Aldehyde & Ketones

LEVEL – I

1. Which of the following gives ketone on oxidation?
   (a) $CH_3CH_2CH_2OH$ (b) $CH_3 \cdot CHOHCH_3$
   (c) $(CH_3)_2CHCH_2OH$ (d) $(CH_3)_3COH$

2. On heating calcium acetate and calcium formate, the product formed is
   (a) CH_3COCH_3 (b) CH_3CHO
   (c) $HCHO + CaCO_3$ (d) $CH_3CHO + CaCO_3$

3. $(HCOO)_2Ca \xrightarrow{\text{dry distillation}} X + Y$ Compounds X and Y are
   (a) Formaldehyde and water (b) Acetaldehyde and water
   (c) Formaldehyde and calcium carbonate (d) Acetaldehyde and calcium carbonate

4. When propyne is treated with dil. H_2SO_4 in presence of $HgSO_4$ the major product is
   (a) Propanal (b) Acetaldehyde
   (c) Acetone (d) Butanone

5. During reduction of carbonyl compounds by hydrazine and KOH, the first intermediate formed is
   (a) $RC \equiv N$ (b) $RCONH_2$
   (c) $RCH = NH$ (d) $RCH = NNH_2$

6. $C_2H_5COCl + H_2 \xrightarrow{Pd/BaSO_4} X + Y$ Compounds X and Y are
   (a) CH_3CHO and HCl (b) C_2H_5CHO and HCl
   (c) CH_3COCH_3 and HCl (d) $CH_3COC_2H_5$ and HCl

7. Oxidation of toluene with CrO_3 in the presence of $(CH_3CO)_2O$ gives a product 'A' which on treatment with aqueous NaOH, produces
   (a) 2,4-diacetyltoluene (b) C_6H_5COONa
   (c) $(C_6H_5CO)_2O$ (d) C_6H_5CHO

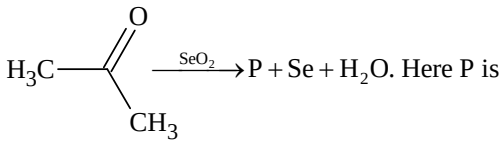
8. In this reaction:
   $CH_3CHO + HCN \longrightarrow CH_3CH(OH)CN \xrightarrow{H_2O} CH_3CH(OH)COOH$
   an asymmetric centre is generated. This acid obtained would be
   (a) 50%D + 50% L-isomer (b) L-isomer
   (c) 20% D + 80% L-isomer (d) D-isomer

9. Which of the following is most reactive towards nucleophilic addition reactions?
   (a) HCHO (b) CH_3CHO
   (c) C_2H_5CHO (d) $CH_3 \cdot CO \cdot CH_3$

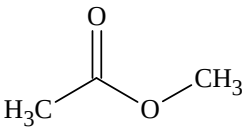
10. The most reactive compound towards formation of cyanohydrin on treatment with KCN followed by acidification is:
(a) Benzaldehyde (b) *p*-Nitrobenzaldehyde
(c) Phenylacetaldehyde (d) *p*-Hydrooxybenzaldehyde

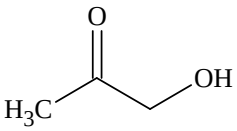
11. $CH_3CH = CHCHO$ is oxidized to $CH_3CH = CHCOOH$ using
(a) Alkaline $KMnO_4$ (b) Selenium dioxide
(c) Ammonical $AgNO_3$ (d) All

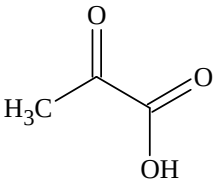
12. Schiff's reagent is
(a) Magenta solution decolourised with sulphurous acid
(b) Magenta solution decolourised with chlorine
(c) Ammonical cobalt chloride solution
(d) Ammonical manganese sulphate solution

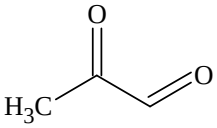
13. 

$\longrightarrow P + Se + H_2O$. Here P is

(a) 

(b) 

(c) 

(d) 

14. Which one of the following pairs is not correctly matched?
(a) $> C = O \longrightarrow > CH_2$ Clmmensen reduction
(b) $> C = O \longrightarrow > CHOH$ Wolff-Kishner reduction
(c) $- COCl \longrightarrow - CHO$ Rosenmund reduction
(d) $- C \equiv N \longrightarrow - CHO$ Stephen reduction

15. If 3-hexanone is reacted with $NaBH_4$ followed by hydrolysis with D_2O, the product will be
(a) $CH_3CH_2CH(OH)CH_2CH_2CH_3$ (b) $CH_3CH_2CD(OH)CH_2CH_2CH_3$
(c) $CH_3CH_2CH(OD)CH_2CH_2CH_3$ (d) $CH_3CH_2CD(OD)CH_2CH_2CH_3$

16. Treatment of propionaldehyde with dil. NaOH solution gives
(a) $CH_3CH_2COOCH_2CH_2CH_3$ (b) $CH_3CH_2CHOHCH(CH_3)CHO$
(c) $CH_3CH_2CHOHCH_2CH_2CHO$ (d) $CH_3CH_2COCH_2CH_2CHO$

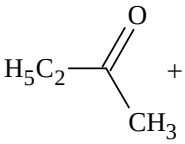
17. Which compound undergoes aldol condensation?
(a) Acetaldehyde (b) Phenylacetaldehyde
(c) Ethyl methyl ketone (d) All

18. Base catalysed aldol condensation occurs with
(a) benzaldehyde` (b) 2-methyl propionaldehyde
(c) 2,2-dimethyl propionaldehyde (d) none

19. Aldol condensation will not observed in
(a) Chloroal (b) Phenylacetaldehyde
(c) Hexanal (d) Nitromethane

20. A mixture of benzaldehyde and formaldehyde on heating with aqueous NaOH solution gives
(a) benzyl alcohol and sodium formate (b) sodium benzoate and methyl alcohol
(c) sodium benzoate and sodium formate (d) benzyl alcohol and methyl alcohol

21. In the reaction below



$+ I_2 + X \longrightarrow Y + CHI_3 + H_2O + NaI$ Identify compounds X and Y
(a) NaOH and C_2H_5ONa (b) NaOH and C_2H_5COOH
(c) NaOH and C_2H_5COONa (d) None

22. Which of the following reagents cannot be used to distinguish between pentanal and pentanone-2?
(a) Tollen's reagent (b) Fehling solution
(c) I_2 in NaOH (d) Br_2 in carbon tetrachloride

23. In the given reaction, X is $CH_3CHO + CH_2(COOH)_2 \xrightarrow[\text{heat}]{\text{Pyridine}} X$
(a) CH_3COOH (b) C_2H_5COOH
(c) $CH_3CH = CH{\cdot}COOH$ (d) $COOH{\cdot}CH = CH{\cdot}COOH$

24. Which of the following reaction can produce R – CO – Ar?
(a) $ArCOCl + H - Ar \xrightarrow{AlCl_3}$ (b) $COCl_2 + RMgX \longrightarrow$
(c) $R + CrO_3 \longrightarrow$ (d) $RCOCl + H - Ar \xrightarrow{AlCl_3}$

25. Which of the following compounds is oxidized to prepare methyl ethyl ketone?
(a) 2-Propanaol (b) 1-Butanol
(c) 2-Butanol (d) *tert*-Butyl alcohol

LEVEL – II

1. In the reaction sequence
$\text{Glycerol} \xrightarrow{KHSO_4/\Delta} X \xrightarrow{Zn-Hg/\text{conc.}HCl/\Delta} Y \xrightarrow{NBS/CCl_4} Z$; (Z) will be
(a) 1-Bromopropane (b) 2-Bromopropane
(c) 3-Bromopropene (d) 1,2-Dibromopropane

2. $C_6H_6 + CO + HCl \xrightarrow{\text{Anhy. } AlCl_3} X + HCl$. Compound X is
(a) $C_6H_5CH_3$ (b) $C_6H_5CH_2Cl$
(c) C_6H_5CHO (d) C_6H_5COOH

3. $(CH_3)_2CO \xrightarrow[(HCl)]{NaCN} A \xrightarrow[\Delta]{H_3O^+} B$
In the above sequence of reactions, A and B are
(a) $(CH_3)_2C(OH)CH$, $(CH_3)_2C(OH)COOH$ (b) $(CH_3)_2C(OH)CN$, $(CH_3)_2C(OH)_2$
(c) $(CH_3)_2C(OH)CN$, $(CH_3)_2CHCOOH$ (d) $(CH_3)_2C(OH)CN$, $(CH_3)C = O$

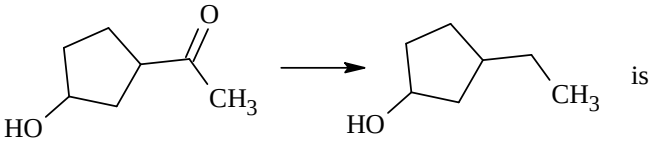
4. The general order of reactivity of carbonyl compounds for nucleophilic addition reactions is:
(a) $H_2C = O > R_2C = O > Ar_2C = O > RCHO > ArCHO$
(b) $H_2C = O > RCHO > R_2C = O > ArCHO > Ar_2C = O$
(c) $ArCHO > Ar_2C = O > RCHO > R_2C = O > H_2O = O$
(d) $Ar_2C = O > R_2C = O > ArCHO > RCHO > H_2C = O$

5. Which of the following chemical system has most acidic hydrogen?
(a) 3-Hexanone (b) 2,4-Hexanedione
(c) 2,5-Hexanedione (d) 2,3-Hexanedione

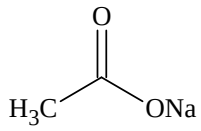
6. Which of the following compounds would not form a silver mirror with Tollne's reagent?
(a) R·CHO (b) Ar·CHO
(c) CH_3·CO·R (d) RCHOHCOR

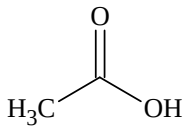
7. An organic compound of molecular formula C_3H_6O did not give a silver mirror with Tollen's reagent, but gave an oxime with hydroxylamine. It may be
(a) $CH_2 = CHCH_2OH$ (b) CH_3CH_2CHO
(c) CH_3COCH_3 (d) $CH_2 = CH{\cdot}O{\cdot}CH_3$

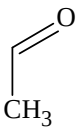
8. The appropriate reagent for the following transformation

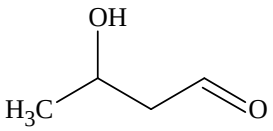


is
(a) Zn(Hg)·HCl (b) NH_2NH_2, OH^-
(c) H_2/Ni (d) $NaBH_4$

9. Predict the product 'B' in the sequence of reaction
$CH \equiv CH \xrightarrow[HgSO_4]{3\%\ H_2SO_4} A \xrightarrow{NaOH} B$
(a) 

(b) 

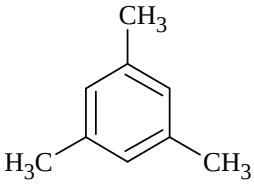
(c) 

(d) 

10. Aldol condensation between which of the following compounds followed by dehydration gives methylvinyl ketone?

(a) HCHO and CH_3COCH_3 (b) HCHO and CH_3CHO

(c) $2CH_3CHO$ (d) $2CH_3COCH_3$

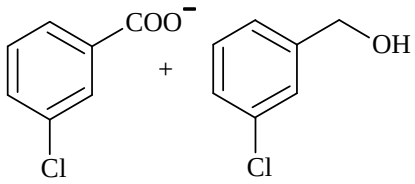
11. 

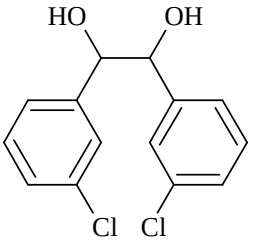
The above compound describes a condensation polymer which can be obtained in two ways. Either treating 3 molecules of acetone (CH_3COCH_3) with conc. H_2SO_4 or passing propyne ($CH_3C \equiv CH$) through a red hot tube. The polymer is

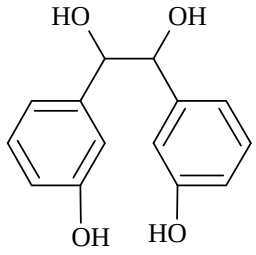
(a) Phorone (b) Mesityl oxide

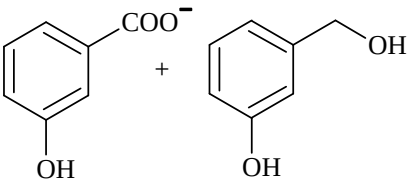
(c) Diacetonyl alcohol (d) Mesitylene

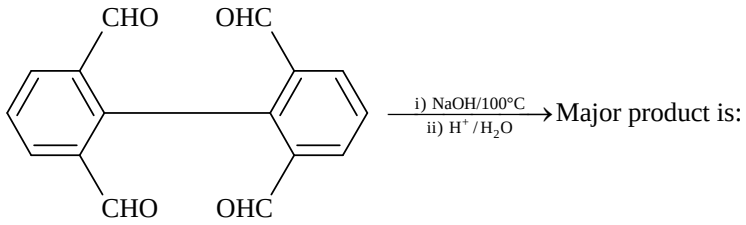
12. When *m*-chlorobenzaldehyde is treated with 50% KOH solution, the product(s) obtained is(are)

(a) 

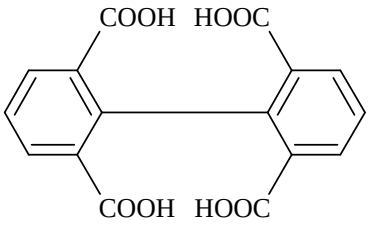
(b) 

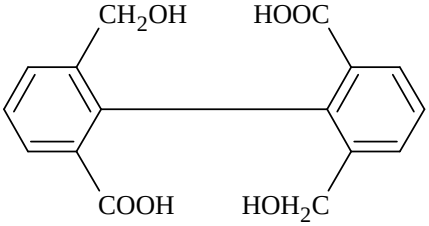
(c) 

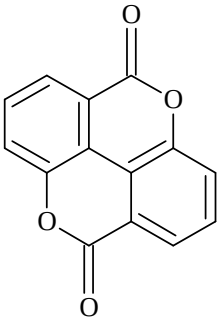
(d) 

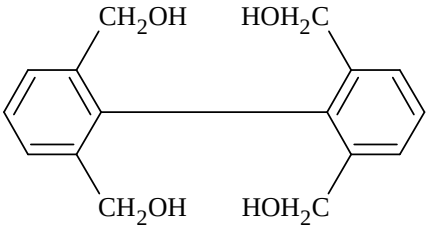
13. 

Major product is:

(a) 

(b) 

(c) 

(d) 

14. Among the following compounds, which will react with acetone to give a product containing C = N – bond?

$\underset{(I)}{C_6H_5NH_2}$ $\underset{(II)}{(CH_3)_3N}$ $\underset{(III)}{C_6H_5NHC_6H_5}$ $\underset{(IV)}{C_6H_5NHNH_2}$

(a) only I (b) only IV
(c) I and IV (d) I, III and IV

15. An organic compound X on treatment with acidified $K_2Cr_2O_7$ gives compound Y which reacts with I_2 and sodium carbonate to form tri-iodomethane. The compound X can be

(a) CH_3OH (b) $CH_3{\cdot}CO{\cdot}CH_3$
(c) CH_3CHO (d) $CH_3CH(OH)CH_3$

16. A substance $C_4H_{10}O$ yields on oxidation a compound, C_4H_8O which gives an oxime and a positive iodoform test. The original substance on treatment with conc. H_2SO_4 gives C_4H_8. The structure of the compound is

(a) $CH_3CH_2CH_2CH_2OH$ (b) $CH_3CHOHCH_2CH_3$
(c) $(CH_3)_3COH$ (d) $CH_3CH_2 – O – CH_2CH_3$

17. Which of the following statements regarding chemical properties of acetophenone are wrong?

I. It is reduced to methylphenylcarbinol by sodium and ethanol
II. It is oxidized to benzoic acid and acidified $KMnO_4$
III. It does not undergo electrophilic substitution like nitration at meta position
IV. It does not undergo iodoform reaction with iodine and alkali

(a) I and III (b) II and IV
(c) III and IV (d) I and II

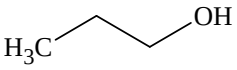
18. A compound possessing α-hydrogen atom, in the presence of dilute alkali forms β-hydroxyaldehyde. This product on heating with dilute acid forms an unsaturated crotonaldehyde. The compound is

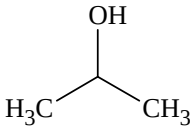
(a) CH_3CHO (b) CH_3CH_2CHO

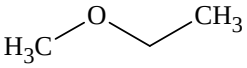
(c) $CH_2 = CHCHO$ (d) $CH \equiv C{\cdot}CHO$

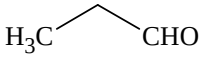
19. Identify X in the sequence

$$C_3H_8O \xrightarrow[H_2SO_4]{K_2Cr_2O_7} C_3H_6O \xrightarrow[\text{warm}]{I_2+NaOH} CHI_3$$

(a) 

(b) 

(c) 

(d) 

20. Identify the product C in the series

$$CH_3CN \xrightarrow{Na/C_2H_5OH} A \xrightarrow{HNO_2} B \xrightarrow{KMnO_4,\ H^+} C$$

(a) CH_3COOH (b) CH_3CH_2NHOH

(c) CH_3CONH_2 (d) CH_3CHO

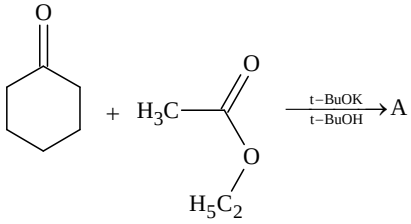
21. In the reaction

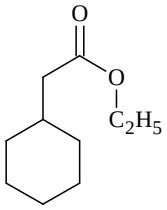
$CH_3 - CH = CH - CHO \xrightarrow[\text{agent}]{\text{oxidizing}} CH_3 - CH = CH - COOH$, the oxidising agent can be

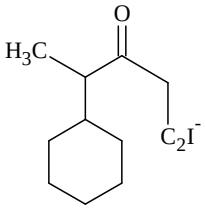
(a) alkaline $KMnO_4$ (b) acidified $K_2Cr_2O_7$

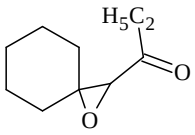
(c) Benedict's solution (d) all of the above

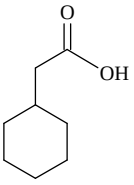
22. What is A in the following reaction?

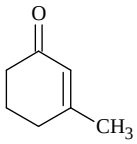


(a) 

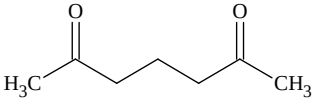
(b) 

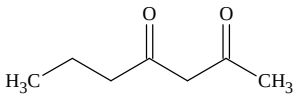
(c) 

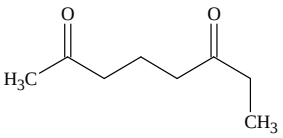
(d) 

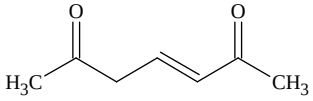
23. 

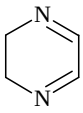
is the final product obtained when one of the following is reacted with base.

(a) 

(b) 

(c) 

(d) 

24. A + B forms  A and B are

(a) $H_2N - CH_2CH_2 - NH_2$, CH_3CHO
(b) CH_3CHO, $NH_2 - NH_2$
(c) $H_2N - CH_2CH_2 - NH_2$, $CHO - CHO$
(d) $HCHO$, CH_3NH_2

25. Identify Z in the series

$$CH_2 = CH_2 \xrightarrow{HBr} X \xrightarrow{\text{Hydrolysis}} Y \xrightarrow[I_2 \text{ excess}]{Na_2CO_3} Z$$

(a) C_2H_5I
(b) C_2H_5OH
(c) CHI_3
(d) CH_3CHO

LEVEL – III

1. Reduction with aluminium isopropoxide in excess of isopropyl alcohol is called Meerwein Ponndorff Verley reduction (MPV). What will be the final product when cyclohex-2-enone is selectively reduced in MPV reaction?
(a) Cyclohexanol
(b) Cyclohex-2-enol
(b) Cyclohexanone
(d) Benzene

2. Identify X in the sequence

$$C_4H_8O \xrightarrow[ii)\ H_2O/H^+]{i)\ CH_3MgI} C_5H_{12}O \xrightarrow[575K]{Cu} C_5H_{10}$$

(a) $CH_3 \cdot CO \cdot CH_2CH_3$
(b) $CH_3CH_2CH_2CHO$
(c) $(CH_3)_2CHCHO$
(d) $CH_3CH_2CH_2CH_2OH$

3. A new carbon-carbon bond formation is possible in
I. Cannizzaro reaction
II. Friedel Craft reaction
III. Clemmensen reduction
IV. Riemer-Tiemann reaction
(a) II
(b) II and IV
(c) All
(d) None

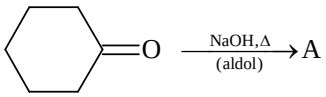
4. Which alkene is formed from the following yield carbonyl pair?

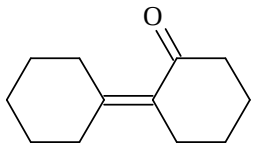
$CH_3CH_2CH_2CH = PPh_3$ + 2-butanone

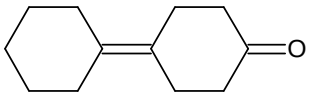
(a) 3-Methyl-3-heptene (b) 4-Methyl-3-heptene
(c) 5-Methyl-3-heptene (d) 1-Methyl-5-heptene

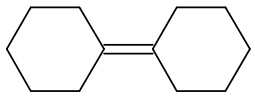
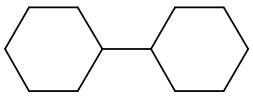
5. An organic compound 'A' has the molecular formula C_3H_6O. It undergoes iodoform test. When saturated with HCl it gives 'B' of molecular formula $C_9H_{14}O$. 'A' and 'B' respectively are
(a) Propanal and mesitylene
(b) Propanone and mesityl oxide
(c) Propanone and 2,6-dimethyl-2, 5-heptadien-4-one
(d) Propane and mesitylene oxide

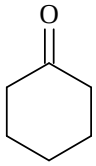
6. Compound 'A' (molecular formula C_3H_8O) is treated with acidified potassium dichromate to form a product 'B' (molecular formula C_3H_6O). 'B' forms a shining silver mirror on warming with ammonical silver nitrate. 'B' when treated with an aqueous solution of $H_2NCONHNH_2.HCl$ and sodium acetate gives a product 'C'. Identify the structure of 'C'.
(a) $CH_3CH_2CH = NNHCONH_2$ (b) $(CH_3)_2C = NNHCONH_2$
(c) $(CH_3)_2C = NCONHNH_2$ (d) $CH_3CH_2CH = NCONHNH_2$

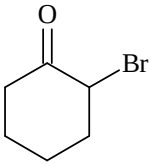
7. 

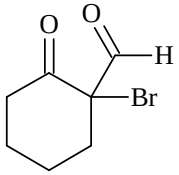
A can be:
(a) 

(b) 

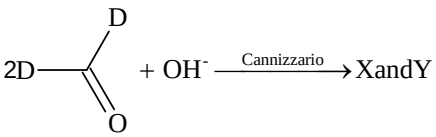
(c) 
(d) 

8. Greatest amount of hydration is in:
(a) 

(b) 

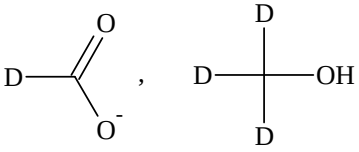
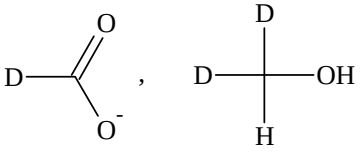
(c) 

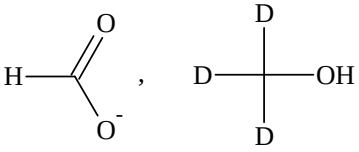
(d) Equal

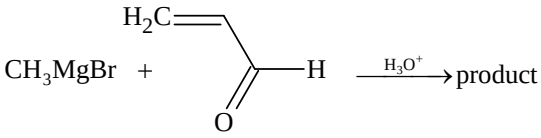
9. 

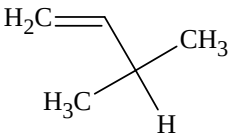
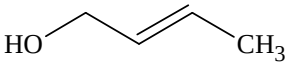
(Y is alcohol, D is deuterium)

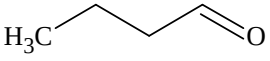
X and Y will have structure

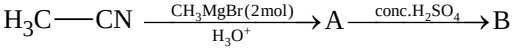
(a)  (b) 

(c)  (d) None is correct

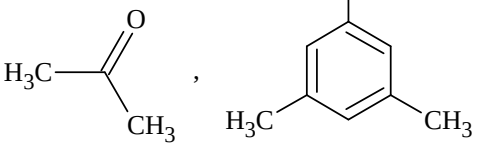
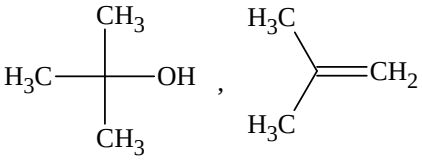
10. 

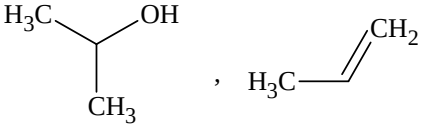
(a)  (b) 

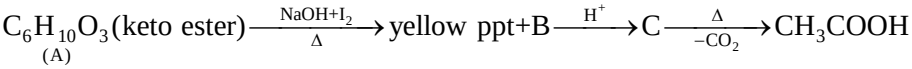
(c)  (d) None is correct

11. 

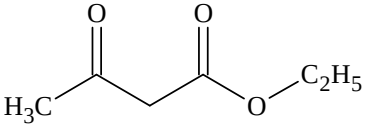
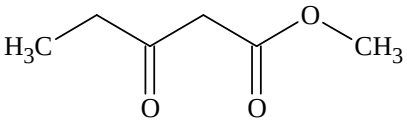
A and B are:

(a)  (b) 

(c)  (d) None is correct

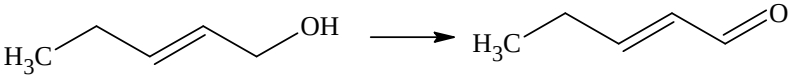
12. 

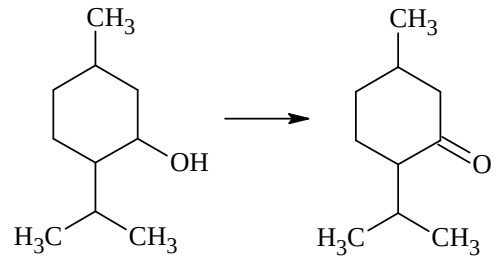
Hence A is:

(a)  (b) 

(c) Both are correct (d) None is correct

13. Suggest suitable oxidizing reagents for allowing conversions:

A) 

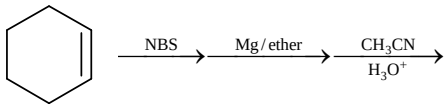
B) 

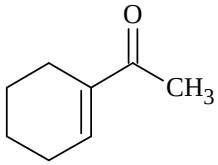
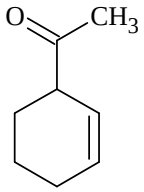
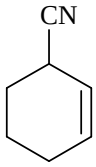
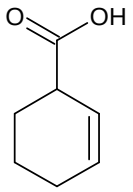
(a) MnO_2 in A and CrO_3 (in glacial acetic acid) in B
(b) CrO_3 in A and MnO_2 in B
(c) both correct
(d) both incorrect

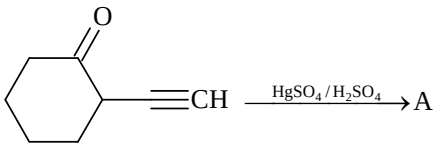
14. $CH_3 - CH = CH - CHO \xrightarrow[\text{aldol}]{OH^-} \xrightarrow{\Delta} A$

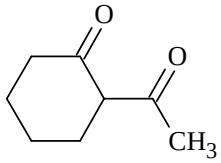
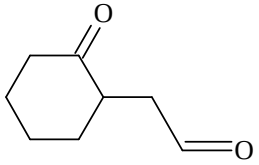
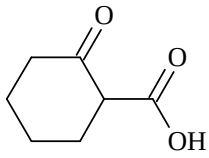
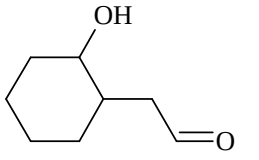
A is
(a) $CH_3(CH{=}CH)_3CHO$
(b) $CH_3CH_2CH_2(CH = CH)_2CHO$
(c) $CH_3(CH_2CH_2)_2CH = CH - CHO$
(d) none is correct

15. End product of the following sequence of reactions is:

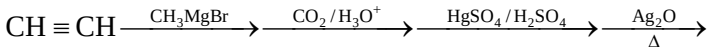


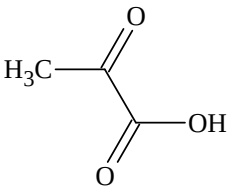
(a) 
(b) 
(c) 
(d) 

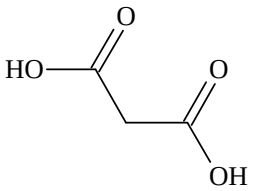
16. 

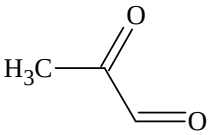
A is:
(a) 
(b) 
(c) 
(d) 

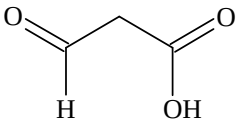
17. End product of the following sequence of reaction is:



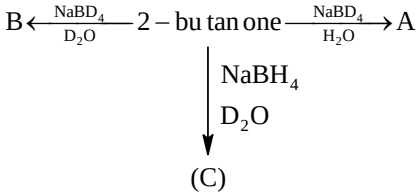
(a) 

(b) 

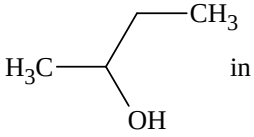
(c) 

(d) 

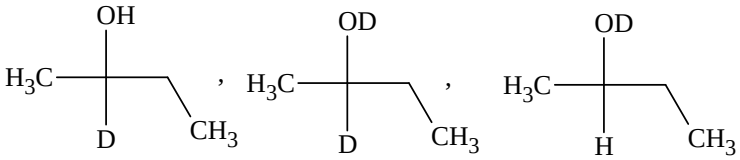
18. Consider reduction of 2-butanone

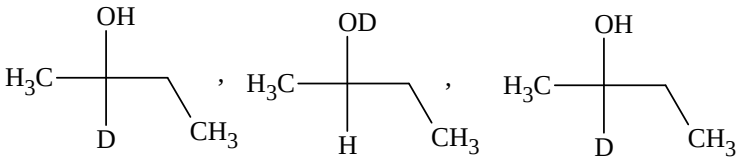


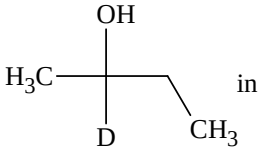
A, B and C are

(a) 

in all cases

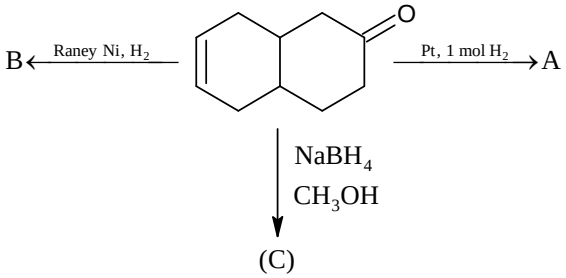
(b) 

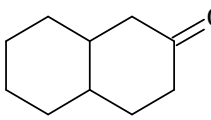
(c) 

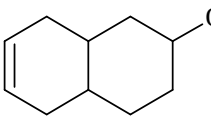
(d) 

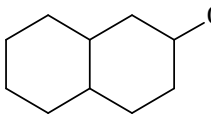
in all cases

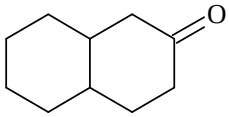
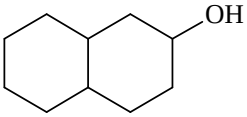
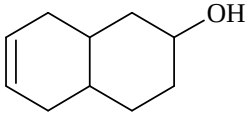
19. What are A, B and C in the following?

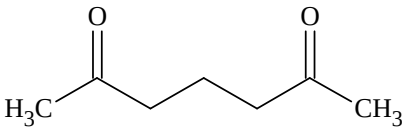


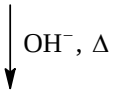
(a)  in all cases

(b)  in all cases

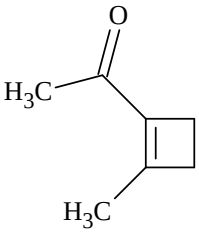
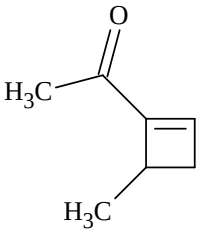
(c)  in all cases

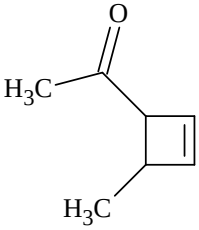
(d) A :  B :  C : 

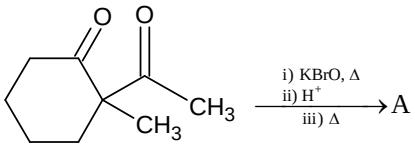
20. 



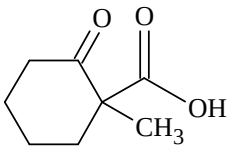
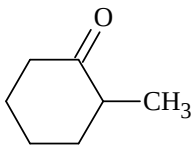
A (formed by aldol condensation) is:

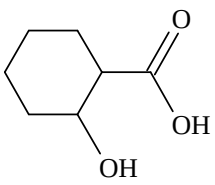
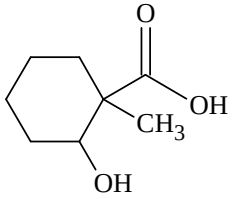
(a)  (b) 

(c)  (d) None is correct

21. 

A is:

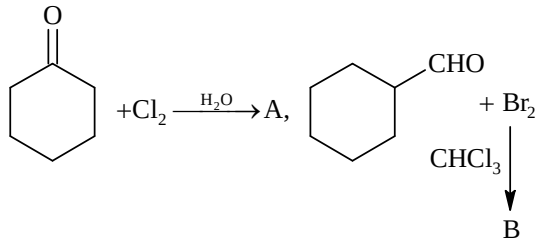
(a)  (b) 

(c)  (d) 

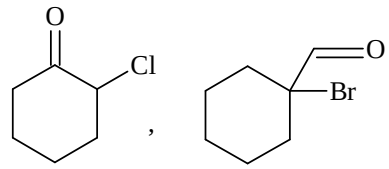
22. $2CH_3-\overset{\overset{O}{\|}}{C}-OC_2H_5 \xrightarrow{C_2H_5ONa} A$

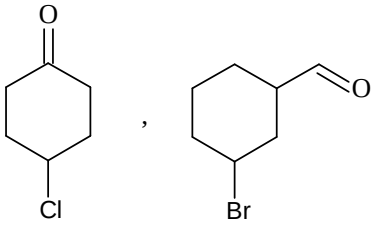
A is formed by Claisen condensation; which is/are true about A?

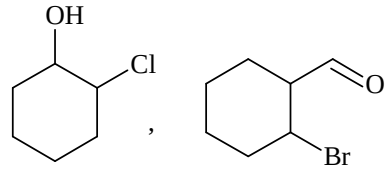
(a) A forms oximes
(b) A shows tautomerism
(c) A shows iodoform test
(d) All true

23. 

A and B are:

(a) 

(b) 

(c) 

(d) None is correct

24. $CH \equiv CH \xrightarrow{HgSO_4/H_2SO_4} B \xrightarrow{\text{reaction R}} A$

A, B and reaction R are:

(a) $CH_3-\overset{\overset{O}{\|}}{C}-Cl$, CH_3CHO
Rosenmund ($Pd/BaSO_4$, H_2)

(b) CH_3COOH, $LiAlH_4$
hydroboration oxidation

(c CH_3CN, CH_3CHO,
Stephen ($SnCl_2/HCl$)

(d) $CH \equiv CH$, CH_3CHO
hydroboration oxidation

25. Which is/are correct statement(s)?

(a) in presence of conc. H_2SO_4, CH_3CHO changes to cyclic trimer-paraldehyde which is a hypnotic.
(b) at room temperature, HCHO forms cyclic trimer-trioxan
(c) in presence of $Ba(OH)_2$, HCHO forms hexose
(d) bakelite is the polymer of HCHO and urea

Answers

Aldehyde & Ketones

LEVEL – I

1.	(b)	10.	(b)	19.	(a)
2.	(d)	11.	(c)	20.	(a)
3.	(c)	12.	(a)	21.	(c)
4.	(c)	13.	(d)	22.	(d)
5.	(d)	14.	(b)	23.	(c)
6.	(b)	15.	(c)	24.	(d)
7.	(d)	16.	(b)	25.	(c)
8.	(a)	17.	(d)		
9.	(a)	18.	(b)		

LEVEL – II

1.	(c)	10.	(a)	19.	(b)
2.	(c)	11.	(d)	20.	(a)
3.	(a)	12.	(a)	21.	(d)
4.	(b)	13.	(b)	22.	(c)
5.	(b)	14.	(c)	23.	(a)
6.	(c)	15.	(d)	24.	(c)
7.	(c)	16.	(b)	25.	(c)
8.	(b)	17.	(c)		
9.	(d)	18.	(a)		

LEVEL – III

1.	(b)	10.	(c)	19.	(d)
2.	(a)	11.	(b)	20.	(a)
3.	(b)	12.	(a)	21.	(b)
4.	(a)	13.	(a)	22.	(d)
5.	(c)	14.	(a)	23.	(a)
6.	(a)	15.	(b)	24.	(a), (c), (d)
7.	(a)	16.	(b)	25.	(a), (b), (c)
8.	(c)	17.	(b)		
9.	(a)	18.	(b)		

Hints & Solutions

LEVEL – I

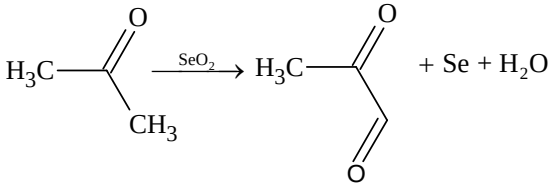
8. The reaction involves the synthesis of chiral centre. In the laboratory, the stereospecifcity of reaction cannot be controlled. Hence, we get both the enantiomeric forms (racemic mixture).

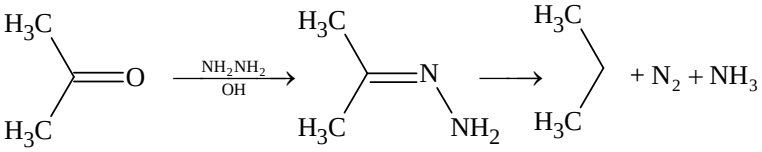
9. Carbon is most electron-deficient and least crowded in HCHO. Thus formaldehyde will be most easily attacked by nucleophile.

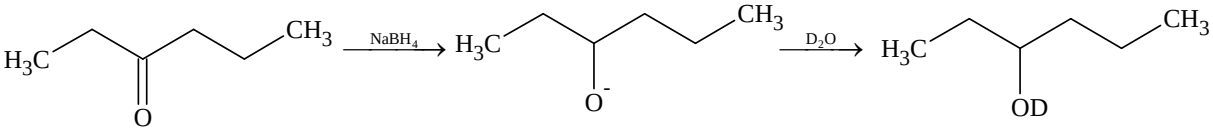
10. Presence of electron withdrawing group in the *p*-position to the –CHO group increases nucleophilic addition.

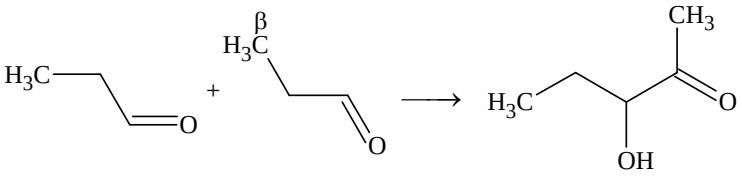
11. Silver ion (Tollen's reagent) is a mild oxidizing agent, hence it does not oxidize carbon-carbon double bond.

12. Schiff's reagent is magenta (a pink coloured dye) solution whose colour has been discharged by sulphur dioxide ($H_2SO_3 \rightarrow H_2O + SO_2$).

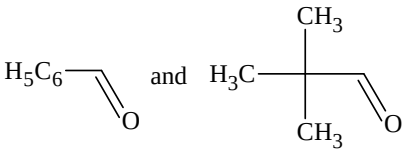
13. 

14. 

15. 

16. 

17. CH_3CHO, $C_6H_5CH_2CHO$ and $C_6H_5COCH_{34}$ all have α-hydrogen atom, hence undergoes aldol condensation.

18.  and do not have any α-hydrogen atom.

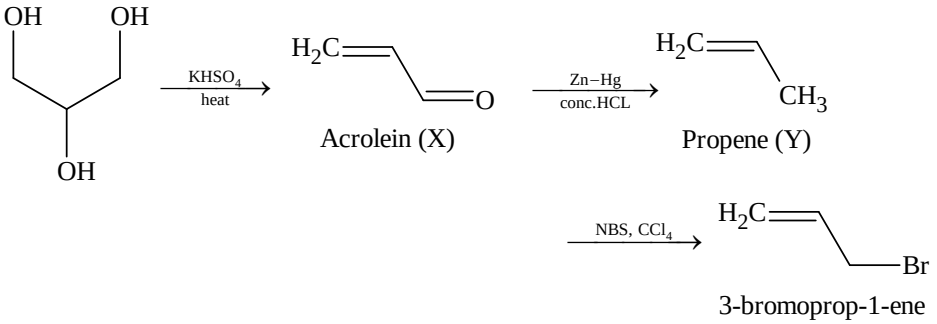
19. Chloral, $Cl_3C.CHO$, does not have α-hydrogen atom.

20. $C_6H_5CHO + HCHO \xrightarrow{\text{aq.NaOH}} C_6H_5CH_2OH + HCOONa$

22. Br_2 in CCl_4 reacts neither with pentanol nor with pentanone-2.

25. $CH_3 \cdot CO \cdot C_2H_5 \longrightarrow \underset{\text{2-Butanol}}{CH_3CHOHC_2H_5}$

LEVEL – II

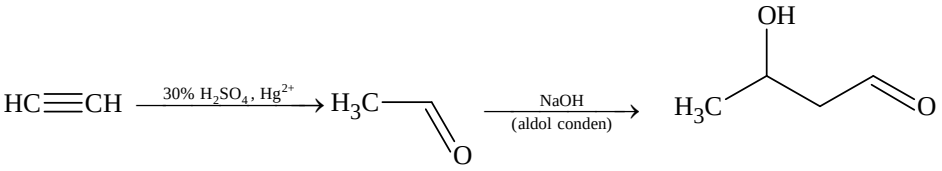
1. 
Acrolein (X)
Propene (Y)
3-bromoprop-1-ene

4. $H_2C = O > RCHO > R_2C = O > ArCH = O > Ar_2C = O$
An aryl group, due to –I effect is expected to speed up the reaction, however, due to resonance it stabilizes the reactant very much and thus causes net deactivation.

5. 2, 4-Hexanedione has $-CH_2$ group surrounded on both sides by electronegative (> C = O) group, hence it is acidic in nature; the carbanion $(CH_3-\overset{\overset{O}{\|}}{C}-\overset{-}{C}H-\overset{\overset{O}{\|}}{C}-CH_2CH_3)$ once formed stabilizes due to resonance.

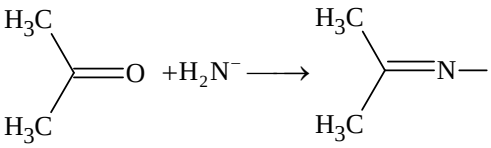
6. Aromatic aldehydes as well as α-hydroxy ketones are oxidisable by Tollen's reagent.

8. Since the starting compound has an – OH group which is sensitive to acid (HCl), Zn(Hg) and HCl can't be used for reduction.

9. 

10. $HCHO + CH_3COCH_3 \xrightarrow[\text{condensation}]{\text{aldol}} HOCH_2 \cdot CH_2 \cdot COCH_3 \xrightarrow[(-H_2O)]{} \underset{\text{Methyl vinyl ketone}}{CH_2 = CHCOCH_3}$

14. Only primary amines will react with acetone to form C = N – bond



15. Since the compound Y responds haloform reaction, it must have $-COCH_3$, $-CHOHCH_3$ or $-CHO$ group. The compound that can yield these grouping is $CH_3CHOH.CH_3$.

$$\underset{X}{CH_3CHOHCH_3} \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3COCH_3 \xrightarrow{I_2/Na_2CO_3} CHI_3$$

16. $$\underset{(C_4H_8)}{CH_3CH=CHCH_3} \longleftarrow \underset{(C_4H_{10}O)}{CH_3CHOHCH_2CH_3} \xrightarrow{(O)} \underset{C_4H_8O}{CH_3\cdot CO\cdot CH_2CH_3}$$

17. $C_6H_5COCH_3$ undergoes electrophilic substitution as well as haloform reaction.

18. $$CH_3CHO \xrightarrow{OH^-} CH_3CHOHCH_2CHO \xrightarrow[heat]{H^+} \underset{\text{Crotonaldehyde}}{CH_3CH=CHCHO}$$

20. $$CH_3 - CN + 4H \xrightarrow{Na/C_2H_5OH} \underset{(A)}{CH_3CH_2NH_2}$$

$$CH_3CH_2NH_2 + HO - N = O \longrightarrow CH_3 - CH_2OH + N_2 + H_2O$$

$$CH_3CH_3OH \xrightarrow[KMnO_4]{[O]} \underset{(C)}{CH_3COOH}$$

20. $$CH_3 - CN + 4H \xrightarrow{Na/C_2H_5OH} \underset{(A)}{CH_3CH_2NH_2}$$

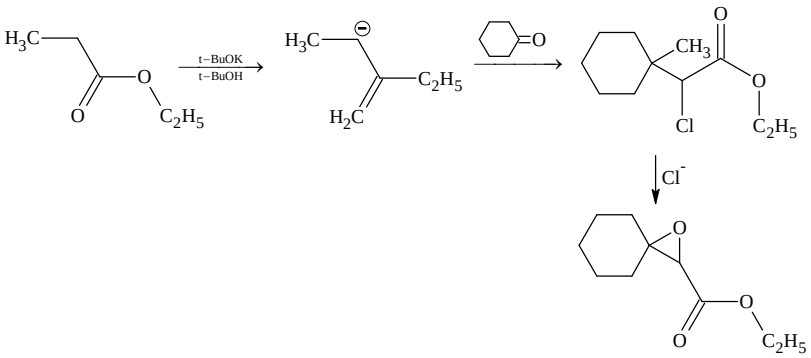
$$CH_3CH_2NH_2 + HO - N = O \longrightarrow CH_3 - CH_2OH + N_2 + H_2O$$

$$CH_3CH_3OH \xrightarrow[KMnO_4]{[O]} \underset{(C)}{CH_3COOH}$$

21. $$CH_3CH = CH - CHO \xrightarrow{\text{Benedict } (Cu^{++}) \text{ solution}} CH_3 - CH = CH - COOH$$

Benedict solution (solution of $CuSO_4$, sodium carbonate and sodium citrate) is specific for oxidation of aldehydes.

22.



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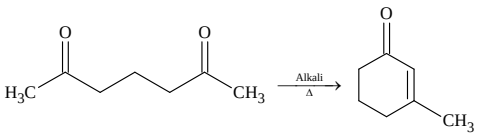

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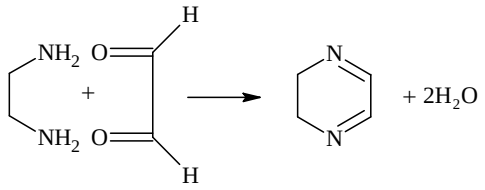
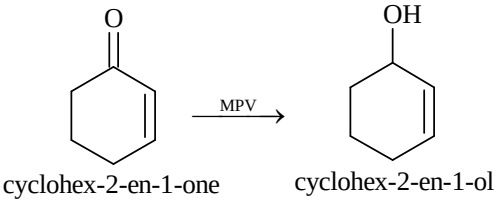


LEVEL – III

1.



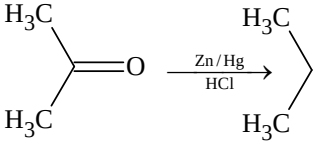
cyclohex-2-en-1-one cyclohex-2-en-1-ol

2. Remember that alkenes (C_5H_{10}) are obtained by heating *ter*-alcohols with copper at 575 K. Hence $C_5H_{12}O$ should be *tert* alcohol and thus X should be ketone.

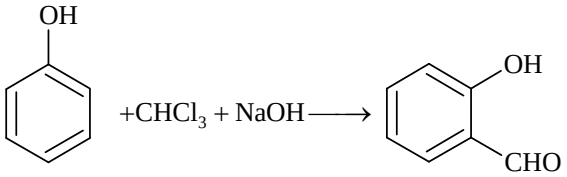
3. I. Cannizzaro reaction: $2HCHO \longrightarrow HCOONa + CH_3OH$

II. Friedel Craft reaction: $C_6H_6 + CH_3Cl \longrightarrow C_6H_5CH_3$

III. Clemmensen reduction:



IV. Reimer-Tiemann reaction:



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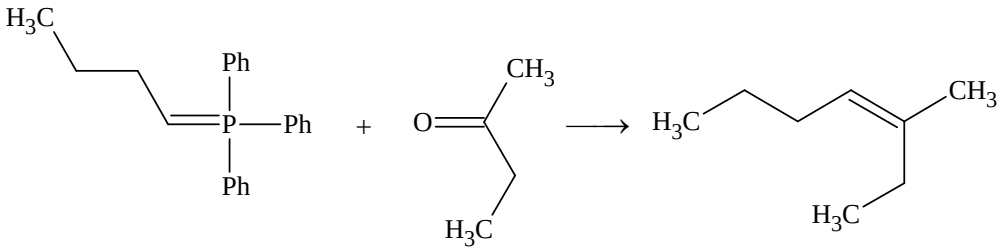


5. Since the compound A has the molecular formula C_3H_6O and undergoes iodoform test, it should be $CH_3{\cdot}CO{\cdot}CH_3$. Further reaction of B with HCl gives $C_9H_{14}O$ having three times the number of carbon atoms in A, former should be trimer of acetone, i.e. it should be phorone.

$$\underset{\text{Acetone (3 moles)}}{(CH_3)_2C=O} + H_3C\cdot CO\cdot CH_3 + \underset{}{O=C(CH_3)_2} \longrightarrow \underset{\text{2,6–Dimethyl–2–5–heptadien–4–one}}{(CH_3)_2C=CHCOCH=C(CH_3)_2}$$

6. $C_3H_8O \xrightarrow[H_2SO_4]{K_2Cr_2O_7} C_3H_6O \xrightarrow[AgNO_3]{\text{ammonical}} \text{Silver mirror}$

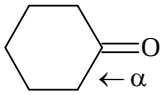
(A) (B)

$\downarrow H_2NCONHNH_2$

(C)

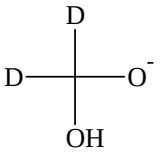
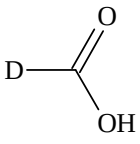
Since B reduces ammonical silver nitrate, it should be an aldehyde and hence A as primary alcohol, which should be $C_2H_5CH_2OH$. Hence

$$\underset{(A)}{CH_3CH_2CH_2OH} \longrightarrow \underset{(B)}{CH_3CH_2CHO} \xrightarrow{H_2NCONHNH_2} \underset{(C)}{CH_3CH_2CH = NNHCONH_2}$$

7 

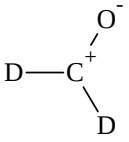
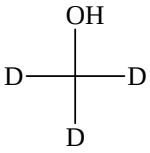
H at α – C takes part which is condensed to carbonyl group of second molecule; heating causes α, β elimination.

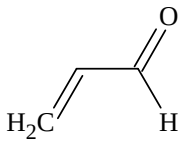
9. Proton hydride transfer reaction, intermediate I.

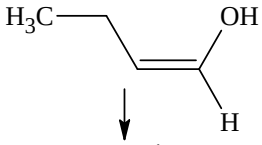
 gives D^- and 

(I) (II)

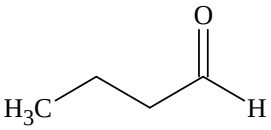
II gives H^+ and $D-\underset{\underset{O^-}{\|}}{C}=O\bullet D^-$ and H^+ are joined to

 forming 

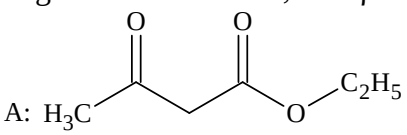
10.  is conjugate system

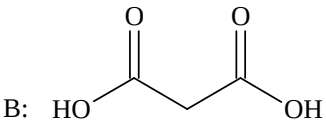
hence $I+CH_2-Mg-Br \xrightarrow{H_3O^+}$ 

tautomerises



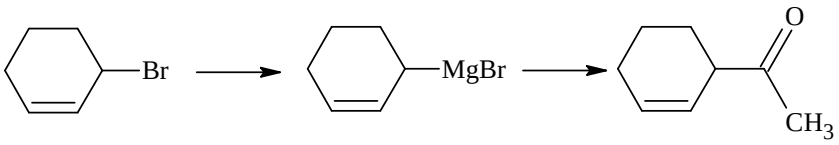
12. A gives iodoform test; A is β-keto ester, hence A is

A: 

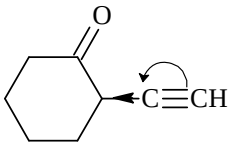
B: 

14. α-H is vinylic hence H of $-CH_3$ is involved in aldol condensation

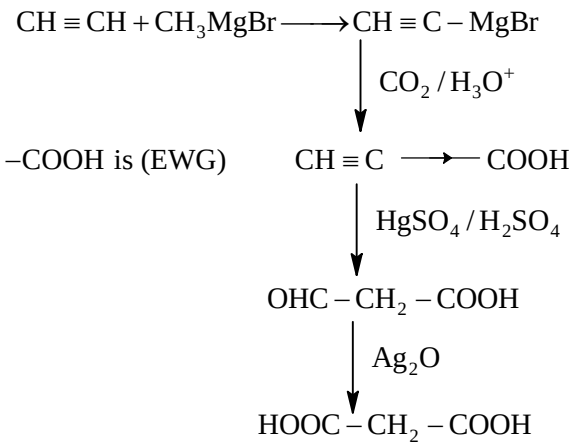
15. Substitution at allylic position by NBS



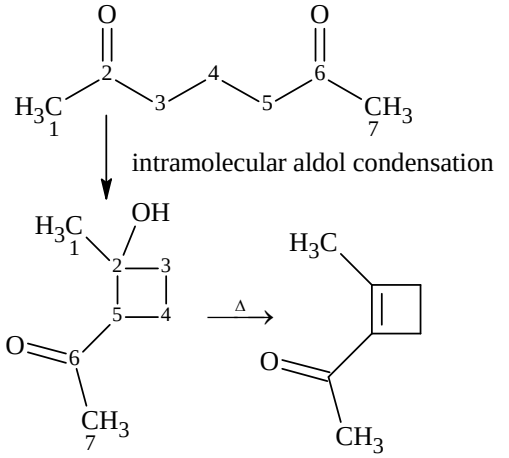
16. C = O is (EWG) hence π electron transfer is towards ring.



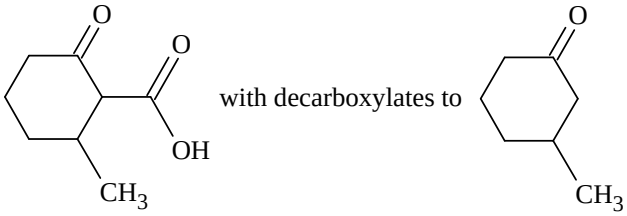
17.



20.

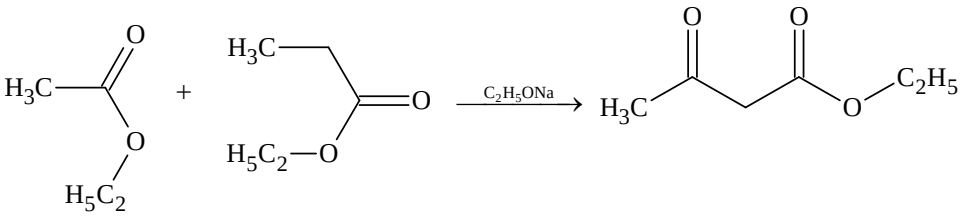


21. Intermediate is



(when β-keto acid is heated, CO_2 is lost)

22.



A has carbonyl group

A has active ($–CH_2$) group w.r.t. (EWG)

A has $CH_3-\overset{\overset{O}{\|}}{C}-$