

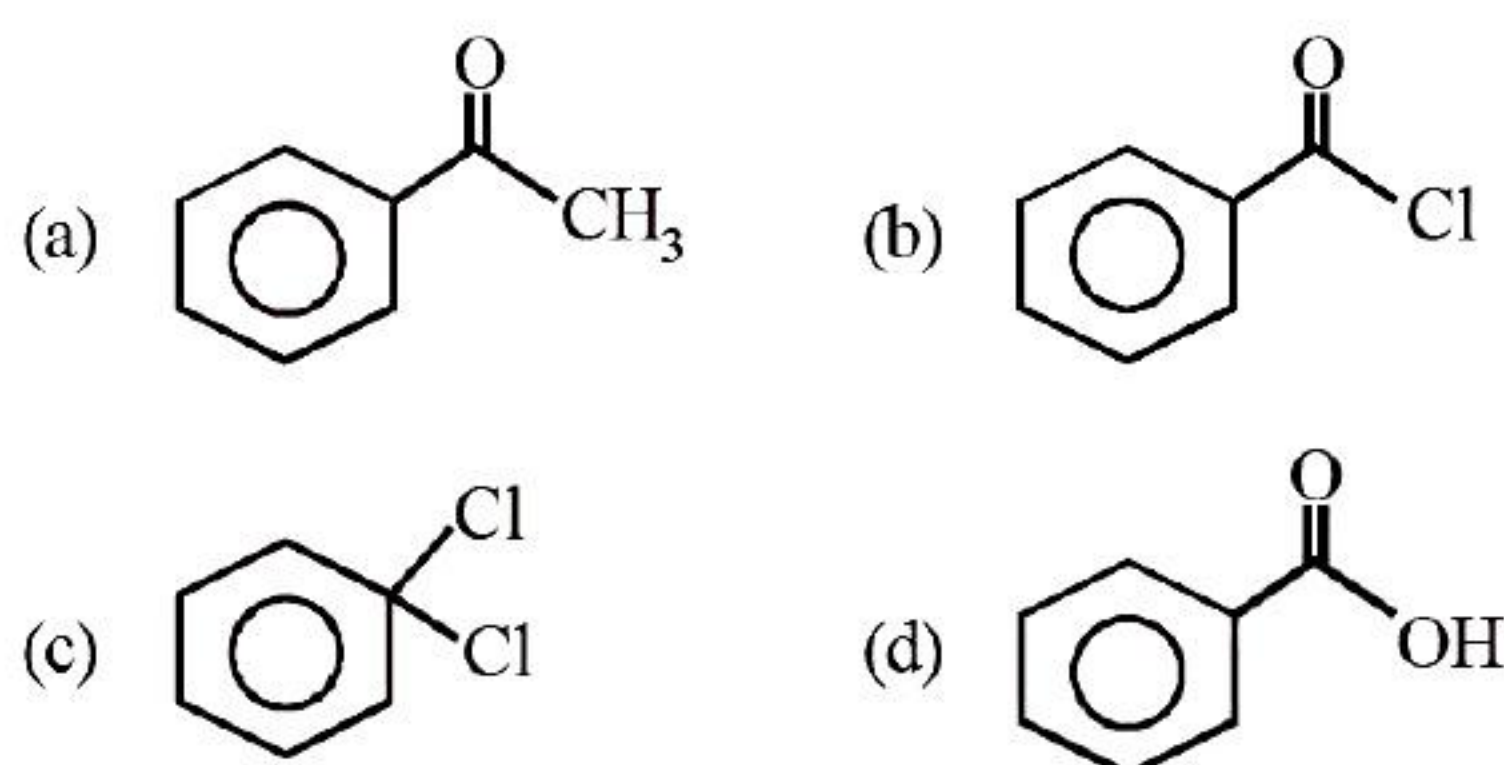
12

Aldehydes, Ketones and Carboxylic Acids

Multiple Choice Questions (MCQs)

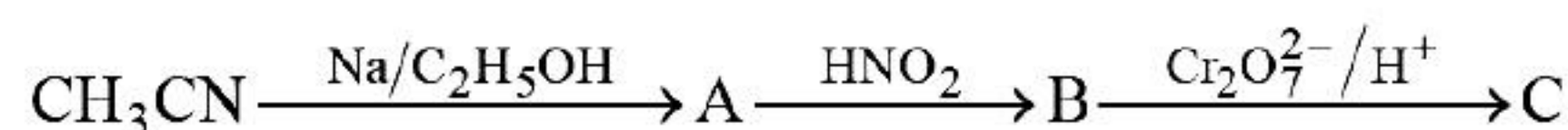
DIRECTIONS : This section contains multiple choice questions. Each question has four choices (a), (b), (c) and (d) out of which only one is correct.

- In $>C=O$ group sigma bond is formed by
(a) sp^2 - p -overlapping (b) sp^3 - p -overlapping
(c) sp - p -overlapping (d) s - p -overlapping
- Benzaldehyde is obtained from Rosenmund's reduction of



- The conversion $PhCN \rightarrow PhCOCH_3$, can be achieved most conveniently by reaction with
(a) CH_3MgBr followed by hydrolysis
(b) $I_2 - NaOH, CH_3I$
(c) dil. H_2SO_4 followed by reaction with CH_2N_2
(d) $LiAlH_4$ followed by reaction with CH_3I
- The reagent which can be used to distinguish acetophenone from benzophenone is
(a) 2,4-dinitrophenylhydrazine
(b) aqueous solution of $NaHSO_3$
(c) benedict reagent
(d) I_2 and Na_2CO_3
- The most appropriate reagent to distinguish between acetaldehyde and formaldehyde is :
(a) Fehling's solution (b) Tollen's reagent
(c) Schiff's reagent (d) Iodine in presence of base
- Cross aldol condensation occurs between
(a) two same aldehydes
(b) two same ketones
(c) two different aldehydes and ketones
(d) None of these

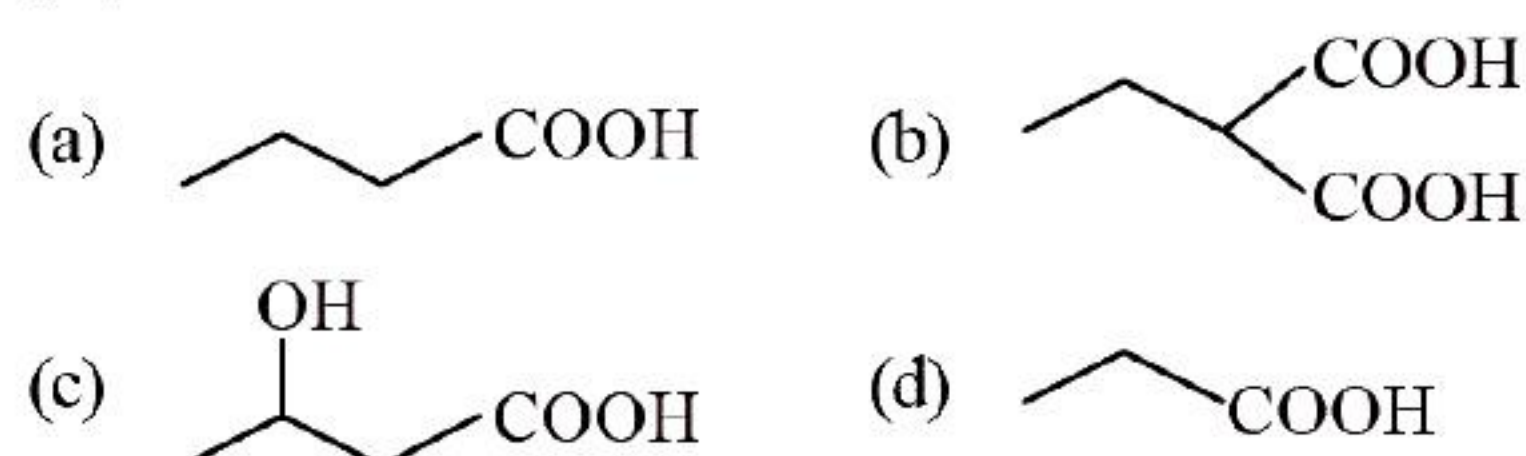
- Imine derivatives of aldehyde and ketone is called as
(a) Schiff's reagent (b) Fehling's reagent
(c) Schiff's base (d) Schiff's acid
- Identify the product C in the series :



- (a) CH_3COOH (b) CH_3CH_2NHOH
(c) CH_3CONH_2 (d) CH_3CHO
- Dimerisation of carboxylic acids is due to
(a) ionic bond
(b) covalent bond
(c) coordinate bond
(d) intermolecular hydrogen bond
 - Which of the following has the maximum acidic strength?
(a) *o*-nitrobenzoic acid (b) *m*-nitrobenzoic acid
(c) *p*-nitrobenzoic acid (d) *p*-nitrophenol
 - The yield of ester in esterification can be increased by
 $CH_3CH_2OH + CH_3COOH \rightleftharpoons CH_3COOCH_2CH_3 + H_2O$
(a) removing water
(b) taking ethanol in excess
(c) taking acetic acid in excess
(d) all the above factors

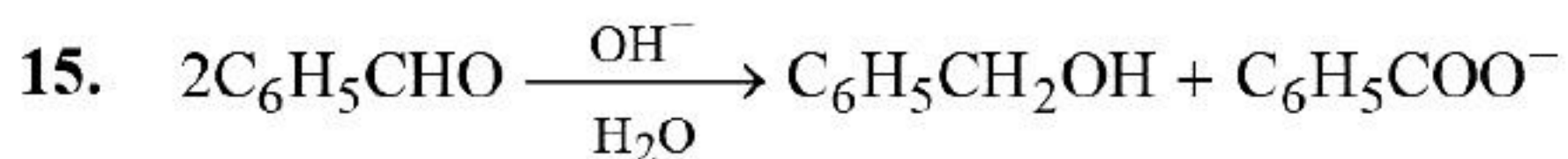
- Consider the following processes
Process (1) C_2H_5OH/H^+ , $LiAlH_4$, PCC
Process (2) $NaBH_4$, $Cu/300^\circ C$
Process (3) PCl_5 , $LiAlH_4$, CrO_3/H_2SO_4
Process (4) $SOCl_2$, $Pd/BaSO_4/H_2$
The process by which acetic acid can be converted into acetaldehyde is/are
(a) 1, 2, 3, 4 (b) 1, 4
(c) 1, 3, 4 (d) 2

- Propionic acid $\xrightarrow{P/BBr_2, H_2O} [W] \xrightarrow{KCN} [X] \xrightarrow{H_3O^+} [Y]$,
[Y] is



14. Among the following acids which has the lowest pK_a value?

- (a) $\text{CH}_3\text{CH}_2\text{COOH}$ (b) $(\text{CH}_3)_2\text{CH}-\text{COOH}$
(c) HCOOH (d) CH_3COOH



Which of the following statements are correct regarding the conversion of benzaldehyde to benzyl alcohol?

- (i) One hydrogen is coming from H_2O as H^+ and another from $\text{C}_6\text{H}_5\text{CHO}$ as H^- .
(ii) One hydrogen is coming from H_2O as H^- and another from $\text{C}_6\text{H}_5\text{CHO}$ as H^+ .
(iii) One hydrogen from H_2O and another from $\text{C}_6\text{H}_5\text{CHO}$, both in the form of H^- .
(iv) This reaction is an example of disproportionation reaction.

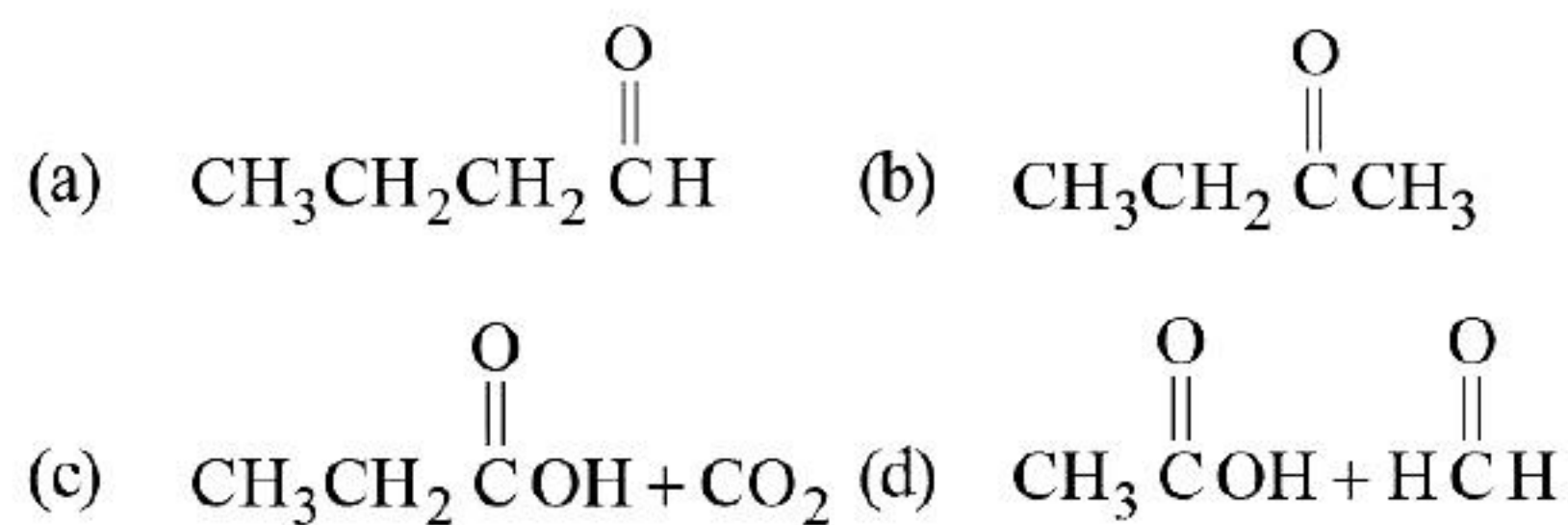
- (a) (i), (ii) and (iii) (b) (i) and (iv)
(c) (ii), (iii) and (iv) (d) (iii) and (iv)

16. Read the following statements and choose the correct option

- (i) The carbonyl carbon atom is sp^2 -hybridised
(ii) The carbonyl carbon is an electrophilic (Lewis acid) centre
(iii) The carbonyl oxygen is a nucleophilic (Lewis base) centre
(iv) Carbonyl compounds are non-polar in nature.

- (a) (i), (ii) and (iv) are correct
(b) (i), (ii) and (iii) are correct
(c) (ii), (iii) and (iv) are correct
(d) (ii) and (iv) are correct

17. Addition of water to alkynes occurs in acidic medium and in the presence of Hg^{2+} ions as a catalyst. Which of the following products will be formed on addition of water to but-1-yne under these conditions?



18. Iodoform test is not given by

- (a) Ethanol (b) Ethanal
(c) Pentan-2-one (d) Pentan-3-one

19. Read the following statements and choose the correct option

- (i) The boiling points of aldehydes and ketones are lower than those of alcohols of similar molecular masses
(ii) Alcohols show intermolecular hydrogen bonding whereas aldehydes and ketones do not show intermolecular hydrogen bonding.
(iii) The lower members of aldehydes and ketones are miscible with water in all proportions, because they form hydrogen bond with water.
(iv) The solubility of aldehydes and ketones increases rapidly on increasing the length of alkyl chain

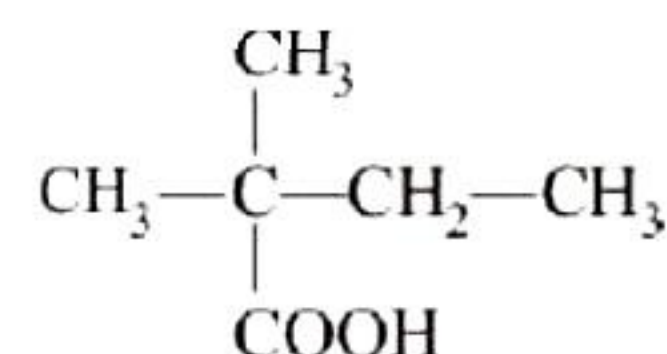
(a) (i), (ii) and (iv) are correct.

(b) (ii), (iii) and (iv) are correct.

(c) only (i) is correct.

(d) (i), (ii) and (iii) are correct.

20. What is the correct IUPAC name of the given compound?



- (a) 2, 2-Dimethylbutanoic acid
(b) 2-Carboxyl-2-methylbutane
(c) 2-Ethyl-2-methylpropanoic acid
(d) 3-Methylbutane carboxylic acid

21. Compound $\text{Ph}-\text{O}-\overset{\text{O}}{\parallel}\text{C}-\text{Ph}$ can be prepared by the reactions of

- (a) phenol and benzoic acid in the presence of NaOH
(b) phenol and benzoyl chloride in the presence of pyridine
(c) phenol and benzoyl chloride in the presence of ZnCl_2
(d) phenol and benzaldehyde in the presence of palladium

22. Which of the following reagent reacts in different ways with CH_3CHO , HCHO and $\text{C}_6\text{H}_5\text{CHO}$?

- (a) Fehling solution (b) $\text{C}_6\text{H}_5\text{NHNH}_2$
(c) Ammonia (d) HCl

23. Calcium acetate, on heating, gives:

- (a) acetic anhydride (b) acetone
(c) acetaldehyde (d) ethyl alcohol

24. Benzaldehyde can be prepared by the hydrolysis of

- (a) benzal chloride (b) benzotrichloride
(c) benzyl chloride (d) benzonitrile

25. Calcium formate on distillation gives:

- (a) HCOOH (b) CH_3COOH
(c) CH_3CHO (d) HCHO

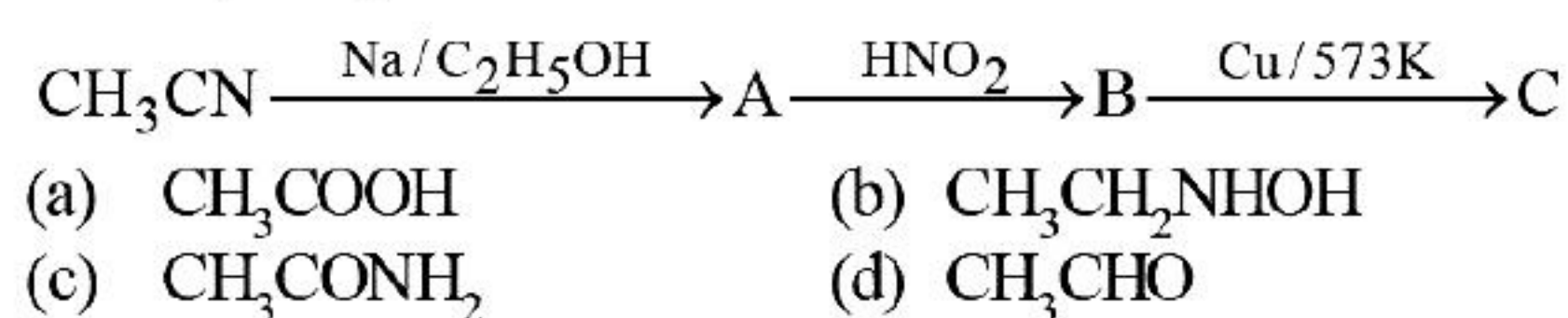
26. Benzaldehyde can be prepared by oxidation of toluene by

- (a) Acidic KMnO_4 (b) $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}^+$
(c) CrO_2Cl_2 (d) All of these

27. The reagent which does not react with both, acetone and benzaldehyde?

- (a) Sodium hydrogen sulphite
(b) Phenyl hydrazine
(c) Fehling's solution
(d) Grignard reagent

28. Identify the product C in the series



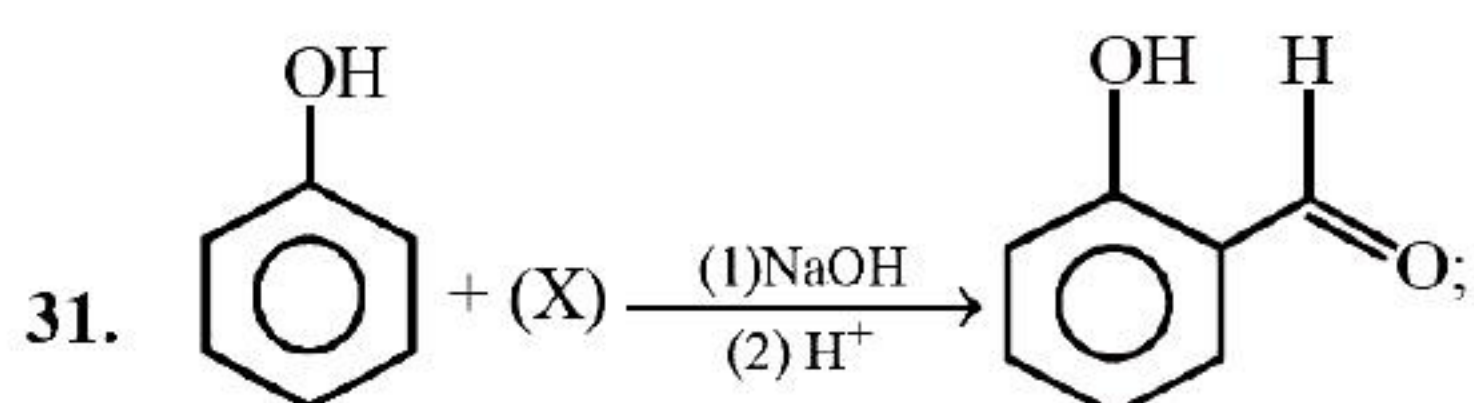
29. Which of the following gases does not form a ketone on treatment with dil H_2SO_4 and 1% HgSO_4 ?

- (a) C_4H_6 (b) C_2H_2
(c) C_3H_4 (d) All of these

30. Ketones [$R-\overset{\overset{O}{\parallel}}{C}-R_1$, where $R = R_1 = \text{alkyl groups}$]

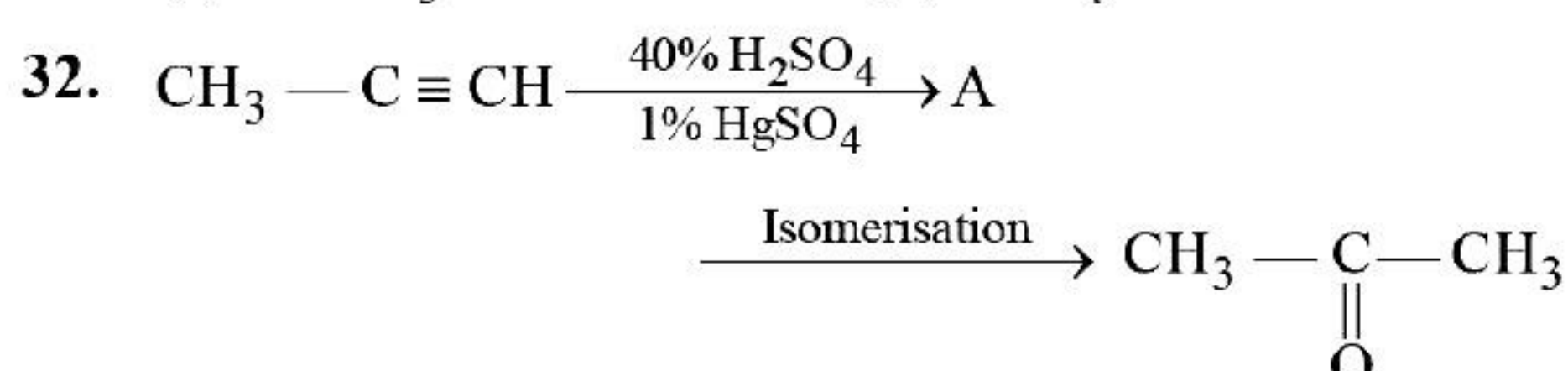
can be obtained in one step by

- (a) oxidation of primary alcohols
- (b) hydrolysis of esters
- (c) oxidation of secondary alcohols
- (d) reaction of acid halides with alcohols



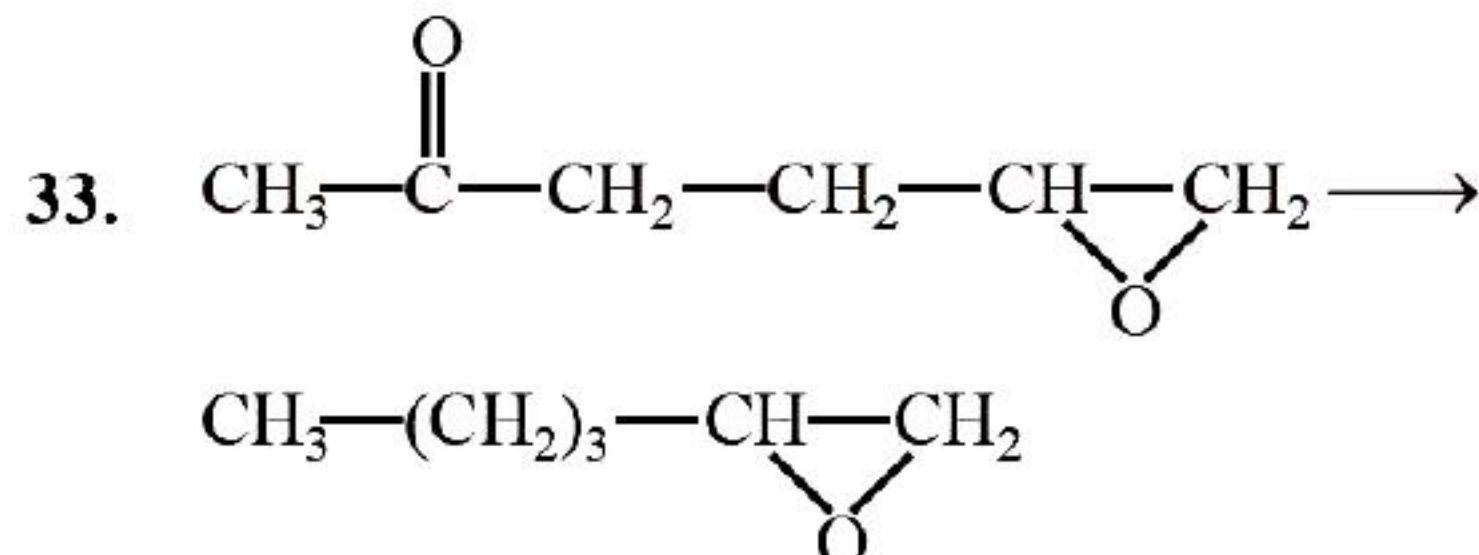
Reactant X is:

- (a) CH_3Cl
- (b) CH_2Cl_2
- (c) CHCl_3
- (d) CCl_4



structure of 'A' and type of isomerism in the above reaction are respectively

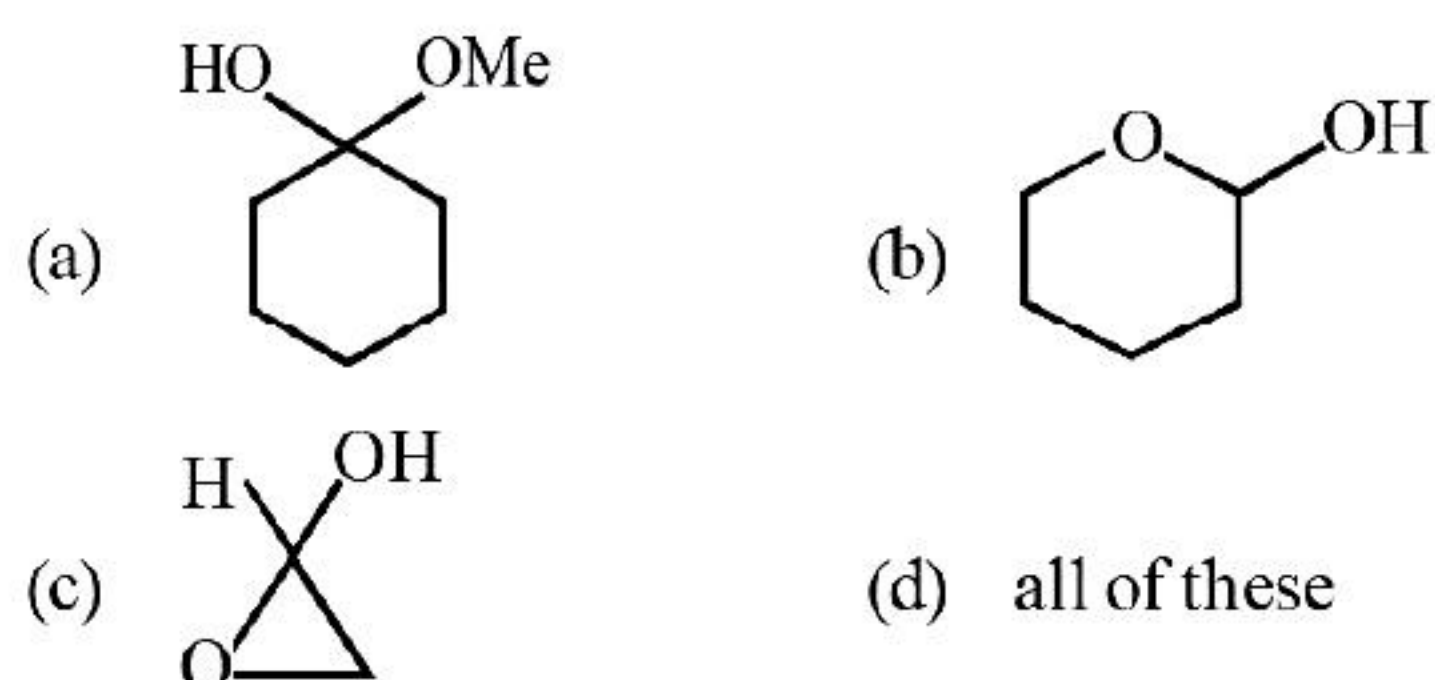
- (a) Prop-1-en-2-ol, metamerism
- (b) Prop-1-en-1-ol, tautomerism
- (c) Prop-2-en-2-ol, geometrical isomerism
- (d) Prop-1-en-2-ol, tautomerism



Above conversion can be achieved by:

- (a) Wolff-Kishner reduction
- (b) Clemmensen reduction
- (c) $\text{HS}-\text{CH}_2-\text{CH}_2-\text{SH}$, following by Raney Ni
- (d) None of these

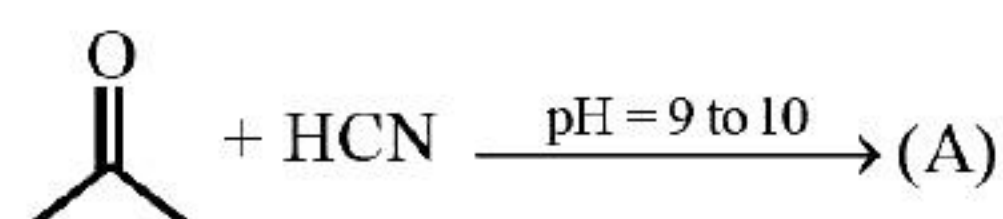
34. Which of following compound is hemiacetal?



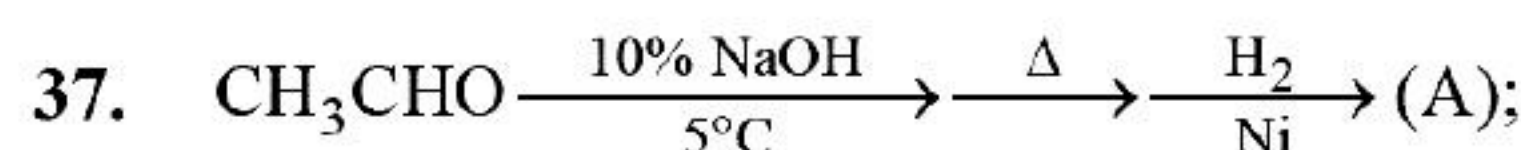
35. The presence of unsaturation in organic compounds can be tested with:

- (a) Schiff's reagent
- (b) Tollens' reagent
- (c) Fehling's reagent
- (d) Baeyer's reagent

36. Which of the following is correct for the reaction?



- (a) A is cyanohydrin
- (b) Nucleophilic-addition reaction
- (c) The above reaction is not shown by alkenes
- (d) All of these



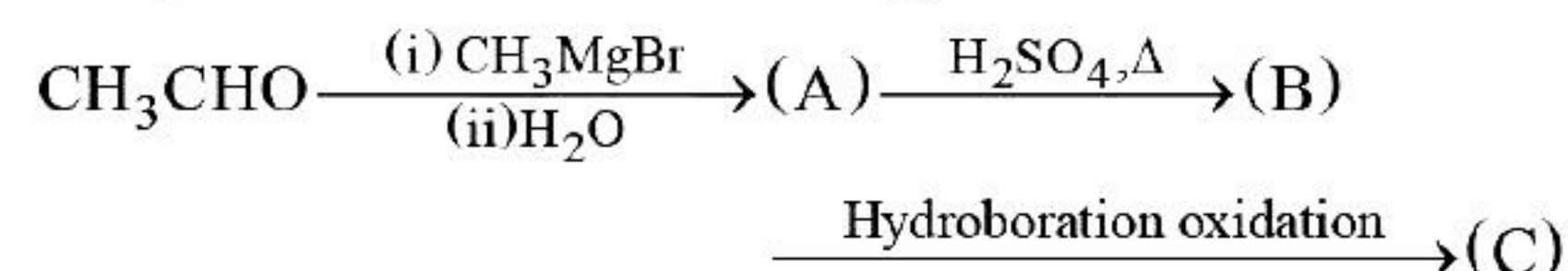
Product (A) of the reaction is:

- (a) propanol
- (b) ethanol
- (c) butanol
- (d) pentanol

38. Which is major product formed when acetone is heated with iodine and potassium hydroxide?

- (a) Iodoacetone
- (b) Acetic acid
- (c) Iodoform
- (d) Acetophenone

39. Compounds A and C in following reaction are



- (a) identical
- (b) positional isomers
- (c) functional isomers
- (d) optical isomers

40. Which of the following compounds will give butanone on oxidation with alkaline KMnO_4 solution?

- (a) Butan-1-ol
- (b) Butan-2-ol
- (c) Both (a) and (b)
- (d) None of these

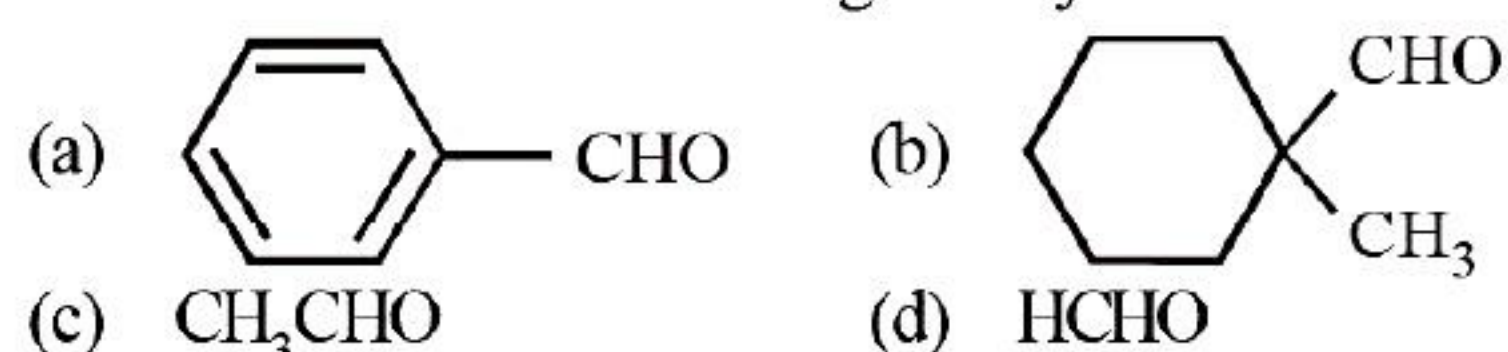
41. A compound that gives a positive iodoform test is

- (a) 1-pentanol
- (b) 2-pentanone
- (c) 3-pentanone
- (d) pentanal

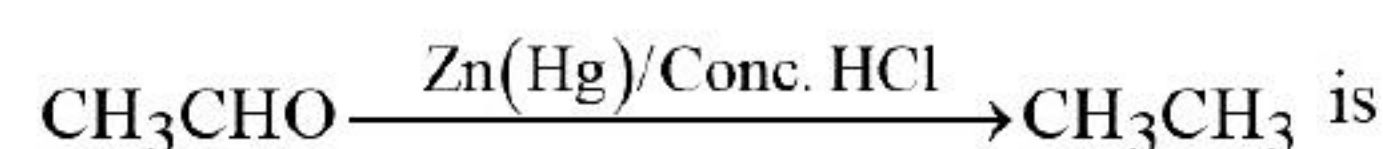
42. Clemmensen reduction of a ketone is carried out in the presence of:

- (a) LiAlH_4
- (b) Zn-Hg with HCl
- (c) Glycol with KOH
- (d) H_2 with Pt as catalyst

43. Cannizzaro's reaction is not given by:

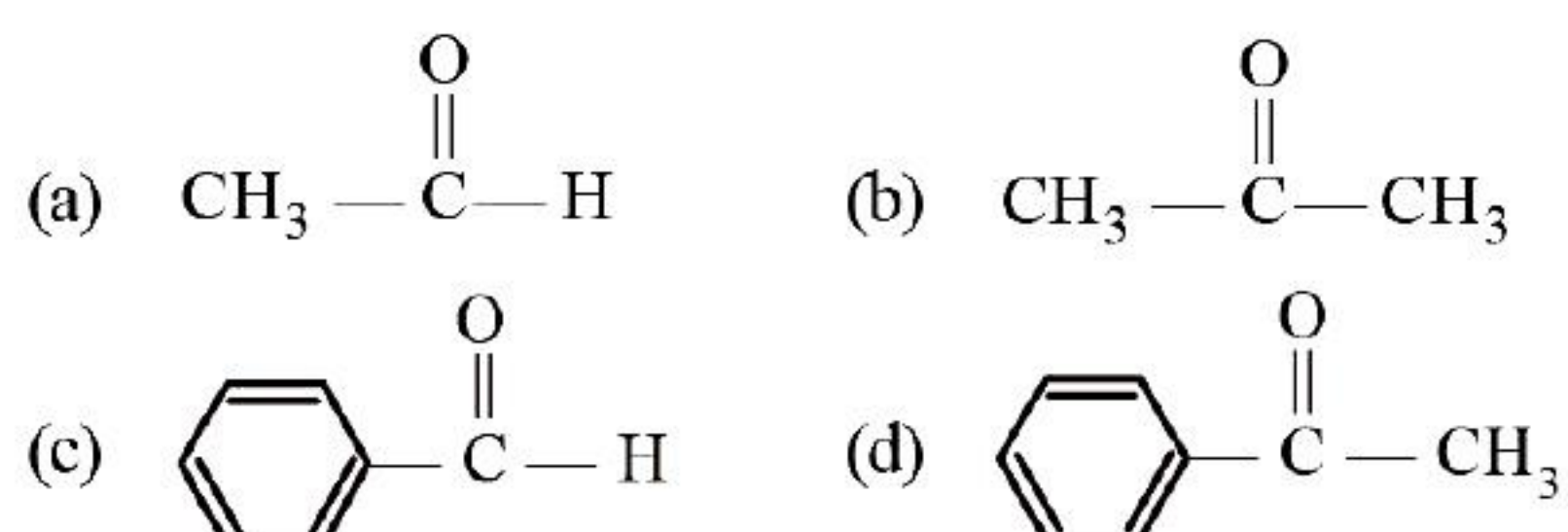


44. The reaction,



- (a) Cannizzaro's reaction
- (b) Rosenmund reduction
- (c) Wolff-Kishner reduction
- (d) Clemmenson reduction

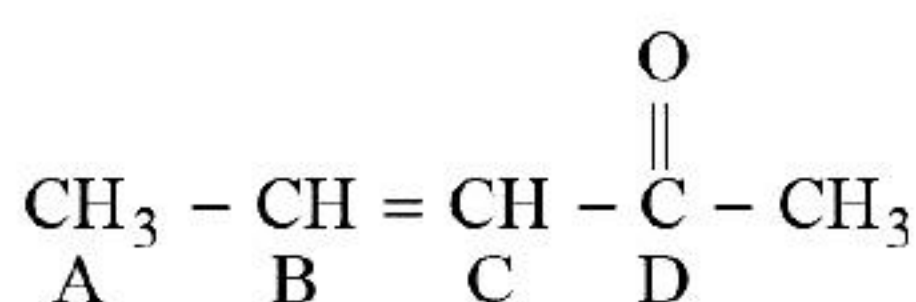
45. Which of the following compounds is most reactive towards nucleophilic addition reactions?



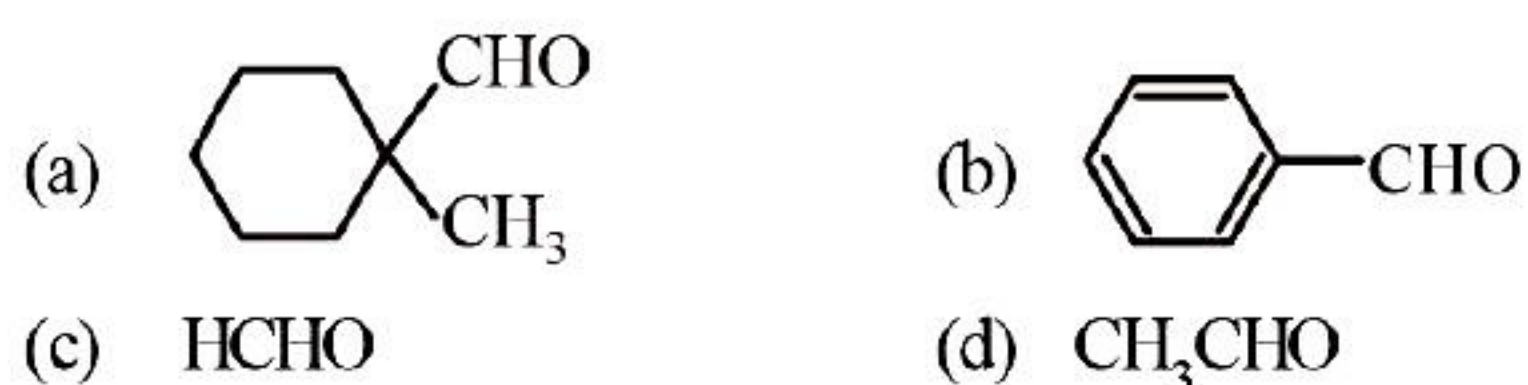
46. Oxidation of toluene with CrO_3 in the presence of $(\text{CH}_3\text{CO})_2\text{O}$ gives a product (A) which on treatment with aqueous NaOH produces

- (a) $\text{C}_6\text{H}_5\text{CHO}$
- (b) $(\text{C}_6\text{H}_5\text{CO})_2\text{O}$
- (c) $\text{C}_6\text{H}_5\text{COONa}$
- (d) 2,4-Diacetyltoylene

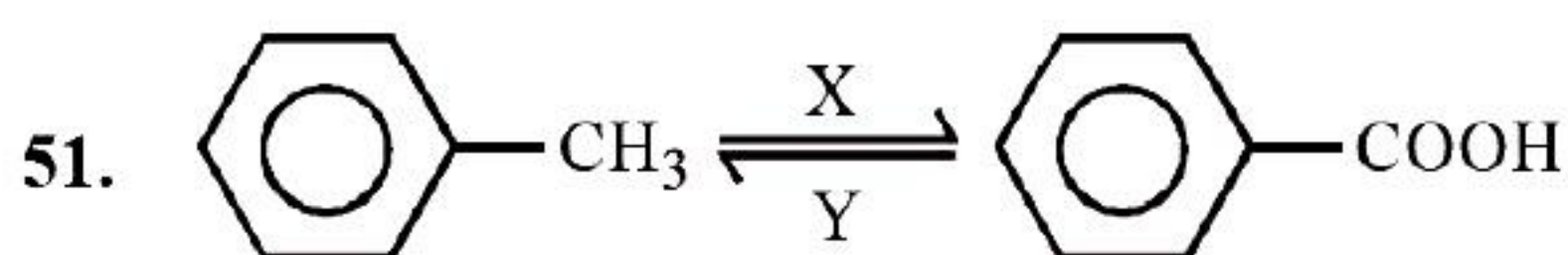
47. Which carbon atoms are most susceptible to nucleophilic attack?



- (a) A and B (b) B and C (c) B and D (d) A and D
48. Chlorination of toluene in the presence of light and heat followed by treatment with aqueous NaOH gives
- (a) *o*-Cresol (b) *p*-Cresol
(c) 2,4-Dihydroxytoluene (d) Benzoic acid
49. Cannizzaro's reaction is not given by

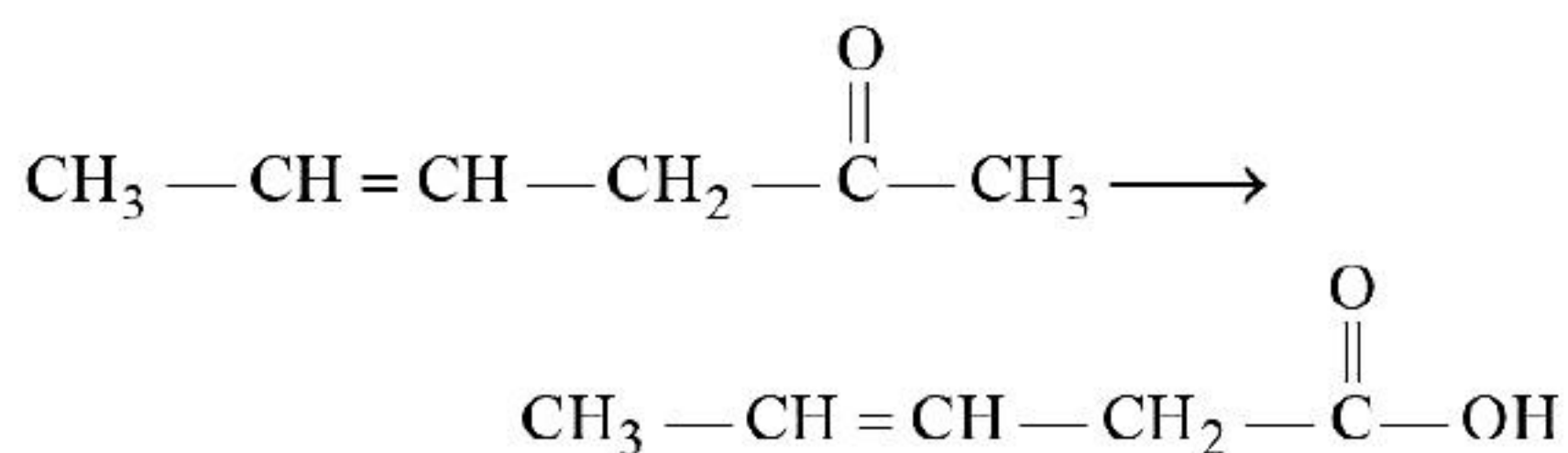


50. The compound that does NOT liberate CO₂ on treatment with aqueous sodium bicarbonate solution, is
- (a) Benzoic acid (b) Benzenesulphonic acid
(c) Salicylic acid (d) Carbolic acid (Phenol)



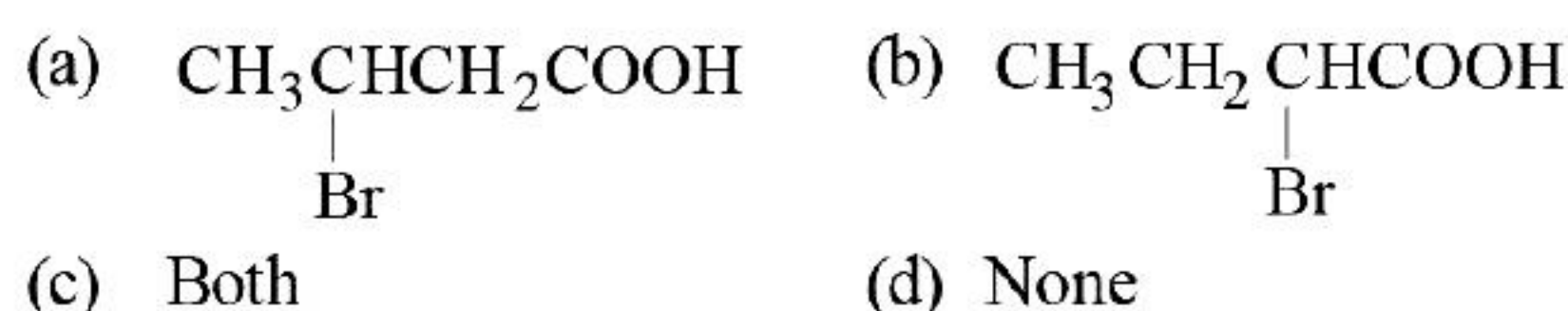
In the above sequence of reaction X and Y are respectively

- (a) H₂/Pt; Br₂ (b) KMnO₄; H₂/Pt
(c) KMnO₄ (aq); HI/P (d) NH₂-NH₂/KOH, HI/P
52. Hydrolysis of an ester may be achieved under acidic as well as basic conditions. Pick up the correct statement regarding this
- (a) Acidic hydrolysis is faster than alkaline hydrolysis.
(b) Alkaline hydrolysis is faster than acidic hydrolysis.
(c) Both occur at the same rate.
(d) In both, the first step is protonation of the —OH part of the —COOH group.
53. Acid amides do not undergo the usual properties of carbonyl, C = O group because
- (a) it is a weak base
(b) it is a weak acid
(c) it is amphoteric
(d) its carbonyl carbon is not electron deficient
54. Which is the most suitable reagent for the following conversion?



- (a) Tollen's reagent
(b) Benzoyl peroxide
(c) I₂ and NaOH solution
(d) Sn and NaOH solution

55. CH₃CH = CHCOOH + HBr → P, here P is

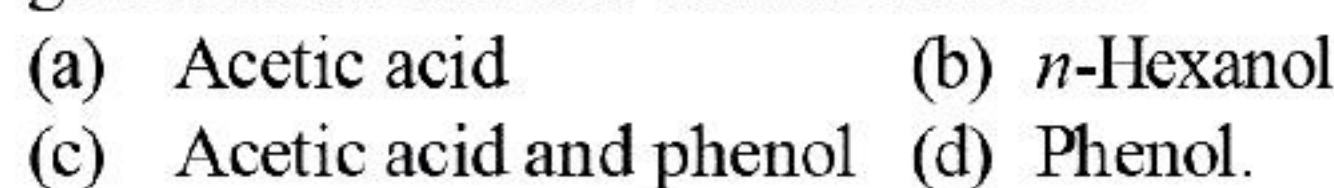


56. When propionic acid is treated with aqueous sodium bicarbonate, CO₂ is liberated. The 'C' of CO₂ comes from
- (a) methyl group (b) carboxylic acid group
(c) methylene group (d) bicarbonate

57. Benzoyl chloride is prepared from benzoic acid by



58. Among acetic acid, phenol and *n*-hexanol, which of the following compounds will react with NaHCO₃ solution to give sodium salt and carbon dioxide?



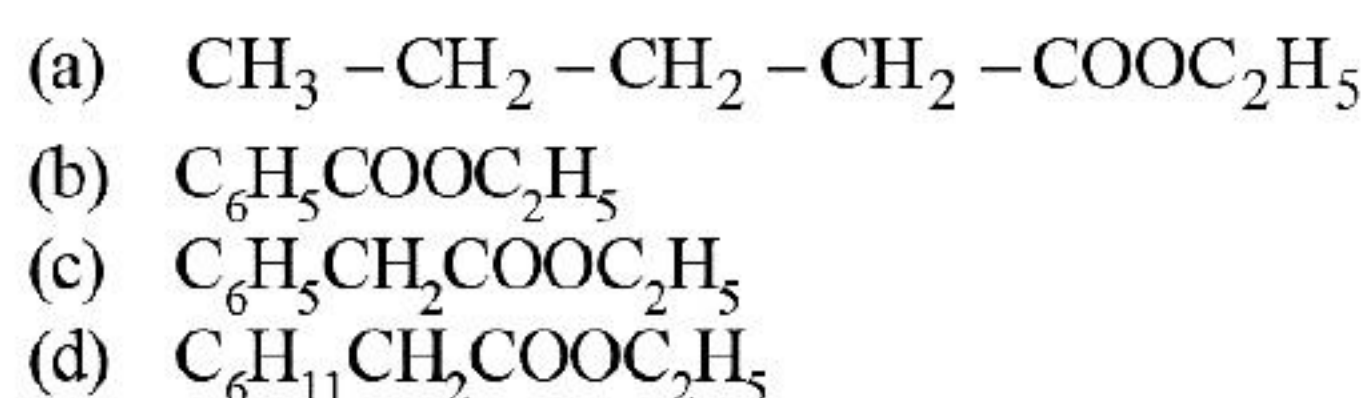
59. An ester is boiled with KOH. The product is cooled and acidified with concentrated HCl. A white crystalline acid separates. The ester is



60. In the Friedel Craft's acylation reaction, the effective electrophile is



61. Which one of the following esters cannot undergo Claisen self-condensation?



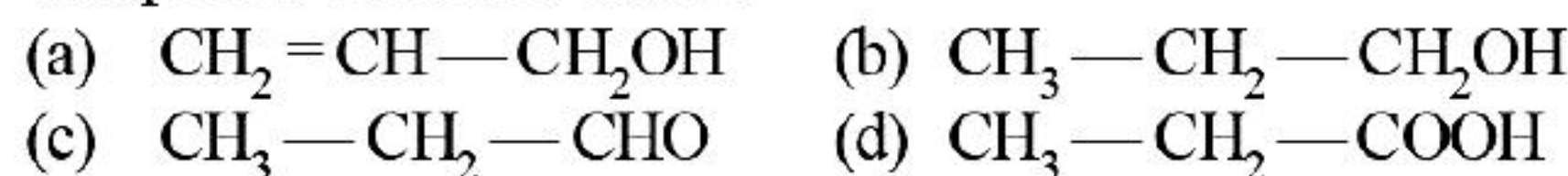
62. The cyanohydrin of a compound on hydrolysis gives an optically active α-hydroxy acid. The compound is



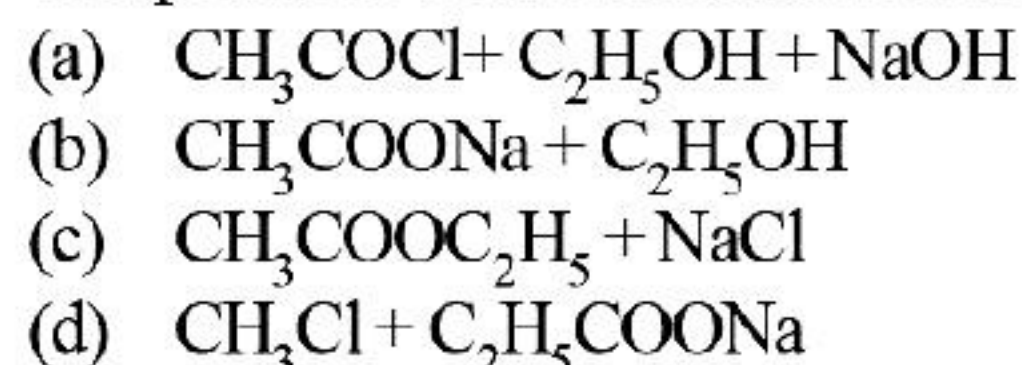
63. CH₃CH₂COOH $\xrightarrow[\text{red P}]{\text{Cl}_2}$ A $\xrightarrow{\text{alc. KOH}}$ B. What is B?



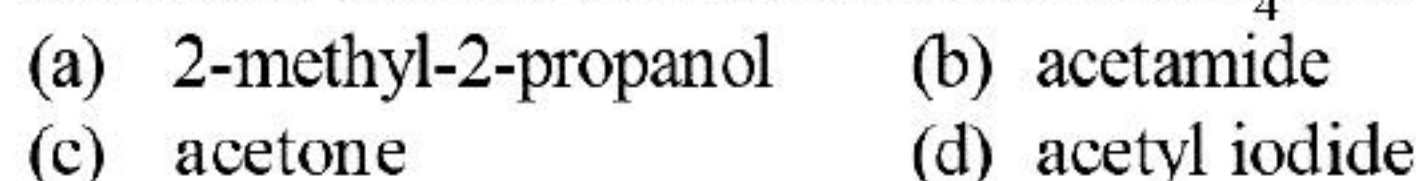
64. When CH₂ = CH - COOH is reduced with LiAlH₄, the compound obtained will be



65. On mixing ethyl acetate with aqueous sodium chloride, the composition of the resultant solution is



66. Acetyl bromide reacts with excess of CH₃MgI followed by treatment with a saturated solution of NH₄Cl and gives



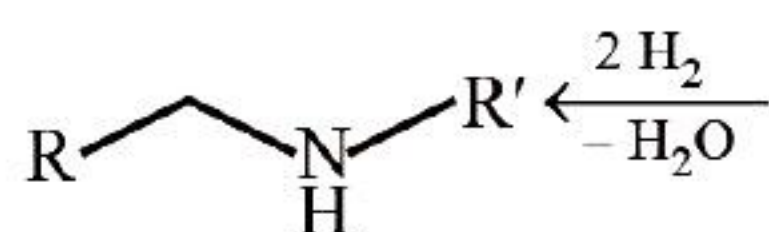
Case/Passage Based Questions

DIRECTIONS: Following are the case/passage based questions.

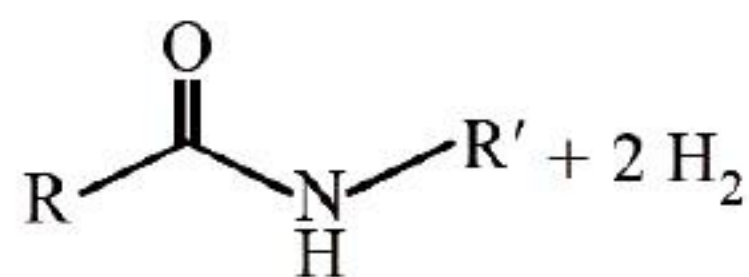
Case/Passage-I

Reduction of carboxylic acids and their derivatives plays an important role in organic synthesis, in both laboratory and industrial processes. Traditionally, the reduction is performed using stoichiometric amounts of hydride reagents, generating stoichiometric amounts of waste. A much more attractive, atom-economical approach is a catalytic reaction using H_2 ; however, hydrogenation of carboxylic acid derivatives under mild conditions is a very challenging task, with amides presenting the highest challenge among all classes of carbonyl compounds. Very few examples of the important hydrogenation of amides to amines, in which the C-O bond is cleaved with the liberation of water (Scheme 1), were reported. C-O cleavage of amides can also be affected with silanes as reducing agents.

Scheme - 1



We have now prepared the new, dearomatized, bipyridine-based pincer complex 3, catalyst 3 (Here referred as Cat. 3). Remarkably, it efficiently catalyzes the selective hydrogenation of amides to form amines and alcohols (eq 1). The reaction proceeds under mild pressure and neutral conditions, with no additives being required. Since the reaction proceeds well under anhydrous conditions, hydrolytic cleavage of the amide is not involved in this process.



(Balaraman, E., Gnanaprakasam, B., Shimon, L. J., & Milstein, D. (2010). Direct hydrogenation of amides to alcohols and amines under mild conditions. *Journal of the American Chemical Society*, 132(47), 16756-16758.)

[From CBSE Question Bank-2021]

In the following questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices on the basis of the above passage.

- Assertion and reason both are correct statements and reason is correct explanation for assertion.
 - Assertion and reason both are correct statements but reason is not correct explanation for assertion.
 - Assertion is correct statement but reason is wrong statement.
 - Assertion is wrong statement but reason is correct statement.
67. **Assertion:** The use of catalyst 3 is an efficient method of preparation of primary amines.
Reason: Use of catalyst 3 is a step down reaction.
68. **Assertion:** Use of hydride catalyst or hydrogen brings about cleavage of C-O bond in amides.
Reason: Hydride catalyst or hydrogen cause to reduction of amides.
69. **Assertion:** N-methyl ethanamide on reaction with catalyst 3 will yield ethanol and methanamine.
Reason: Use of Catalyst 3 brings about cleavage of C-N bond of amides
70. **Assertion:** Aniline can be prepared from suitable amide using catalyst 3
Reason: The use of catalyst 3 is limited to aliphatic amides only.

Case/Passage-II

Ketones may be prepared by the oxidation of secondary alcohols in the presence of acid dichromate. The reaction probably proceeds via the rate limiting formation of a chromate ester followed by decomposition of the ester to give the products. In case of primary alcohol, this process may lead to oxidation of the alcohol to carboxylic acid. This problem is overcome by attenuating the oxidizing power of chromic acid based reagents to generate a milder oxidizing agent. The two most popular oxidizing agents for oxidizing primary alcohols to aldehydes are pyridinium chlorochromate (PCC) and pyridiniumdichromate (PDC). These reagents are prepared by the treatment of chromic acid with pyridine. The ketones may also be generated from the secondary alcohols using aluminium t-butoxide in the presence of acetone. The secondary alcohol is refluxed with the reagent in an excess of acetone. This reagent is particularly helpful in oxidation of unsaturated alcohol as only the alcoholic OH is oxidized.

71. Which of the following statement(s) is/are true regarding preparation of aldehydes and ketones?
- Both can be prepared by the oxidation of the concerned alcohol with copper at about 250°C.
 - Both can be prepared by the oxidation of the concerned alcohol by Oppenauer oxidation.
 - Both can be prepared by the oxidation of respective alcohol with acidic dichromate.
- (i) only
 - (ii) and (iii)
 - (i) and (iii)
 - All the three
72. Consider the following statements : Acetophenone can be prepared by
- oxidation of 1-phenyl ethanol
 - reaction of benzaldehyde with methyl magnesium bromide
 - Friedel-Crafts reaction of benzene with acetyl chloride
 - distillation of calcium benzoate
- II and III
 - I and IV
 - I and III
 - III and IV
73. 2-Pentanone and 3-pentanone can be distinguished by :
- Cannizzaro's reaction
 - Aldol condensation
 - Iodoform reaction
 - Clemmensen's reduction
74. Phenylmethyl ketone can be converted into ethylbenzene in one step by which of the following reagents?
- $LiAlH_4$
 - $Zn-Hg/HCl$
 - $NaBH_4$
 - CH_3MgI
75. Which of the following compounds will give butanone on oxidation with alkaline $KMnO_4$ solution?
- Butan-1-ol
 - Butan-2-ol
 - Both of these
 - None of these

» Assertion & Reason

DIRECTIONS : Each of these questions contains an assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

- (a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
 (b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
 (c) If the Assertion is correct but Reason is incorrect.
 (d) If the Assertion is incorrect but the Reason is correct.
76. **Assertion:** Carbonyl compounds when react with NaHSO_3 form white crystalline solid.
Reason: Aldehydes are used in the blending of perfumes and flavouring agents.
77. **Assertion:** Benzaldehyde gives silver mirror test.
Reason: Benzaldehyde gives Fehling's solution test.
78. **Assertion:** Aldehydes are more reactive than ketones in nucleophilic addition reaction.
Reason: This is due to steric and electronic reasons.
79. **Assertion:** *p*-Chlorobenzoic acid is a stronger acid than *m*-chlorobenzoic acid.
Reason: In *meta* position, only inductive effect is considered.
80. **Assertion:** Carboxylic acids when reacts with NaHCO_3 , the CO_2 evolved comes from carboxylic acid and not from NaHCO_3 .
Reason: RCOOH is a stronger acid than H_2CO_3 .
81. **Assertion:** The carboxylate ion is more stabilised than phenoxide ion.
Reason: This is because the negative charge is delocalised over two electronegative oxygen atoms in carboxylate ion, whereas it is less effectively delocalised over one atom in phenoxide ion.
82. **Assertion :** Compounds containing $-\text{CHO}$ group are easily oxidised to corresponding carboxylic acids.
Reason : Carboxylic acids can be reduced to alcohols by treatment with LiAlH_4 .
83. **Assertion :** The α -hydrogen atom in carbonyl compounds is less acidic.
Reason : The anion formed after the loss of α -hydrogen atom is resonance stabilised.
84. **Assertion :** Aldehydes and ketones, both react with Tollen's reagent to form silver mirror.
Reason : Both, aldehydes and ketones contain a carbonyl group.
85. **Assertion:** Acetylene on treatment with alkaline KMnO_4 produces acetaldehyde.
Reason: Alkaline KMnO_4 is an oxidising agent.
86. **Assertion:** 2, 2-dimethylpropanal undergoes Cannizzaro reaction with conc. NaOH .
Reason: Cannizzaro reaction is a disproportionation reaction.
87. **Assertion:** Isobutanol does not give iodoform test.
Reason: It does not have α -hydrogen.

» Match the Following

DIRECTIONS : Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column-I have to be matched with statements (p, q, r, s) in column-II.

88. Match the columns

| Column-I (Common names) | Column-II (IUPAC names) |
|---|-----------------------------|
| (A) Cinnamaldehyde | (p) Pentanal |
| (B) Acetophenone | (q) Prop-2-enal |
| (C) Valeraldehyde | (r) 4-Methylpent-3-en-2-one |
| (D) Acrolein | (s) 3-Phenylprop-2-enal |
| (E) Mesityl oxide | (t) 1-Phenylethanone |
| (a) A – (s), B – (t), C – (p), D – (q), E – (r) | |
| (b) A – (p), B – (q), C – (s), D – (t), E – (r) | |
| (c) A – (t), B – (s), C – (p), D – (r), E – (q) | |
| (d) A – (q), B – (t), C – (r), D – (s), E – (p) | |

89. Match the columns

| Column-I | Column-II |
|--|------------------------------|
| (A) $\text{R}-\text{CO}-\text{CH}_3 \xrightarrow{\text{Zn-Hg/HCl}}$ $\text{R}-\text{CH}_2-\text{CH}_3$ | (p) Friedel-Craft's reaction |
| (B) $2\text{C}_6\text{H}_5\text{CHO} \xrightarrow{\text{NaOH}}$ $\text{C}_6\text{H}_5\text{COONa} + \text{C}_6\text{H}_5\text{CH}_2\text{OH}$ | (q) Kolbe's reaction |
| (C) $\text{C}_6\text{H}_6 + \text{CH}_3\text{COCl} \xrightarrow[\text{AlCl}_3]{\text{Anhyd.}}$ $\text{C}_6\text{H}_5\text{COCH}_3$ | (r) Clemmensen's reaction |
| (D) $\text{C}_6\text{H}_5\text{OH} + \text{CO}_2 + \text{NaOH} \rightarrow$ $\text{HOC}_6\text{H}_4\text{COONa}$ | (s) Cannizzaro's reaction |
| (a) A – (p), B – (q), C – (r), D – (s) | |
| (b) A – (r), B – (p), C – (q), D – (s) | |
| (c) A – (r), B – (s), C – (p), D – (q) | |
| (d) A – (s), B – (r), C – (p), D – (q) | |

90. Match the columns

| Column-I (Reactions) | Column-II (Reagents) |
|--|---|
| (A) Benzophenone \rightarrow | (p) LiAlH_4 Diphenylmethane |
| (B) Benzaldehyde \rightarrow | (q) DIBAL-H 1-Phenylethanol |
| (C) Cyclohexanone \rightarrow | (r) Zn(Hg)/conc. HCl Cyclohexanol |
| (D) Phenyl benzoate \rightarrow | (s) CH_3MgBr Benzaldehyde |
| (a) A – (p), B – (s), C – (r), D – (q) | |
| (b) A – (q), B – (s), C – (p), D – (r) | |
| (c) A – (s), B – (r), C – (q), D – (p) | |
| (d) A – (r), B – (s), C – (p), D – (q) | |

» Fill in the Blanks

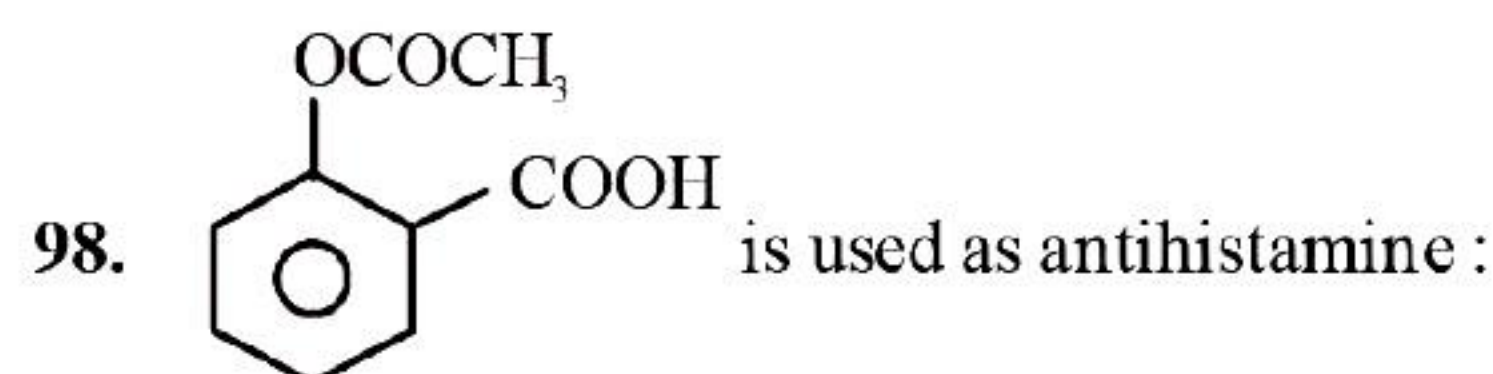
DIRECTIONS : Complete the following statements with an appropriate word / term to be filled in the blank space(s).

91. Tollen's reagent and Fehling solutions are used to distinguish between _____.
92. Monocarboxylic acids are functional isomers of _____.
93. Rancidity of butter is due to the formation of _____.
94. Formic acid is obtained when calcium acetate is heated with _____.
95. The catalyst used in Rosenmund's reduction is _____.

» True / False

DIRECTIONS : Read the following statements and write your answer as true or false.

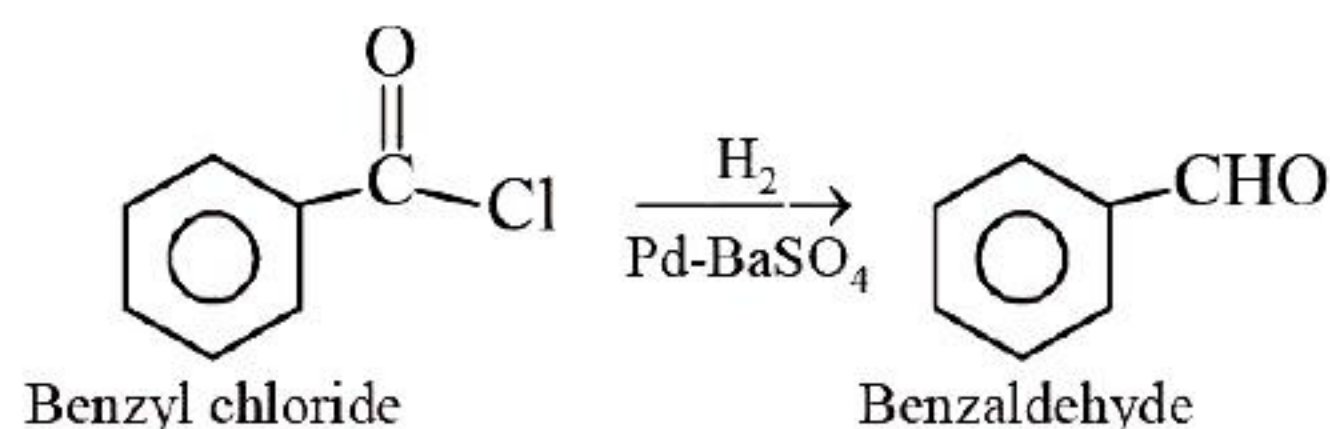
96. The preparation of ethyl acetoacetate involves Cannizzaro's reaction.
97. Phthalic acid reacts with resorcinol in the presence of concentrated H_2SO_4 to give Coumarin.



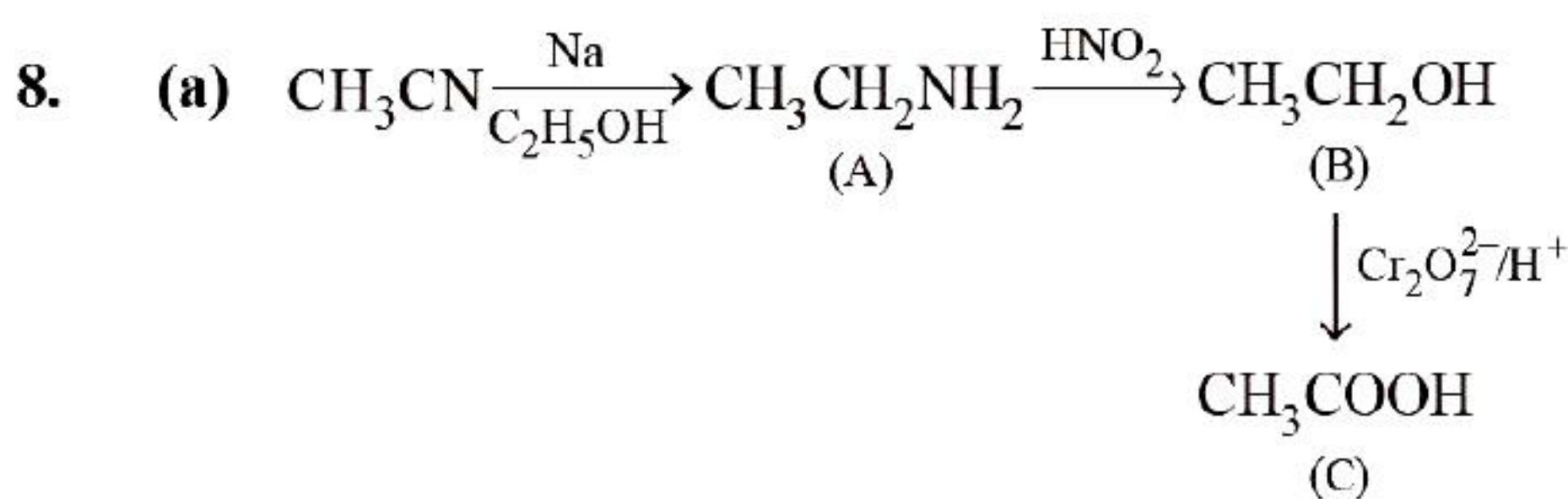
99. The enolic form of acetone contains 9 sigma bonds, 1 pi-bond and 2 lone pairs.
100. Formaldehyde can be distinguished from acetaldehyde by the use of I_2/Alkali .

ANSWER KEY & SOLUTIONS

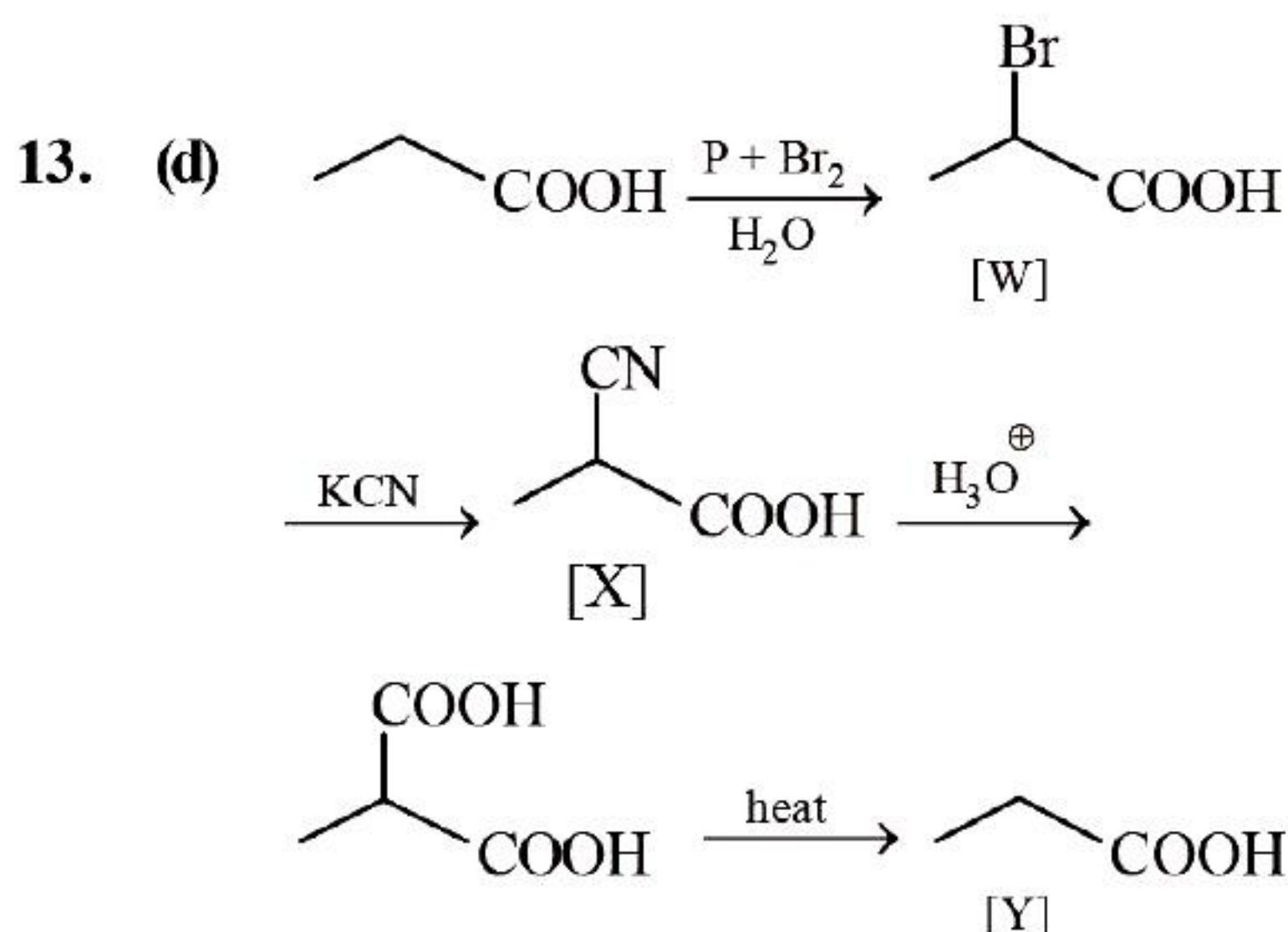
1. (a)
2. (b) Rosenmund's reduction:
Acylchloride is hydrogenated over catalyst, Pd-BaSO₄.
This reaction is called Rosenmund reduction.



3. (a) Alkanenitriles (other than methanenitrile) benzonitrile give ketones with Grignard reagents.
4. (d) I₂ and Na₂CO₃ react with acetophenone (C₆H₅COCH₃) to give yellow ppt. of CHI₃ but benzophenone (C₆H₅COC₆H₅) does not and hence can be used to distinguish between them.
5. (d) HCHO does not undergo iodoform test, while acetaldehyde undergoes iodoform test (I₂ in presence of base) to form yellow precipitate of iodoform.
6. (c) In cross aldol condensation aromatic aldehydes or ketones (with or without α-hydrogen) react with aldehydes, ketones or esters having α-hydrogen atoms in the presence of dilute alkali to form a β-unsaturated carbonyl compound.
7. (c)



9. (d)
10. (a) *o*-Nitrobenzoic acid is more acidic due to ortho effect and higher inductive effect compared to *-m* and *-p* derivatives.
11. (d) The yield of product in a reversible reaction can be increased by (i) removing one of the products, (ii) taking either of the reactant in excess.
12. (b)

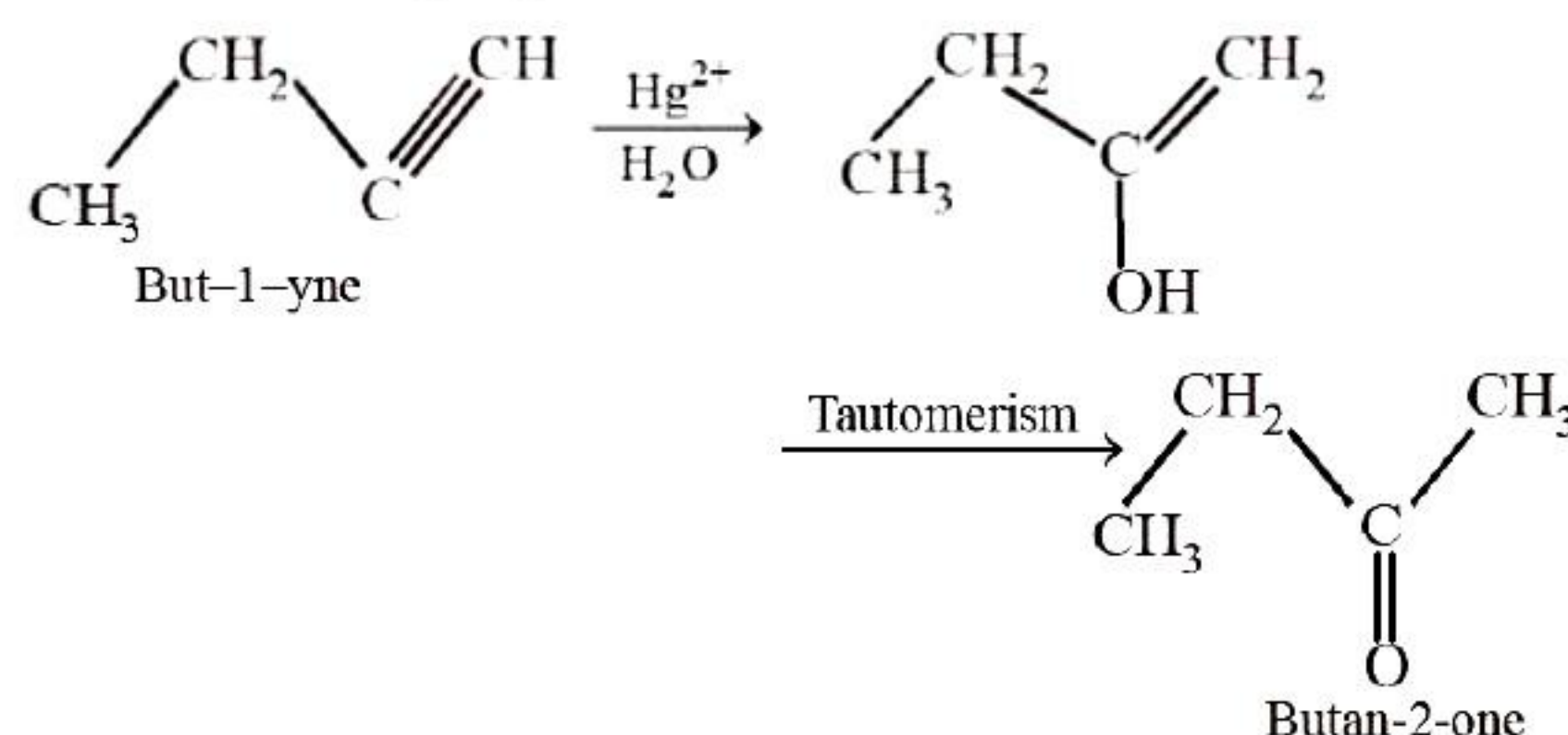


14. (c) $\text{p}K_a = -\log K_a$; HCOOH is the strongest acid and hence it has the highest K_a or lowest $\text{p}K_a$ value.

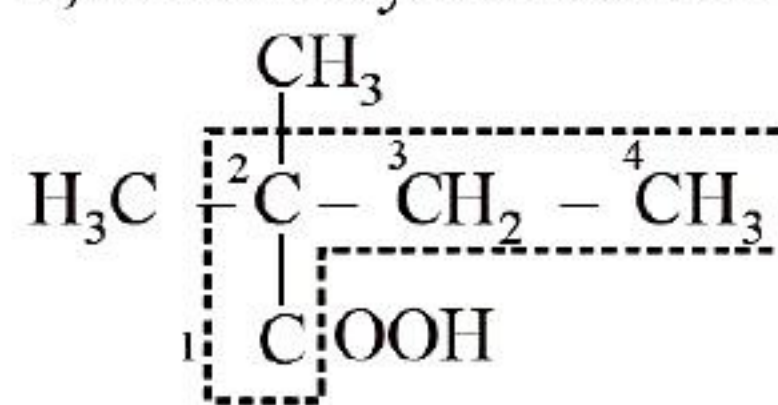
15. (b) The hydrogen atom that is added to the carbonyl carbon of the aldehyde in the reduction is derived directly from the other aldehyde molecule as a hydride ion. The second hydrogen that is added to the negatively charged oxygen is coming from the solvent (consult mechanism of Cannizzaro reaction). Oxidation of one molecule of the compound at the expense of other molecule of the same compound is known as disproportionation.

16. (b) Carbonyl compounds have substantial dipole moments and are polar in nature. The high polarity of the carbonyl group is due to resonance.

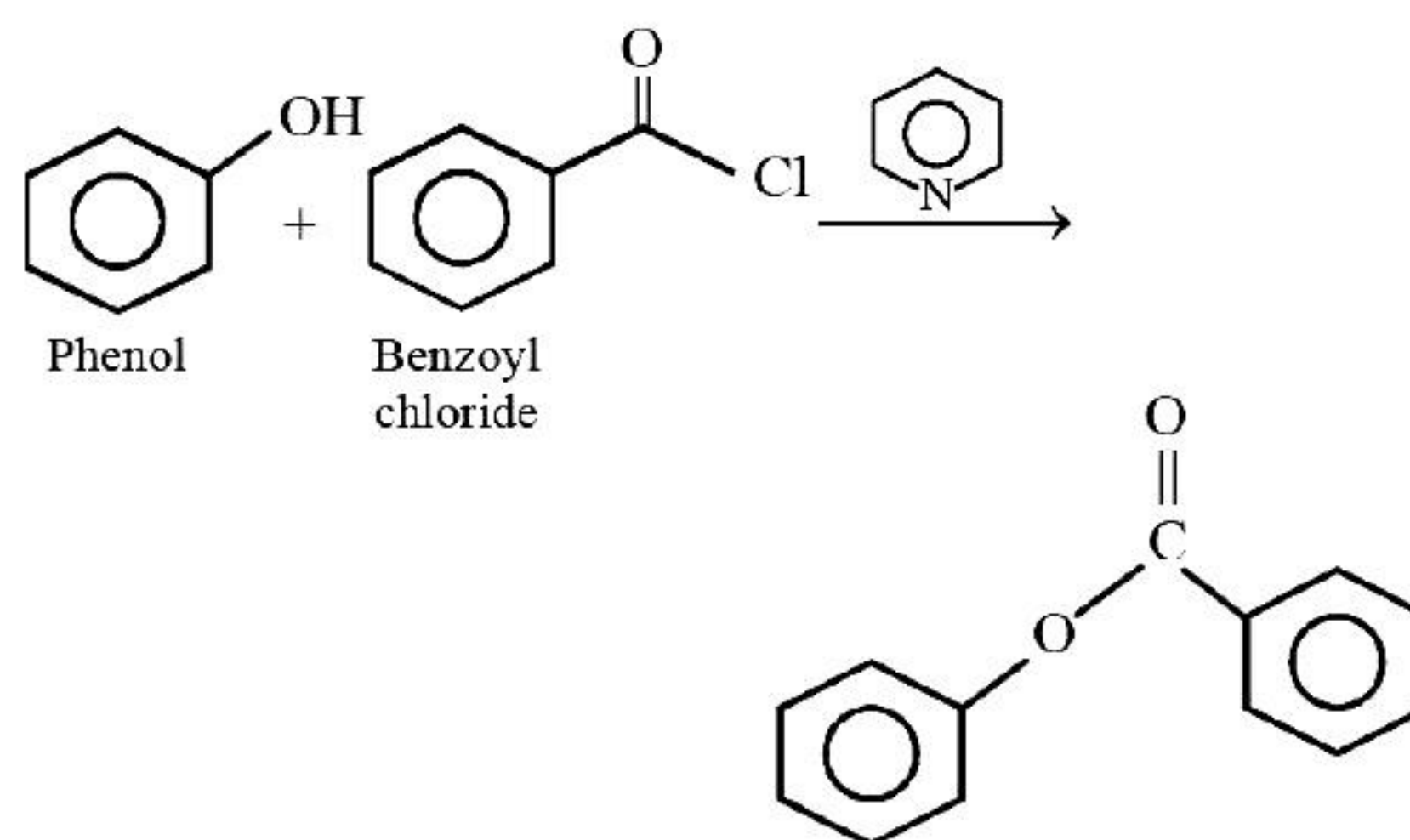
17. (b) But-1-yne on reaction with water in presence of Hg²⁺ ions as a catalyst produces butan-2-one.



18. (d) The iodoform test is a test for the presence of carbonyl compounds with the structure RCOCH₃ and alcohols with the structure R-CH(OH)CH₃.
19. (d) The solubility of aldehydes and ketones decreases on increasing the length of alkyl chain.
20. (a) 2,2-Dimethylbutanoic acid

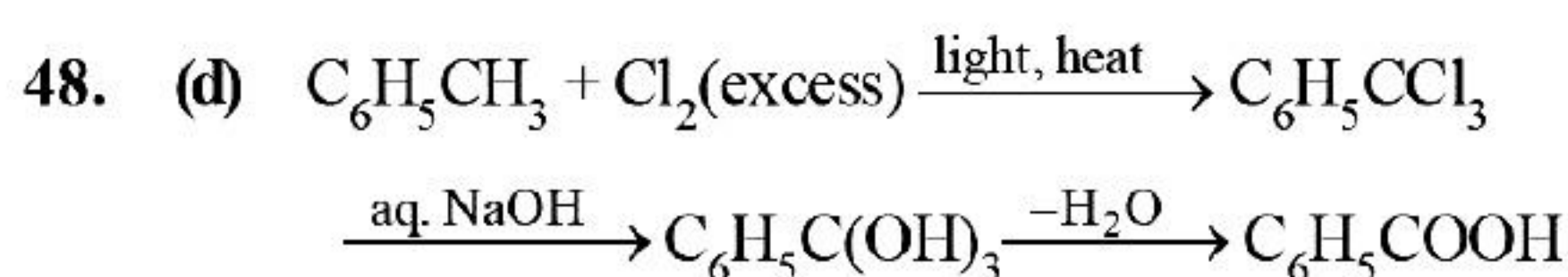
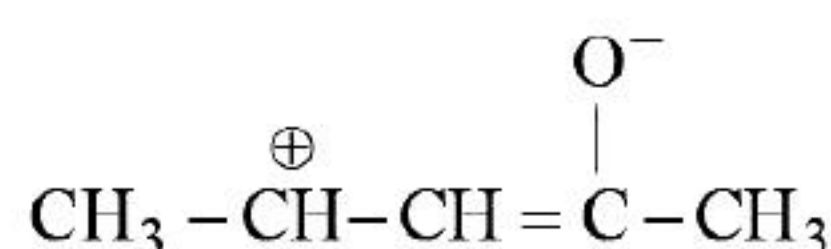
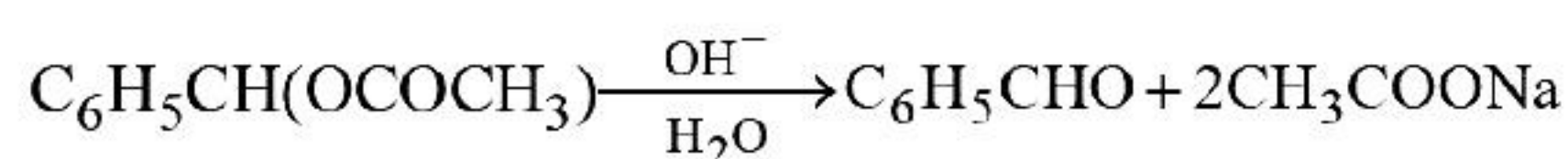
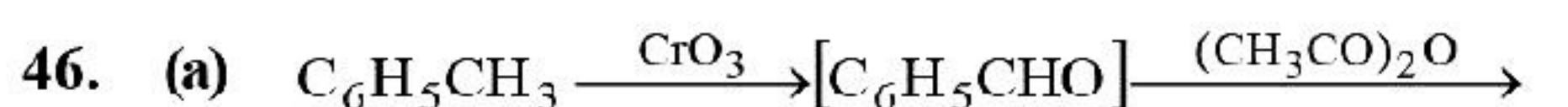


21. (b) Compound Ph-COO-Ph can be prepared by the reaction of phenol and benzoyl chloride in the presence of pyridine. This is an example of **Schotten-Baumann reaction**.



45. (a) The carbonyl group in ketones being influenced by two alkyl group is less reactive than in aldehydes where the carbonyl group is under the influence of one alkyl group only. As the number of alkyl group increases both the +I effect and the steric hinderance get increases preventing the attack of nucleophile.

Now among benzaldehyde and acetaldehyde former is less electrophilic than carbon atom of carbonyl group present in ethanal. The polarity of carbonyl group is reduced in benzaldehyde due to resonance hence it is less reactive than ethanal.



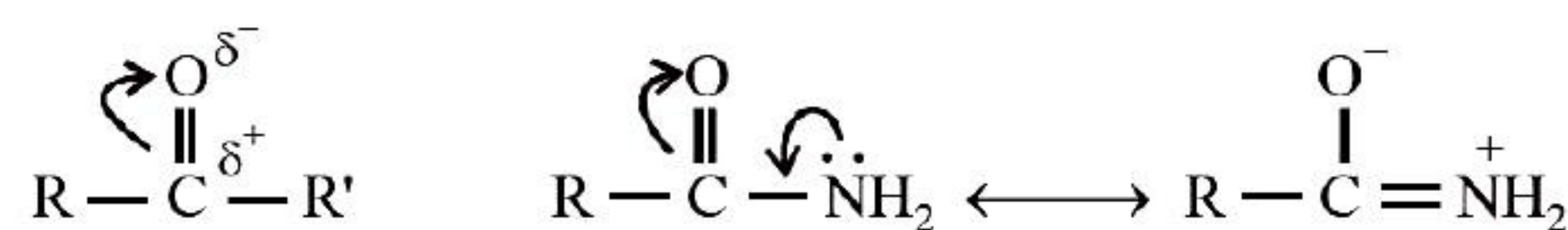
49. (d) Cannizzaro reaction is given by those aldehydes which have absence of α -hydrogen atom. So, CH_3CHO will not give Cannizzaro reaction.

50. (d) Carboic acid (Phenol) is weaker acid than carbonic acid and hence does not liberate CO_2 on treatment with aq. NaHCO_3 solution.

51. (c) KMnO_4 converts $-\text{CH}_3$ group of toluene into $-\text{COOH}$ while HI reduces $-\text{COOH}$ group into $-\text{CH}_3$ group.

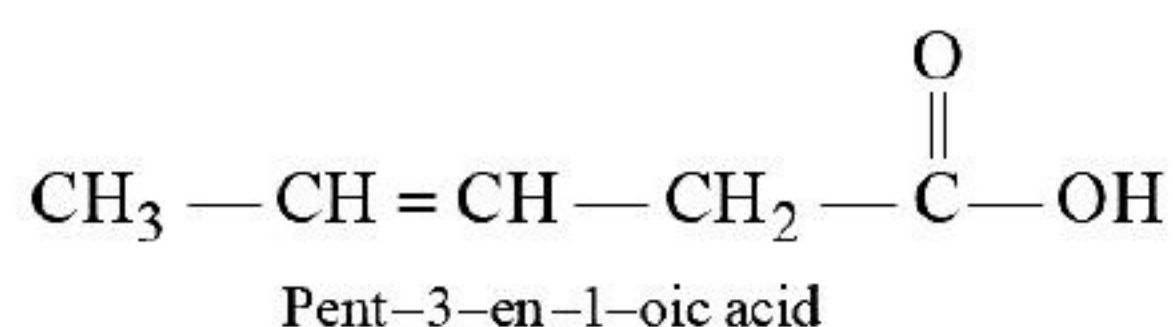
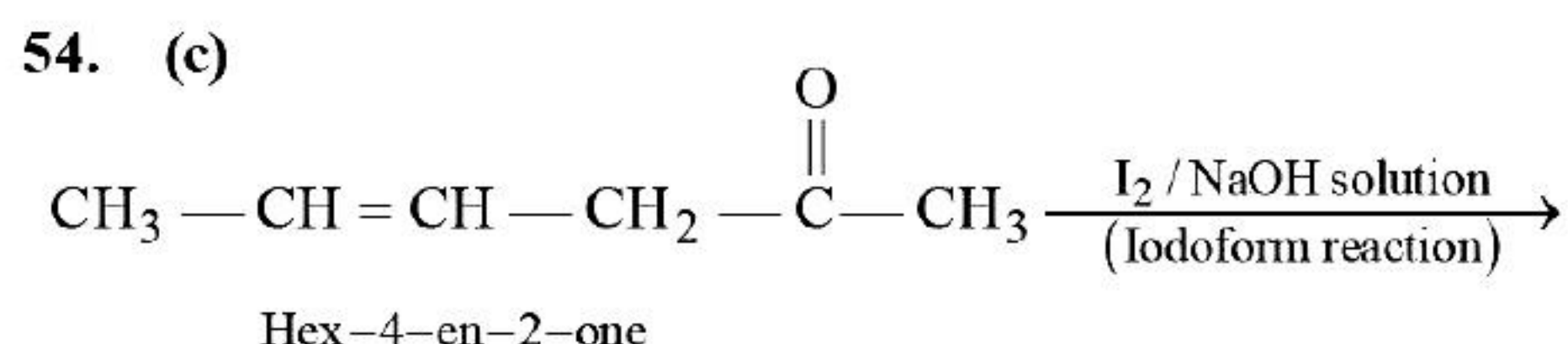
52. (b) Alkaline hydrolysis is irreversible because here RCOO^- is isolated; moreover the product RCOO^- stabilizes itself due to resonance.

53. (d) Due to possibility of resonance, carbonyl carbon is no more electron deficient.

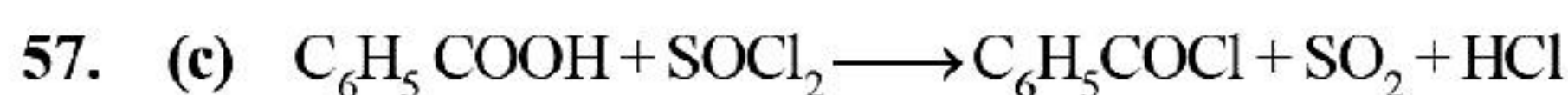
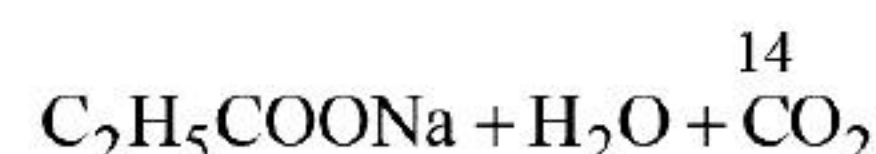


Aldehyde or Ketone
(Electron deficient carbon)

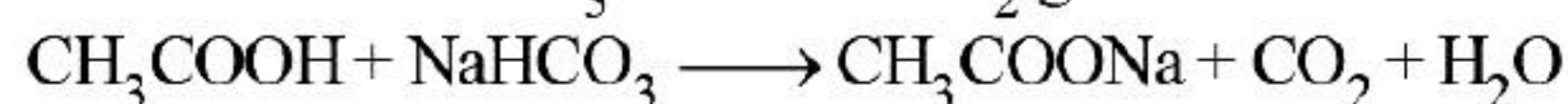
Resonance in acid amides
(Carbonyl carbon is not electron deficient)



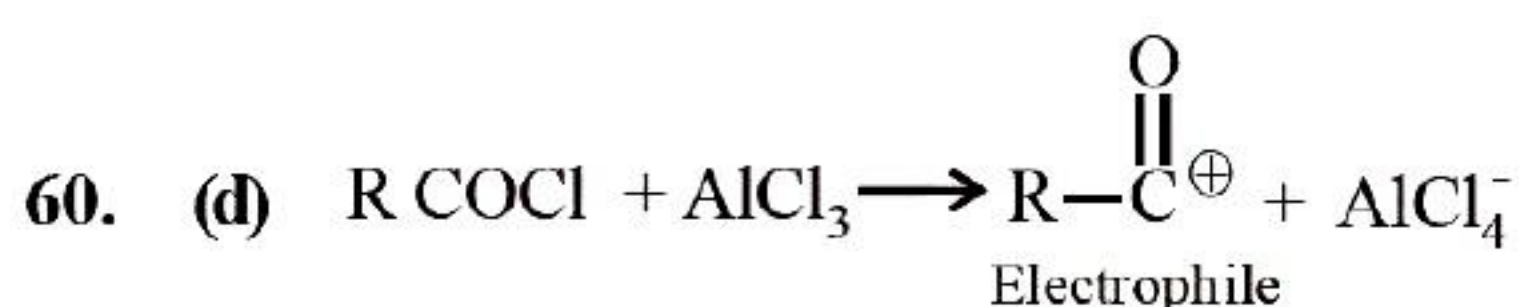
55. (a) Addition of an unsymmetrical reagent to an α, β -unsaturated carbonyl compound takes place in such a way that hydrogen becomes attached to the α -carbon and the negative group becomes attached to the β -carbon.



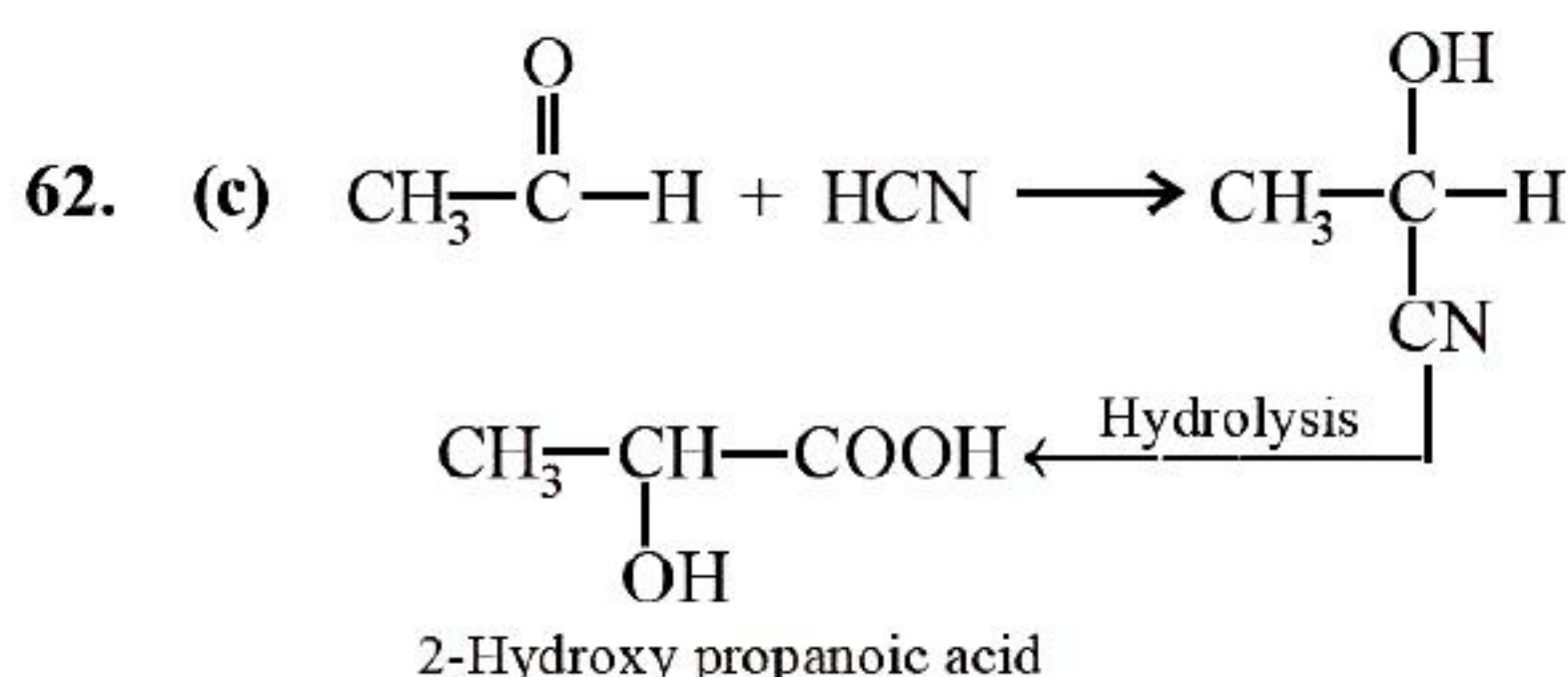
58. Among acetic acid, phenol and *n*-hexanol, only CH_3COOH reacts with NaHCO_3 to evolve CO_2 gas.



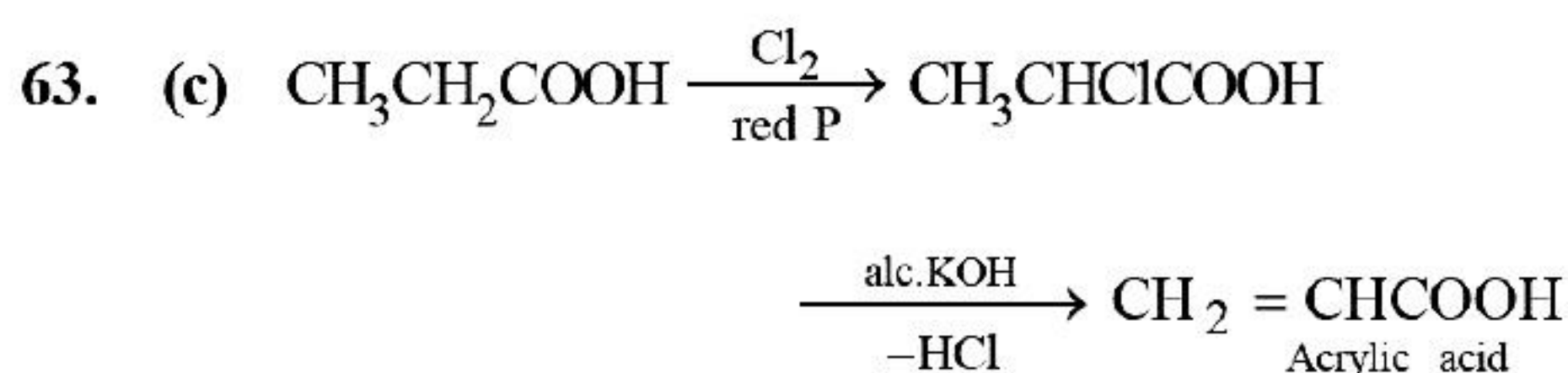
59. (d) Methyl acetate and ethyl acetate on hydrolysis give CH_3COOH which is a liquid. Similarly, ethyl formate on hydrolysis will give formic acid which is also a liquid. Only ethyl benzoate on hydrolysis will give benzoic acid which is a solid.



61. (b) Esters having α -hydrogen atom show Claisen condensation reaction. We know that ethyl benzoate ($\text{C}_6\text{H}_5\text{COOC}_2\text{H}_5$) does not contain α -hydrogen. Therefore, $\text{C}_6\text{H}_5\text{COOC}_2\text{H}_5$ does not undergo Claisen self condensation.



(As it has a chiral C-atom thus it is optically active)

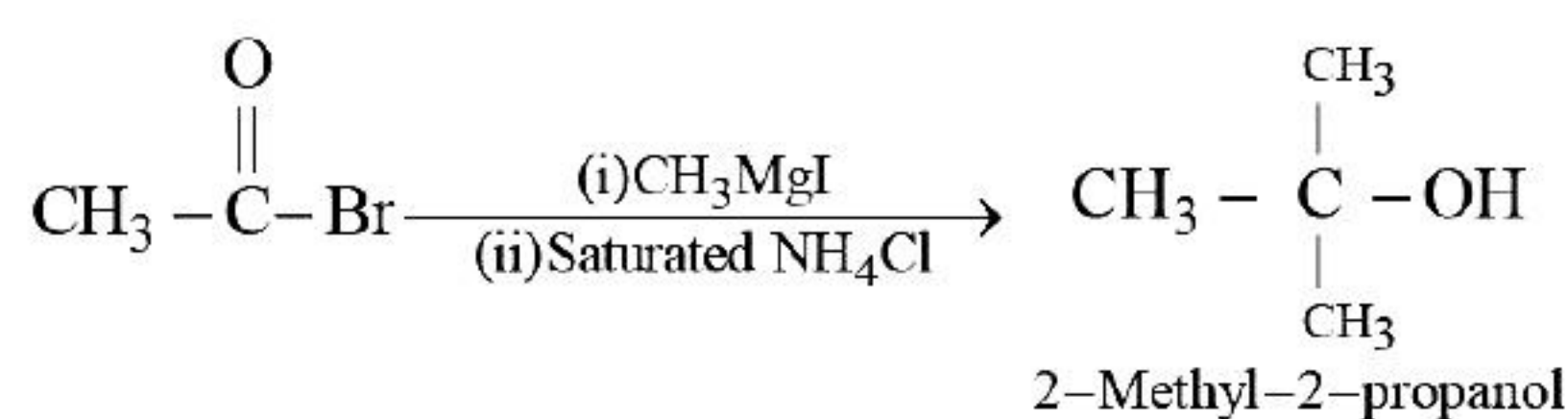


64. (a) LiAlH_4 can reduce COOH group, and not the double bond.



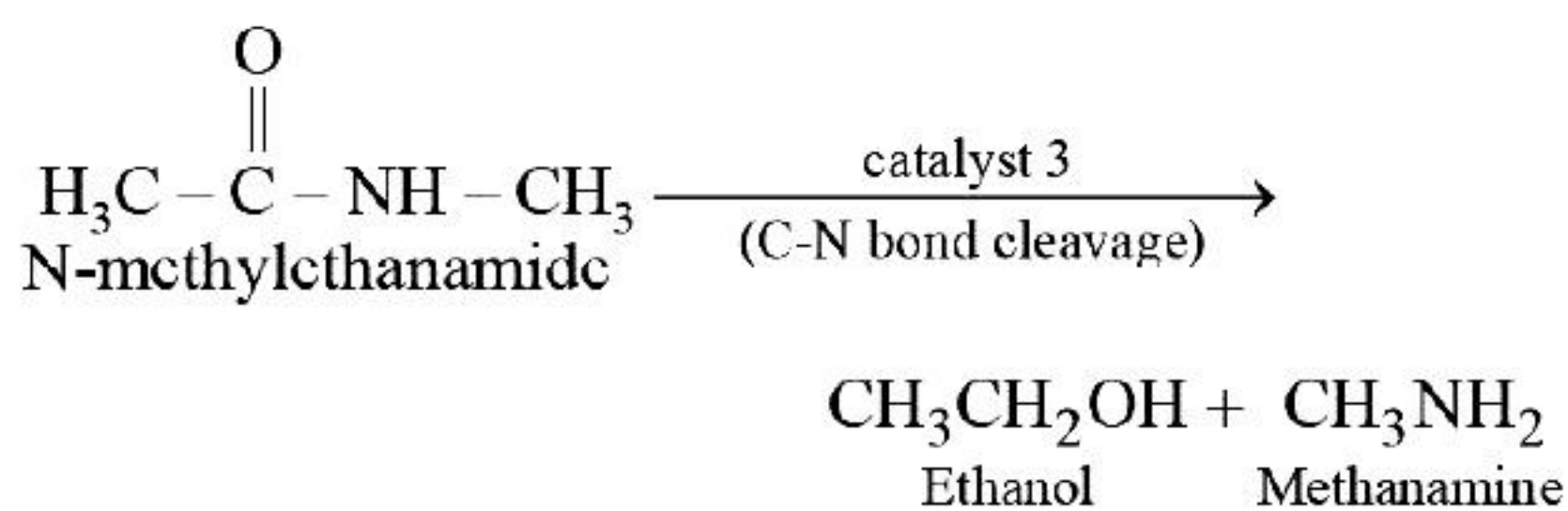
65. (c) There is no reaction hence the resultant mixture contains $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaCl}$.

66. (a)



67. (b) 68. (b)

69. (a) Use of catalyst 3 brings about cleavage of C – N bond of amides and will yield amines and alcohols.

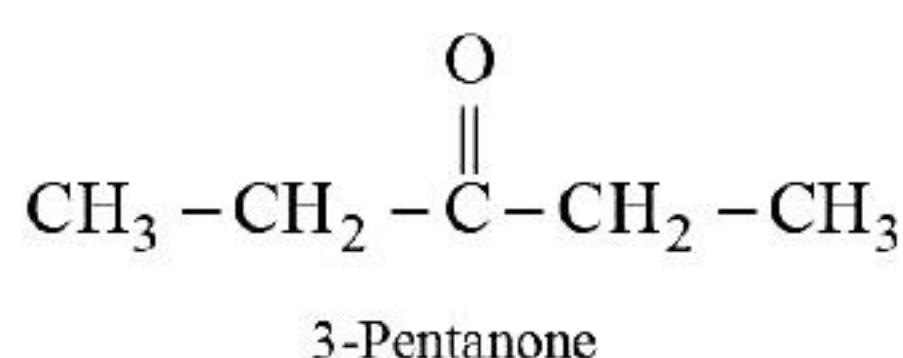
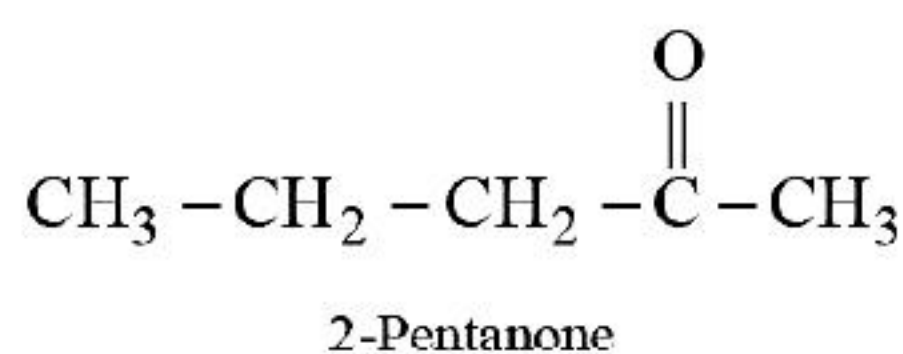


70. (c)

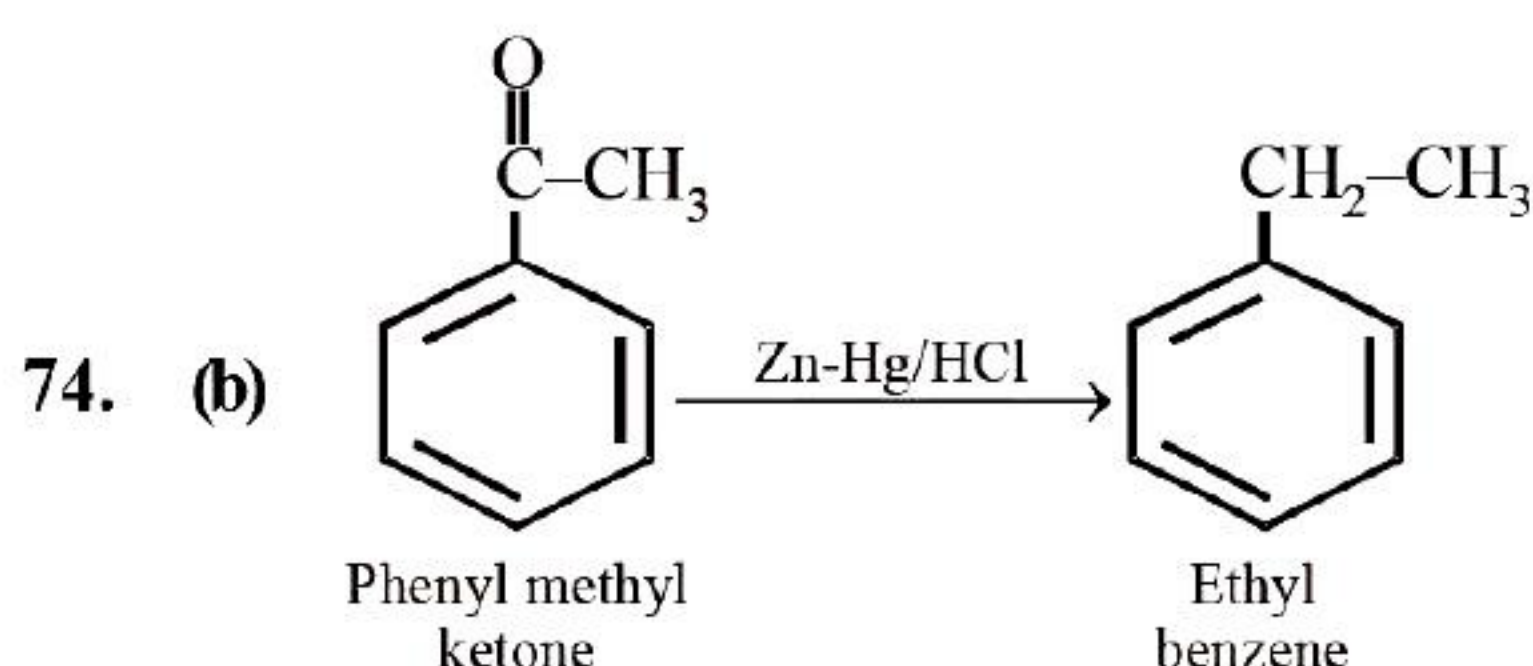
71. (a) Primary alcohols on oxidation give carboxylic acids as the final product, of course through aldehydes. Oppenauer oxidation involves oxidation of 2° alcohols to ketones, and not for the oxidation of 1° alcohols.

72. (c)

73. (c) Iodoform test is given by compounds which have CH_3CO group.



∴ 2-pentanone has CH_3CO group, so it gives iodoform test, while 3-pentanone does not have CH_3CO group, so it does not give iodoform test.

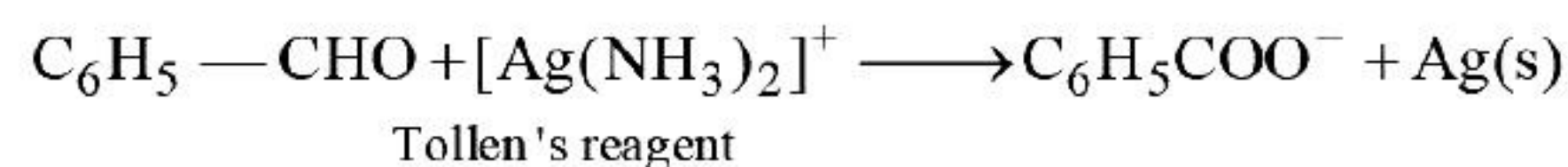


This reaction is known as Clemmensen's reduction.

75. (b) Secondary alcohol on oxidation with alkaline KMnO_4 produces corresponding Ketone.

76. (b) Carbonyl compounds shows nucleophilic addition reaction with NaHSO_3 and form white crystalline solid which is on hydrolysis with dil. HCl gives original carbonyl compounds and thus, this property is used for the purification of carbonyl compounds as well as for their separation.

77. (c) Benedict's solution (Cu^{+2} + citric acid + base) and Fehling's solution (Cu^{+2} + tartaric acid + base) are weaker oxidising agent than Tollen's reagent, therefore, they oxidise only aliphatic aldehydes, but not aromatic aldehydes.



78. (a)

79. (d) In *p*-chlorobenzoic acid, Cl shows +*R* and –*I* effect and due to +*R* effect, the acidic character of *p*-chlorobenzoic acid decreases. At *meta*-position, only inductive effect is considered, therefore, *m*-chlorobenzoic acid will be more acidic due to –*I* effect.

80. (d) $\text{RCOOH} + \text{NaHCO}_3 \longrightarrow \text{RCOONa} + \text{CO}_2 + \text{H}_2\text{O}$
In this reaction, CO_2 is evolved from NaHCO_3 . Carboxylic acid is a stronger acid than carbonic acid.

81. (a) In carboxylate ion, electron cloud is equally delocalised between two oxygen atoms, therefore, each oxygen atom has least charge density, hence carboxylate ion becomes more stable. Phenoxide ion has only one oxygen atom which has higher electron density, hence the ion is less stable.

82. (b) Compounds containing –CHO group are easily oxidised to corresponding carboxylic acids. Correct reason is due to electron withdrawing nature of $\text{C}=\text{O}$ group, C – H bond in aldehydes is weak and easily oxidised to the corresponding carboxylic acids even with mild oxidising agent like Fehling's solution and Tollen's reagents.

83. (d) The α -hydrogen atom in carbonyl compounds is acidic in nature due to presence of electron withdrawing carbonyl group.

84. (d) Aldehydes but not ketones react with Tollen's reagent to form silver mirror.

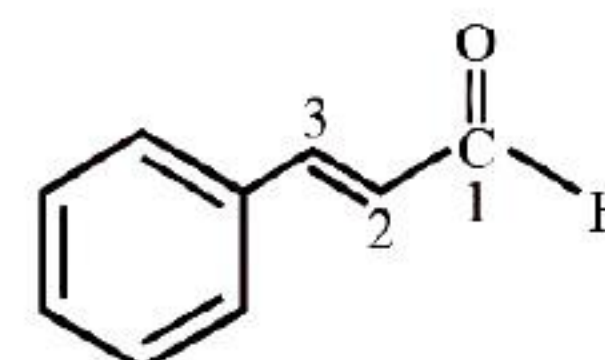
85. (d) KMnO_4 is an oxidising agent and acetylene on treatment with alkaline KMnO_4 produces oxalic acid.



86. (b) Aldehydes which do not contain α -hydrogen undergo cannizzaro reaction.

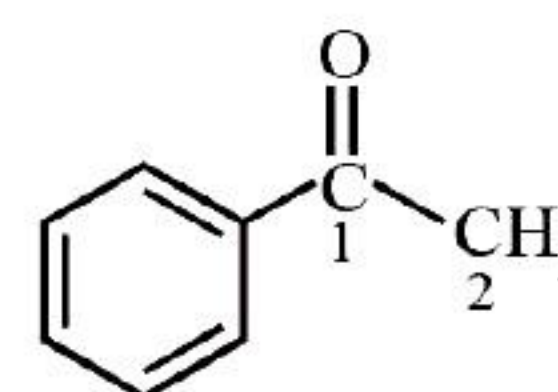
87. (c) Isobutanal does not give iodoform test as it does not have – COCH_3 group.

88. (a) (A) Cinnamaldehyde:



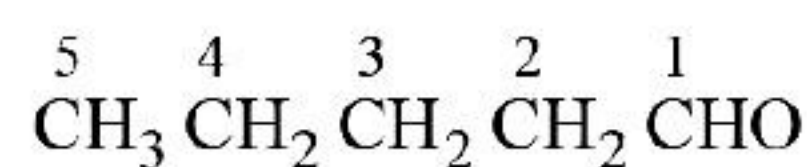
3-Phenylprop-2-enal

(B) Acetophenoneone



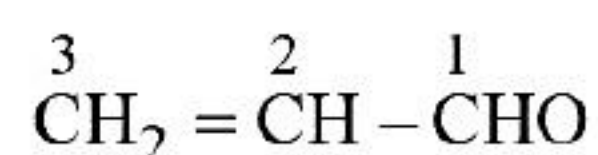
1-Phenylethan one

(C) Valeraldehyde



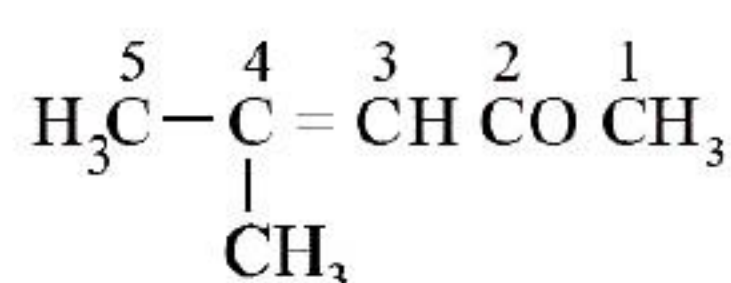
Pentanal

(D) Acrolein



Prop-2-enal

(E) Mesityl oxide



4-Methyl pent-3-en-2-one

89. (c) 90. (d)

91. Ketones and aldehyde.

Note :- Benzaldehyde do not give reaction with Fehling solution.

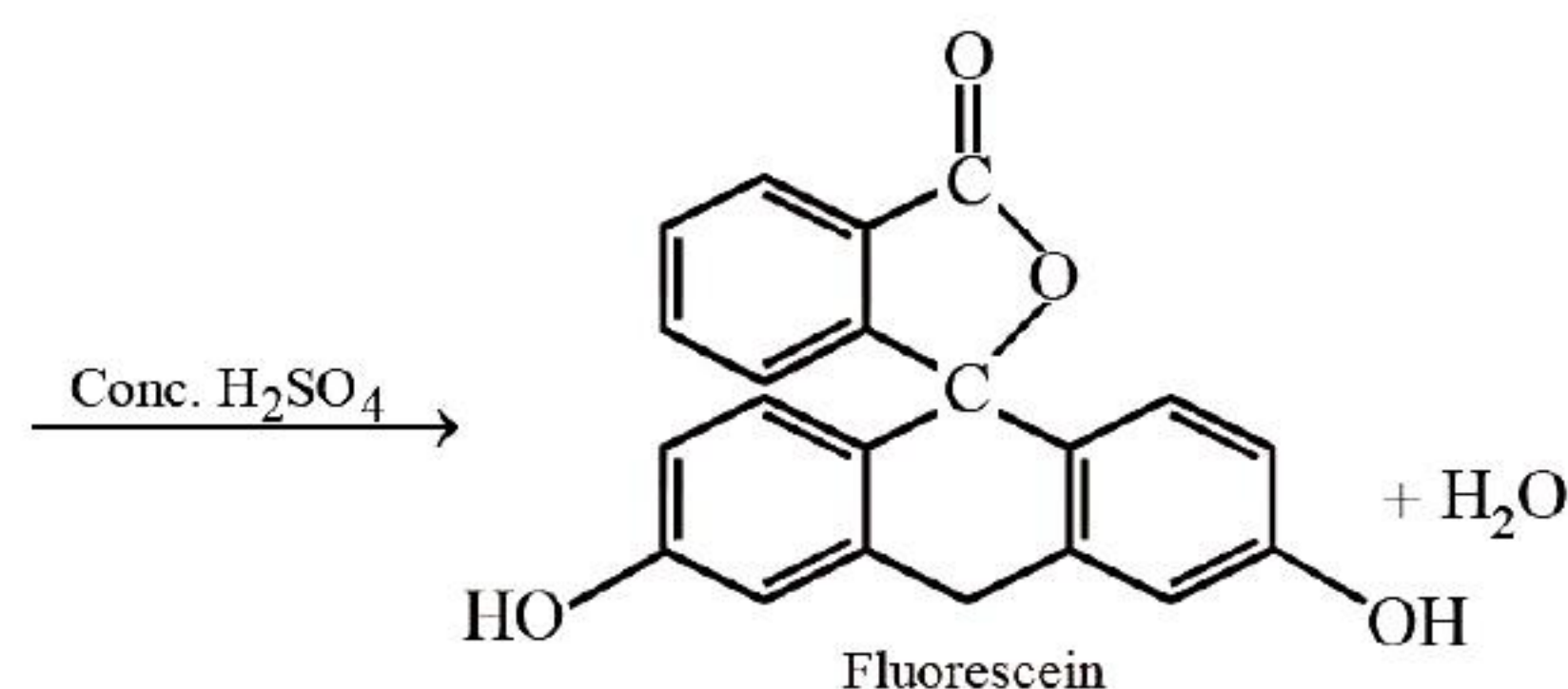
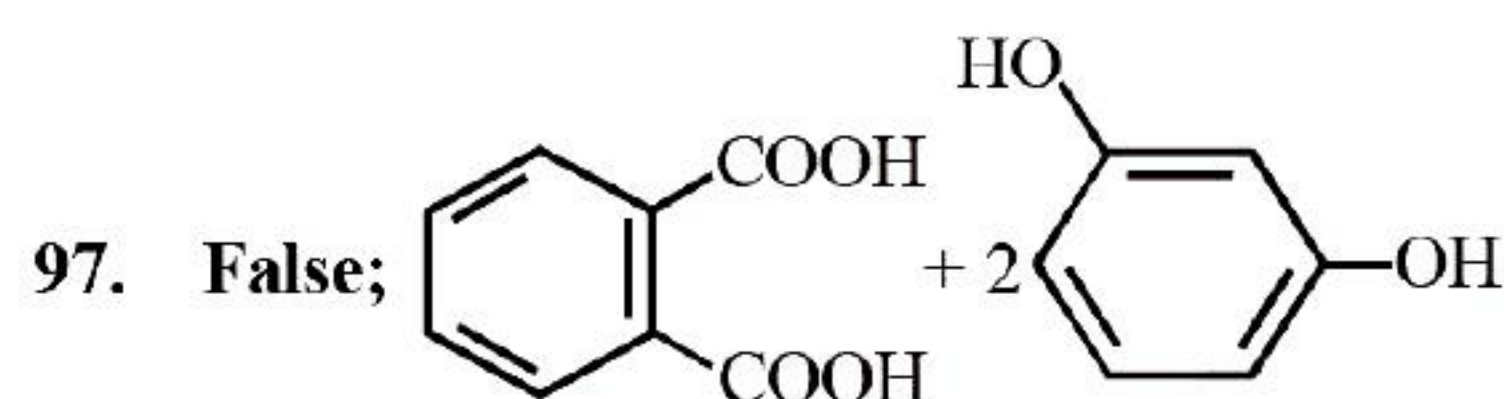
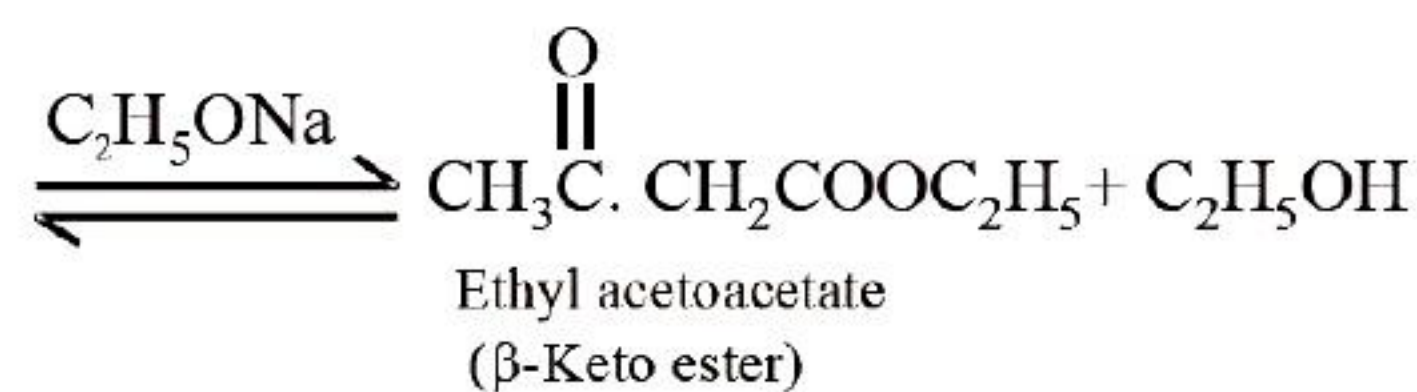
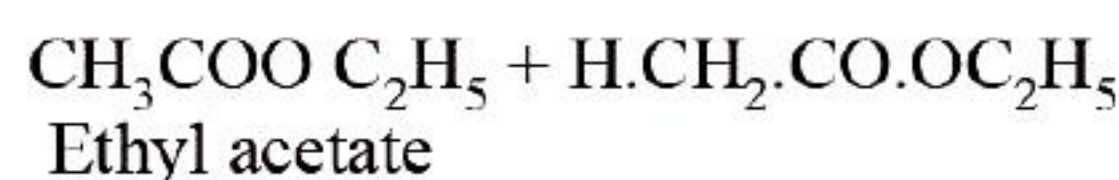
92. Esters

93. Butanoic acid; Under moist and warm conditions, glycerides present in butter are hydrolysed to give butanoic acid (along with other volatile acids like caproic and caprylic acids) which produces disagreeable smell ; this reaction is called **rancidity**.

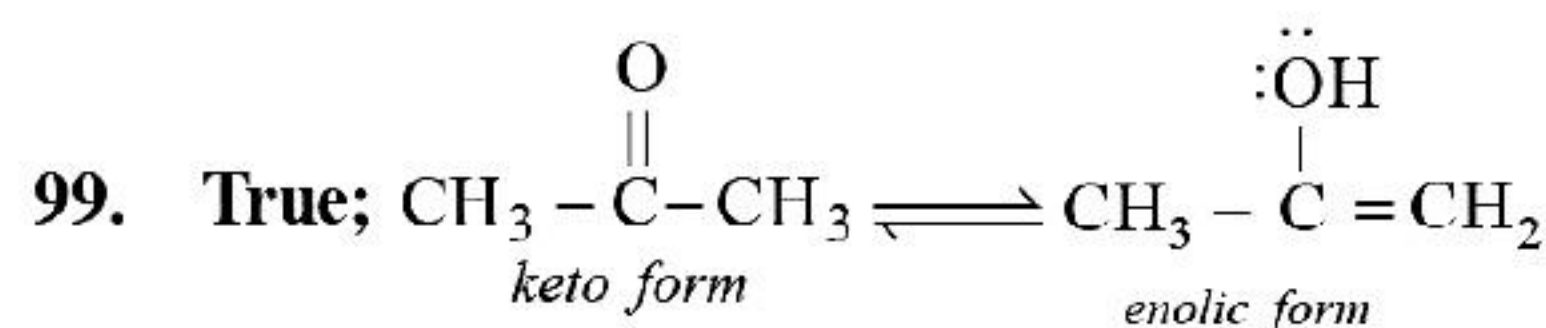
94. Conc. H_2SO_4 .

95. Pd/BaSO_4

96. **False; Claisen condensation:** Intermolecular condensation of esters containing α -hydrogen atom in presence of strong base to form β -keto ester



98. (a) **False;** Aspirin (acetylsalicylic acid) is a non-narcotic analgesic.



No. of σ bonds in enolic form : $3 + 1 + 1 + 1 + 1 + 2 = 9$

No. of π bonds in enolic form : 1

No. of lone pairs of electrons in enolic form = 2

100. **True**