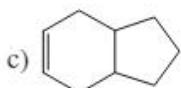
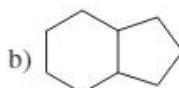
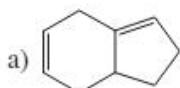
LEVEL-II (ADVANCED)

Straight Objective Type Questions

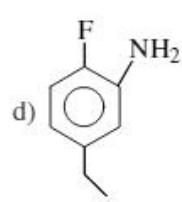
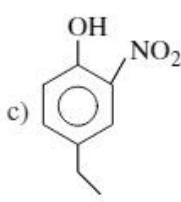
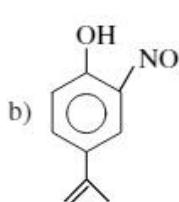
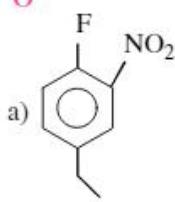
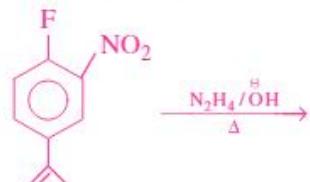
1. In the given reaction  (X); (X) will be

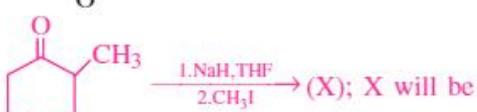


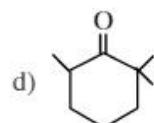
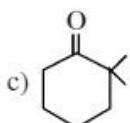
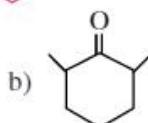
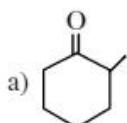
2. In the given reaction 

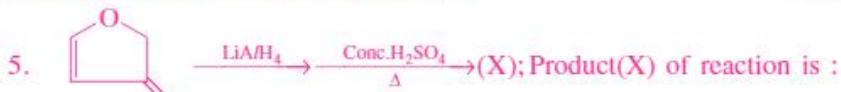


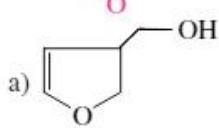
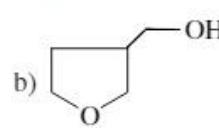
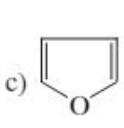
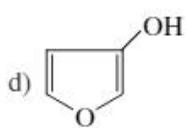
3. Find the product of the following reaction:



4. In the given reaction 





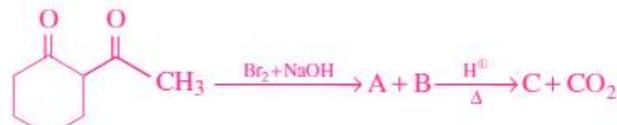
- a)  b)  c)  d) 

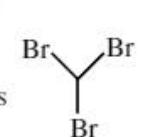
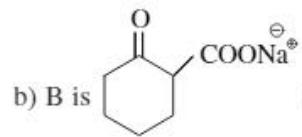
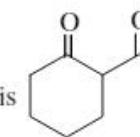
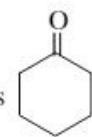


Which of the following sets of reagents is the most appropriate to perform the above conversion?

- a) $\text{HIO}_4; \overset{\ominus}{\text{OH}}; \text{Zn-Hg}/\text{HCl}$
 b) Cold $\text{KMnO}_4; \text{Pb(OA)}_4; \overset{\ominus}{\text{OH}}; \text{Li/NH}_3$
 c) $\text{O}_3/\text{Me}_2\text{S}; \overset{\ominus}{\text{OH}}; \text{Li/NH}_3$
 d) $\text{KMnO}_4; \overset{\ominus}{\text{OH}}/\Delta; \text{N}_2\text{H}_4/\overset{\ominus}{\text{OH}}, \Delta$

7. Which of the following are correct for reaction?

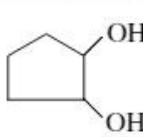
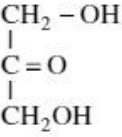
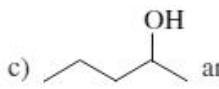
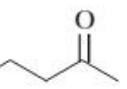
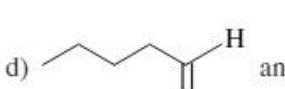
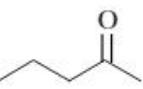


- a) A is  b) B is  c) C is  d) C is 

8. Which of the following pairs are not correctly matched?

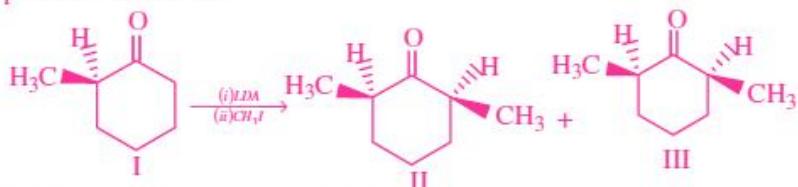
- a) $\text{C=O} \xrightarrow[\text{HCl}]{\text{Zn-Hg}} \text{CH}_2$
 b) $\text{C=O} \xrightarrow[\text{OH}]{\text{N}_2\text{H}_4/\overset{\ominus}{\text{OH}}} \text{CH-OH}$
 c) $\text{Cl-C=O} \xrightarrow[\text{H}_2, \text{Pd-BaSO}_4]{\text{H}} \text{H-C=O}$
 d) $\text{-C}\equiv\text{N} \xrightarrow{\text{Sn+HCl}} \text{-C(=O)-NH}_2$

9. Which compounds will be oxidized by HIO_4 ?

- a) $\text{CH}_3-\underset{\text{OH}}{\underset{\parallel}{\text{CH}}}-\text{C}-\text{H}$ and 
 b) $\text{CH}_3-\underset{\text{OH}}{\underset{\parallel}{\text{CH}}}-\text{CH}_2-\text{CH}_3$ and 
 c)  and 
 d)  and 

More than one correct answer Type Questions

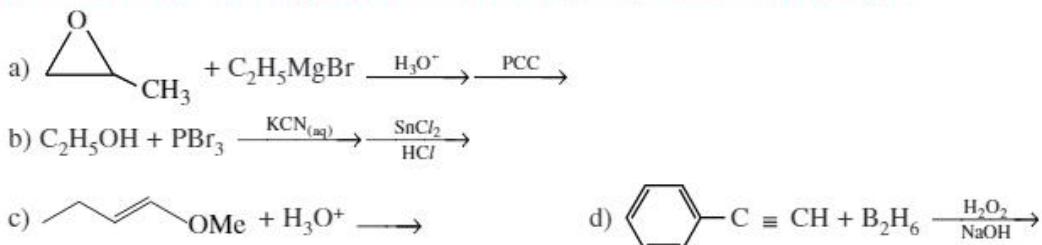
10. Methylation of chiral chiral ketone I as shown below affords a mixture of two dimethyl ketone products II and III.



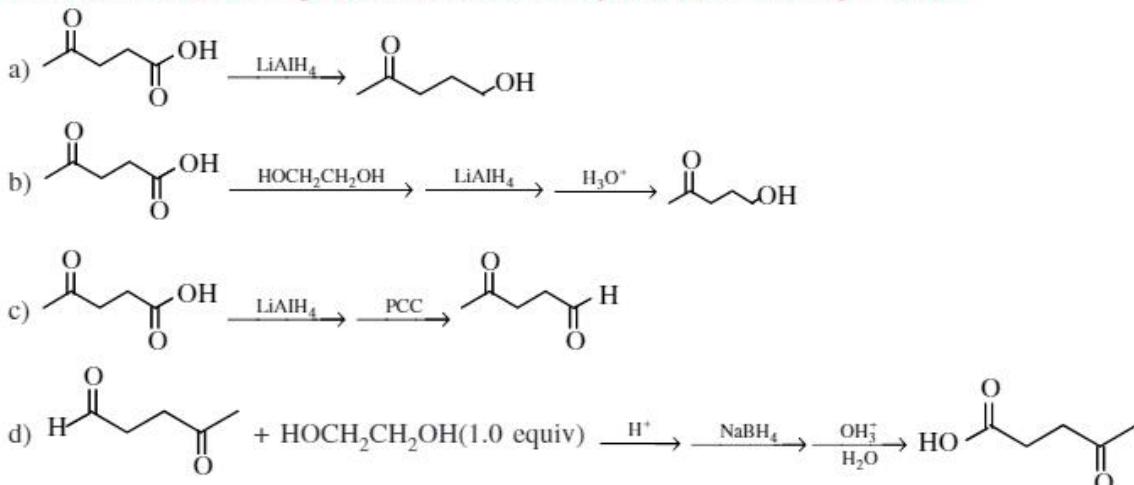
Which of the following is (are) true?

- II and III are produced in equal amounts
- III is the only chiral product ie, its enantiomer will not be formed
- Product II has a plane of symmetry
- Products are formed from thermodynamically more stable enol

11. In which of the following reactions, the end organic product is an aldehyde?



12. In which of the following reaction, reactants and products are correctly matched?



13. Which of the following have more than two enol tautomers?



14. Which of the following combinations of carbonyl compound and phosphonium ylide could be used successfully to prepare? $(\text{CH}_3)_2\text{C} = \text{CHCH}_2\text{CH}_3$
- $(\text{CH}_3)_2\text{C} = \text{O} + \text{CH}_3\text{CH}_2\text{CH} = \text{PPh}_3$
 - $\text{CH}_3\text{CH}_2\text{CHO} + (\text{CH}_3)_2\text{C} = \text{PPh}_3$
 - $(\text{CH}_3)_2\text{CHCHO} + \text{CH}_3\text{CH} = \text{PPh}_3$
 - None of the above

Linked Comprehension Type Questions

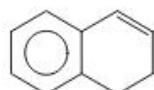
Passage-I :

A neutral organic compound $A(\text{C}_{10}\text{H}_{20}\text{O}_2)$ neither reduces Tollen's reagent nor forms precipitate with 2,4-dinitrophenyl hydrazine, but can be resolved into enantiomers. A on acid hydrolysis form two compounds B and C, both are enantiomeric. C neither reduces Fehling's solution nor forms iodoform with alkaline iodine solution. C on oxidation with $\text{CrO}_3/\text{HCl}/$ pyridine forms D which is still resolvable into enantiomers. D on further treatment with aqueous $(\text{C}_2\text{H}_5\text{O})_3\text{Al}$ solution give back A..

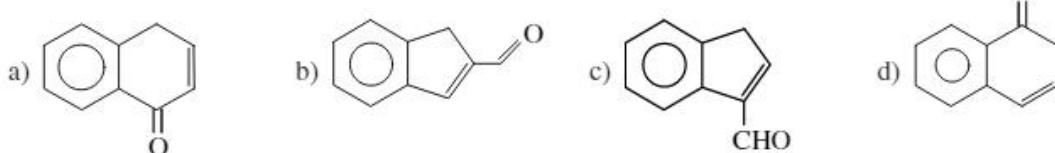
15. How many different stereoisomers exist for A?
- 2
 - 4
 - 5
 - 6
16. What is true regarding D ?
- It forms a yellow precipitate with KOH/I_2
 - It forms an orange precipitate with 2,4-dinitrophenyl hydrazine
 - On oxidation with $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$, it forms B
 - On treatment with NaHSO_3 , it forms salt which cannot be separated by fractional crystallization
17. The correct statement regarding the following reaction is $\text{D} + \text{Cl}_2 \xrightarrow{\text{H}_2\text{SO}_4} \alpha\text{-chlorination}$
- Product is achiral
 - Product is a racemic mixture
 - Product is a pair of diastereomer
 - No α - halogenations occur with D

Passage-II :

An organic compound 'P' ($\text{C}_{10}\text{H}_{10}$) on ozonolysis gives 'Q' ($\text{C}_{10}\text{H}_{10}\text{O}_2$) which show positive test with Fehling reagent. 'Q' on treating with OH^-/Δ gives 'R' which on reacting with excess of H_2/Pt gives S. S on reaction with H^+/Δ / gives (T)

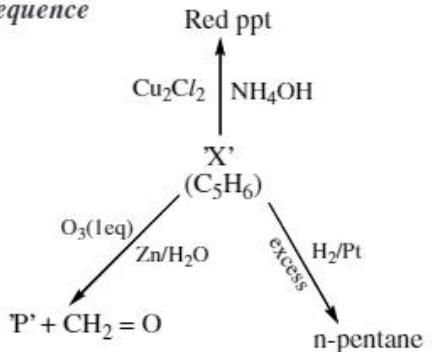


18. The product R is



19. Select the correct statement(s) regarding P and T.

- P and T may be same
- P and T may be structural isomer
- P and T both give phthalic acid on oxidation by KMnO_4
- Number of benzylic hydrogen in P is less than number of benzylic hydrogen in T

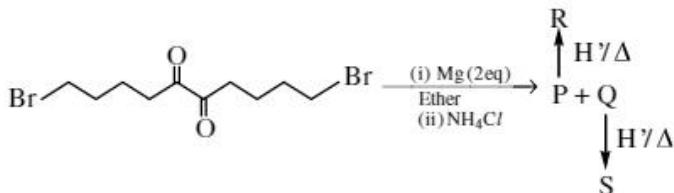
Passage-III :*In this given reaction sequence*

20. P is

- a) $\begin{array}{c} \text{CH}_2 - \text{CH}_2 - \text{CH} = \text{CH}_2 \\ || \\ \text{O} \end{array}$ b) $\begin{array}{c} \text{CH}_3 - \underset{\parallel}{\text{C}} - \text{CH} = \text{CH}_2 \\ \text{O} \end{array}$
- c) $\begin{array}{c} \text{CH}_3 - \underset{\parallel}{\text{C}} - \text{C} \equiv \text{CH} \\ \text{O} \end{array}$ d) $\begin{array}{c} \text{CH} - \text{CH}_2 - \underset{\parallel}{\text{C}} \equiv \text{CH} \\ \text{O} \end{array}$

21. Red ppt. cannot be obtained by reaction of $\text{NH}_4\text{OH}/\text{Cu}_2\text{Cl}_2$ with

- a) X b) P c) Ethene d) Ethyne

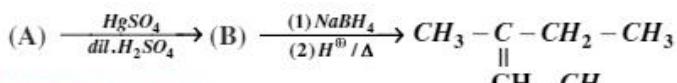
Passage-IV :*In the following reaction sequence, if P can show stereoisomerism*

22. Relation between R and S is

- a) Identical b) Enantiomer c) Diastereomers d) Structural Isomer

23. The product 'V' is $\text{Q} \xrightarrow{\text{HIO}_4} \text{T} \xrightarrow[\Delta]{-\text{OH}} \text{U} \xrightarrow[\text{(ii)-OH, } \Delta]{\text{(i)N}_2\text{H}_4} \text{V}$

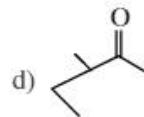
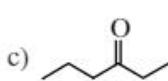
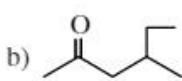
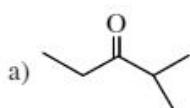
- a) b) c) d)

Passage-V :

24. Reactant (A) is:

- a) $\text{CH}_3 - \text{C} \equiv \text{C} - \underset{\text{CH}_3}{\underset{|}{\text{CH}}} - \text{CH}_3$
- b)
- c) $\text{CH}_3 - \underset{\text{CH}_2 - \text{CH}_3}{\underset{|}{\text{CH}}} - \text{C} \equiv \text{CH}$
- d) $\text{CH}_3 - \text{C} \equiv \text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$

25. Product (B) is:



Matrix Matching Type Questions

26. Match the qualitative tests listed in Column-I with compounds from Column-II that gives positive response to these tests and mark the correct option from the codes given below.

Column-I

- A) Yellow precipitate with 2,4-dinitrophenyl hydrazine
- B) Orange precipitate with 2,4-dinitrophenyl hydrazine
- C) Red precipitate with ammonical Cu (ii) tartarate
- D) White precipitate with NaHSO_3

Column-II

- p) $\text{C}_6\text{H}_5\text{CHO}$
- q) Cyclohexanone
- r) 3-hydroxy butanone
- s) Ethanal (CH_3CHO)

27. **Column-I (Compound)**

- A) Hexan-1-ol to hexanal
- B) But-2-ene to ethanoic acid
- C) Cyclohexanol to cyclohexanone
- D) Allyl alcohol to propenal

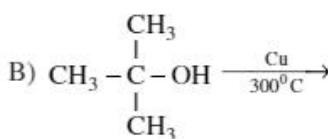
Column-II (Tests)

- p) $\text{C}_5\text{H}_5\text{NH}^+\text{CrO}_3\text{Cl}^-$
- q) KMnO_4 in H^+
- r) $\text{O}_3/\text{H}_2\text{O}_2$
- s) MnO_2
- t) $\text{Cu}/300^\circ\text{C}$

28. **Column-I (Reaction)**



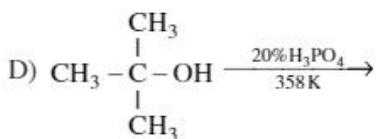
- p) Dehydrogenation



- q) Oxidation



- r) Dehydration



- s) Elimination reaction

29. **Column-I (Compound)**

- A) CH_3-CHO
- B) HCHO
- C) PhCHO
- D) CH_3COCH_3 reaction

Column-II (Properties)

- p) Can participate in self aldol
- q) Can participate in haloform
- r) Can reduce Tollen's reagent
- s) Can participate in Cannizaro's
- t) Can reduce Fehling solution

Integer Type Questions

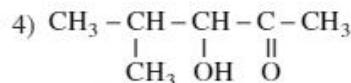
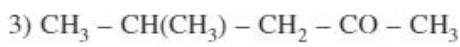
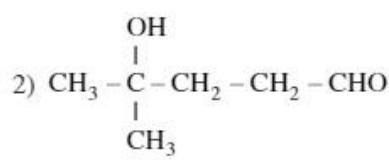
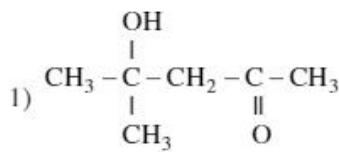
30. In reaction of $C_6H_5COCH_3$ with KOH – I_2 to form iodoform, how many moles of KOH are consumed per mole of ketone?
31. How many different isomers of C_5H_8O , on treatment with 2,4-dinitrophenyl hydrazine gives orange precipitate?

EXERCISE-IV

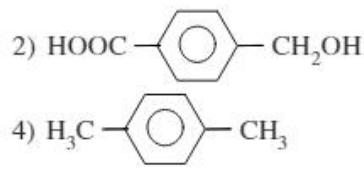
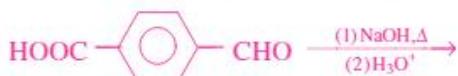
(Condensation reactions, Aldol, Cannizzaro, Bezon)

LEVEL-I (MAIN)Straight Objective Type Questions

1. I) $HCHO$; II) CH_3CHO ; III) CCl_3CHO ; IV) CH_3COCH_3 ; V) CCl_3COCH_3 ; VI) C_6H_5CHO
Which of the above compounds undergo aldol condensation?
- 1) Only II,III,IV and VI 2) Only II,IV and V
3) Only II and III 4) II & IV
2. What is the "X" in the following reaction $2CH_3COCH_3 \xrightarrow{Ba(OH)_2} X$.



3. Which of the following is the product of the sequence of the reactions



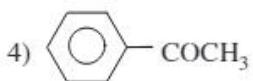
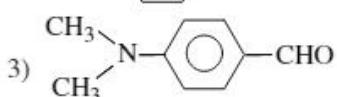
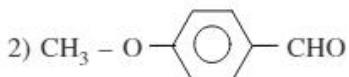
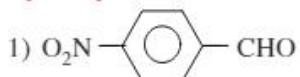
4. $PhCHO + (CH_3CO)_2O \xrightarrow{CH_3COONa} A$. The product A is



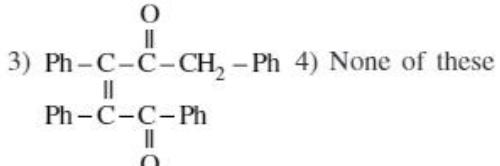
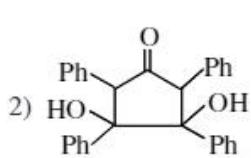
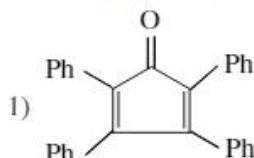
5. Acetaldehyde can be converted in to $OHCH_2 - \begin{array}{c} CH_2OH \\ | \\ C - CH_2OH \\ | \\ CH_2OH \end{array}$ by which reagent



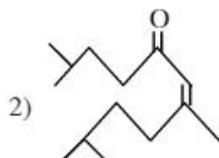
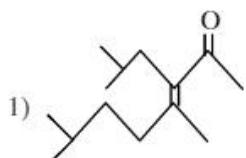
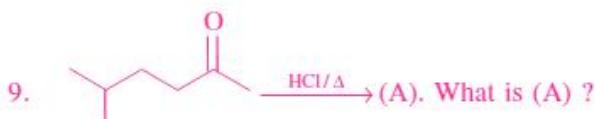
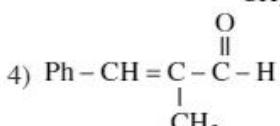
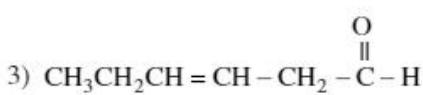
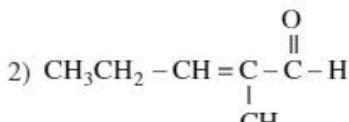
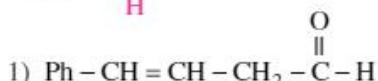
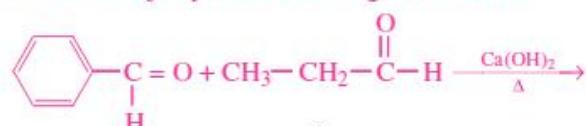
6. Cyanohydrin formation constant will be highest for?



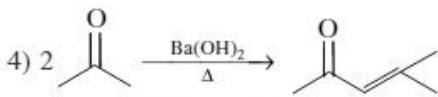
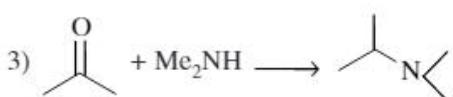
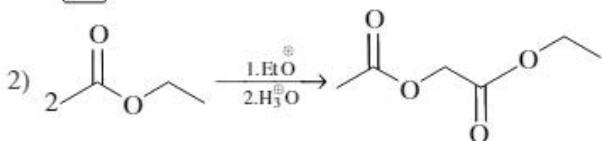
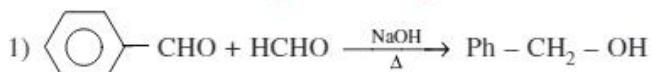
7. Find the product of the following reaction:



8. Find the major product of the given reaction:

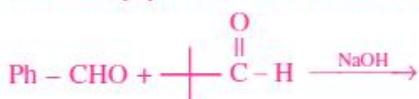
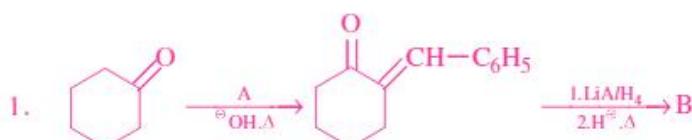


10. Which of the following is an example of aldol condensation reaction?

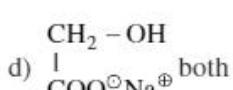
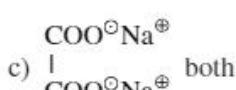
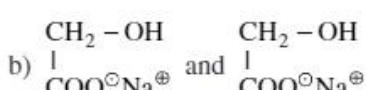
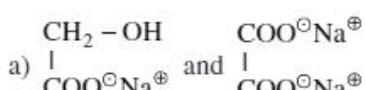
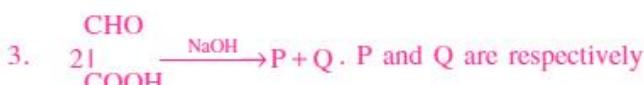
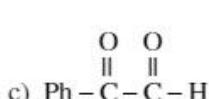
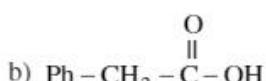
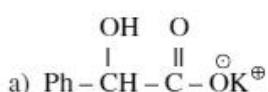
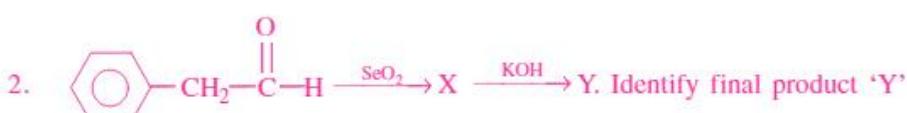
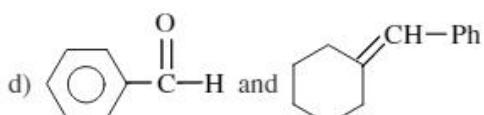
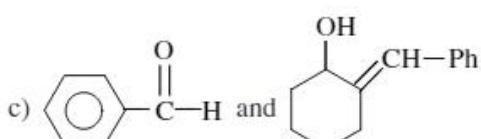
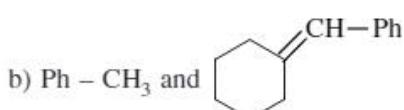
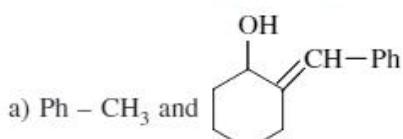


Numerical Value Type Questions

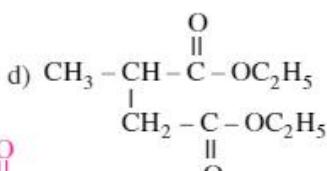
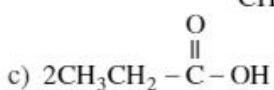
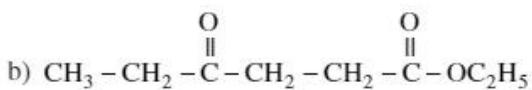
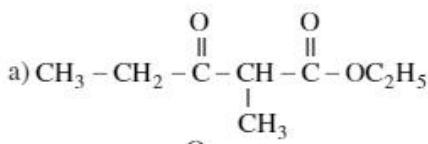
11. How many products will obtain in the following reaction?

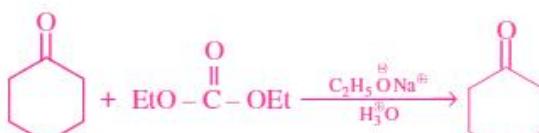
**LEVEL-II (ADVANCED)**Straight Objective Type Questions

Reactant (A) and product (B) are respectively



4. Find the product of following reaction? $2\text{CH}_3\text{CH}_2 - \overset{\text{O}}{\underset{\text{H}_3\text{O}^+}{\text{C}}} - \text{OC}_2\text{H}_5 \xrightarrow{\text{C}_2\text{H}_5\text{O}^-} (\text{X})$. 'X' will be

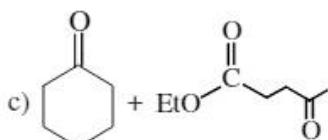
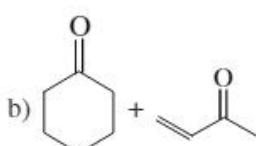
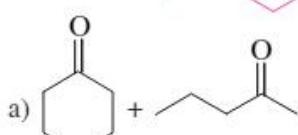


5.  Identify name of reaction:

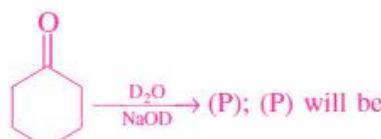
- a) Aldol condensation
c) Crossed Claisen condensation

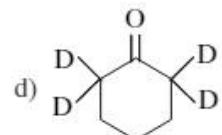
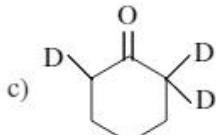
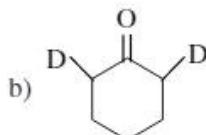
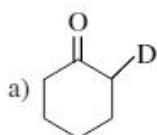
- b) Cannizzaro condensation
d) Tischenko reaction

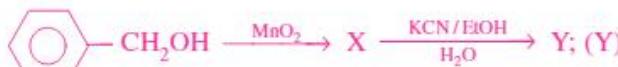
6. $\text{A} + \text{B} \xrightarrow[2.\text{H}_3\text{O}^+]{1.\text{C}_2\text{H}_5\text{O}^-}$  Identify A and B

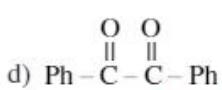
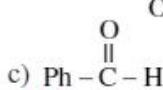
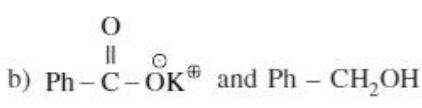
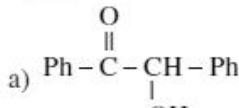


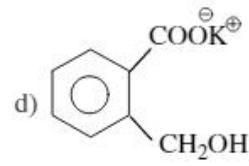
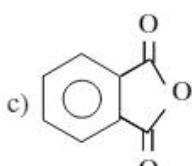
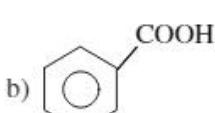
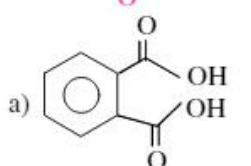
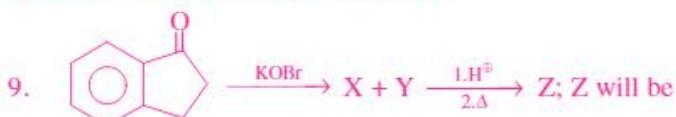
- d) None of these

7. In the given reaction:  (P) will be

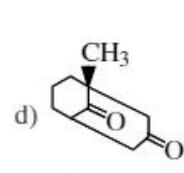
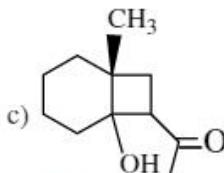
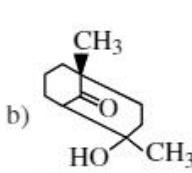
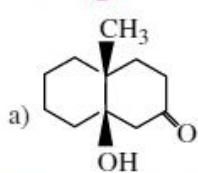
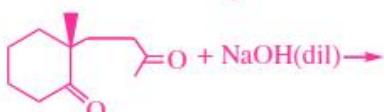


8. 

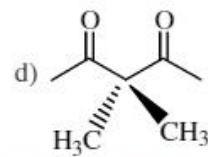
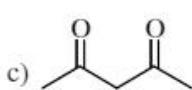
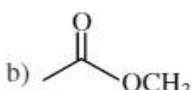
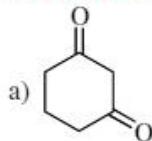


*More than One correct answer Type Questions*

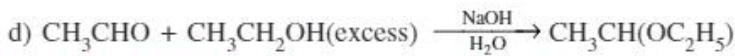
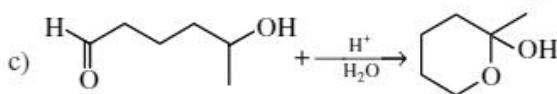
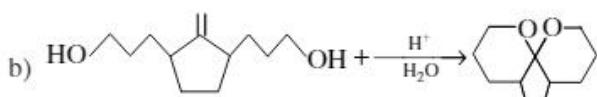
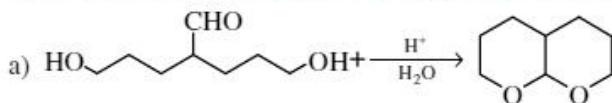
10. What are the aldol products in the following reactions?



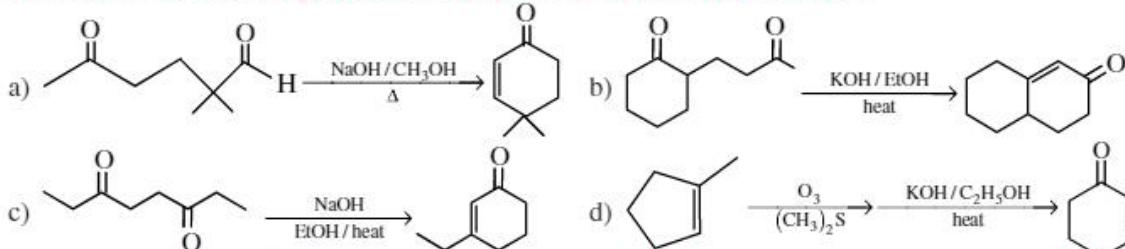
11. Which carbonyl compound will be essentially quantitatively deprotonated by the base NaOEt?



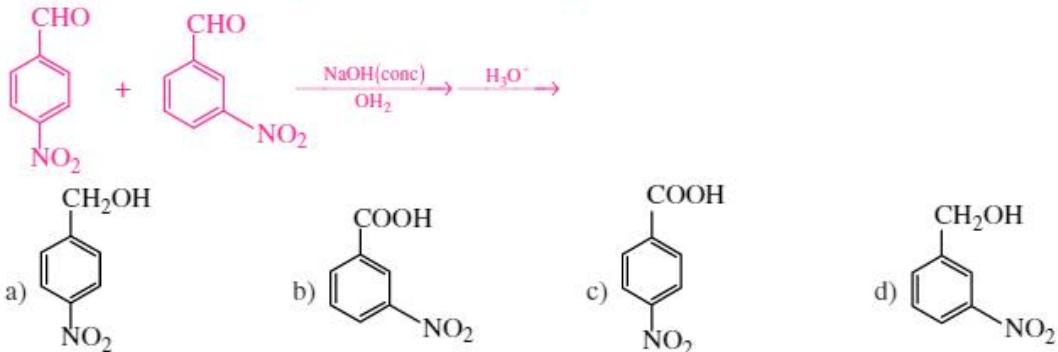
12. In which of the following reaction(s), reactant and product is (are) correctly matched?



13. In which of the following, reactants and products are correctly matched?

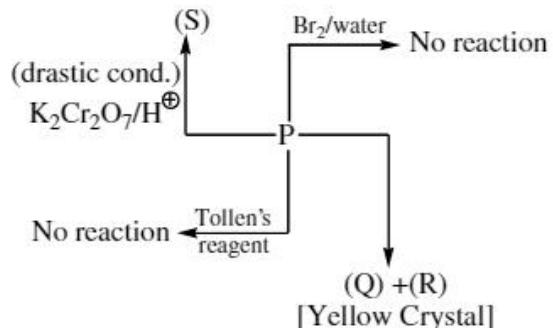


14. What are the important products in the following reaction?



Linked Comprehension Type Questions

Passage-I :



(P) has molecular formula ' $\text{C}_8\text{H}_8\text{O}$ '. Which forms red-orange ppt with on acidification forms $\text{C}_7\text{H}_6\text{O}_2$

15. Choose the correct options(S):

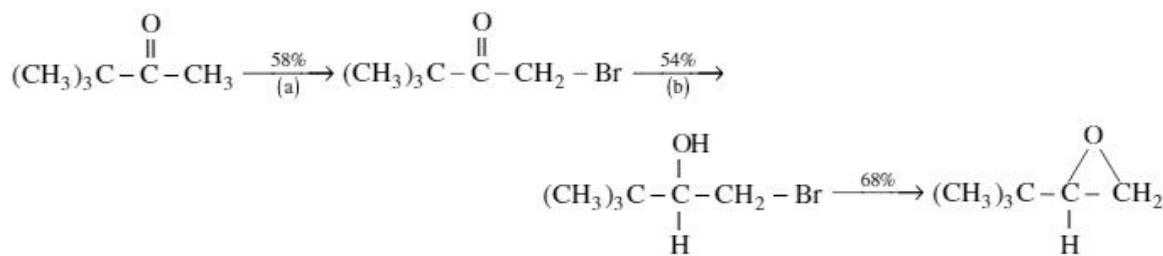
- | | |
|------------------------------|--|
| a) (R) is used as antiseptic | b) Red-Orange ppt. is 2,4-dinitrophenyl hydrazone |
| c) (P) is acetophenone | d) (S) evolves CO_2 gas with NaHCO_3 |

16. Choose the correct option(S):

- | | |
|--|---|
| a) (P) forms vic-diol with Bayer's reagent | b) (P) forms racemic mixture with LAH |
| c) (P) to (S) is degradation reaction | d) (S) has molecular formula $\text{C}_7\text{H}_6\text{O}_2$ |

Passage-II :

Consider the following reactions and answer A and B.



17. Suggest a reagent appropriate step (a) the synthesis

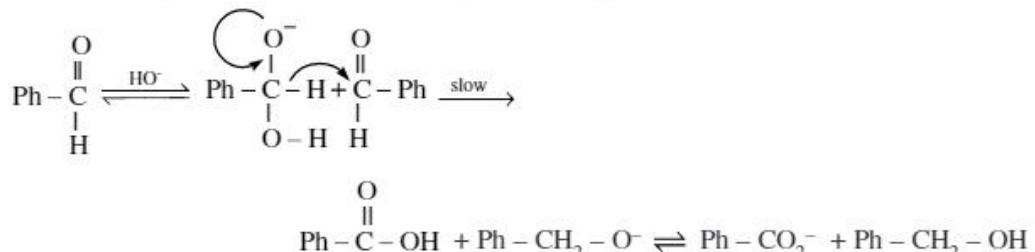
- | | |
|---------------------------------------|--------------------------------------|
| a) HO^-/Br_2 (1 mole) | b) H^+/Br_2 (1 mole) |
| c) both (a) and (b) | d) None of these |

18. Yield of each step as actually carried out in laboratory is given above each arrow. What is overall yield of the reaction?

- a) 60% b) 21% c) 40% d) 68%

Passage-III :

Mechanism of Cannizzaro's reaction of benzaldehyde is



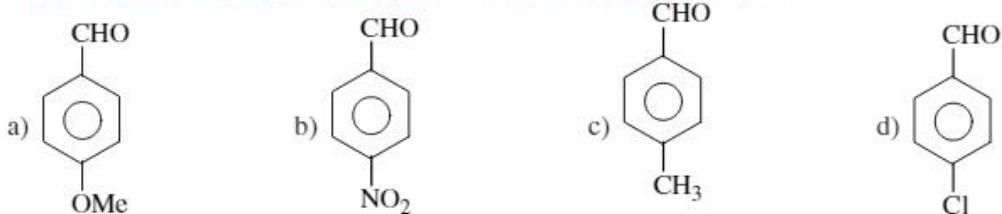
19. Which of the following reactants can undergo Cannizaro's reaction?

- a) $\text{H}-\overset{\text{O}}{\underset{\text{H}}{\text{C}}}-\text{H}$ b) R_3CCHO c) d) All of these

20. Order of the above reaction is;

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

21. Which of the following is best hydride donor in Cannizaro's reaction?



22. Cannizaro's reaction is:

- a) Reduction b) Disproportionation reaction
c) Oxidation d) Ion-exchange reaction

23. Which of the following cannot undergo intramolecular Cannizaro's reaction?

- a) $\text{H}-\overset{\text{O}}{\underset{\text{H}}{\text{C}}}-\text{C}-\text{H}$ b) $\text{H}-\overset{\text{O}}{\underset{\text{H}}{\text{C}}}-\text{C}-\text{Ph}$ c) $\text{Ph}-\overset{\text{O}}{\underset{\text{H}}{\text{C}}}-\text{C}-\text{Ph}$ d) $\text{H}-\overset{\text{O}}{\underset{\text{H}}{\text{C}}}-\text{C}-\text{H}$

◆◆◆ EXERCISE-V ◆◆◆

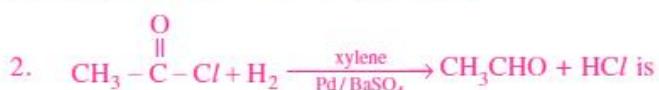
(Polymerisation & other naming reactions - Knoevenagel reaction, Claisen-Schmidt Reaction, Schmidt Reaction, Reformatsky reaction, Tischenko Reaction)

LEVEL-I (MAIN)

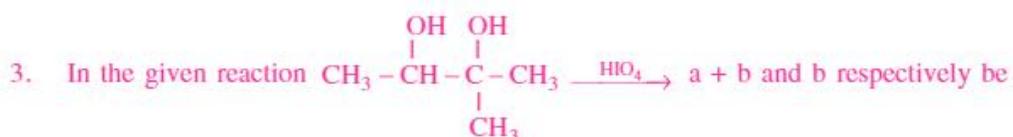
Straight Objective Type Questions

1. Which of the following forms stable semicarbazone

- 1) 2) 3) $\text{CH}_3-\text{CO}-\text{CH}_3$ 4) CH_3CHO



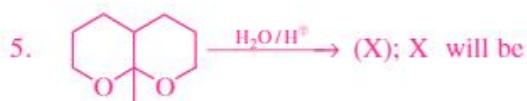
- 1) Stephen's reaction 2) Rosenmund reaction
3) Hofmann reaction 4) Cannizzaro's reaction



- 1) CH_3CHO and CH_3CHO 2) CH_3COCH_3 and CH_3CHO
 3) CH_3COCH_3 and CH_3COCH_3 4) CH_3COOH and CH_3COCH_3

4. Tischenko reaction is a modification of

- | | |
|------------------------|-------------------------------|
| 1) Aldol condensation | 2) Claisen condensation |
| 3) Cannizzaro reaction | 4) Pinacol-pinacolon reaction |



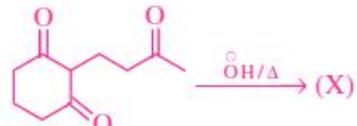
- 1) 

2) 

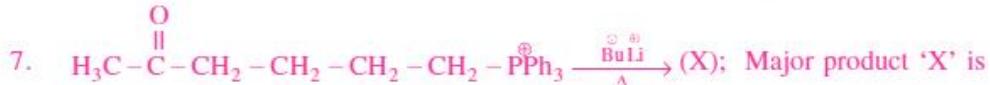
3) 

4) 

6. What is the product (X) of the following reaction?

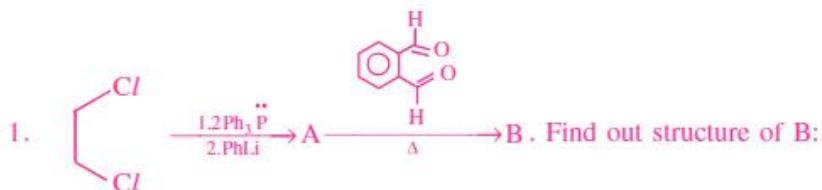


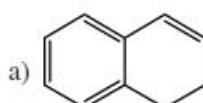
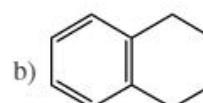
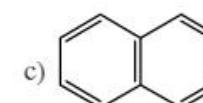
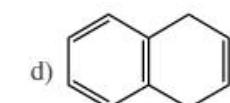
- 1)  2)  3)  4) 

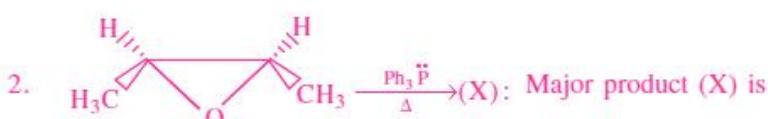


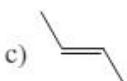
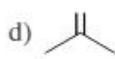
- 1)  2)  3)  4) 

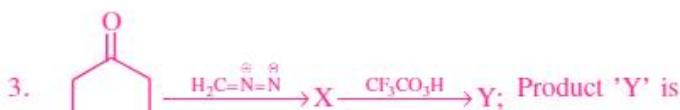
LEVEL-II (ADVANCED)

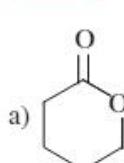
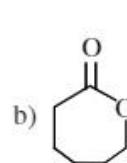
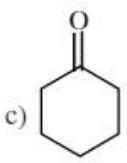
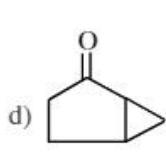
Straight Objective Type Questions

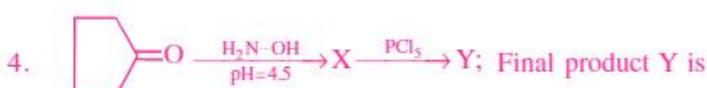
- a)  b)  c)  d) 

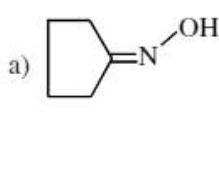
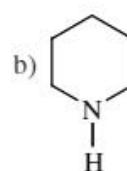
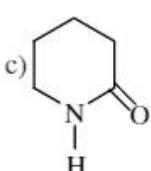
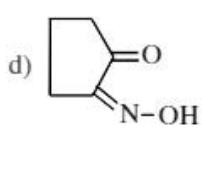


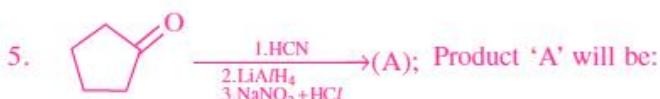
- a)  b)  c)  d) 

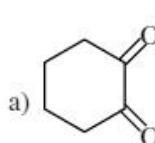
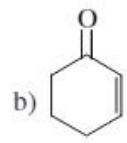
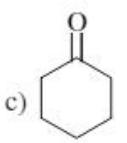


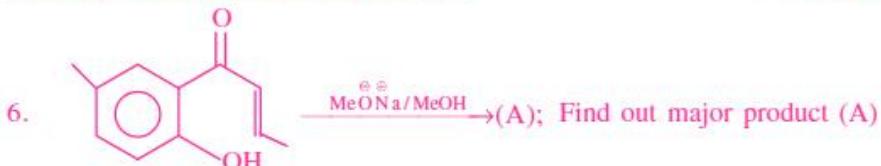
- a)  b)  c)  d) 

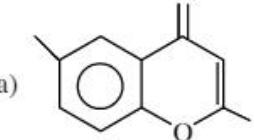
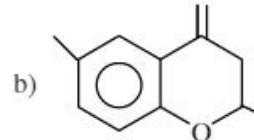
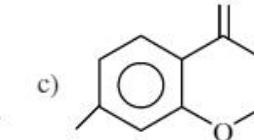
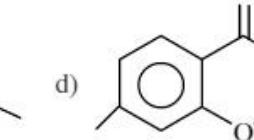


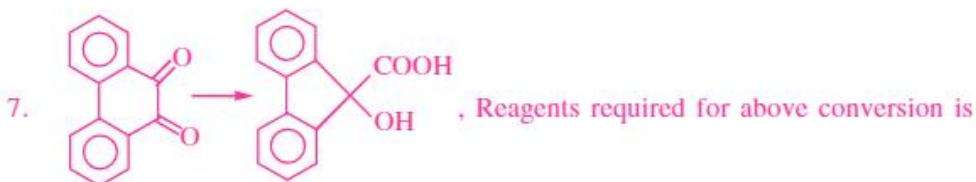
- a)  b)  c)  d) 



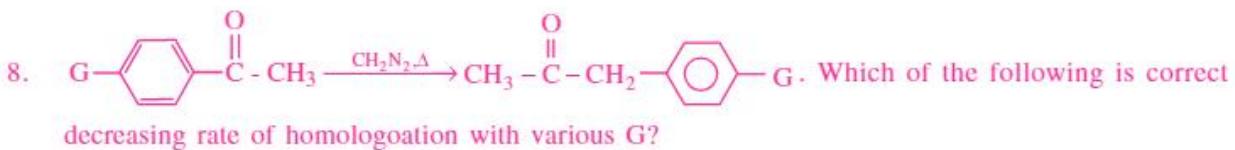
- a)  b)  c)  d) None of these



- a)  b)  c)  d) 

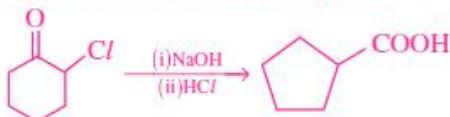


- a) $\text{LiAlH}_4, \text{H}^\oplus, \Delta$ b) $\overset{\ominus}{\text{OH}}/\Delta, \text{H}^\oplus$ c) $\text{H}^\oplus, \overset{\ominus}{\text{OH}}/\Delta$ d) $\text{NaBH}_4, \text{H}^\oplus$



- a) $\text{O}^- - \text{Me} > -\text{CH}_3 > -\text{NO}_2 > -\text{H} > -\text{F}$
 b) $-\text{NO}_2 > -\text{F} > -\text{H} > -\text{CH}_3 < -\text{OCH}_3$
 c) $-\text{OMe} > -\text{CH}_3 > -\text{H} > -\text{F} > -\text{NO}_2$
 d) $-\text{OMe} > -\text{NO}_2 > -\text{H} > -\text{F} > \text{CH}_3$

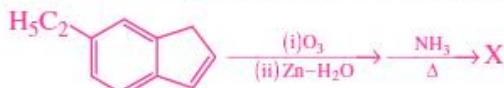
9. Consider the following reaction,

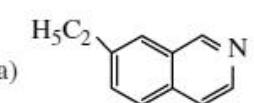
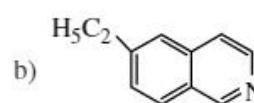
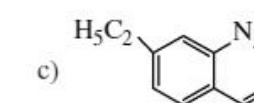
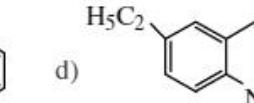


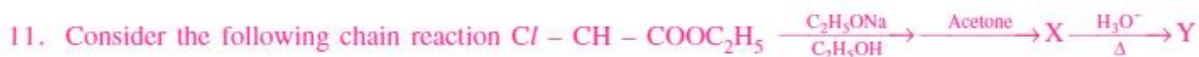
The correct statement regarding the above reaction is

- a) It is a condensation reaction
 b) It is a simple oxidation reaction
 c) Reaction involves a rearrangement via a bicyclic intermediate
 d) All of the above

10. In the reaction given below, the final product X is



- a)  b)  c)  d) 

More than One correct answer Type Questions

The correct statement concerning the above reaction is/are

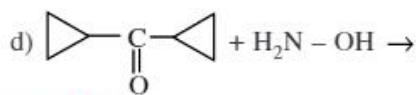
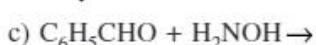
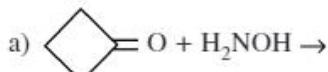
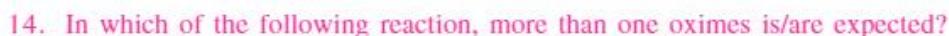
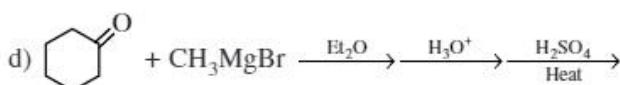
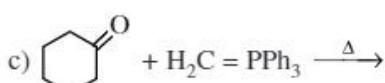
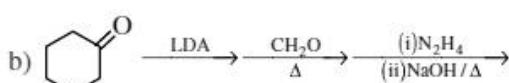
- a) X is an α,β - epoxy ester
- b) Y is an aldehyde
- c) Y is a ketone
- d) In the last step, an unstable enol is formed which tautomerises into stable keto form



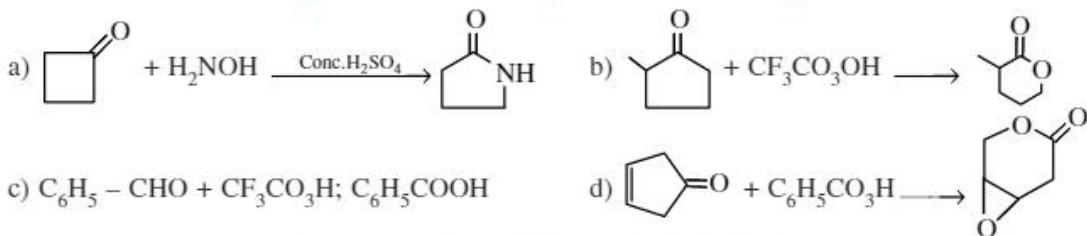
- a) X is an unstable intermediate
- b) Y is 1-methyl cyclopentene $\text{Ph}_3\text{P} = \text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CHO}$
- c) Y is cyclohexene
- d) Y on treatment with cold, dilute and alkaline KMnO_4 gives racemic mixture of diols



Which of the following sequence of reaction can bring about the above transformation in good yield?



15. In which of the followings, the reactants and products are correctly matched?

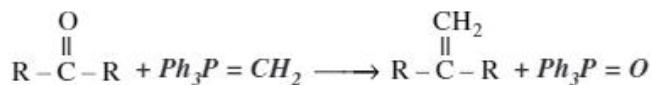


Linked Comprehension Type Questions

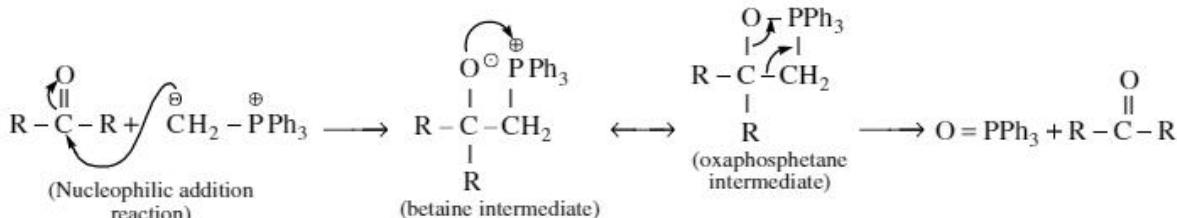
Passage :

Witting reaction:

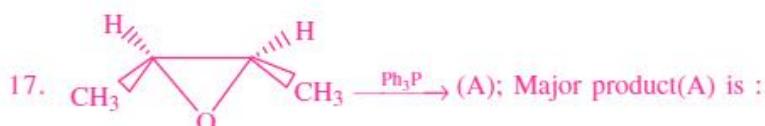
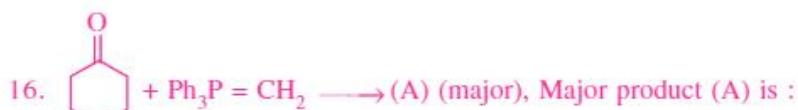
The reaction of a phosphorus ylide with an aldehyde (or) ketone introduces a carbon-carbon double bond in place of the carbonyl bond.



Mechanism:



Driving force of the reaction is high bond energy of (P = O). ($\Delta H - \text{ve}$)

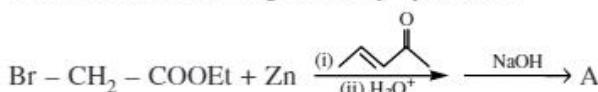


- a) cis-2-butene b) trans-2-butene c) iso-butene d) 1-butene



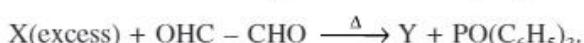
Integer Type Questions

19. Consider the following two step synthesis:



Cyclic diketone X. If X is finally treated with excess of NaBH_4 followed by acid work-up, how many different isomers of diols would be formed?

20. Consider the reaction given below, $\text{CH}_3\text{CH}_2\text{Cl} \xrightarrow[\text{(ii) C}_4\text{H}_9\text{Li}]{\text{(i) (C}_6\text{H}_5)_3\text{P}} \text{X}$.



How many different isomeric hydrocarbons of Y are formed?

KEY SHEET (PRACTICE SHEET)**EXERCISE-I**

LEVEL-I 1) 3 2) 3 3) 2 4) 3 5) 8

LEVEL-II 1) b 2) a 3) a 4) b 5) c 6) abc 7) ad 8) abcd
9) abd 10) a 11) b 12) c 13) A-qrs; B-qr; C-pqt; D-pqt

EXERCISE-II

LEVEL-I 1) 1 2) 1 3) 3 4) 1 5) 1 6) 2 7) 3

LEVEL-II 1) c 2) c 3) d 4) d 5) c 6) ab 7) abc 8) cd
9) bd 10) ac 11) b 12) a 13) a

EXERCISE-III

LEVEL-I 1) 4 2) 1,2,3,4 3) 1 4) 2 5) 4

LEVEL-II 1) c 2) c 3) c 4) c 5) c 6) d 7) b 8) b
9) a 10) ac 11) bcd 12) bc 13) cd 14) ab 15) b 16) c
17) b 18) b 19) abc 20) a 21) c 22) a 23) c 24) c
25) a 26) A-qrs; B-p; C-rs; D-pqrs 27) A-pt; B-qr; C-pqt; D-pst
28) A-qp; B-sr; C-qp; D-sr 29) A-pqt; B-rs; C-rs; D-pq 30) 4 31) 9

EXERCISE-IV

LEVEL-I 1) 4 2) 4 3) 1,2 4) 1 5) 1 6) 1 7) 1 8) 4
9) 1 10) 4 11) 4

LEVEL-II 1) d 2) a 3) a 4) a 5) c 6) b 7) d 8) a
9) c 10) abc 11) ac 12) ab 13) bd 14) ab 15) abcd 16) bcd
17) c 18) b 19) d 20) c 21) a 22) b 23) bc

EXERCISE-V

LEVEL-I

1) 1 2) 2 3) 2 4) 1 5) 2 6) 1 7) 4

LEVEL-II

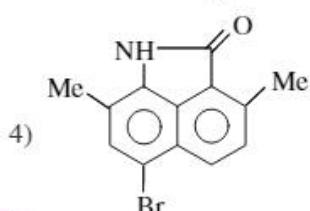
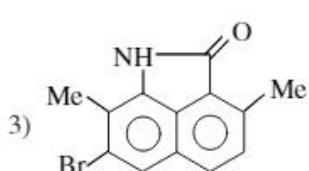
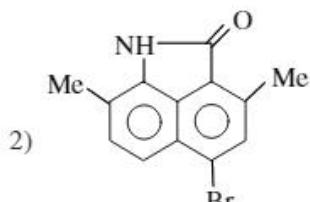
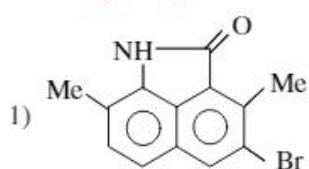
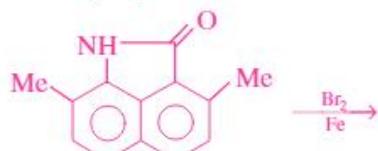
1) c 2) c 3) b 4) c 5) c 6) b 7) c 8) a
 9) c 10) b 11) acd 12) ac 13) bc 14) bc 15) acd
 16) a 17) b 18) b 19) 4 20) 3

ADDITIONAL PRACTICE EXERCISE

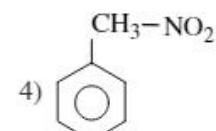
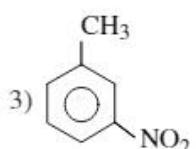
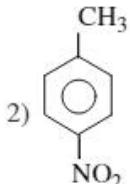
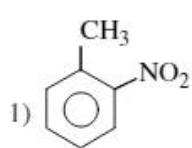
LEVEL-I (MAIN)

Straight Objective Type Questions

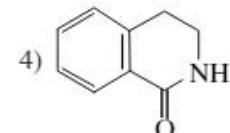
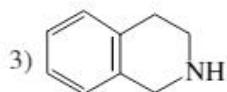
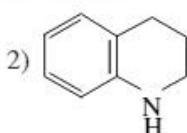
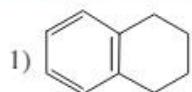
1. The major product of the below reaction is:



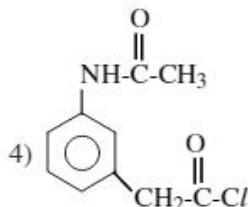
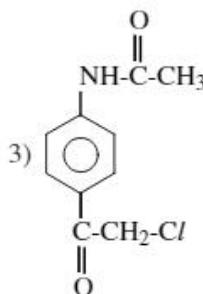
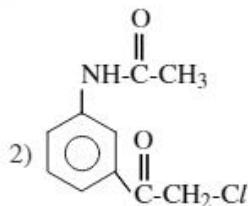
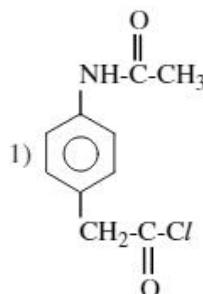
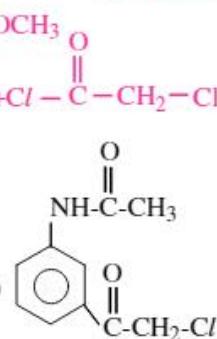
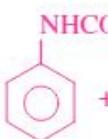
2. The product A in below reaction is (A)



3. Which one of the following compounds undergoes bromination of its aromatic ring (electrophilic aromatic substitution) at fastest rate?

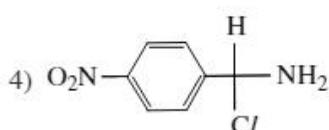
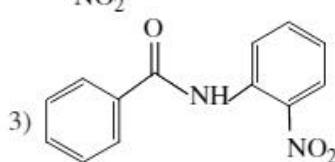
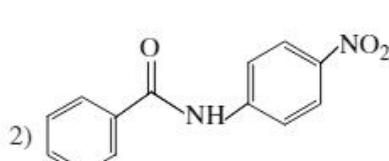
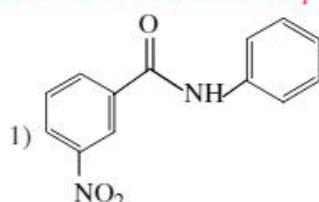


4. The product (P) in the below reaction is

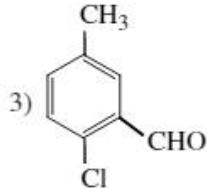
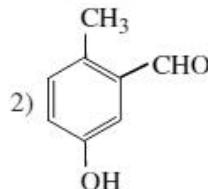
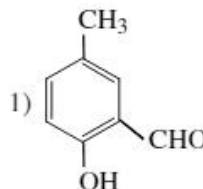
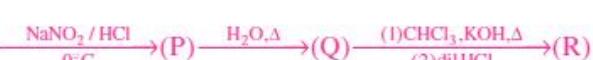


5. $(\text{P}) \xrightarrow[\text{(2)H}^+]{\text{(1)NaOH}} (\text{Q}) \xrightarrow{\text{SOCl}_2} (\text{R}) \xrightarrow[\text{NaOH}]{\text{C}_6\text{H}_5\text{NH}_2} (\text{S}) \xrightarrow[\text{conc H}_2\text{SO}_4 \text{ (1 equivalent)}]{\text{Conc HNO}_3} (\text{T}) \text{ (Major)}$

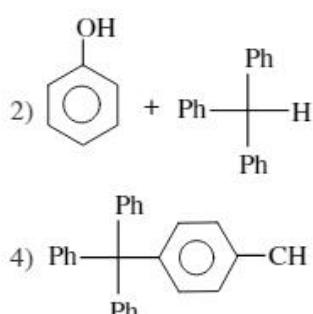
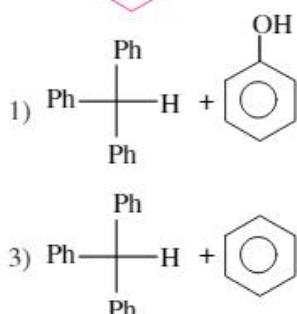
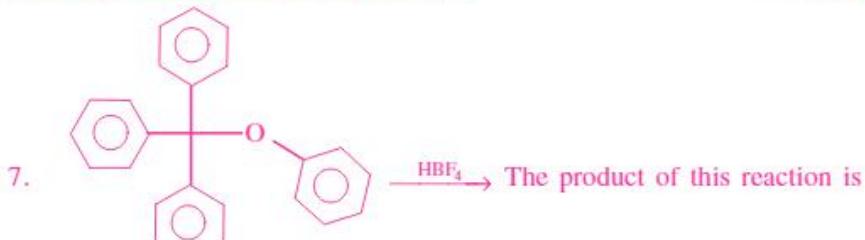
In the above reaction sequence, (T) can be:



6. Identify R in the reaction.



4) None of these



8. Arrange these compounds in decreasing order of reactivity for the nucleophilic addition reaction :

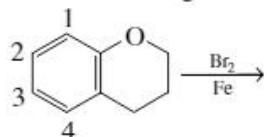
- (I) Acid chloride (II) Aldehyde (III) Ketone (IV) Ester

Select the correct answer from the codes given below :

- 1) I > II > III > IV 2) IV > III > II > I 3) III > II > I > IV 4) I > IV > II > III

Numerical Value Type Questions

9. In the following reaction, the substitution takes place at which position?



10. If all benzenoid aromatic carbonyl compounds having formula $\text{C}_8\text{H}_8\text{O}$ react with NH_2OH , the number of different oximes possible are

11. In the reaction $\text{HO}-\text{CH}_2-\text{CHO} \xrightarrow{\text{dil. NaOH}}$

How many distinct products (saturated) are possible ?

LEVEL-II

LECTURE SHEET (ADVANCED)

Straight Objective Type Questions

1. Schiff's reagent is used for the differentiation between :

- a) HCHO and CH_3CHO b) CH_3COCH_3 and CH_3CHO
c) $\text{C}_6\text{H}_5-\text{CH}_2-\text{COCH}_3$ and $\text{C}_6\text{H}_5-\text{COCH}_2-\text{CH}_3$ d) HCHO and $\text{C}_6\text{H}_5\text{CHO}$

2. Arrange acidity of given four compounds in decreasing order :

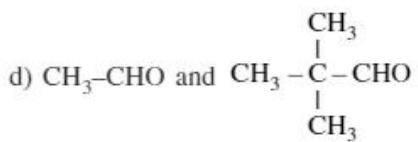
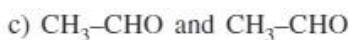
- (I) $\text{CH}_3-\text{COCH}_2-\text{COCH}_3$ (II) $\text{CH}_3-\text{COCH}_3$
(III) $\text{CH}\equiv\text{CH}$ (IV) CH_3-CHO

Select correct answer from the codes given below :

- a) I > IV > III > II b) I > IV > II > III c) III > I > IV > II d) II > IV > I > III

3. In the given reaction $X + Y \xrightarrow[50^\circ\text{C}]{\text{NaOH}} \text{CH}_3 - \text{CH(OH)} - \text{CH(CH}_3) - \text{CHO}$; (X) and (Y) will respectively be :

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



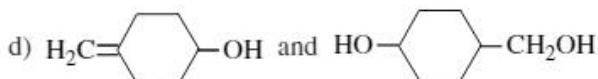
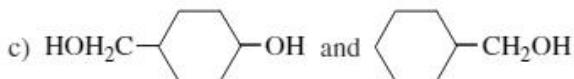
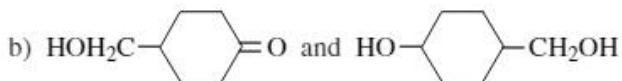
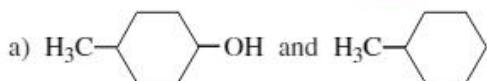
4. Which one of the combinations will give propanaldehyde on dry distillation ?

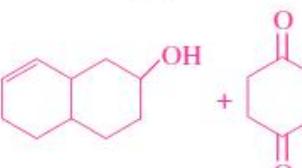
- a) $(\text{C}_6\text{H}_5\text{COO})_2\text{Ca}$ and $(\text{HCOO})_2\text{Ca}$
 b) $(\text{CH}_3\text{COO})_2\text{Ca}$ and $(\text{CH}_3 - \text{CH}_2 - \text{COO})_2\text{Ca}$
 c) $(\text{CH}_3 - \text{CH}_2 - \text{COO})_2\text{Ca}$ and $(\text{HCOO})_2\text{Ca}$
 d) $(\text{CH}_3\text{COO})_2\text{Ca}$ and $(\text{CH}_3\text{COO})_2\text{Ca}$

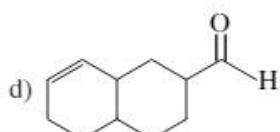
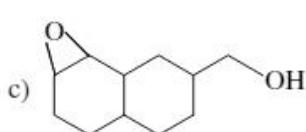
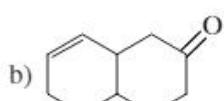
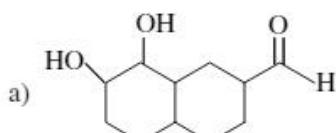
5. Two isomeric ketones, 3-pentanone and 2-pentanone can be distinguished by :

- a) I_2/NaOH b) NaSO_3H c) NaCN/HCl d) 2, 4-DNP

6. In the given reaction : $\text{H}_2\text{C} = \text{Cyclohexenone} \xrightarrow{\text{NaBH}_4} (\text{X}) \xrightarrow[(\text{ii})\text{H}_2\text{O}_2/\text{OH}]{(\text{i})\text{BH}_3,\text{THF}} (\text{Y})$. (X) & (Y) are :



7. 



More than One correct answer Type Questions

8. (A) $\xrightarrow[(iii)(B)]{(i)\text{Ph}_3\text{P}} \text{Cyclohexene} = \text{CH} - \text{CH}_3$. In above reaction (A) and (B) will respectively be
- - $\text{CH}_3\text{CH}_2\text{Cl}$ &
 -
 - $\text{Cl}/\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$ & CH_3CHO
9. Which of the following form stable hemiketal
- $\text{Ph} - \text{CO} - \text{Ph}$
 - $\text{HO} - (\text{CH}_2)_3 - \text{COCH}_3$
 - $\text{CH}_2\text{OH} - \text{CO}(\text{CHOH})_3 - \text{CH}_2 - \text{OH}$
 - $\text{HO} - \text{CH}_2 - (\text{CH}_2)_4 - \text{COCH}_3$
10. In the following reaction compound B formed can
- undergo tautomerism
 - form oximes
 - give colour with FeCl_3
 - B is an equilibrium mixture of B_1 and B_2 .
- 11.
- $$\xrightarrow[\text{CF}_3\text{CO}_3\text{H}]{\text{Ieq.}} \text{A} \xrightarrow{\text{HCN}} \text{B} \xrightarrow[(ii)\text{H}^+]{(i)\text{KOH}} \text{C} + \text{D}$$
- Which is/are correctly matched
- | Compound | Qualitative Test |
|-----------------|---|
| a) C and D both | Br_2 water decolourization |
| b) C and D both | Give effervescence with baking soda solution |
| c) C and D both | Red coloration to ceric ammonium nitrate solution |
| d) C and D both | Upon dry heating loose CO_2 . |

Linked Comprehension Type QuestionsPassage-I :

An alkene (A) $\text{C}_{16}\text{H}_{16}$ on ozonolysis gives only product (B) $\text{C}_3\text{H}_8\text{O}$. (B) also can be obtained by hydrolysis of the product obtained by reaction between cyano benzene and CH_3MgBr . (A) can show geometrical isomerism and it can decolourise Br_2 water. (B) on treatment with SeO_2 produces (C).

12. Which is not correct about (A) ?
- A is optically inactive
 - On catalytic hydrogenation 'trans' of A produces racemic mixture
 - A can be prepared by wittig reaction on acetophenone with $\text{Ph}_3\text{P}=\text{C}(\text{CH}_3)\text{Ph}$.
 - On treatment with per acid followed by hydrolysis 'trans' form of A produces racemic mixture.
13. Which is not correct about B ?
- It gives iodoform test
 - On treatment with LiAlH_4 , $\text{H}_2\text{-O}$ it produces a compound which also responds to iodoform test.
 - It gives Tollen's test
 - On treatment with NH_2NH_2 , EtO^- at high temperature it produces ethyl benzene.

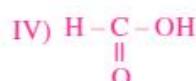
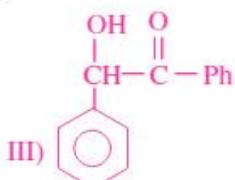
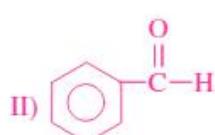
14. Which is not correct about C ?

- a) On treatment with NaBH_4 it will produce a diol.
- b) On treatment with OH^- (conc.) followed by acidification it produces an optically active acid.
- c) It gives Tollen's test
- d) It can take part in aldol condensation.

Passage-II :

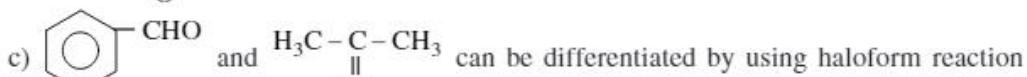
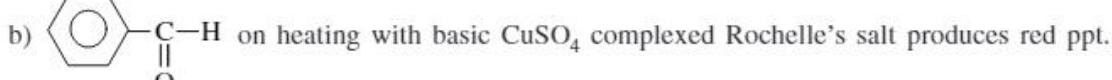
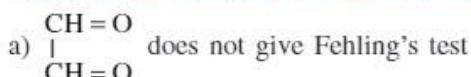
Aldehydes and ketones can be differentiated from non-carbonyl compounds through their reactions with derivatives of ammonia, semicarbazide, 2, 4-DNP. Hydrazine and hydroxylamine react with aldehydes and ketones to form precipitates. Semi carbazones and oximes are usually colourless. Whereas 2,4-DNP derivatives are usually orange. The M.P. of these derivatives can also be used in identifying specific aldehydes and ketones. The ease with which aldehydes undergo oxidation provides a useful test that differentiates aldehydes from ketones.

15. Which of the following respond to $[\text{Ag}(\text{NH}_3)_2]^+$.

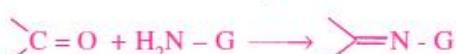


- a) only II, V
- b) only III, IV, V
- c) only II, IV, V
- d) A, B, C, correct

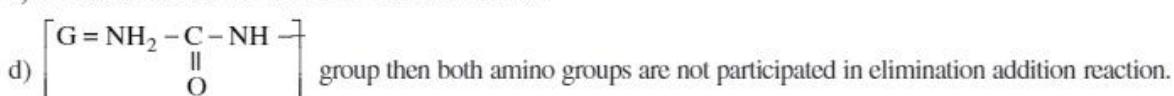
16. Which of the following statement is incorrect ?



17. Which of the following statement is incorrect regarding following reaction ?



- a) The reaction takes place at moderately acidic medium ($\text{pH} = 4-5$)
- b) Unsymmetrical ketones on treating with hydroxylamine produces two isomers
- c) In basic medium the rate of reaction is fast

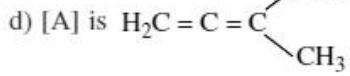
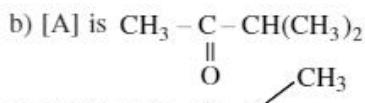
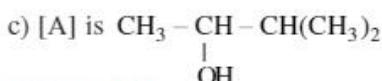
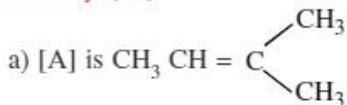


Passage-III :

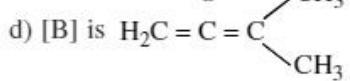
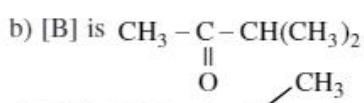
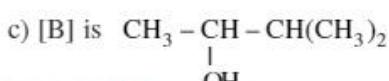
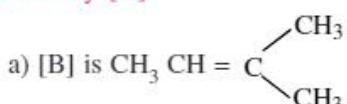
A ketone [A] gives haloform reaction and forms a compound [B] on reduction.

Compound [B] on heating with concentrated sulphuric acid gives a compound [C], which on ozonolysis gives acetaldehyde and acetone. Identify [A], [B], and [C].

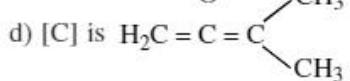
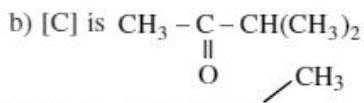
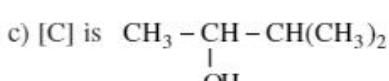
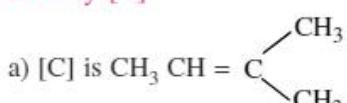
18. Identify [A]



19. Identify [B]



20. Identify [C]

**PRACTICE SHEET (ADVANCED)**Linked Comprehension Type QuestionsPassage-I :

An organic compound [A] of molecular weight 140.5 has 68.32% of carbon, 6.4% of hydrogen, and 25.26% of chlorine. The hydrolysis of [A] with a dilute acid gives compound [B], $\text{C}_8\text{H}_{10}\text{O}$.

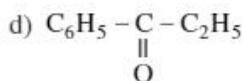
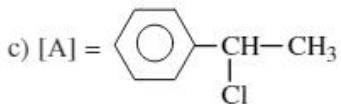
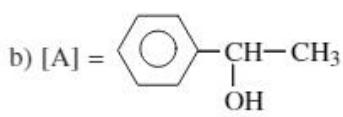
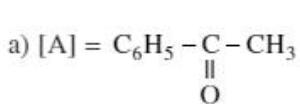
Compound [B] can be oxidised under mild conditions to compound [C], $\text{C}_8\text{H}_8\text{O}$. Compound [C] forms a phenyl hydrozone [D] with phenyl hydrazine and gives positive iodoform test.

1. What is Molecular formula of [A]

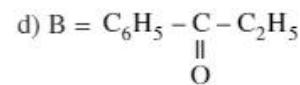
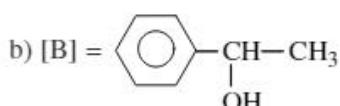
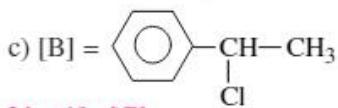
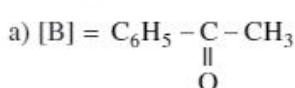
- a) $\text{C}_8\text{H}_9\text{Cl}$
c) $\text{C}_8\text{H}_{16}\text{Cl}_2$

- b) $\text{C}_8\text{H}_{10}\text{Cl}_2$
d) $\text{C}_8\text{H}_{14}\text{Cl}_2$

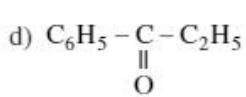
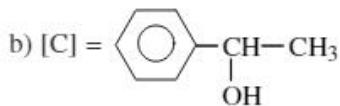
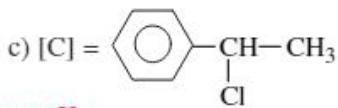
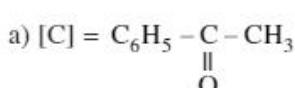
2. Identify [A]



3. Identify [B]



4. Identify [C]

*Passage-II :*

An organic compound [A] contains 40% C and 6.7% H. Its vapour density is 15. On reacting with concentrated solution of KOH, it gives two compounds [B] and [C]. When [B] is oxidised, the original compound [A] is obtained. When [C] is treated with concentrated HCl, it gives a compound [D], which reduces Fehling's solution and ammoniacal AgNO_3 solution, and also gives effervescence with aqueous NaHCO_3 solution.

5. What is the empirical formula of [A]

- a) CH_2O b) CH_2OH c) CH_3OH d) CHO

6. Identify [B]

- a) CH_3OH b) CH_2O c) HCOO^-K^+ d) CHO

Passage-III :

An organic compound [A] $\text{C}_4\text{H}_9\text{Cl}$ on reacting with aqueous KOH gives [B], and on reaction with alcoholic KOH gives [C], which is also formed on passing the vapours of [B] over heated copper. Compound [C] readily decolourises bromine water. The ozonolysis of [C] gives two compounds [D] and [E]. Compound [D] reacts with NH_2OH to give [F] and the compound [E] reacts with NaOH to give an alcohol [G] and sodium salt [H] of an acid. [D] can also be prepared from propyne on treatment with water in presence of Hg^{2+} and H_2SO_4 . Identify [A] to [H] with proper reasoning.

7. Identify compounds A & B

- a) $(\text{CH}_3)_2\text{CH} - \text{Cl}$ & $(\text{CH}_3)_3\text{COH}$ b) $(\text{CH}_3)_2 - \text{CH} - \text{Cl}$ & CH_3OH
 c) CH_3OH & HCOONa d) $(\text{CH}_3)_3\text{C} - \text{Cl}$ & $\begin{matrix} | \\ -\text{C}-\text{OH} \end{matrix}$

8. Identify compounds D & F.

- a) $(\text{CH}_3)_2\text{CH} - \text{Cl}$ & $(\text{CH}_3)_3\text{COH}$ b) CH_3OH & HCOONa
 c) $(\text{CH}_3)_3\text{C} - \text{Cl}$ & $\begin{matrix} | \\ -\text{C}-\text{OH} \end{matrix}$ d) $(\text{CH}_3)_2\text{C} = \text{O}$ & $(\text{CH}_3)_2\text{C} = \text{NOH}$

9. Identify compound G&H

- a) $\text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{OH}$ b) $\text{CH}_3\text{COONa} + \text{CH}_3\text{CH}_2\text{OH}$
 c) $(\text{CH}_3)_2\text{C} = \text{O}$ & $(\text{CH}_3)_2\text{C} = \text{NOH}$ d) CH_3OH & HCOONa

Passage-IV :

An organic compound [A] gives positive Liebermann's reaction, and on treatment with CHCl_3/KOH followed by hydrolysis gives [B] and [C]. Compound [B] gives colour with Schiff's reagent but [C], which is steam volatile, on treatment with LiAlH_4 gives [D], $\text{C}_7\text{H}_8\text{O}_2$ which on oxidation gives [E]. Compound [E] reacts with $(\text{CH}_3\text{CO})_2\text{O}/\text{CH}_3\text{COOH}$ to give a pain reliever, [F]. Identify [A] to [F] with proper reasoning.

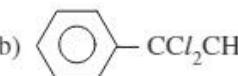
10. What is the percentage of carbon in compound [A]

- a) 57.85% b) 79.85% c) 54.85% d) 74.85%

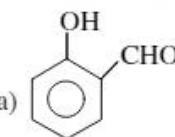
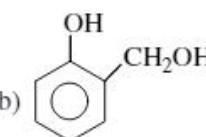
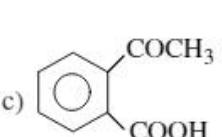
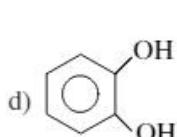
11. What is the Empirical formula of [A]

- a) $\text{C}_4\text{H}_4\text{Cl}$ b) $\text{C}_4\text{H}_5\text{Cl}_2$ c) $\text{C}_4\text{H}_4\text{Cl}_3$ d) $\text{C}_2\text{H}_2\text{Cl}$

12. Identify compound [A]

- a) $(\text{Ph})_3\text{C} - \text{CHCl}_2$ b)  c) $(\text{Ph})\text{CHCl}/\text{CH}_3$ d) $(\text{Ph})\text{CH}_2 - \text{CHCl}_2$

13. Identify compounds [C]

- a)  b)  c)  d) 

14. How many Double Bond present in compound [D] [A]

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

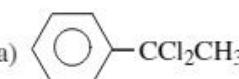
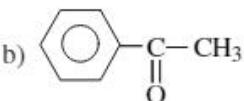
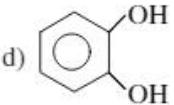
Passage-V :

0.450 g of an aromatic compound [A] on ignition gives 0.905 g of CO_2 and 0.185 g of H_2O . 0.350 g of [A] on boiling with HNO_3 and adding AgNO_3 solution gives 0.574 g of AgCl . The vapour density of [A] is 87.5. [A] on hydrolysis with $\text{Ca}(\text{OH})_2$ yields [B], which on mild reduction gives an optically active compound [C]. On heating [C] with I_2 and NaOH , iodoform is produced alongwith [D]. With HCl , [D] gives a solid which is markedly more soluble in hot water than in cold water. Identify [A] to [D] with proper explanation.

15. How much amount of carbon present in 0.905gm of CO_2

- a) $\frac{12}{44} \times 0.905$ b) $\frac{44}{12} \times 0.905$ c) 10 d) 0.4

16. Identify compound [A]

- a)  b) 
- c)  d) 

22. List-I (Compound)

A) 1,4 addition

B) Tautomerism

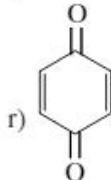
C) Allylic bromination

D) Preparation of Ketone from 2° alcohol

List-II (Used as)



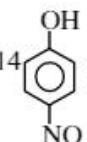
q) PCC



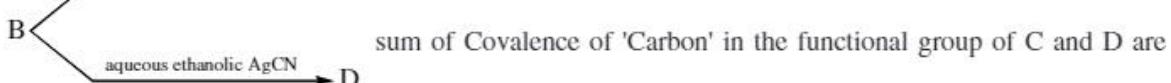
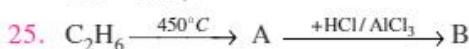
s) NBS

Integer Type Questions

23. How many tautomeric structures are possible for the given compound, which have got a carbonyl group ?



24. 0.535 g ethanol and acetaldehyde mixture when heated with Fehling solution gave 1.2 g of a red precipitate. x is the percentage of acetaldehyde in the mixture then calculate $\frac{x}{10} =$ (At. wt. of Cu = 63.8)



KEY SHEET (ADDITIONAL PRACTICE EXERCISE)

LEVEL-I (MAIN)

- 1) 2 2) 2 3) 2 4) 3 5) 2 6) 2 7) 3 8) 1 9) 3 10) 10
 11) 4

LEVEL-II

LECTURE SHEET (ADVANCED)

- 1) b 2) b 3) d 4) c 5) a 6) d 7) b 8) b 9) a 10) ab
 11) bcd 12) d 13) c 14) d 15) d 16) b 17) c 18) b 19) c 20) a

PRACTICE SHEET (ADVANCED)

- 1) a 2) c 3) b 4) a 5) a 6) a 7) d 8) d 9) d 10) c
 11) a 12) b 13) a 14) a 15) a 16) a 17) b 18) b
 19) A-r; B-qs; C-s; D-p 20) A-q, B-s, C-r, D-p 21) A-q, B-p, C-r, D-s
 22) A-pr; B-p; C-s; D-qs 23) 4 24) 7 25) 7

