CHAPTER

5

Carbonyl Compounds and Acid Derivatives

Question Bank

LEVEL 1

1. When phenyl ethanoate is alkylated with chloroethane/$AlCl_3$, the para product is the major product. This is because

(a) Alkylation usually occurs at the para position.

(b) The -Cl group is a weakly deactivating and an ortho/para director.

(c) The -OCOMe group is an activator and an ortho/para director.

(d) The -Et group is weakly activating and an ortho/para director.

2. Terminal alkynes react with 9-borabicyclononane (9-BBN) and then aq. alkaline hydrogen peroxide to give aldehydes because

(a) Acid catalysed electrophilic addition of water follows Markovnikov's rule.

(b) Acid catalysed electrophilic addition of water is anti-Markovnikov.

(c) The radical addition is anti-Markovnikov.

(d) Steric and electronic effects cause the boron to the terminal carbon.

3. In general, ketones are more reactive towards nucleophiles than esters because

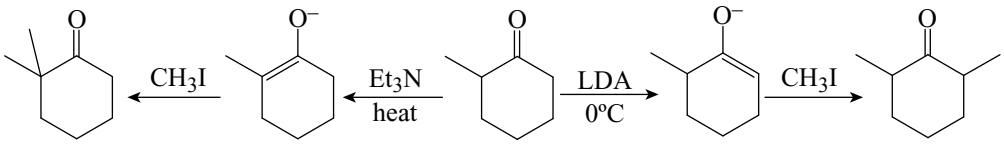
(a) The α-protons of a ketone are more acidic than those of an ester.

(b) The alkyl group in a ketone is an electron donating group due to hyperconjugation.

(c) Alkoxy (RO-) groups are sterically larger than the related alkyl group.

(d) Alkoxy (RO-) groups are stronger electron donating than alkyl groups via resonance.

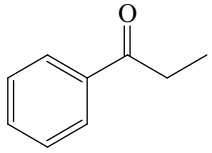
4. When 2-methylcyclohexanone reacts with a base and is then treated with an electrophile such as methyl iodide the product depends on the reaction conditions, see below. At high temperature, the major product is the geminal dimethyl compound. This is because



(a) Alkyl groups are weak electron donors due to inductive effects and hyperconjugation.
(b) The enolate formed at high temperature is more stable.
(c) diisopropyl amide (LDA) is a much stronger base than Et_3N.
(d) Lithium diisopropyl amide (LDA) promotes an anti-Markovnikov type addition.

5. The reaction of a Grignard reagent with a carboxylic acid does not give a secondary alcohol. This is because
(a) Grignard reagents only react with the aldehydes, ketones, esters and epoxides.
(b) The carboxylic acid is too sterically hindered to react.
(c) The carboxylic acid is not electrophilic enough to react.
(d) The Grignard reagent is a base, so an acid–base reaction occurs.

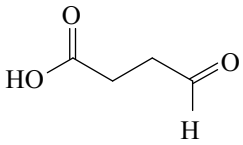
6. When 1-phenylpropyne reacts with $H_2O/HgSO_4/H_2SO_4$, the major product is propiophenone shown below. This is because



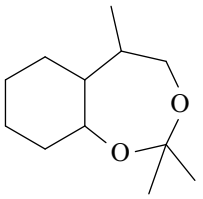
(a) Alkyl groups are weak electron donors due to inductive effects and hyperconjugation.
(b) Carbonyl groups are electron withdrawing groups due to resonance.
(c) Phenyl groups can stabilise positive charge by resonance.
(d) The reaction is controlled by steric factors.

7. When methyl benzoate is nitrated with HNO_3/H_2SO_4, the meta product is the major product. This is because
(a) The $-CO_2CH_3$ group is a meta director.
(b) The $-OCH_3$ is a meta director.
(c) The $-NO_2$ group is deactivating and a meta director.
(d) Nitration usually occurs at the meta position.

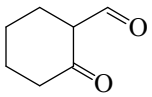
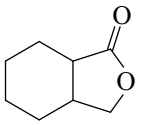
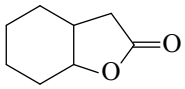
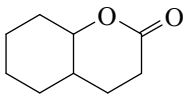
8. A chemist attempted to reduce the compound shown below with $NaBH_4$, but could not isolate the desired product 4-hydroxybutanoic acid. This is because

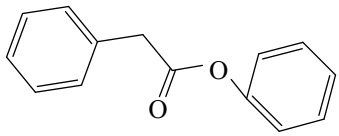


(a) $NaBH_4$ reduced both the carboxylic acid and the aldehyde.
(b) $NaBH_4$ is not reactive enough to reduce the carboxylic acid or the aldehyde.
(c) An intermediate was formed that reacted to give a cyclic acetal.
(d) An intermediate was formed that reacted to give a cyclic ester.

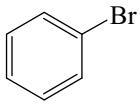
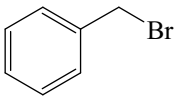
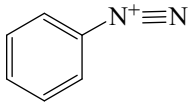
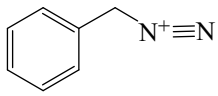
9. ? $\xrightarrow[\text{(ii) } LiAlH_4 \text{ then } H_3O^+]{\text{(i) LDA then methyl iodide}}$  Identify reactant

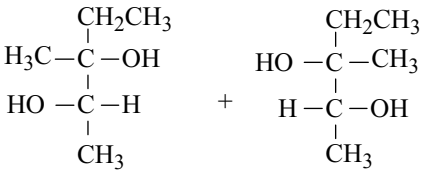
(iii) TsOH, propanone, heat

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

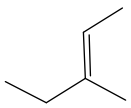
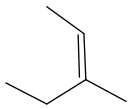
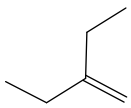
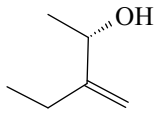
10. ? $\xrightarrow{\text{(i) NaCN}}$  Identify reactant

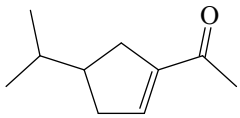
(ii) H^+, H_2O, heat
(iii) $SOCl_2$, Et_3N
(iv) Benzl alcohol, pyridine

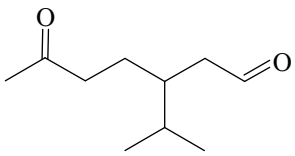
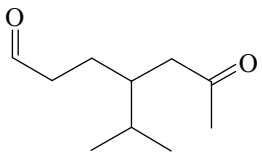
(a)  (b)  (c)  (d) 

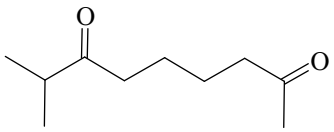
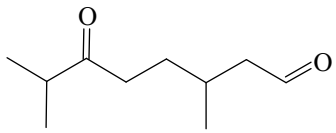
11. ? $\xrightarrow[\text{(ii) } H^+, H_2O]{\text{(i) } CH_3CO_3H}$  Identify reactant

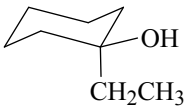
(50:50 of these enantiomers)

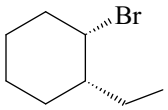
(a)  (b)  (c)  (d) 

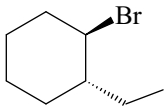
12. $\xrightarrow{\text{NaOEt, EtOH, heat}}$  Identify reactant

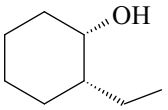
(a)  (b) 

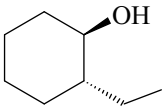
(c)  (d) 

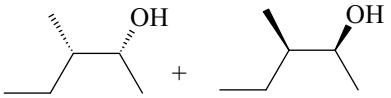
13. ? $\xrightarrow[\text{(ii) } H^+, H_2O]{\text{(i) KOH, heat}}$  Identify reactant

(a) 

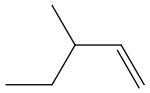
(b) 

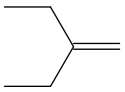
(c) 

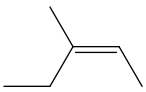
(d) 

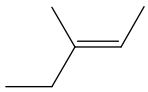
14. ? $\xrightarrow[\text{(ii) NaOH, } H_2O_2]{\text{(i) } BH_3}$  Identify reactant

(50:50 of these enantiomers)

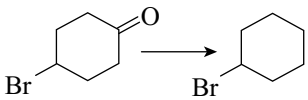
(a) 

(b) 

(c) 

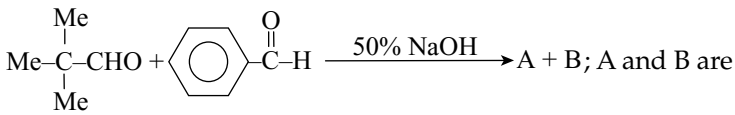
(d) 

15. Appropriate reagent for the following conversion is



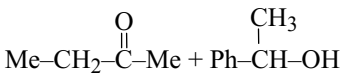
(a) NH_2NH_2; $EtOH/OH^-$ (b) Red P + I_2 (c) Zn–Hg/HCl (d) All of them

16. In the given reaction

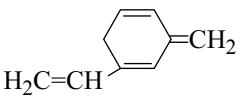


(a) $Me_3C–CH_2OH + Ph–COO^-$ (b) $Me_3C–COO^- + Ph–CH_2OH$

(c) 

(d) 

17. Which of the following gives glyoxal as one of the product on ozonolysis

(a)  (b) 

(c) $H_3C=CH–CH=CH_2$ (d) Both (a) and (c)

18. The correct statement is

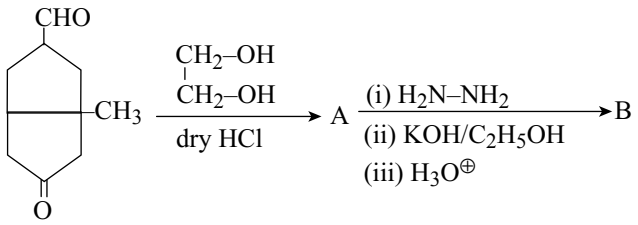
(a) chloral forms stable hydrate

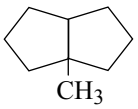
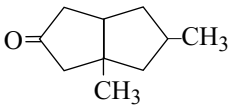
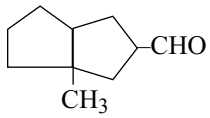
(b) methanal is more reactive than ethanal towards nucleophilic addition

(c) protonated carbonyl group is more reactive towards KCN

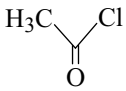
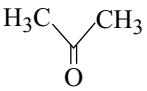
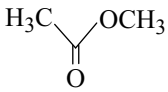
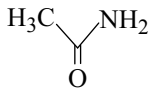
(d) all of them

19. In the given reaction sequence, the B is



(a)  (b)  (c)  (d) none of these

20. The maximum reactive towards the nucleophilic attack is

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

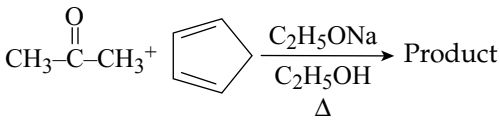
21. Match column I (reaction) with column II (name of the reaction) and select the correct answer using the codes given.

Column I	**Column II**
(a) $2C_6H_5CHO \xrightarrow{20\%\ NaOH}$	(i) Benzoin condensation
(b) $C_6H_5CHO + HCHO \xrightarrow{20\%\ NaOH}$	(ii) Self-Cannizzaro reaction
(c) $2C_6H_5CHO \xrightarrow{KCN/(alc.)}$	(iii) Cross Cannizzaro reaction
(d) $C_6^{''}H_5CHO + (CH_3CO)_2O \xrightarrow[\Delta]{CH_3COONa}$	(iv) Perkin reaction

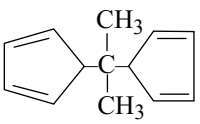
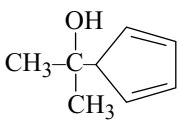
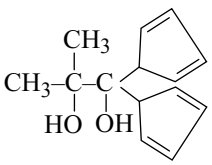
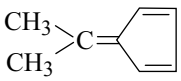
(a) a - i, b - ii, c - iii, d - iv (b) a - ii, b - iii, c - i, d - iv

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

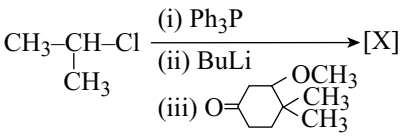
22. In the reaction

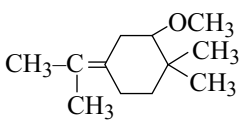
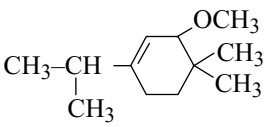


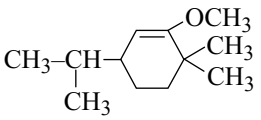
the product is

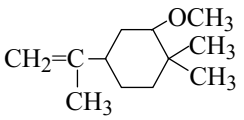
(a)  (b)  (c)  (d) 

23. The product of the given reaction is



(a)  (b) 

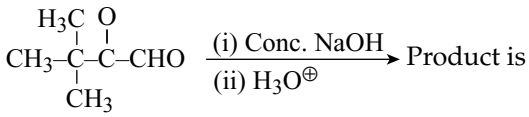
(c) 

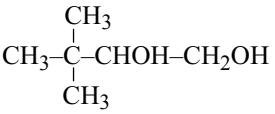
(d) 

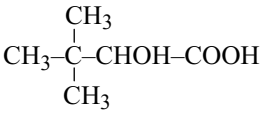
24. Which of the following gives positive Fehling's solution test

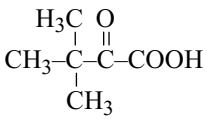
(a) Ph–CHO (b) CH_3CHO (c) CCl_3CHO (d) All of them

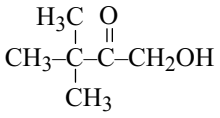
25. In the given reaction



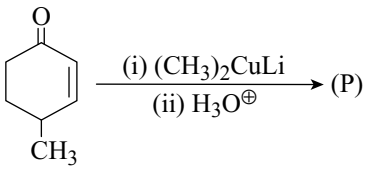
(a) 

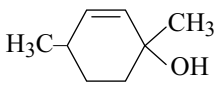
(b) 

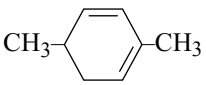
(c) 

(d) 

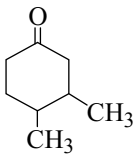
26. In the given reaction, (P) will be



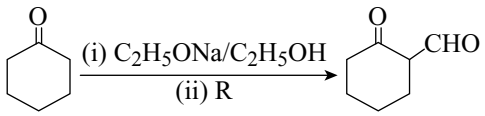
(a) 

(b) 

(c) 

(d) 

27. In the given reaction



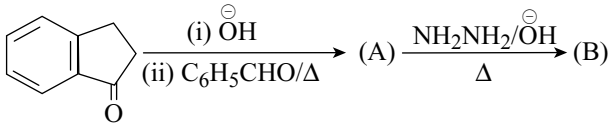
(R) would be

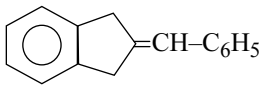
(a) HCHO (b) CH_3CHO (c) $HCOOC_2H_5$ (d) $(COOC_2H_5)_2$

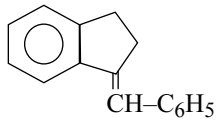
28. Aldehydes and ketones react with α-bromo esters and zinc in ether or benzene medium to yield

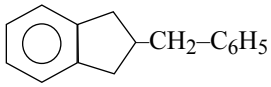
(a) α-keto ester (b) β-hydroxy ester (c) γ-keto acids (d) β-keto ester

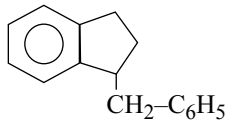
29. In the given reaction sequence, compound (B) is



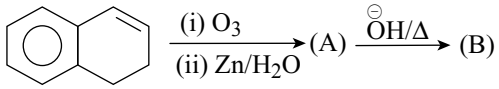
(a) 

(b) 

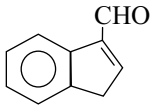
(c) 

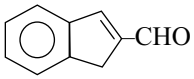
(d) 

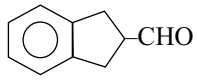
30. In the given reaction sequence

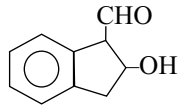


compound (B) is

(a) 

(b) 

(c) 

(d) 

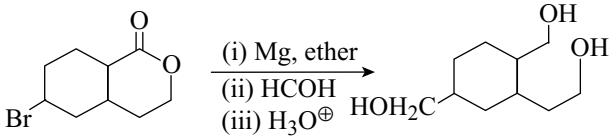
31. Two isomeric ketones, 3-pentanone and 2-pentanone can be distinguished by

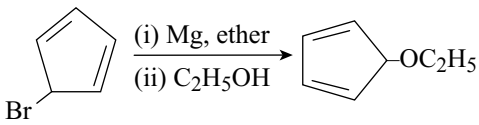
(a) I_2/NaOH (b) $NaHSO_3$ (c) NaCN/HCl (d) 2,4-DNP

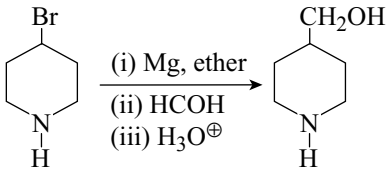
32. Silver mirror test with Tollen's reagent is given by

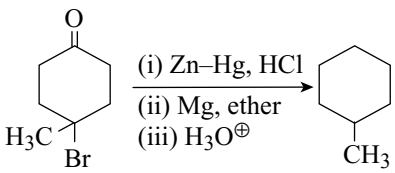
(a) C_6H_5CHO (b) Ph–OH (c) $C_6H_5–CH_2–\underset{\underset{O}{\|}}{C}–CH_2OH$ (d) CH_3CHO

33. Which of the following is a correct conversion?

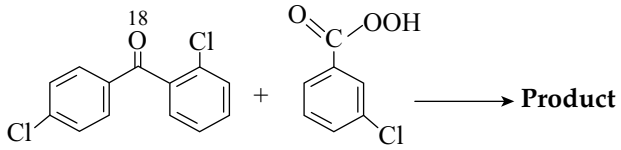
(a) 

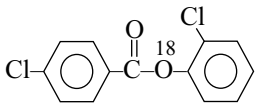
(b) 

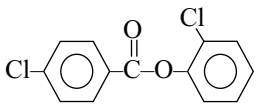
(c) 

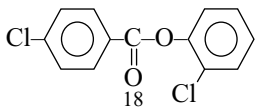
(d) 

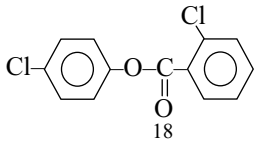
34. For the given reaction, the product is



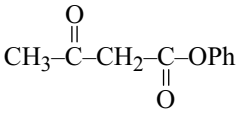
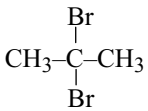
(a) 

(b) 

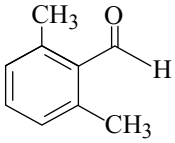
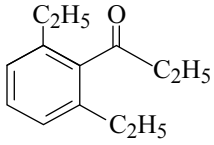
(c) 

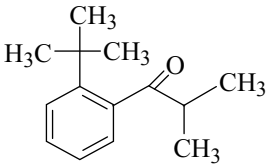
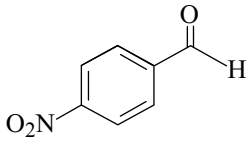
(d) 

35. Which one of the following does not respond positive to iodoform test even on heating?

(a)  (b)  (c) CH_3NO_2 (d) Both (a) and (b)

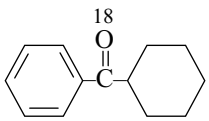
36. The rate of reduction of the following carbonyl compounds by $NaBH_4$

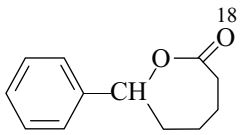
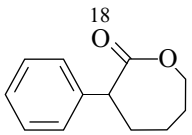
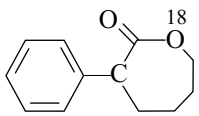
(i)  (ii) 

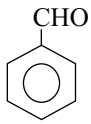
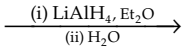
(iii)  (iv) 

(a) iv > i > ii > iii (b) i > ii > iv > iii

(c) iii > ii > i > iv (d) ii > i > iii > iv

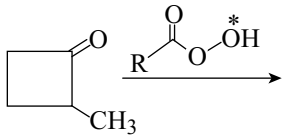
37.  A; product (A) is

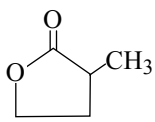
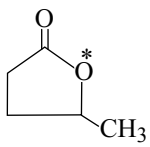
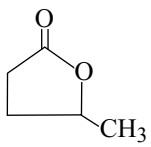
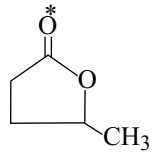
(a)  (b)  (c)  (d) None of these

38.  A  Products

The number of possible stereoisomers in the product mixture is

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

39.  A ; The product (A) is

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

40. The incorrect statement amongest the following is

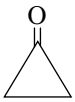
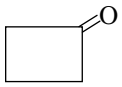
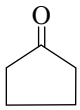
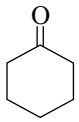
(a) The order of reduction reaction by $LiAlH_4$ and that of the reduction by $NaBH_4$ each is two

(b) Al–H bond is more ionic than B–H bond and hence $LiAlH_4$ can produce larger concentration of hydride ion than that of $NaBH_4$

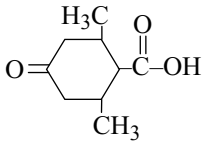
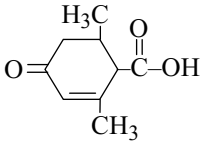
(c) $LiAlH_4$ cannot reduce $-NO_2$ group

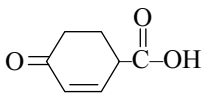
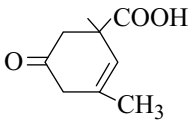
(d) Inspite of very small rate constant of reduction of any carbonyl function other than aldehydes and ketones, the rate of reduction with $LiAlH_4$ becomes appreciable due to large concentration of hydride ion

41. Which of the following ketones has the largest equilibrium constant for addition of water?

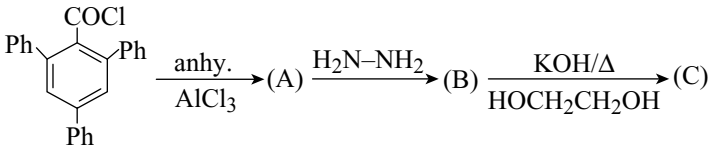
(a)  (b)  (c)  (d) 

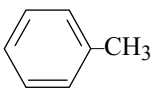
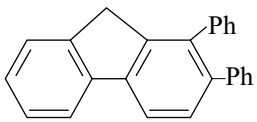
42. Ethyl acetoacetate react with $CH_3-\overset{\overset{O}{\|}}{C}-H$ in the presence of base/Δ followed by acidic hydrolysis and subjected to heat, product formed is

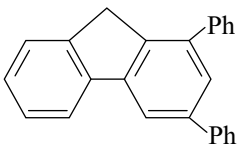
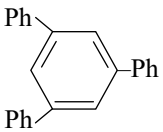
(a)  (b) 

(c)  (d) 

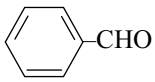
43. Identify the product (C) of the given sequence of reaction



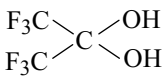
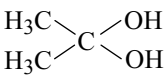
(a)  (b) 

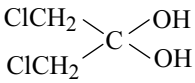
(c)  (d) 

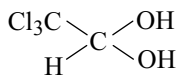
44. Which of the following gives positive Fehling's solution test

(a) HCOOH (b) HOOC–CHO (c)  (d) 

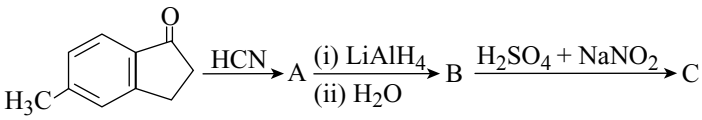
45. Which of the following geminal diol is most unstable?

(a)  (b) 

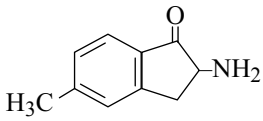
(c) 

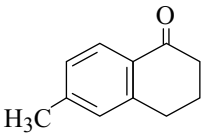
(d) 

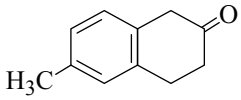
46. In the given reactions, sequence

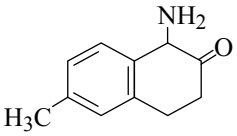


The compound C is

(a) 

(b) 

(c) 

(d) 

47. What will be the pH of an acetate-acetic acid solution when the ratio of $[CH_3CO_2^-]/[CH_3CO_2H]$ is 10? (A table of pK_a data is given below.)

(a) 5.76
(b) 4.76
(c) 3.76
(d) 1.76

Some useful	pK_a values
CH_3CO_2H	4.76
H_3PO_4	2.2
$H_2PO_4^-$	7.2
HPO_4^{2-}	12.4

48. If the internal pH of a muscle cell is 6.8. Which one of the following statements about the concentrations of PO_4^{3-}, HPO_4^{2-}, $H_2PO_4^{1-}$, and H_3PO_4 is true?
(Hint: use the table of pK_as given in the previous question.)

(a) The species with the highest concentration is H_3PO_4.
(b) The species with the highest concentration is $H_2PO_4^{1-}$.
(c) The species with the highest concentration is PO_4^{3-}.
(d) The species with the highest concentration is HPO_4^{2-}.

49. Choose the incorrect statement about the following acid/base reactions involving propyne and its anion propynide.

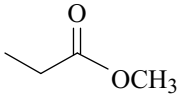
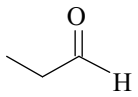
	pK_a
H_2O	16
$H_3C-C\equiv CH$	25
NH_3	34

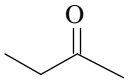
(i) $H_3C-C\equiv CH + OH^{\ominus} \rightleftharpoons H_3C-C\equiv C^{\ominus} + H_2O$

(ii) $H_3C-C\equiv CH + NH_2^{\ominus} \rightleftharpoons H_3C-C\equiv C^{\ominus} + NH_3$

(a) The equilibrium in equation (i) lies to the left.
(b) The equilibrium in equation (ii) lies to the right.
(c) In reaction (ii) ammonia, NH_3, acts as a base.
(d) Propyne, $CH_3C\equiv CH$, is a stronger acid than ammonia, NH_3.

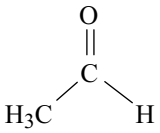
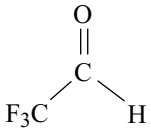
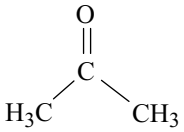
50. Choose among the following reactions those that will give a racemic mixture of two enantiomers as the products.

(i)  $\xrightarrow[(ii)\ H_2O]{(i)\ CH_3Li}$ (ii)  $\xrightarrow[(ii)\ H_2O]{(i)\ CH_3Li}$

(iii)  $\xrightarrow[(ii)\ H_2O]{(i)\ NaBH_4}$

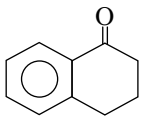
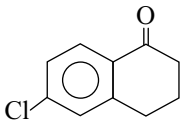
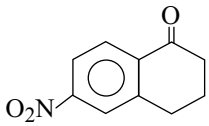
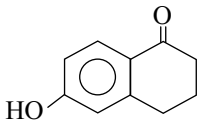
(a) i (b) ii (c) iii (d) ii + iii

51. Choose the order that has the following carbonyl groups correctly arranged with respect to increasing reactivity with $NaBH_4$.

(i)  (ii)  (iii) 

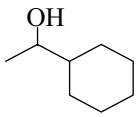
(a) i < iii < ii $\xrightarrow[\text{acidity}]{\text{increasing}}$ (b) i < ii < iii $\xrightarrow[\text{acidity}]{\text{increasing}}$ (c) ii < i < iii $\xrightarrow[\text{acidity}]{\text{increasing}}$ (d) iii < i < ii $\xrightarrow[\text{acidity}]{\text{increasing}}$

52. Which of the following is the correct order for hydrate formation of the given compounds?

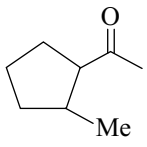
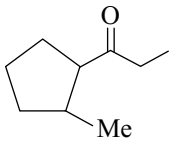
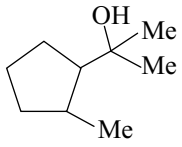
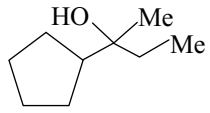
(i)  (ii)  (iii)  (iv) 

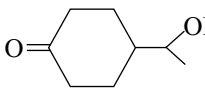
(a) i > ii > iii > iv (b) iv > i > ii > iii

(c) iii > ii > i > iv (d) iii > i > iv > ii

53.  $\xrightarrow[\Delta]{H_2SO_4}$ [X] $\xrightarrow[(ii)\ Me_2S]{(i)\ O_3}$ [Y] $\xrightarrow[(ii)\ (CH_3)_2\ CuLi\ (iii)\ H_2O]{(i)\ \text{dil. } OH^{\ominus}/\Delta}$ [Z]

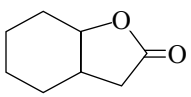
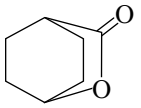
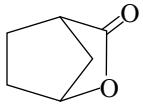
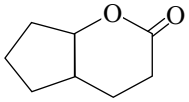
In the above sequence, compoud [Z] is

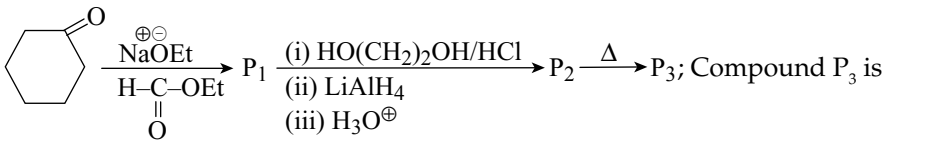
(a)  (b)  (c)  (d) 

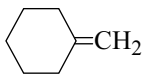
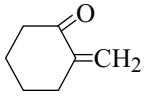
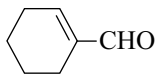
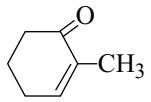
54.  $\xrightarrow{PCC}$ P_1 $\xrightarrow[NaOH]{I_2}$ $P_2 + P_3$ (Yellow ppt.)

$P_2 \xrightarrow[(ii)\ H^{\oplus},\ \Delta]{(i)\ NaBH_4} P_4$

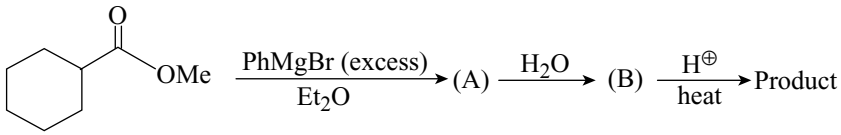
Final compound P_4 is

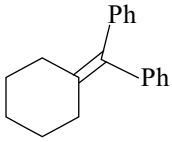
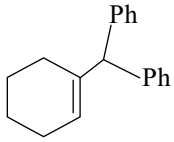
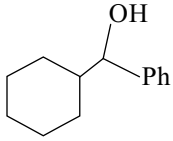
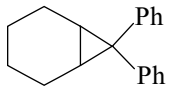
(a)  (b)  (c)  (d) 

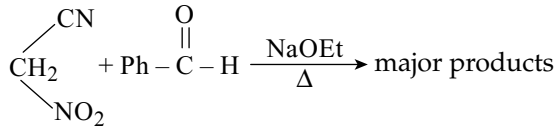
55. 

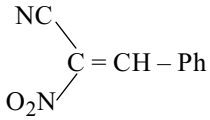
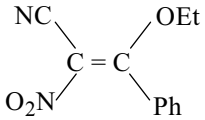
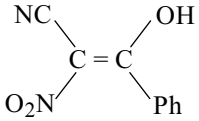
(a)  (b)  (c)  (d) 

56. Product "P" obtained by the reaction

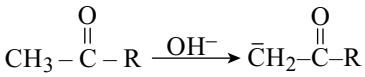


(a)  (b)  (c)  (d) 

57. 

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

58. Aldehydes and ketones having α-hydrogen convert into carbanion in the presence of base as follows



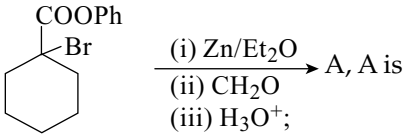
This carbanion is stable because of

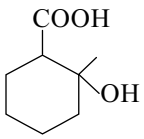
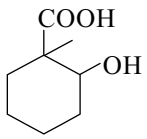
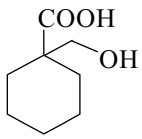
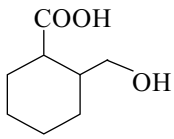
(a) Presence of -I group (–CO–)

(b) Delocalisation of negative charge by pi bond

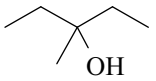
(c) Presence of +I group (i.e., R) on –CO–

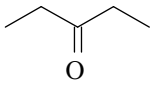
(d) Both (a) and (b)

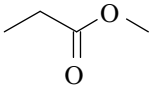
59. 

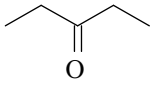
(a)  (b)  (c)  (d) 

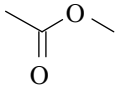
60. Choose the reaction that would not be successful for the preparation of the following alcohol.



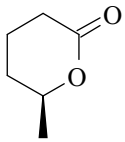
(a)  (i) CH_3MgBr (ii) NH_4Cl, H_2O

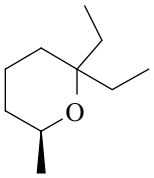
(b)  (i) CH_3MgBr (ii) NH_4Cl, H_2O

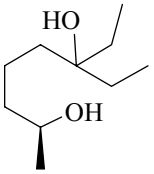
(c)  (i) CH_3CH_2MgBr

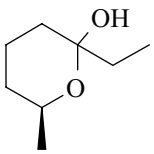
(d)  (i) CH_3CH_2MgBr (2 eq) (ii) NH_4Cl, H_2O

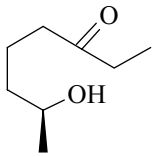
61. Choose the major product of the following reaction sequence.

 (i) CH_3CH_2Li (excess) (ii) NH_4Cl, H_2O

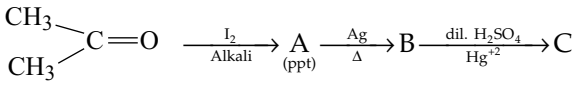
(a) 

(b) 

(c) 

(d) 

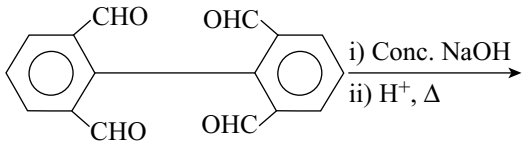
62. The compounds A, B and C in the reaction sequence

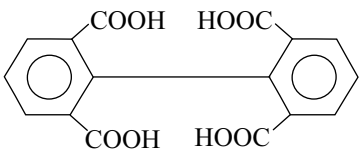


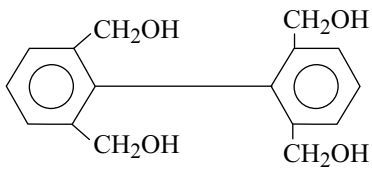
are given by the set

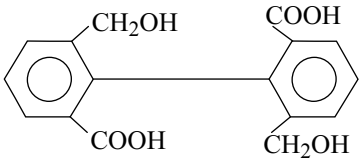
(a) Iodoform, ethylene, ethyl alcohol (b) Iodoform, acetylene, acetaldehyde

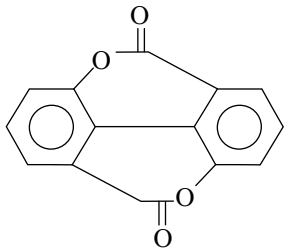
(c) Iodoform, propyne, acetone (d) Iodoform, 2-propanol, propanone

63. Any one of the product formed is by  i) Conc. NaOH ii) H^+, Δ

(a) 

(b) 

(c) 

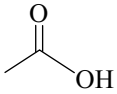
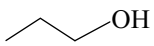
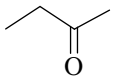
(d) 

64. A compound "A" formula of $C_3H_6Cl_2$ on reaction with alkali can give "B" of formula C_3H_6O or "C" of formula C_3H_4. "B" on oxidation gave a compound of the formula $C_3H_6O_2$. "C" with dilute H_2SO_4 containing Hg^{2+} ion gave "D" of formula C_3H_6O, which with bromine and alkali gave the sodium salt of $C_2H_4O_2$. Then "A" is

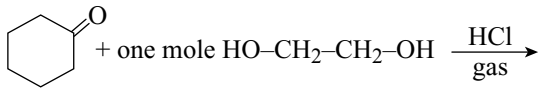
(a) $CH_3CH_2CHCl_2$ (b) $CH_3CCl_2CH_3$ (c) $CH_2ClCH_2CH_2Cl$ (d) $CH_3CHClCH_2Cl$

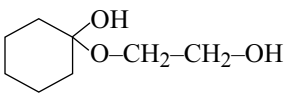
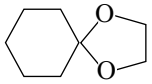
65. Identify compound [X] in the given reaction

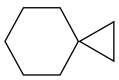
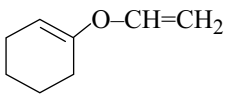
$$Me–C\equiv C–H \xrightarrow[\text{dil. } H_2SO_4]{1\%\ HgSO_4} [P_1] \xleftarrow{P.C.C} \text{compound [X]}$$

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

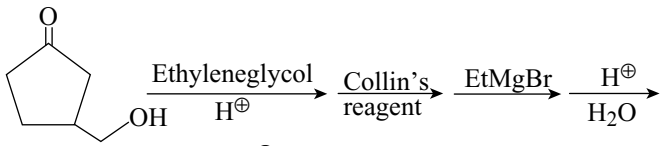
66. What is the major product obtained from the following reaction

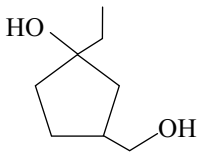
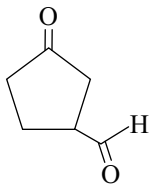
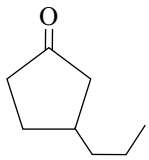
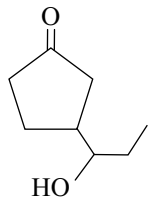


(a)  (b) 

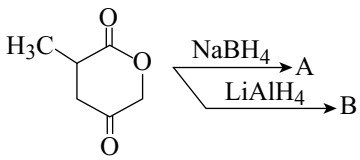
(c)  (d) 

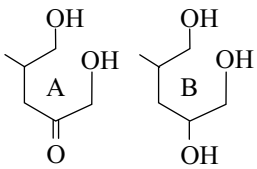
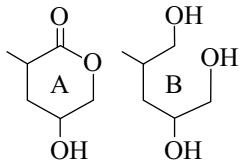
67. Give the product from the following reaction sequence

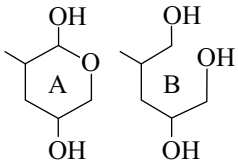
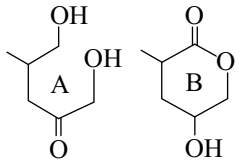


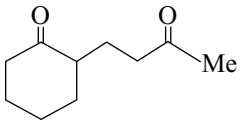
(a)  (b)  (c)  (d) 

68. Predict the major organic product from the following reaction

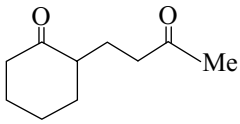
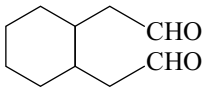
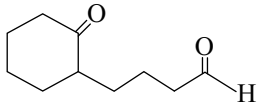
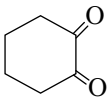


(a)  (b) 

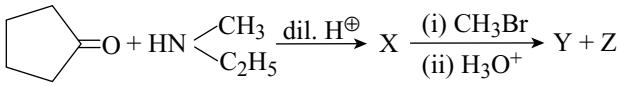
(c)  (d) 

69.  $\xrightarrow[\Delta]{\text{dil. } \overset{\ominus}{O}H}$ [X] $\xrightarrow[\text{(ii) } KOH/C_2H_5OH]{\text{(i) } H_2N–NH_2}$ [Y] $\xrightarrow[\text{(ii) } H_2O–Zn]{\text{(i) } O_3}$ [Z].

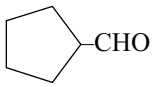
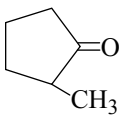
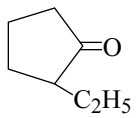
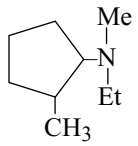
The product (Z) is

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

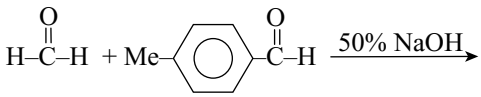
70. The final product (Y) of the following reaction sequence is



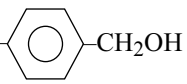
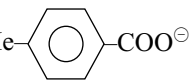
Z + Hinsberg reagent $\xrightarrow{KOH}$ (No dissolution/solid residue)

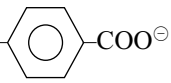
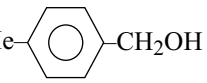
(a)  (b)  (c)  (d) 

71. In the given reaction

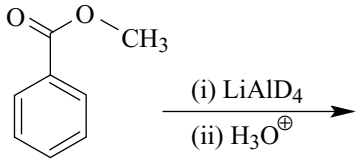
 A + B (A and B are cross Cannizaro product);

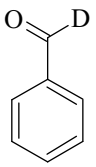
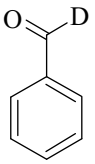
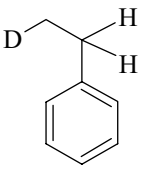
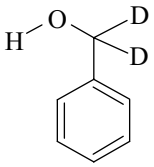
A and B are

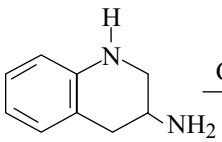
(a) $HCOO^-$ +  (b) CH_3OH + 

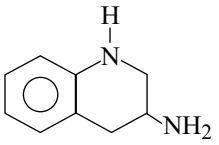
(c) $HCOO^-$ +  (d) CH_3OH + 

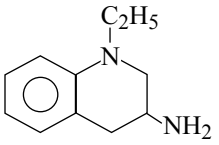
72. Choose the major product of the following reaction.

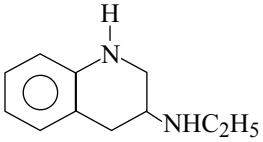


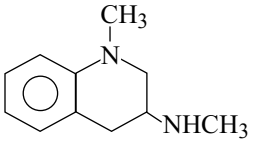
(a)  (b)  (c)  (d) 

73.  $\xrightarrow[\text{(1 Eq.)}]{CH_3CHO}$ A $\xrightarrow{Sn+HCl}$ B. B is

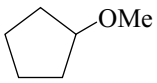
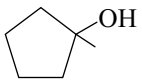
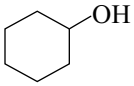
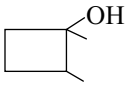
(a) 

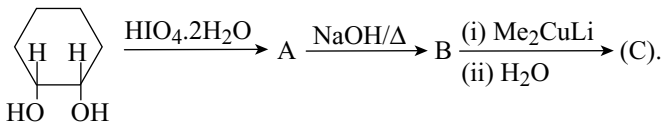
(b) 

(c) 

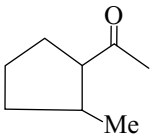
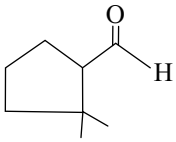
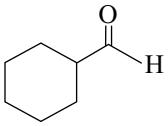
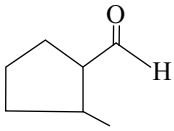
(d) 

74. An organic compound A($C_6H_{12}O$) neither decolourise bromine water nor changes the colour of acidic dichromate solution. A on heating with H_2SO_4 produces an alkene which on oxidative ozonolysis gives B($C_6H_{10}O_3$), which gives an yellow precipitate with $NaOH/I_2$. The most probable structure of A is

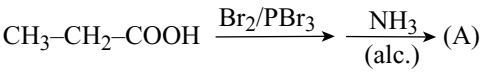
(a)  (b)  (c)  (d) 

75. 

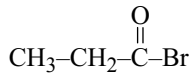
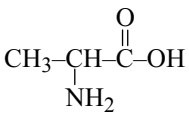
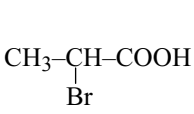
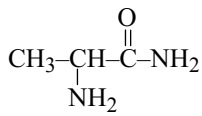
Identify "(C)" product

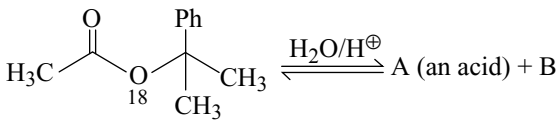
(a)  (b)  (c)  (d) 

76. In the given reaction

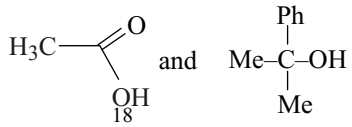
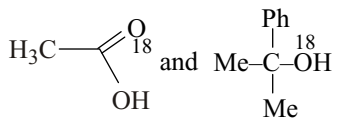


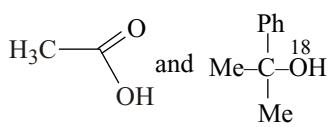
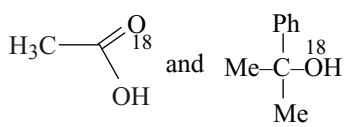
(a) would be

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

77. 

where A and B are, respectively

(a)  (b) 

(c)  (d) 

78. $CH_3–\underset{\displaystyle NH_2}{\underset{|}{CH}}–COOH$ can be converted into $CH_3–\underset{\displaystyle NH_2}{\underset{|}{CH}}–CH_2OH$ by the use of

(a) H_2/Pd (b) $LiAlH_4$ (c) $NaBH_4$ (d) CH_3MgBr

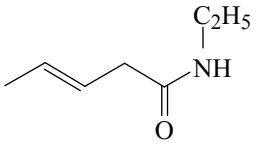
79. Arrange in increasing order of reactivity towards nucleophile

(i) $H_3C–\overset{\displaystyle O}{\overset{\|}{C}}–NH_2$ (ii) $CH_3–\overset{\displaystyle O}{\overset{\|}{C}}–Cl$ (iii) $CH_3–\overset{\displaystyle O}{\overset{\|}{C}}–OAc$ (iv) $H_3C–\overset{\displaystyle O}{\overset{\|}{C}}–OCH_3$

(a) ii > iv > i > iii (b) ii > iii > iv > i

(c) iii > ii > i > iv (d) iii > iv > ii > i

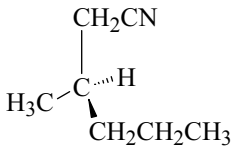
80. What is the name of the following compound?



(a) trans-N-ethyl-3-pentenamide (b) trans-1-ethyl-3-pentenamide

(c) trans-N-ethyl-4-pentenamide (d) trans-1-ethyl-4-pentenamide

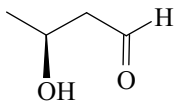
81. What is the name of the following compound?



(a) (R)-3-methylhexaneamine (b) (S)-3-methylhexaneamine

(c) (R)-3-methylhexanenitrile (d) (S)-3-methylhexanenitrile

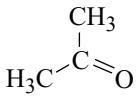
82. What is the name of the following compound?



(a) (R)-3-hydroxybutanal (b) (S)-3-hydroxybutanal

(c) (R)-3-hydroxybutanol (d) (S)-3-hydroxybutanol

83. What is not the name of the following compound?

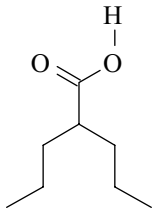


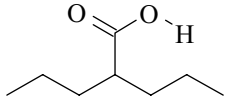
(a) acetone (b) dimethyl ketone (c) 2-oxoketone (d) propanone

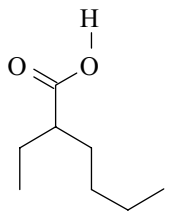
84. Which of the following compound has the highest boiling point?

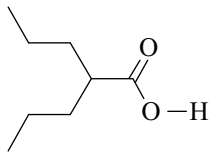
(a) $CH_3CH_2CH_3$ (b) CH_3CO_2H (c) CH_3COCH_3 (d) CH_3CH_2OH

85. Valproic acid found clinical use as an anticonvulsant and mood-stabilizing drug that has proven useful in the treatment of epilepsy, bipolar disorder, and other problems. Choose the constitutional isomer(s) of valproic acid.

(i) 



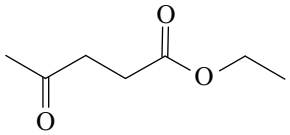
(ii) 

(iii) 

valproic acid

(a) i (b) ii (c) iii (d) i and ii

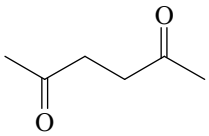
86. What is the name of the following compound?

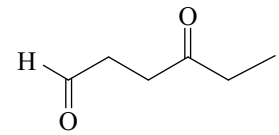


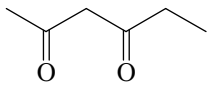
(a) ethyl 4-oxopentanoate (b) ethyl ester methyl ketone

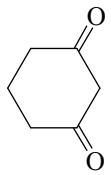
(c) ethyl 4-ketonepentanoate (d) ethyl 4-ketone pentyl ester

87. What is the structure of 2,4-hexanedione?

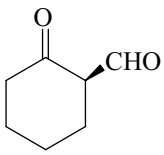
(a) 

(b) 

(c) 

(d) 

88. What is the name of the following compound?



(a) (R)-2-ketocyclohexane carbaldehyde (b) (R)-2-aldehydecyclohexanone

(c) (S)-2-formylcyclohexanone (d) (S)-2-aldehydecyclohexanone

89. If only one equivalent of NH_3 (one mole of NH_3 reacts with one mole of cyclohexyl chloride) was used, the reaction may not go to completion. Why?

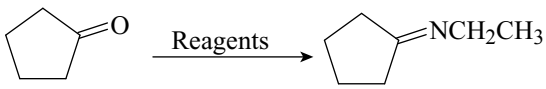
(a) NH_3 is not a strong nucleophile. Therefore, more NH_3 is needed.

(b) Cl is not a good leaving. Therefore, more NH_3 is needed.

(c) Cyclohexyl group presents large steric hindrance. Therefore, more NH_3 is needed.

(d) NH_3 will be protonated by HCl as reaction proceeds. Therefore, the reaction will be incomplete.

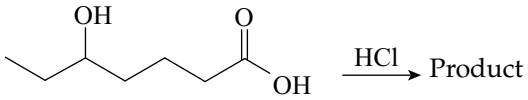
90. What could be the best reagents for the following reaction?

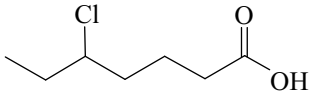


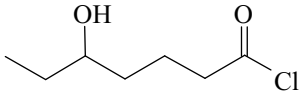
(a) H_2NEt and CH_3CO_2H (b) H_2NEt and HCl

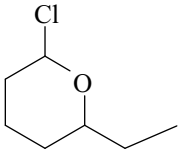
(c) H_2NEt and NaOH (d) H_2NEt and $Na^+–OCH_3$

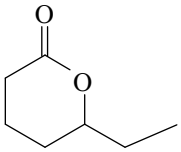
91. What could be the product for the following reaction?



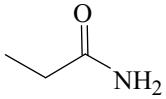
(a) 

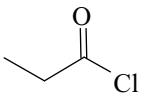
(b) 

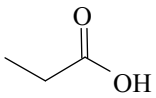
(c) 

(d) 

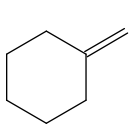
92. What is the order of increasing boiling points (from the lowest to highest) for the following compounds?

(i) 

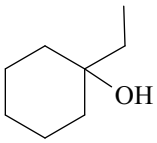
(ii) 

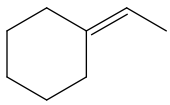
(iii) 

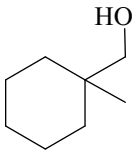
(a) ii, i, iii (b) ii, iii, i (c) i, iii, ii (d) iii, i, ii

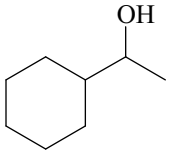
93. 

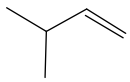
product is

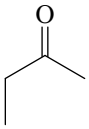
(a) 

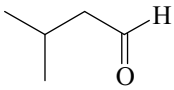
(b) 

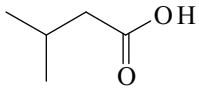
(c) 

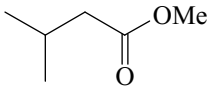
(d) 

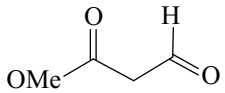
94. 

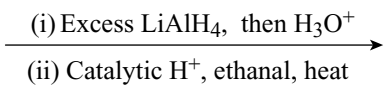
(a) 

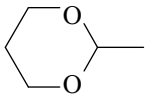
(b) 

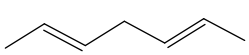
(c) 

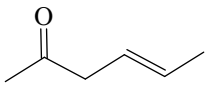
(d) 

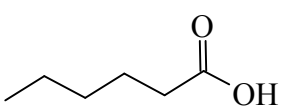
95. 

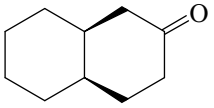


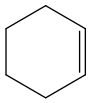
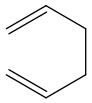
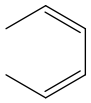
(a) 

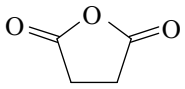
(b) 

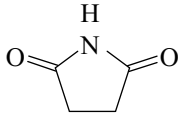
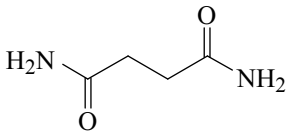
(c) 

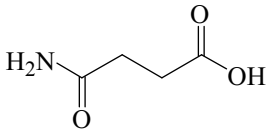
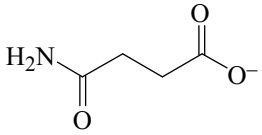
(d) 

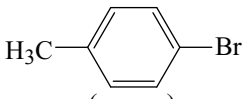
96. ? $\xrightarrow[\text{(ii) } Hg(OAC)_2,\ H_2O \\ \text{(iii) } NaBH_4 \\ \text{(iv) PCC}]{\text{(i) 1, 3-butadiene, heat}}$ 

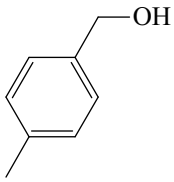
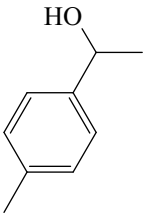
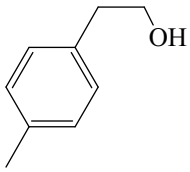
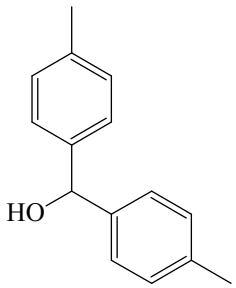
(a)  (b)  (c)  (d) 

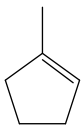
97.  $\xrightarrow{\text{Aqueous } NH_3}$

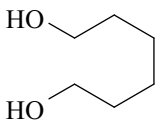
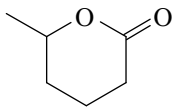
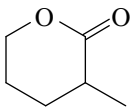
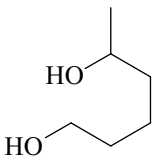
(a)  (b) 

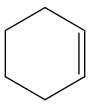
(c)  (d) 

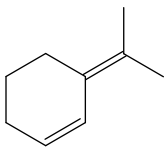
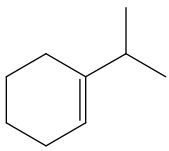
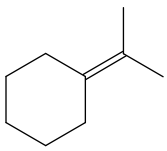
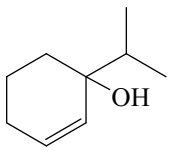
98.  (excess) $\xrightarrow[\text{(ii) Methyl ethanote, then } H_3O^+]{\text{(i) Mg, Ether}}$?

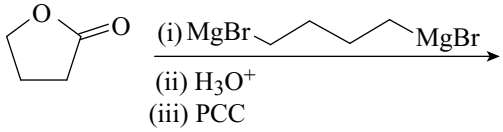
(a)  (b)  (c)  (d) 

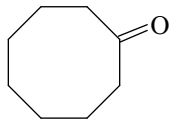
99.  $\xrightarrow[\text{(ii) } NaBH_4 \\ \text{(iii) Catalytic } H_+]{\text{(i) } O_3\text{, then } H_2O_2}$?

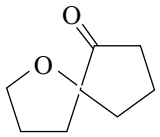
(a)  (b)  (c)  (d) 

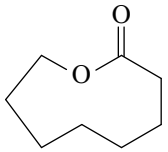
100.  $\xrightarrow[\text{(ii) } Ph_3P\text{, then } CH_3CH_2CH_2CH_2Li \\ \text{(iii)}\ \underset{}{\overset{O}{\parallel}}\!\!-CH_3]{\text{(i) } Br_2/UV\ light}$

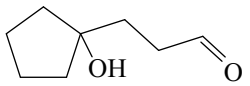
(a)  (b)  (c)  (d) 

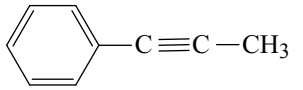
101. 

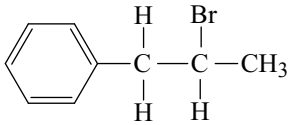
(a) 

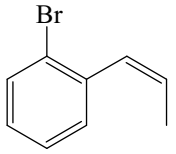
(b) 

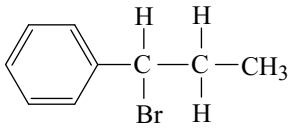
(c) 

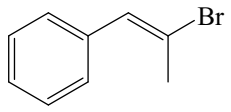
(d) 

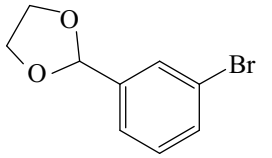
102.  product is

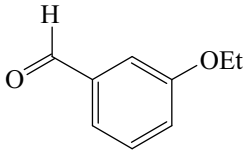
(a) 

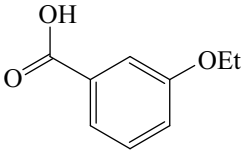
(b) 

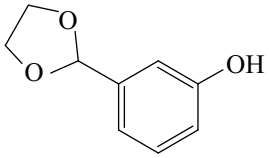
(c) 

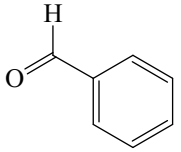
(d) 

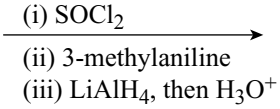
103. 

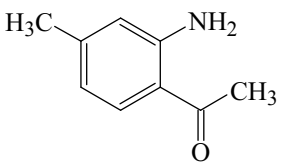
(a) 

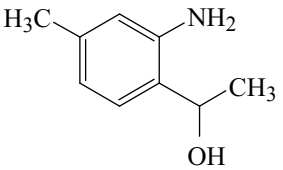
(b) 

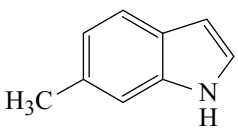
(c) 

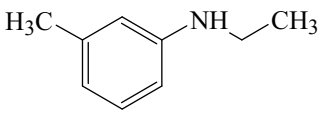
(d) 

104. CH_3CO_2H 

(a) 

(b) 

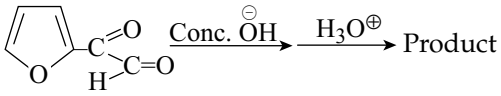
(c) 

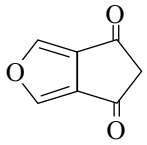
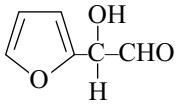
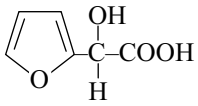
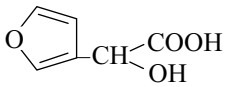
(d) 

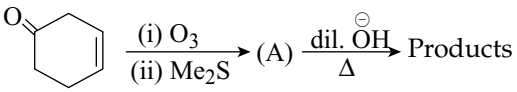
LEVEL 2

Single and Multiple-choice Type

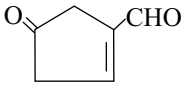
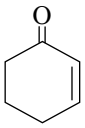
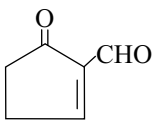
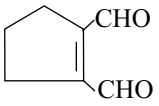
1. The product is

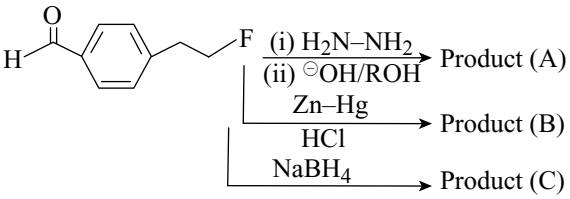


(a) 
(b) 
(c) 
(d) 

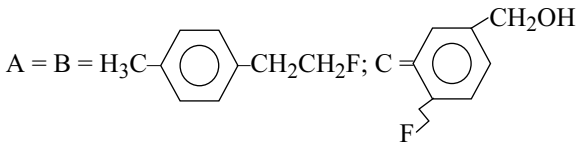
2. 

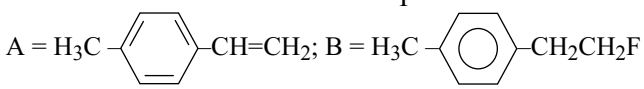
In the above sequence the final products of the reaction is/are

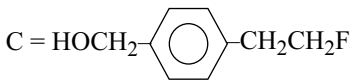
(a) 
(b) 
(c) 
(d) 

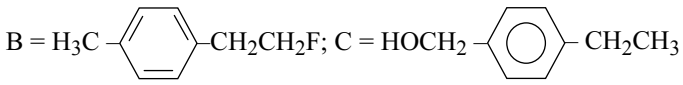
3. 

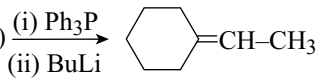
Correct option is

(a) 

(b) 

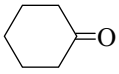
(c) 

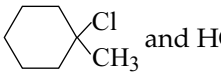
(d) 

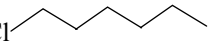
4. 

In the above reaction, (A) and (B) will respectively be

(a)  and CH_3CHO

(b) CH_3CH_2Cl and 

(c)  and HCHO

(d)  and CH_3CHO

5. Which of the following pairs will form the same product with phenyl hydrazine/$H^{\oplus}$?

(a) $CH_2OH–CO–CH_3$ and $CHO–CHOH–CH_3$

(b) Glucose and mannose

(c) Glucose and fructose

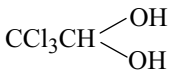
(d) Glucose and sucrose

6. Which is/are untrue statement(s)?

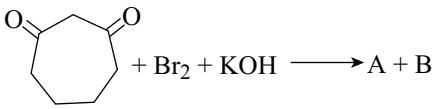
(a) Protonation increases electrophilic nature of carbonyl group

(b) $CF_3SO_3^-$ is a better leaving group than $CH_3SO_3^-$

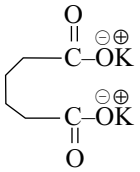
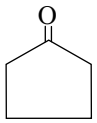
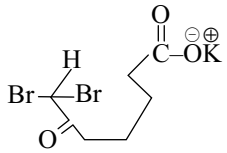
(c) Benzyl carbonium ion is stabilised by resonance

(d)  is unstable

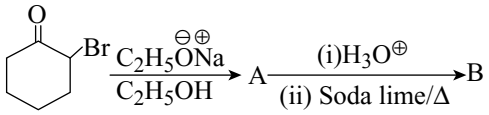
7. Identify the product in the following reaction



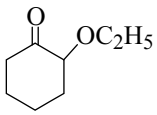
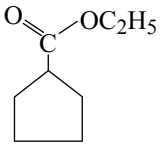
A and B are

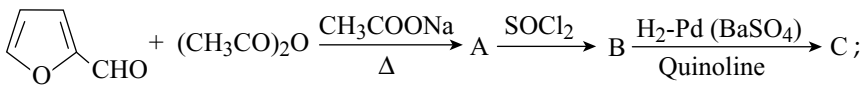
(a) $CHBr_3$ (b)  (c)  (d) 

8. In the following reaction

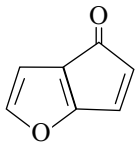
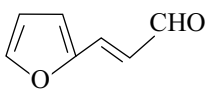
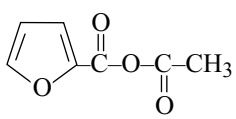
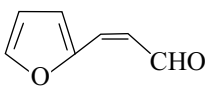


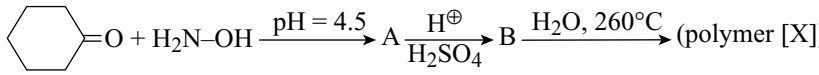
Product A and B are

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

9. 

Product (C) is/are

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

10. 

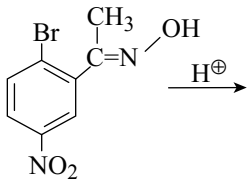
Correct statements about [X] are

(a) the polymer is bakelite

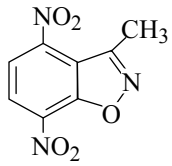
(b) the polymer is Nylon-6

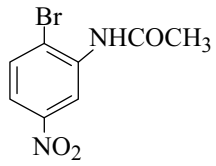
(c) the polymer contains six carbon atoms in the repeating units

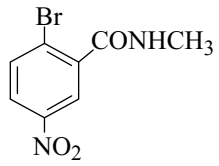
(d) it is condensation polymer(s)

11. 

$\xrightarrow{H^{\oplus}}$ Product; The product formed is

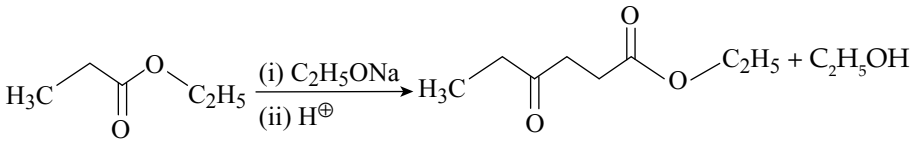
(a) 

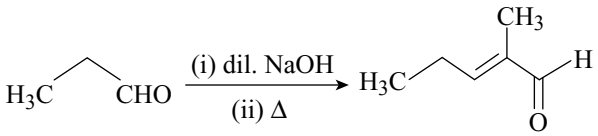
(b) 

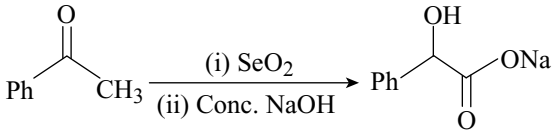
(c) 

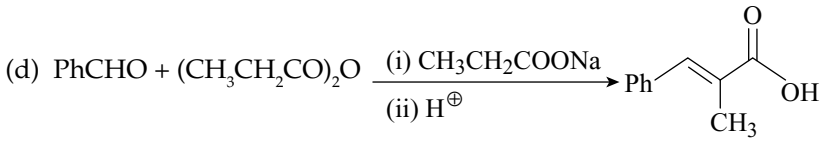
(d) None of these

12. Select the correct reactions

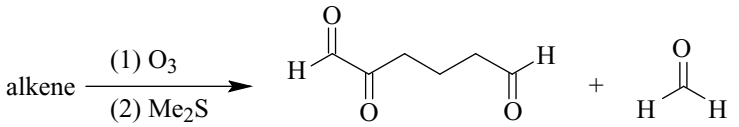
(a) 

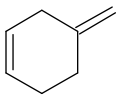
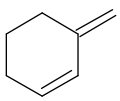
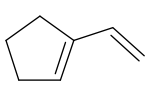
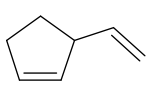
(b) 

(c) 

(d) 

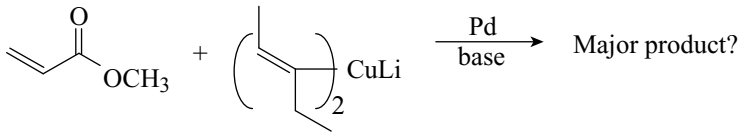
13. Choose the alkene(s) that would give the two products of the following ozonolysis reaction.

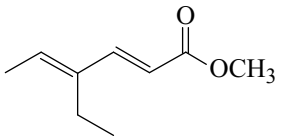


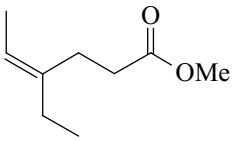
(i)  (ii)  (iii)  (iv) 

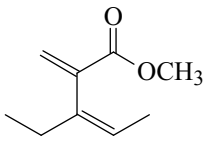
(a) i (b) ii (c) ii and iii (d) iii and iv

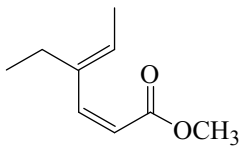
14. Choose the major product of the following reaction



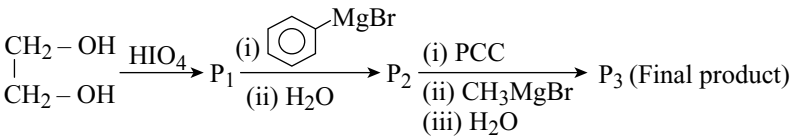
(a) 

(b) 

(c) 

(d) 

15. Which of the following is correct for the final product of the given sequence of reaction



(a) Compound P_3 on oxidation with (CrO_3 + H_2SO_4) gives a compound which gives 2, 4 DNP test

(b) Compound P_3 on reaction with I_2 + NaOH gives yellow ppt

(c) Compound P_3 on reaction with cerric ammonium nitrate gives red colouration

(d) Compound P_3 on reaction with MnO_2 gives carboxylic acid

16. Identify correct method of preparation of acetaldehyde from reaction of cyanide

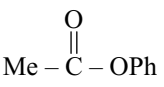
(a) $Me - C \equiv N \xrightarrow[(ii)\ H_3O^+]{(i)\ DIBAL}$

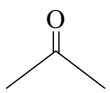
(b) $Me - C \equiv N \xrightarrow[(ii)\ H_3O^+]{(i)\ SnCl_2 + HCl}$

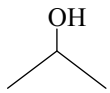
(c) $Me - C \equiv N \xrightarrow[(ii)\ dill.\ NaOH]{(i)\ Conc.\ H_2SO_4}$

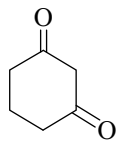
(d) $Me - C \equiv N \xrightarrow[(ii)\ H_3O^{\oplus}]{(i)\ Pd/BaSo_4\ /\ H_2}$

17. Identify compounds that give iodoform test

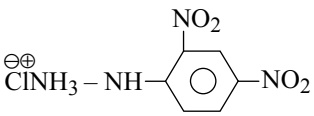
(a) 

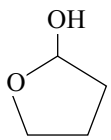
(b) 

(c) 

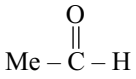
(d) 

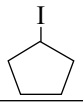
18. Identify compounds which give PPT with Tollen's reagent

(a) 

(b) 

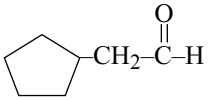
(c) $Me - C \equiv C - H$

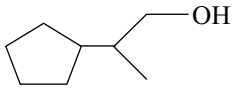
(d) 

19. $H-C\equiv C-H \xrightarrow{1\text{ eq. } NaNH_2} P_1$  $\rightarrow P_2 \xrightarrow[\text{dil. } H_2SO_4]{1\%\ HgSO_4} P_3$

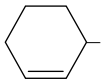
Identify the correct statement for the above reaction sequence?

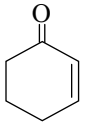
(a) P_3 – Product gives +ve iodoform test

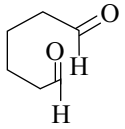
(b) P_2 – Product on reaction with $HB(Sia)_2$ and $H_2O_2/OH^{\ominus}$ gives 

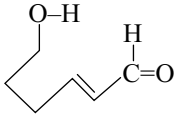
(c) P_3 – Product $\xrightarrow{CH_2=PPH_3} X \xrightarrow[(ii)\,NaOH/H_2O_2]{(i)\,B_2H_6\text{-THF}}$ 

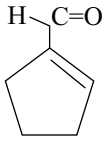
(d) P_3 – Product gives Tollen's test

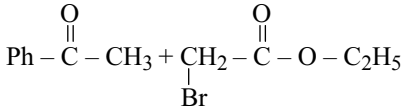
20.  $\xrightarrow{H^{\oplus}}$ Products is/are

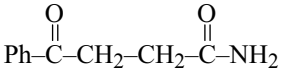
(a) 

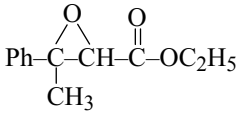
(b) 

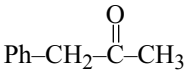
(c) 

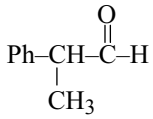
(d) 

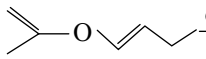
21.  $\xrightarrow{NaNH_2}$ A $\xrightarrow[H^+/\Delta]{KOH/H_2O}$ B; Products A and B are

(a) 

(b) 

(c) 

(d) 

22.  $\xrightarrow{\text{dil. } H_2SO_4} P_1 + P_2$

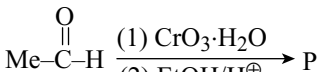
P_1 and P_2 products are identified by

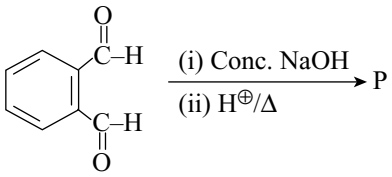
(a) Tollen's reagent (b) Iodoform test (c) $Br_2 + H_2O$ test (d) 1% alkaline $KMnO_4$

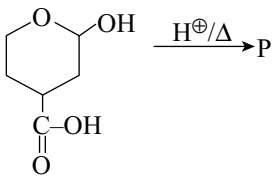
23. Benzene $\xrightarrow[AlCl_3]{Et-\overset{O}{\overset{\|}{C}}-Cl} P_1 \xrightarrow[\Delta]{NH_2-NH_2/\overset{\ominus}{O}H} P_2 \xrightarrow{Cl_2/h\nu} P_3 \xrightarrow[\text{Aq. NaOH}]{} P_4 \xrightarrow{R} P_1$; Regent "R" is

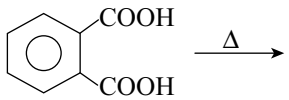
(a) MnO_2/Δ (b) P.C.C. (c) $Br_2 + H_2O$ (d) LAH

24. Among the following reactions identify lactonisation reactions

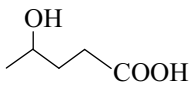
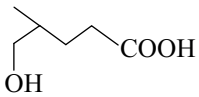
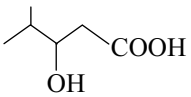
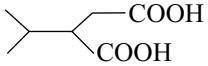
(a) 

(b) 

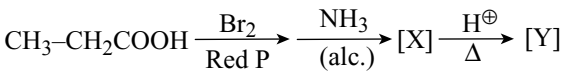
(c) 

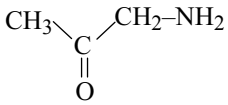
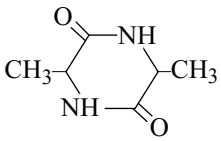
(d) 

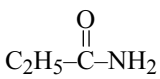
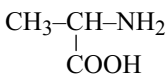
25. The compound which gives lactone on heating or in the presence of Conc. $H^{\oplus}$ medium

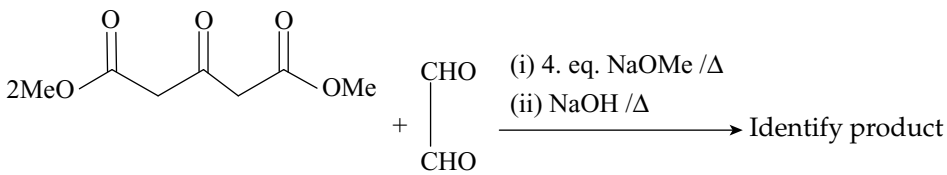
(a)  (b)  (c)  (d) 

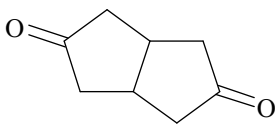
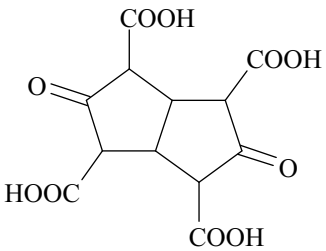
26. The products Y and X are

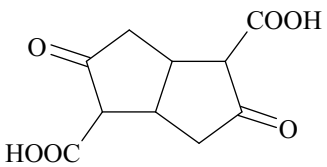
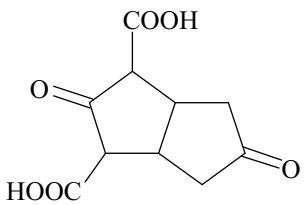


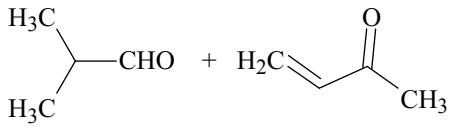
(a)  (b) 

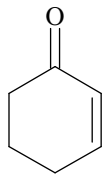
(c)  (d) 

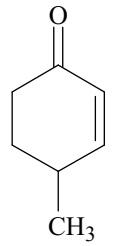
27. 

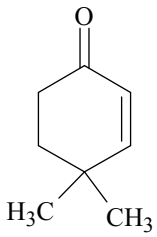
(a)  (b) 

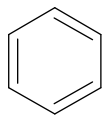
(c)  (d) 

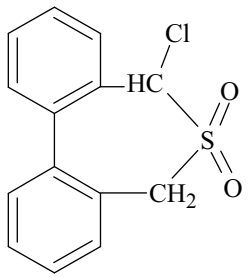
28.  (i) NaOMe /Δ → Identify product

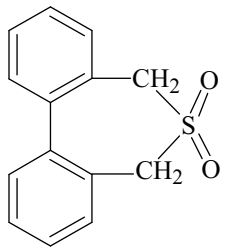
(a) 

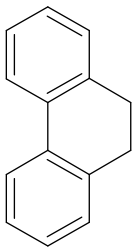
(b) 

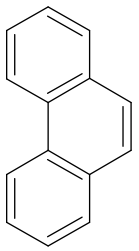
(c) 

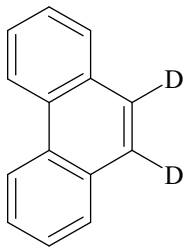
(d) 

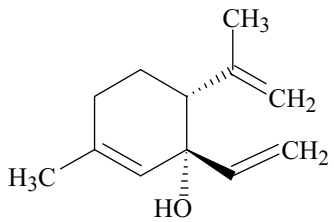
29.  NaOD / D_2O, Dioxane → Identify product

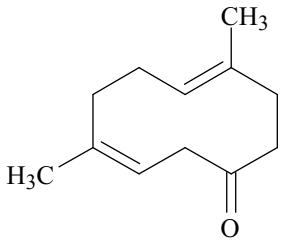
(a) 

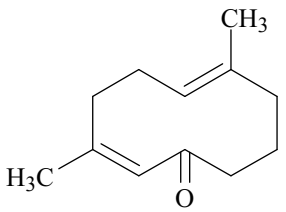
(b) 

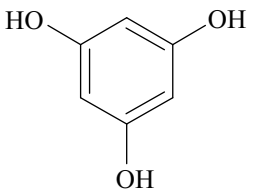
(c) 

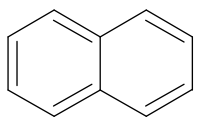
(d) 

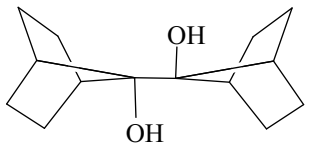
30.  KH 18-Crown-6 / THF → Identify product

(a) 

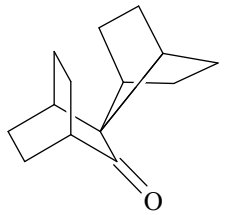
(b) 

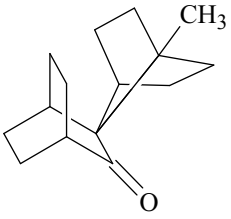
(c) 

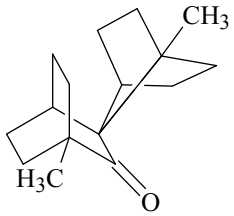
(d) 

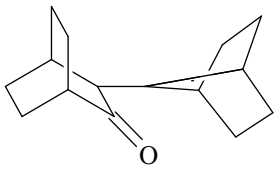
31. 

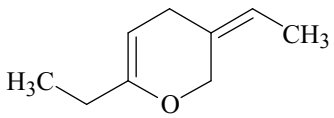
$\xrightarrow{\text{Conc. } H_2SO_4}$ Identify product

(a) 

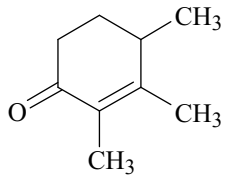
(b) 

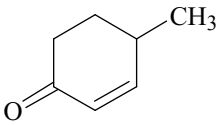
(c) 

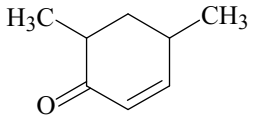
(d) 

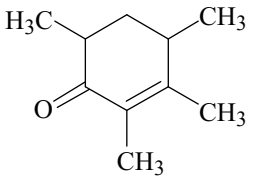
32. 

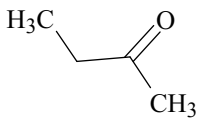
$\xrightarrow{\text{Conc. } H_2SO_4}$ Identify product

(a) 

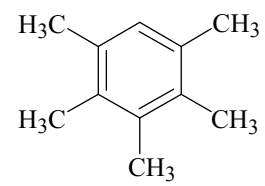
(b) 

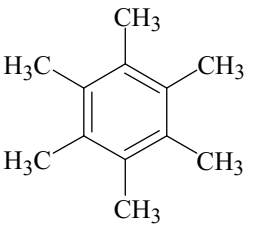
(c) 

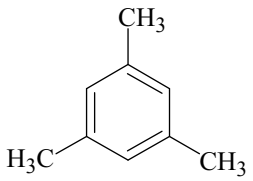
(d) 

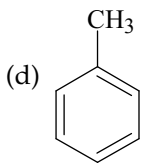
33. 

$\xrightarrow{\text{Conc. } H_2SO_4}$ Identify product

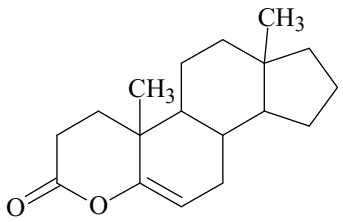
(a) 

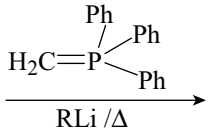
(b) 

(c) 

(d) 

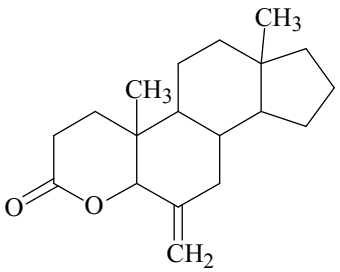
34.



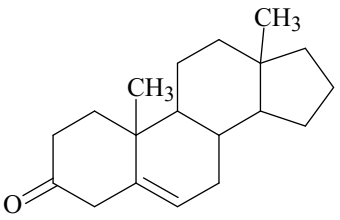


Identify product

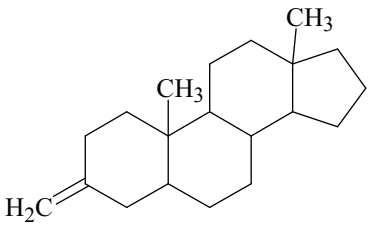
(a)



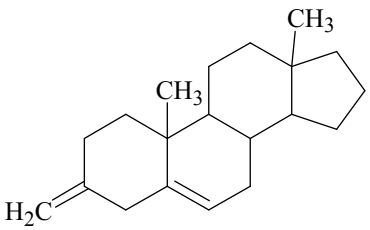
(b)



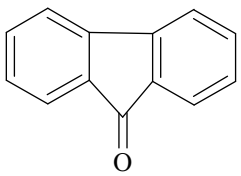
(c)



(d)



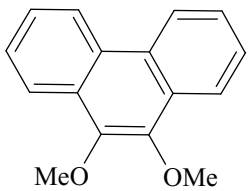
35.



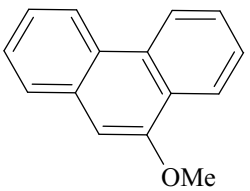
(i) CH_2N_2
(ii) NaH
(iii) MeI

Identify product

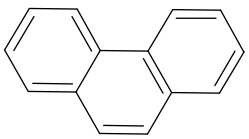
(a)



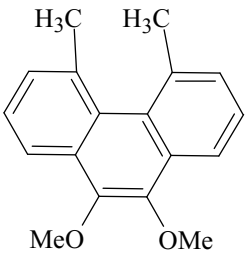
(b)



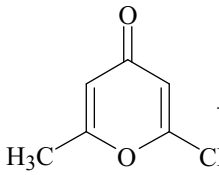
(c)



(d)

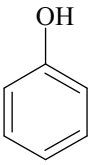


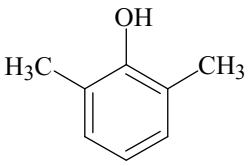
36.

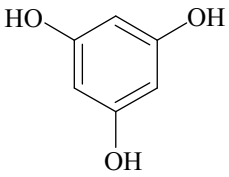


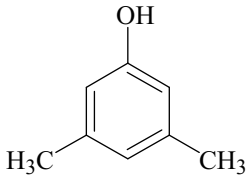
(i) MeMgCl
(ii) $HClO_4$ (aq.)
(iii) NaOH (aq.)

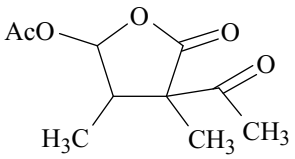
Identify product

(a) 

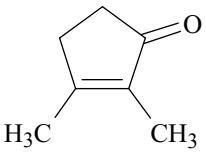
(b) 

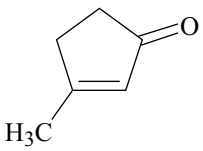
(c) 

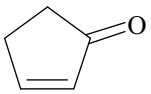
(d) 

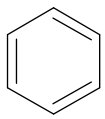
37. 

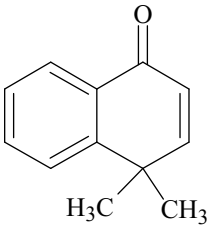
Aq. NaOH /Δ → Identify product

(a) 

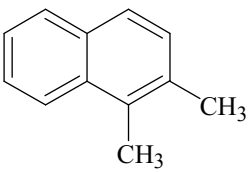
(b) 

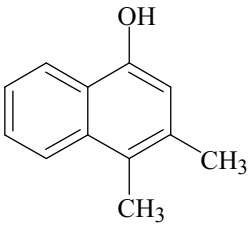
(c) 

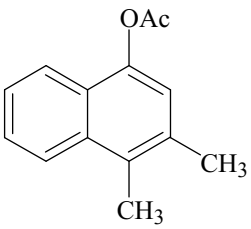
(d) 

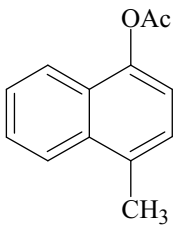
38. 

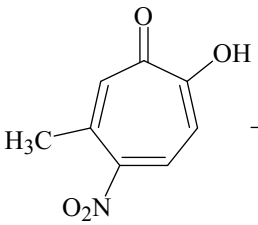
Ac_2O → Identify product

(a) 

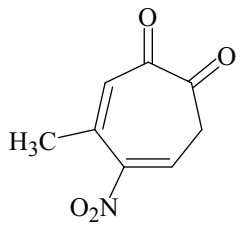
(b) 

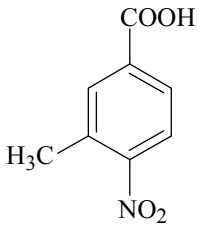
(c) 

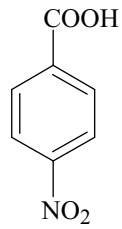
(d) 

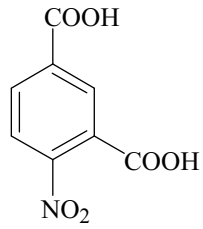
39. 

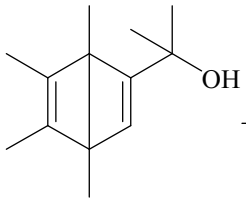
NaOH → Identify product

(a) 

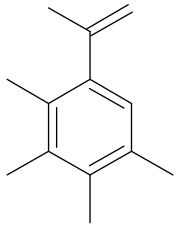
(b) 

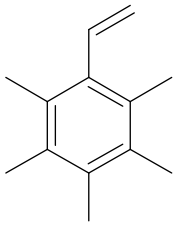
(c) 

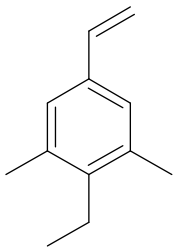
(d) 

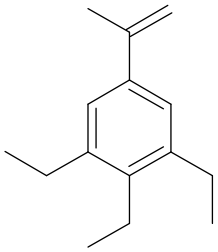
40. 

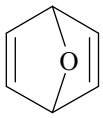
$\xrightarrow{\text{Conc. } H_2SO_4\ /\Delta}$ Identify product

(a) 

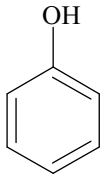
(b) 

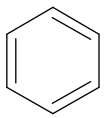
(c) 

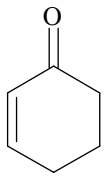
(d) 

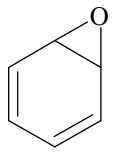
41. 

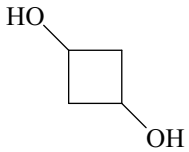
$\xrightarrow{\text{Conc. } H_2SO_4\ /\Delta}$ Identify product

(a) 

(b) 

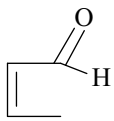
(c) 

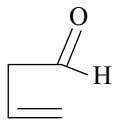
(d) 

42. 

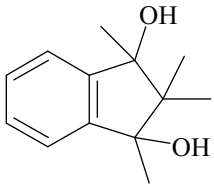
$\xrightarrow{\text{Conc. } H_2SO_4\ /\Delta}$ Identify major product

(a) 

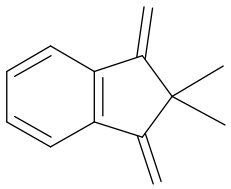
(b) 

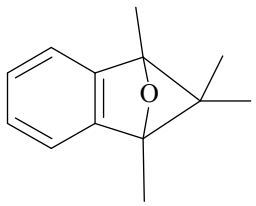
(c) 

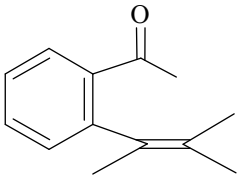
(d) 

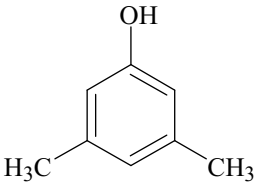
43. 

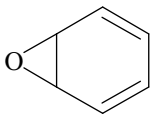
$\xrightarrow{\text{Conc. } H_2SO_4\ /\Delta}$ Identify major product

(a) 

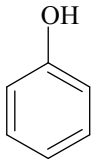
(b) 

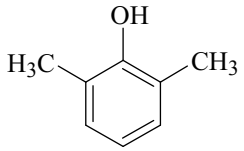
(c) 

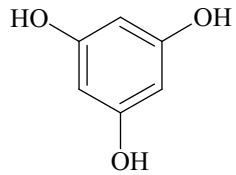
(d) 

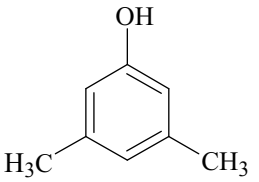
44. 

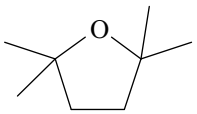
$\xrightarrow{\text{Conc. } H_2SO_4\ /\Delta}$ Identify product

(a) 

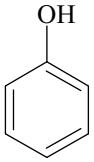
(b) 

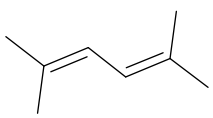
(c) 

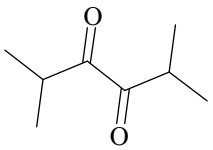
(d) 

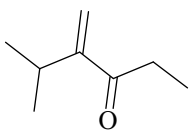
45. 

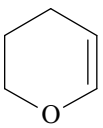
$\xrightarrow{\text{Conc. } H_2SO_4\ /\Delta}$ Identify product

(a) 

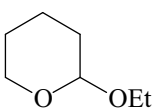
(b) 

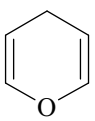
(c) 

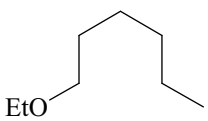
(d) 

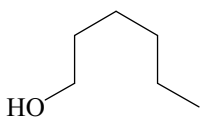
46. 

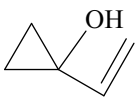
$\xrightarrow[\text{EtOH}]{\text{Conc. } H_2SO_4}$ Identify product

(a) 

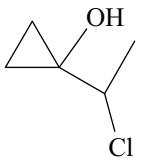
(b) 

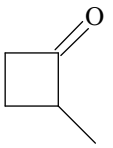
(c) 

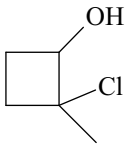
(d) 

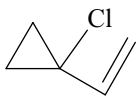
47. 

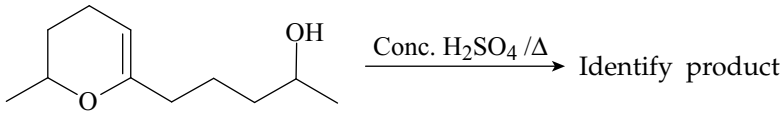
$\xrightarrow{\text{Conc. HCl}}$ Identify product

(a) 

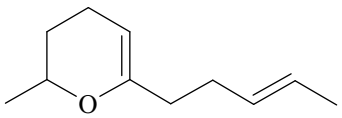
(b) 

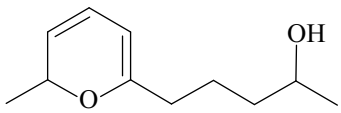
(c) 

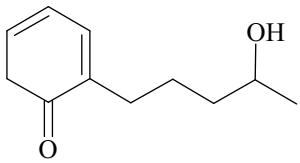
(d) 

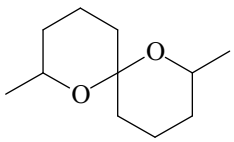
48. 

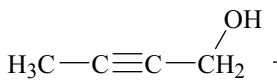
Identify product

(a) 

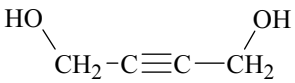
(b) 

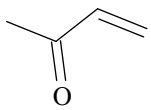
(c) 

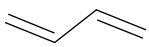
(d) 

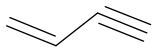
49. 

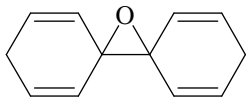
Identify product

(a) 

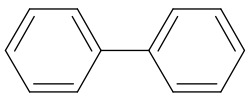
(b) 

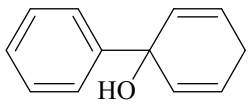
(c) 

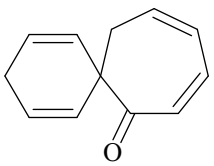
(d) 

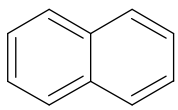
50. 

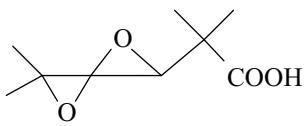
Identify product

(a) 

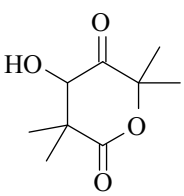
(b) 

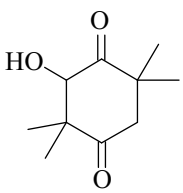
(c) 

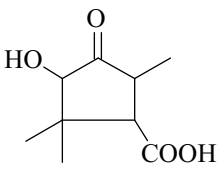
(d) 

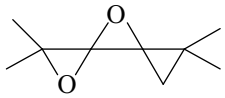
51. 

Product is?

(a) 

(b) 

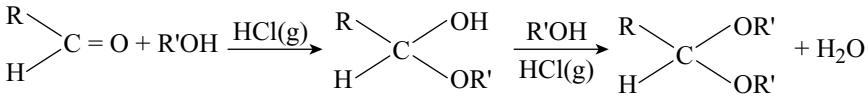
(c) 

(d) 

Comprehension Type

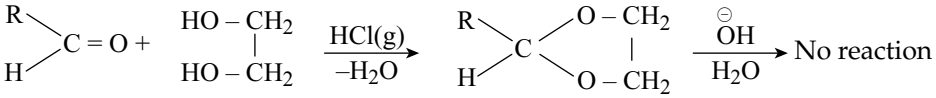
Passage 1

If we take an alcohol solution of an aldehyde (or ketone) and pass into it a small amount of gaseous HCl the hemiacetal forms, and hemiacetal reacts with a second molar equivalent of the alcohol to produce an acetal (or ketal).

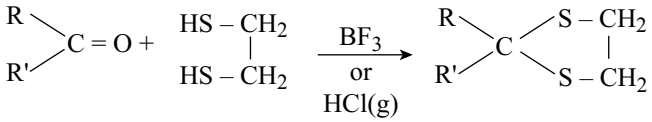


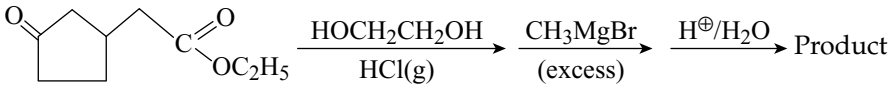
All the steps in the formation of an acetal from an aldehyde (or ketone) are reversible. With excess of alcohol, equilibrium favours forward (acetal formation) direction.

Although acetals are hydrolysed to aldehydes and ketones in aqueous acid, they are stable in basic solution. Because of this property, it is a convenient method for protecting aldehyde and ketone from a series reaching in basic solution.

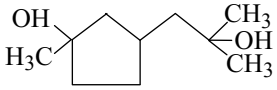


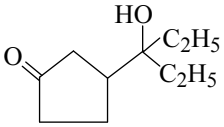
Similarily, thioacetal (ketal) formation takes place.

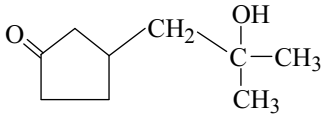


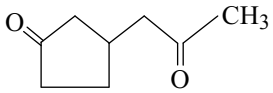
52. 

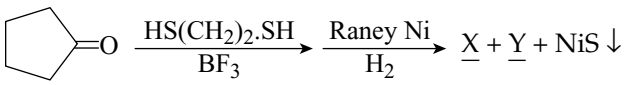
The final product of the reaction is

(a) 

(b) 

(c) 

(d) 

53. 

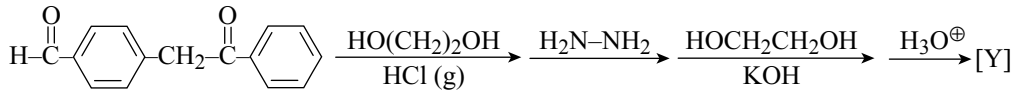
Correct statement for the given reaction is

(a) X and Y are structural isomers

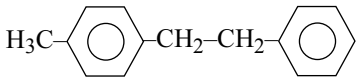
(b) both X and Y gives only one monochlorinated product

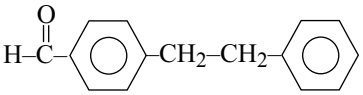
(c) X on oxidative ozonolysis gives gluteric acid

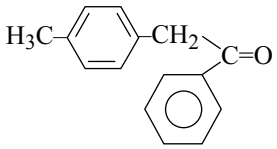
(d) X and Y on reaction with $H_2N - OH$ gives oxime

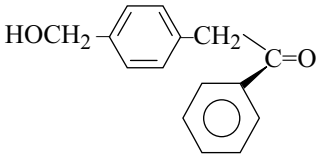
54. 

The product (Y) is

(a) 

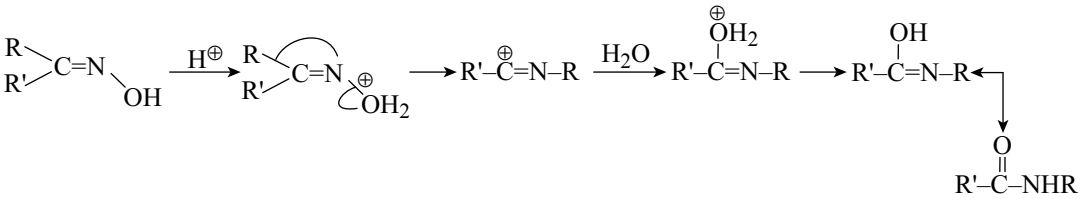
(b) 

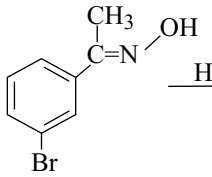
(c) 

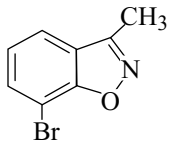
(d) 

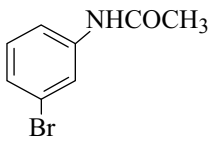
Passage 2

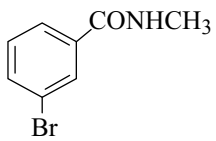
In organic chemistry various reactions take palce by rearrangements. These rearrangements can be classified on the basis of migratory group and its nature. One of the well-known rearrangement is the formation of N-substituted amides by rearrangement of aldoximes or ketoximes. This is known as Beckmann rearrangement. It is catalysed by various acidic reagents. The mechanism of this reaction is given as



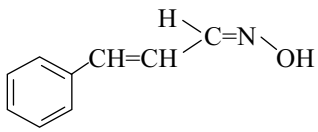
55.  $\xrightarrow{H^{\oplus}}$ Product; The product formed is

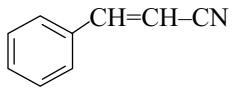
(a) 

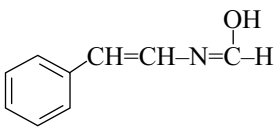
(b) 

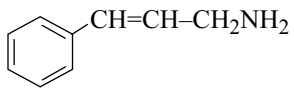
(c) 

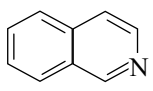
(d) none of these

56.  $\xrightarrow{P_2O_5}$ Product; The final product is

(a) 

(b) 

(c) 

(d) 

57. $(CH_3)(C_2H_5)C{=}NOH \xrightarrow{C_6H_5SO_2Cl} (A) \xrightarrow{H_2O/H^{\oplus}} CH_3NH_2 + C_2H_5COOH$

The formation of final product suggest the migration of

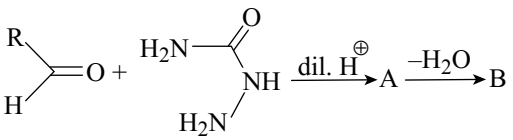
(a) $-CH_3$ group (b) $-C_2H_5$ group

(c) $C_6H_5-SO_2-$group (d) cannot predicated without structure

Passage 3

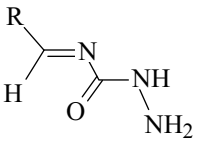
Aldehydes and ketones show nucleophilic addition reactions. The α-hydrogens in aldehydes and ketones are acidic. Therefore, aldehydes and ketones having at least one α-H undergo aldol condensation in the presence of a base such as NaOH. Aldehydes having no α-hydrogen undergo Cannizzaro reaction in the presence of concentrated alkali. The carbonyl group of aldehydes and ketones can be reduced to methylene group by Clemmensen or Wolf Kishner reduction. Aldehydes are easily oxidised to carboxylic acids by Tollen's reagent and Fehling's solution. Functional derivatives of carboxylic acids undergo nucleophilic acyl substitution with nucleophiles.

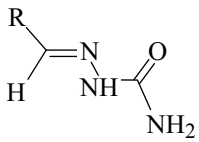
58. In the reaction given hereunder, correct statement (s) about A and B are



(i) A is optically active and dextrorotatory

(ii) A is racemic mixture and optically inactive

(iii) B is 

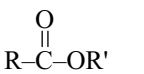
(iv) B is 

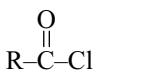
(a) i and iii (b) ii and iv (c) ii and iii (d) i and iv

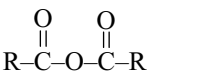
59. To convert $CH_2{=}CH{-}CH_2CHO$ to $CH_2{=}CH{-}CH_2COOH$, the best reagent will be

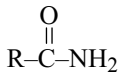
(a) $KMnO_4$ (b) P.C.C. (c) $[Ag(NH_3)_2]OH$ (d) HIO_4

60. The reactivity order of the following toward nucleophilic substitution will be

(i) 

(ii) 

(iii) 

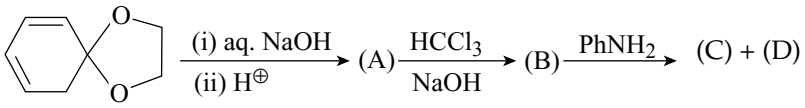
(iv) 

(a) i > iii > iv > ii (b) ii > iii > i > iv

(c) iii > iv > i > ii (d) iii > i > iv > ii

Passage 4

Identify the missing products in the following sequence of reactions.



61. Which statements about compound A are correct?

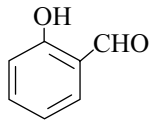
(i) Compound A is used in the formation of phenolphthalein

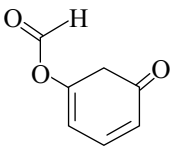
(ii) Compound A is used in the formation of aspirin

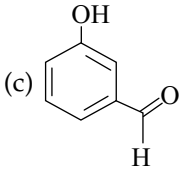
(iii) Compound A gives colour with $FeCl_3$

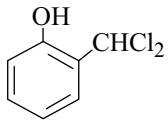
(a) i and iii (b) i and ii (c) ii and iii (d) i, ii and iii

62. Compound B will be

(a) 

(b) 

(c) 

(d) 

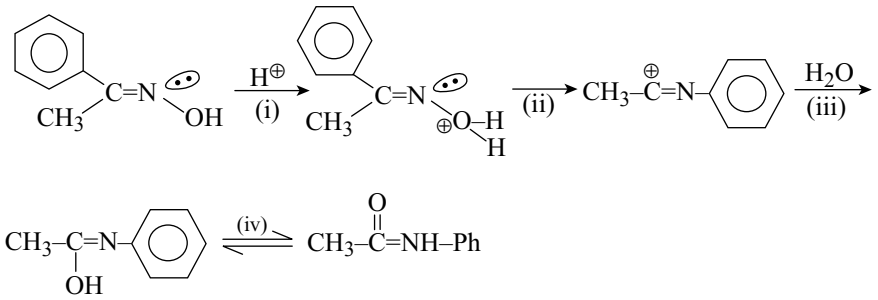
63. Compounds C and D are

(a) Identical (b) Geometrical isomers

(c) Functional isomers (d) Optical isomers

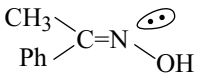
Passage 5

Given hereunder is the mechanism of Beckmann rearrangement.



64. Rate-determing step in Beckmann rearrangement is

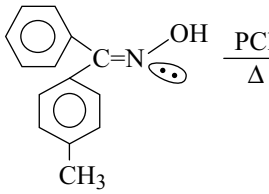
(a) i (b) ii (c) iii (d) iv

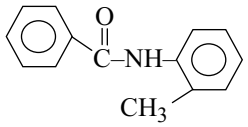
65. 

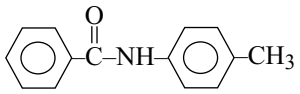
On treatment with H_2SO_4 followed by hydrolysis in acidic medium, the above compound gives

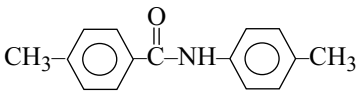
(a) $CH_3–CO_2H$, $Ph–NH_2$ (b) $Ph–CO_2H + CH_3–CO_2H$

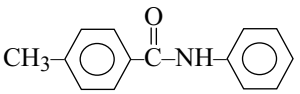
(c) $Ph–CH_2–NH_2 + Ph–CO_2H$ (d) $CH_3–NH_2$, $Ph–CO_2H$

66.  (A); Product (A) of the reaction is

(a) 

(b) 

(c) 

(d) 

Passage 6

Ethanal is heated with a base in two separate testtubes. In one testtube nothing except the two mentioned reactants were present. In another testtube, malonic ester, $CH_2(COOR)_2$ was also added. The final products of both testtubes add easily 1, 3-butadiene molecule. The product obtained in the first test tube can be converted into second product identical in all respects with that obtained in the second testtube.

67. The respective reaction involved in the two testtubes are

(a) Aldol condensation and Cannizaro reaction

(b) Aldol condensation and Perkin reaction

(c) Aldol condensation and Knoevenagel reaction

(d) Aldol reaction and Claisen condensation

68. Which feature is common in the products of both reactions?

(a) presence of an acidic group

(b) presence of an aldehydic group

(c) presence of α, β unsaturation

(d) presence of a ketonic group

69. What would have been the final product when ethanal of the first testtube is replaced by propanal?

(a) $CH_3CH_2CH{=}CHCH_2CHO$

(b) $CH_3CH_2CH{=}C(CH_3)CHO$

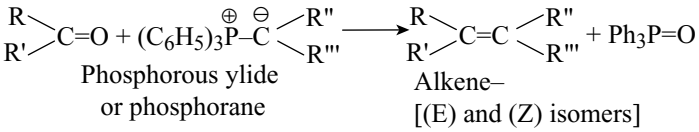
(c) $CH_3CH_2C(CH_3){=}CH{-}CHO$

(d) $CH_3CH{=}CH{-}CH(CH_3)CHO$

Passage 7

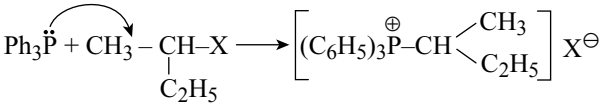
Aldehydes and ketones react with phosphorous ylides to yield alkenes and triphenylphosphine oxide. (An ylide is a neutral molecule having a negative carbon adjacent to appositive heteroatom).

Phosphorous ylides are also called phosphoranes.

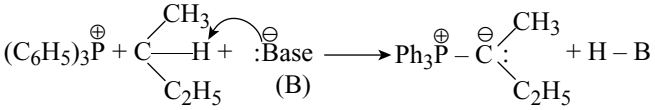


Through reaction, known as the Witting reaction, phosphorus ylides are easily prepared from triphenylphosphine and alkyl halides. Their preparation involves two reactions:

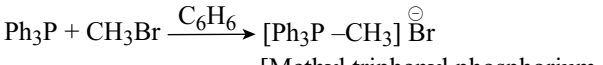
Reaction 1:

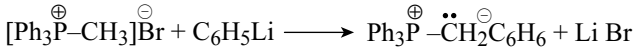


Reaction 2:

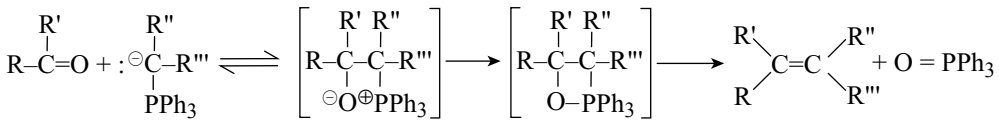


Specific example:



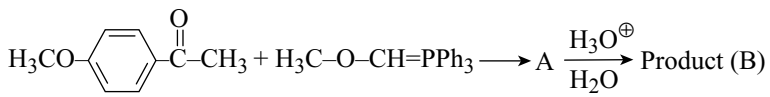


Mechanism of Witting reaction



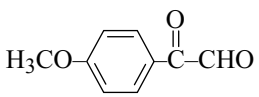
The mechanism suggested that the ylide, acting as a carbonion, attacks the carbonyl carbons of the aldehydes or ketone to form an unstable intermediate with separated change called a betaine. In the next step, betaine forms oxaphosphetane, which spontaneously loses triphenylphosphine oxide to become an alkene.

70.

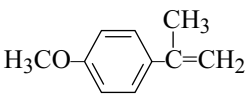


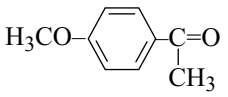
In the given sequence of reaction, the product (B) is

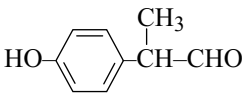
(a)



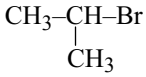
(b)

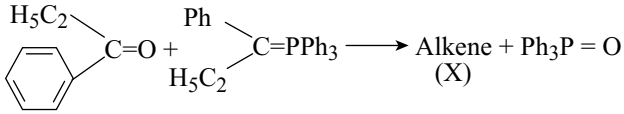


(c) 

(d) 

71. Which of the following cannot be used in the preparation of ylide?

(a) CH_3CH_2Br (b) $(CH_3)_3C–I$ (c)  (d) Both (b) and (c)

72. 

In the given reaction, the correct statement for alkene (X) is

(a) X on reaction with Br_2/CCl_4 forms an optically inactive mixture

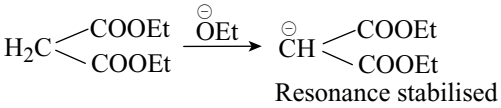
(b) X on reaction with alk. $KMnO_4$ forms an optically inactive mixture

(c) X on reaction with alk. $KMnO_4$ forms an optically active mixture

(d) Both (a) and (b)

Passage 8

Active methylene compounds are of great importance in synthetic chemistry. When $–CH_2$ (methylene) group is flanked between two electron withdrawing groups, then its hydrogen becomes acidic and can be replaced easily. The acidity of methylene hydrogen depends upon the strength of electron withdrawing group. Acetoacetic ester, malonic ester, etc. are the examples of active methylene compound. In synthetic application acidic hydrogen is trapped by a strong base to get resonance stabilised anion which reacts accordingly to give the desired product.



73. $CH_3COCH_2COOEt \xrightarrow[\text{(ii) } CH_3CH_2Br \text{ not in excess}]{\text{(i) NaOEt}} A \xrightarrow[\text{(ii) Heat}]{\text{(i) dil. HCl}}$ Products; Products are

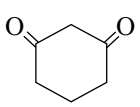
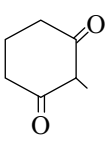
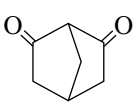
(a) $CH_3COCH_3 + CO_2 + EtOH$

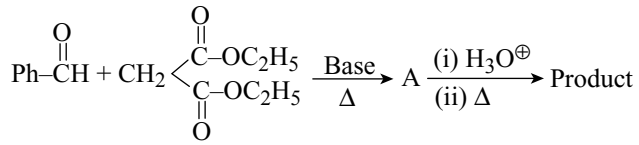
(b) 2 mol of $CH_3COCH_2CH_2CH_3 + CO_2$

(c) $CH_3COCH_2CH_2CH_3 + 2EtOH$

(d) $CH_3COCH_2CH_2CH_3 + EtOH + CO_2$

74. Which one of the following is most effective as an active methylene compound?

(a)  (b) CH_3COCH_2COOEt (c)  (d) 

75. 

The final product is

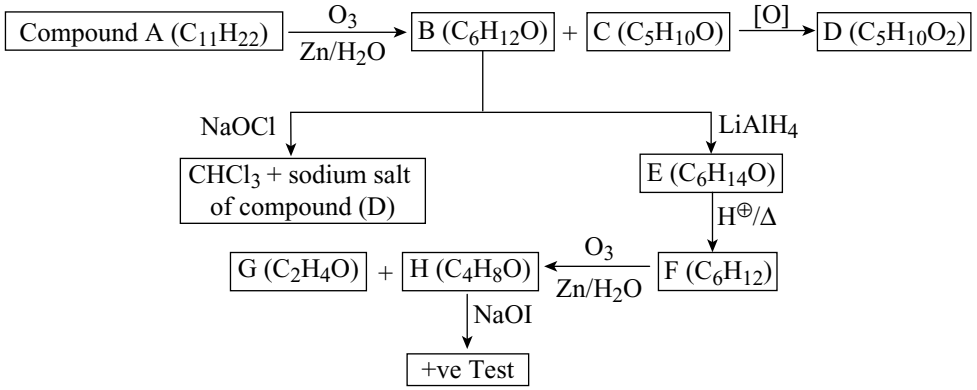
(a) Ph–COOH

(b) 

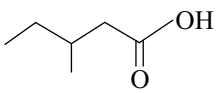
(c) Ph–CH=CH–COOH

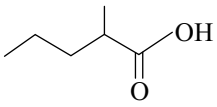
(d) Ph–CH=CH–CHO

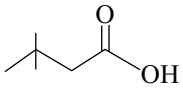
Passage 9

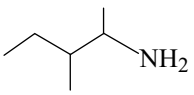


76. $D(C_5H_{12}O_2) \xrightarrow{SOCl_2} x \xrightarrow[H_2O/Ag_2O]{CH_2=\overset{\oplus}{N}=\overset{\ominus}{N}} y$; product y is

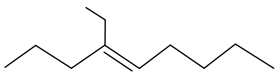
(a) 

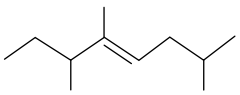
(b) 

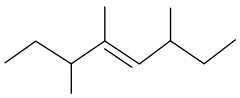
(c) 

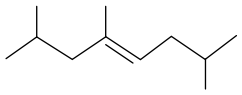
(d) 

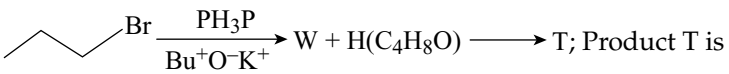
77. Compound A is

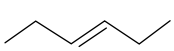
(a) 

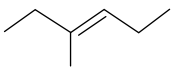
(b) 

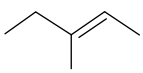
(c) 

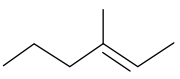
(d) 

78. 

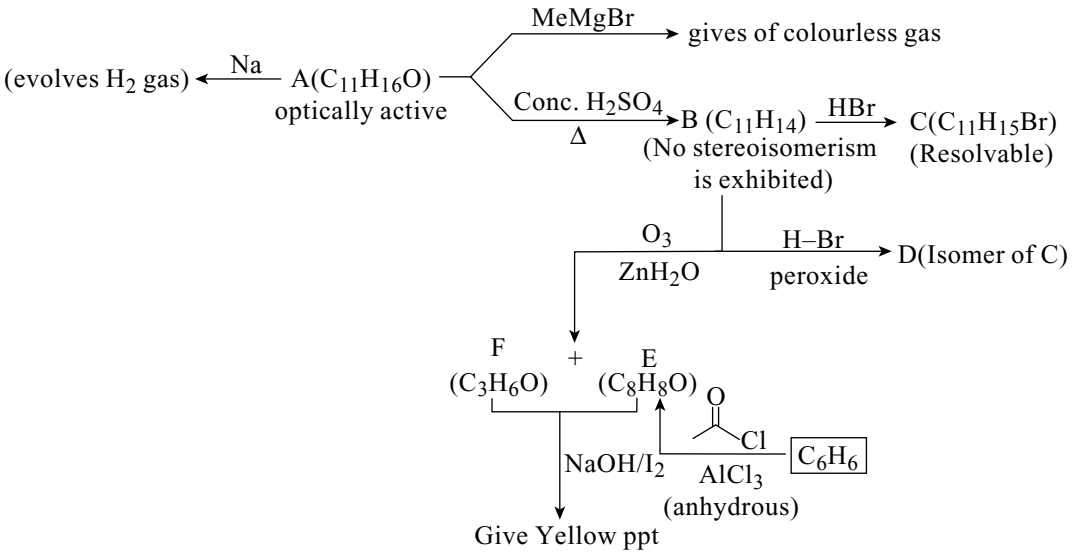
(a) 

(b) 

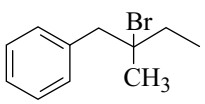
(c) 

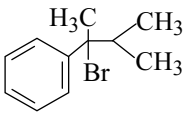
(d) 

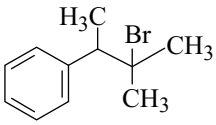
Passage 10

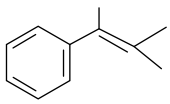


79. Compound (C) is

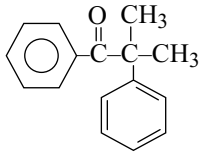
(a) 

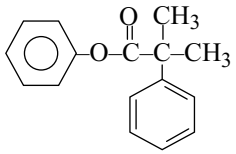
(b) 

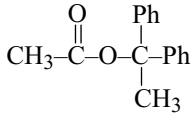
(c) 

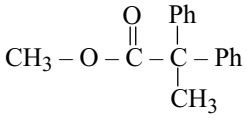
(d) 

80. Compound (E) $\xrightarrow[H_2O]{Mg–Hg}$ (X) $\xrightarrow[(ii)\ F_3C–\overset{O}{\overset{\|}{C}}–OOH]{(i)\ H^{\oplus}}$ (Y); compound (Y) is

(a) 

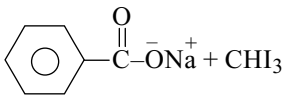
(b) 

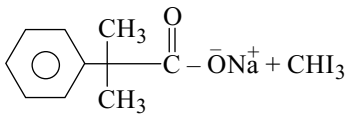
(c) 

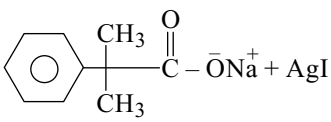
(d) 

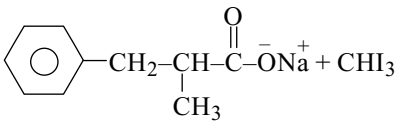
81. Compound (A) $\xrightarrow[\text{Acetone (aq.)}]{H_2CrO_4}$ (R) $\xrightarrow{NaOI}$ (S) + (T) . Compound (S) and (T) respectively are

Yellow ppt.

(a) 

(b) 

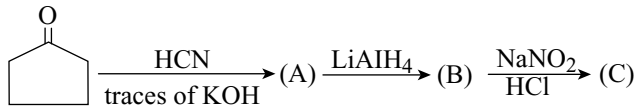
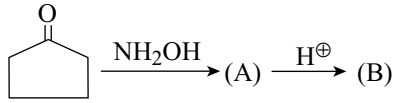
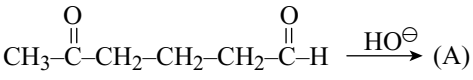
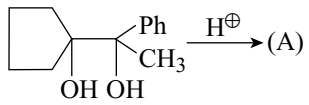
(c) 

(d) 

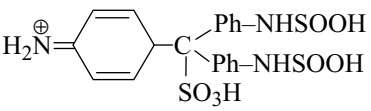
82. Match the reactions in column I with their reagents in column II.

Column I	**Column II**
(a) $CH_3–CH_2=CH–CHO \rightarrow CH_3CH=CHCOOH$	(p) $LiAlH_4$
(b) $CH_3–CH=CH–CHO \rightarrow CH_3CH=CH–CH_2OH$	(q) $NaBH_4$
(c) $Ph–CH=CH–CHO \rightarrow Ph–CH_2–CH_2–CHO$	(r) $Pd–C/H_2$
(d) $CH_2=CH–CH_2CHO \rightarrow CH_2=CH–CH_2CH_2OH$	(s) $Ag(NH_3)_2^{\oplus}$

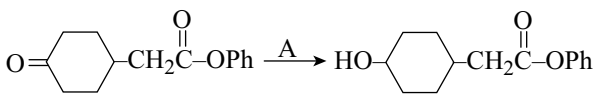
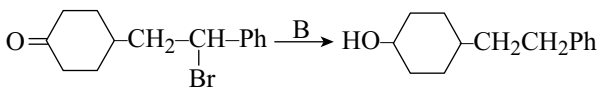
83. Match the columns.

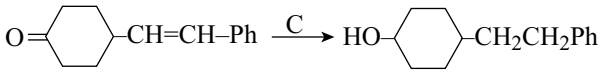
Column I	**Column II (In the given sequence)**
(a) 	(p) Formation of six member ring takes place
(b) 	(q) Final product is ketone
(c) 	(r) Final product formed will give positive Tollen's test
(d) 	(s) Final product formed will react with 2,4-DNP. (2, 4-di-nitrophenyl hydrazine)

84. Match the chemical compounds in Column I with the reagents used to test them in Column II.

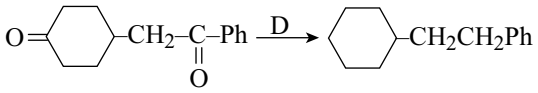
Column I	**Column II**
(a) Ethanol	(p) $[Ag(NH_3)_2]OH$
(b) Glucose	(q) Fehling's solution
(c) Glyoxal	(r) 
(d) Acetone	(s) $I_2/NaOH$

85. Match the columns.

Column I (Reaction)	**Column II (Reducing reagent)**
(a) 	(p) Zn + Hg/HCl
(b) 	(q) $LiAlH_4$

(c) 

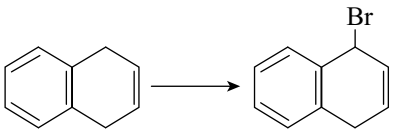
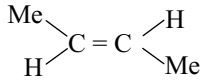
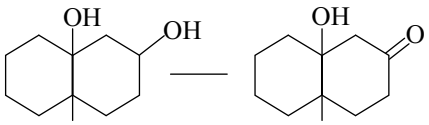
(r) $NaBH_4$

(d) 

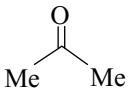
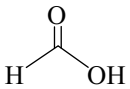
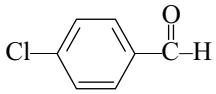
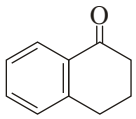
(s) Red P + HI

(t) Ni/H_2

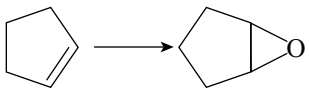
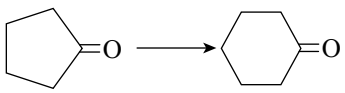
86. Match the columns.

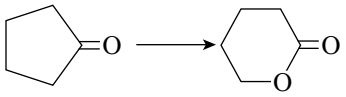
Column I	**Column II**
(a) PCC (Pyridiniumchlorochromate)	(p) 
(b) NBS (N-Bromosuccinimide)	(q) $MeC \equiv CMe \longrightarrow$ 
(c) $AlPO_4$	(r) 
(d) Li/Liquid NH_3	(s) $CH_3COOH \longrightarrow CH_2 = C = O$

87. Match column I with column II.

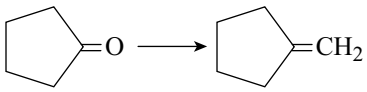
Column I	**Column II**
(a) 	(p) 2, 4-DNP test
(b) 	(q) Tollen's reagent test
(c) 	(r) I_2 + NaOH (Iodoform test)
(d) 	(s) Fehling's solution test

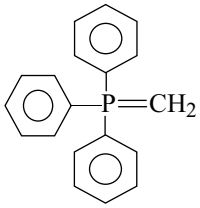
88. Match column I with column II.

Column I (conversion)	**Column II (reagents)**
(a) 	(p) HCN; H_2/Ni; HNO_2
(b) 	(q) CH_2N_2

(c) 

(r) m-CPBA (Meta-chloroperbenzoic acid)

(d) 

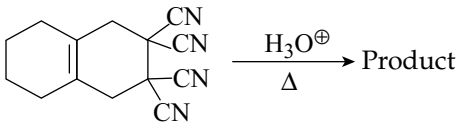
(s) 

89. Match Column I with Column II.

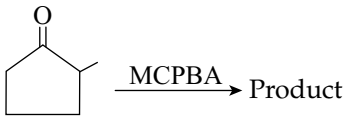
Column I	**Column II**
(a) Aldol condensation	(p) Hydride ion transfer
(b) Cannizzaro reaction	(q) Zinc enolate
(c) Reformatsky reaction	(r) $\overline{C}N$ as catalyst
(d) Benzoin condensation	(s) Enolate ion

90. Match the coloumns.

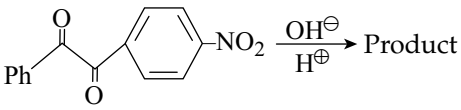
Column I **Column II**

(a) 

(p) Anhydride

(b) 

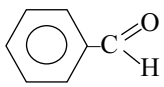
(q) Carboxylic acid

(c) 

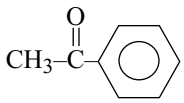
(r) Alkene
(s) Optical active compound
(t) Ester

91. Match the columns.

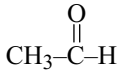
Column I (compound) **Column II (Tests)**

(a) 

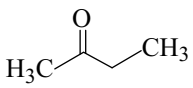
(p) 2, 4-DNP test

(b) 

(q) Yellow ppt. with NaOH + I_2

(c) 

(r) Red ppt. with Fehling's solution

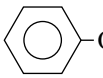
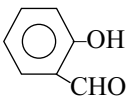
(d) 

(s) Silver mirror with Tollen's reagent

92. Match the columns.

Column I (Reagents)	**Column II**
(a) Tollen's reagent give white ppt. with	(p) Me–CH=CH–Me
(b) $Br_2 + H_2O$ test given by	(q) Me–C≡C–H
(c) Product of reaction of acetylene with 1% $HgSO_4$ and dil. H_2SO_4	(r) $Cl\overset{\oplus}{N}H_3 - NH_2$
(d) Pd/H_2 reacts with	(s) Me–C(=O)–H
	(r) Me–C(=O)–Me

93. Match column I with column II.

Column I	**Column II**
(a) $CH_3CHO + CH_3CH_2CHO \xrightarrow[\Delta]{\text{dil. } \overset{\ominus}{O}H}$	(p) $CH_3–CH_2CH=CH–CHO$
(b) $PhCHO + CH_3–\underset{\underset{O}{\|}}{C}–CH_3 \xrightarrow[\Delta]{\overset{\ominus}{O}H}$	(q) $CH_3–\underset{\underset{CHO}{\|}}{C}=CH–CH_3$
(c) $PhCHO + HCHO \xrightarrow[\Delta]{\overset{\ominus}{O}H}$	(r) $HCOO^-$
(d)  $+ CHCl_3 \xrightarrow[\Delta]{\overset{\ominus}{O}H}$	(s) $Ph–CH=CH–\overset{\overset{O}{\|}}{C}–Me$
	(t) 

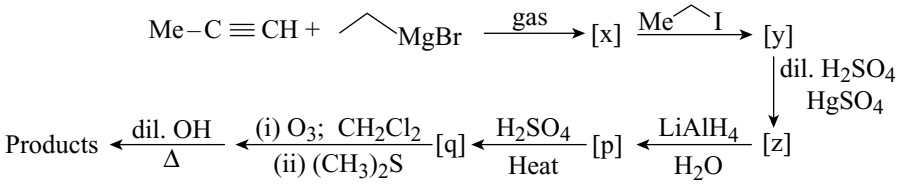
94. Match the column I with column II.

Column I	**Column II**
(a) Schimdt reaction	(p) $RCOOH \xrightarrow[\Delta]{NaOH/CaO} RH$
(b) Curtius reaction	(q) $R–CH_2COOH \xrightarrow[\Delta]{\text{Red } P/X_2} R–\underset{\underset{X}{\|}}{CH}–COOH$
(c) Decarboxylation	(r) $RCOCl \xrightarrow[\Delta]{\text{(i) } NaN_3} RNH_2$ (ii) H_3O
(d) HVZ reaction	(s) $RCOOH \xrightarrow[\Delta]{N_3H} RNH_2$

Integer Type

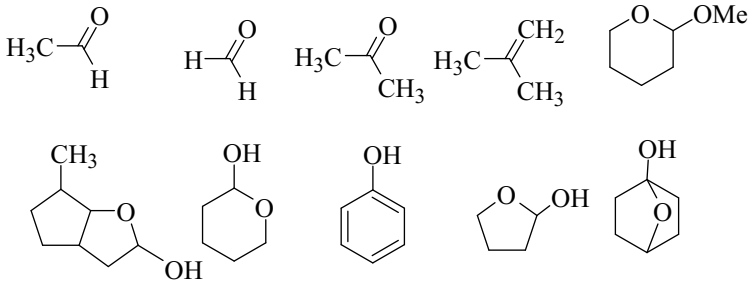
95. How many products are possible when ethanal and phenyl ethanal (mixture) is treated with dil. NaOH at about 10°C.

96. For the given sequence of reaction

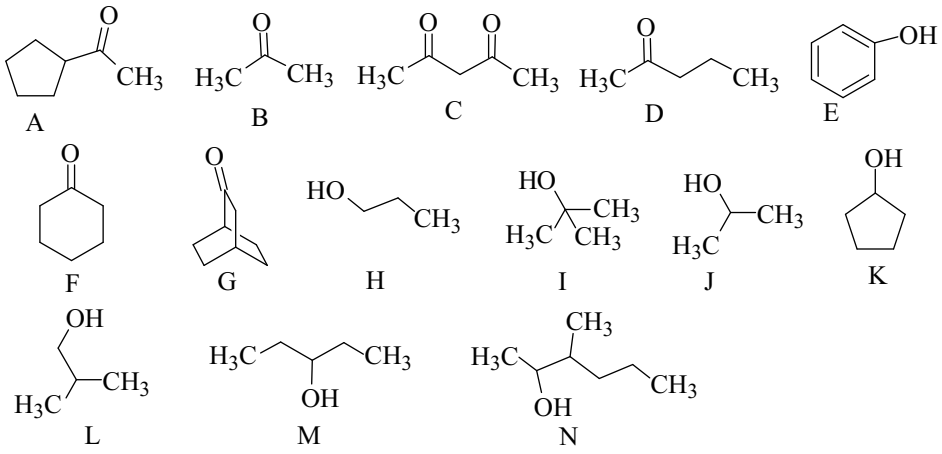


How many products are obtained finally?

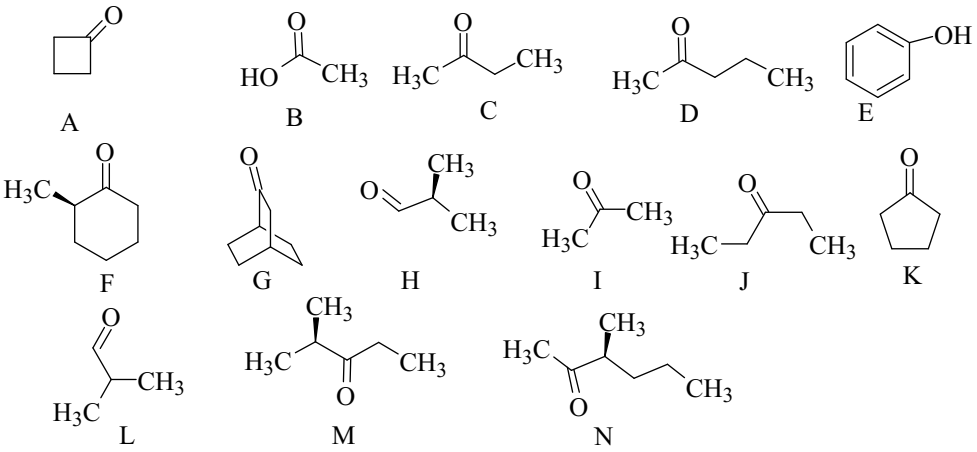
97. Identify the total number of compounds that give positive test with Tollen's reagent



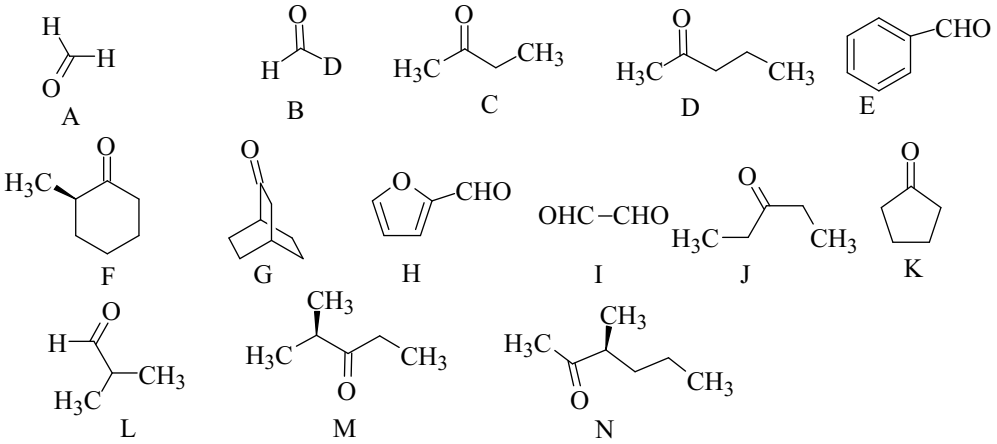
98. Identify the total number of compounds that give positive iodoform test



99. Identify the total number of compounds that give diastereomeric product on reaction with MeMgCl



100. Identify that compounds that give Cannizaro reaction



Answer Keys

LEVEL 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
c	d	d	b	d	c	a	d	c	bd	b	a	a	c	c
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
ab	d	d	c	a	b	d	a	bc	b	d	c	b	a	b
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
ab	abcd	d	d	c	a	d	c	b	c	a	b	c	abd	b
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
b	a	b	c	d	d	c	b	b	c	a	a	d	c	bc
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
b	b	c	a	c	b	d	b	c	b	a	d	c	b	d
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
b	a	b	b	a	c	b	c	b	b	a	c	a	d	b
91	92	93	94	95	96	97	98	99	100	101	102	103	104	
d	d	a	b	a	a	d	d	b	a	d	c	d	d	

LEVEL 2

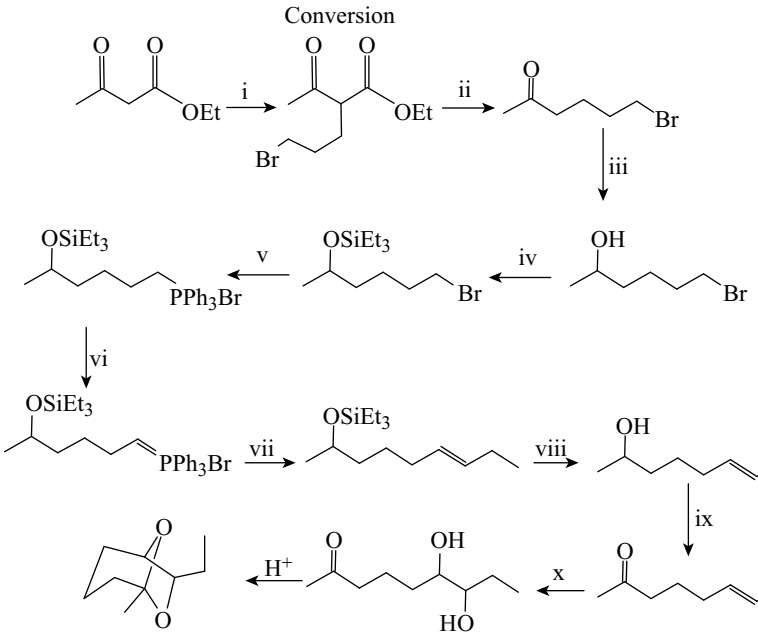
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
c	ac	bc	ab	abc	d	ab	bd	bd	bcd	b	bcd	a	b	abc
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
abd	bcd	ac	abc	abc	bd	ab	ab	bc	ab	bd	a	c	d	b
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
a	a	b	b	b	d	a	c	b	a	a	b	c	a	b
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
a	b	d	b	a	a	c	b	b	b	a	a	b	c	b
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
d	a	b	b	d	b	c	c	b	d	b	d	d	a	c
76	77	78	79	80	81	82(a)	82(b)	82(c)	82(d)	83(a)	83(b)	83(c)	83(d)	84(a)
a	c	b	b	c	b	s	p	r	pq	pqs	p	pqs	pqs	s
84(b)	84(c)	84(d)	85(a)	85(b)	85(c)	85(d)	86(a)	86(b)	86(c)	86(d)	87(a)	87(b)	87(c)	87(d)
pq	pqr	s	r	qr	t	ps	r	pr	s	q	pr	qs	pq	p
88(a)	88(b)	88(c)	88(d)	89(a)	89(b)	89(c)	89(d)	90(a)	90(b)	90(c)	91(a)	91(b)	91(c)	91(d)
r	pq	r	s	s	p	q	r	pr	st	qs	ps	pq	pqrs	pq
92(a)	92(b)	92(c)	92(d)	93(a)	93(b)	93(c)	93(d)	94(a)	94(b)	94(c)	94(d)	95	96	97
qr	pq	s	pqst	pq	s	r	t	s	r	p	q	12	11	6
98	99	100												
6	2	6												

WORKBOOK EXERCISES

EXERCISE 1

Identify reagents (1 to 10) used in the following conversion from reagent present in second Column II (A to P).

Column I (Conversion)



Column II (Reagent)

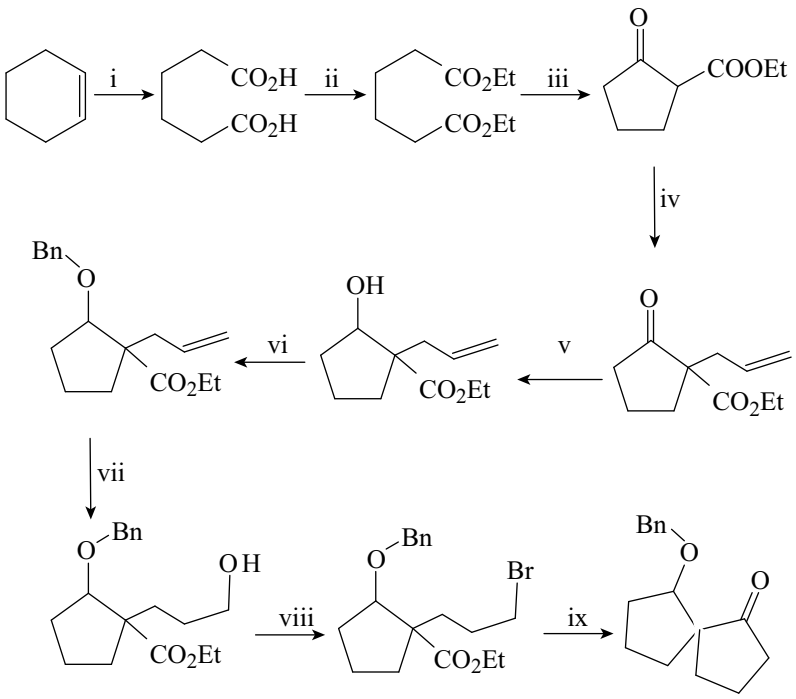
Reagent

A. $CH_3CH_2CH_2CH_2Li$ / THF
B. $CH_3CH_2CH_2Br$
C. Et_3SiCl / Et_3N
D. Et_3SiH / pyridine
E. CH_3CHO
F. CH_3CH_2CHO
G. PDC
H. PPH_3
I. $CH_2 = CHCH_2Br$
J. H_3O^+ / Δ
K. Conc. H_2SO_4 / Δ
L. NaOEt then $Br(CH_2)_3Br$
M. Et_3N
N. $NaBH_4$ then H_3O^+
O. Bu_4NF then H_2O
P. $KMnO_4$ / aq. NaOH / 0°C

EXERCISE 2

Identify reagents (1 to 10) used in the following conversion from reagent present in second Column II (A to T).

Column I (Conversion)



NOTE: Bn = Benzyl group, $PhCH_2^-$

Column II (Reagent)

(A) $NaBH_4$ then NH_4Cl

(B) $LiAlH_4$ then H_3O^+

(C) O_3 then Zn / CH_3CO_2H

(D) O_3 then H_2O_2

(E) NaOH

(F) Na dissolved in EtOH

(G) AC. H_3O^+

(H) BH_3 then NaOH / H_2O_2

(I) Na then add PhBr

(J) Na then add $PhCH_2Br$

(K) Pyridinium chlorochromate

(L) $Na_2Cr_2O_7$ / H_3O^+

(M) NaBr / acetone

(N) PBr_3

(O) Br_2 / hv

(P) LDA / THF / –78°C

(Q) Mg / Et_2O

(R) EtOH / H^+ / heat

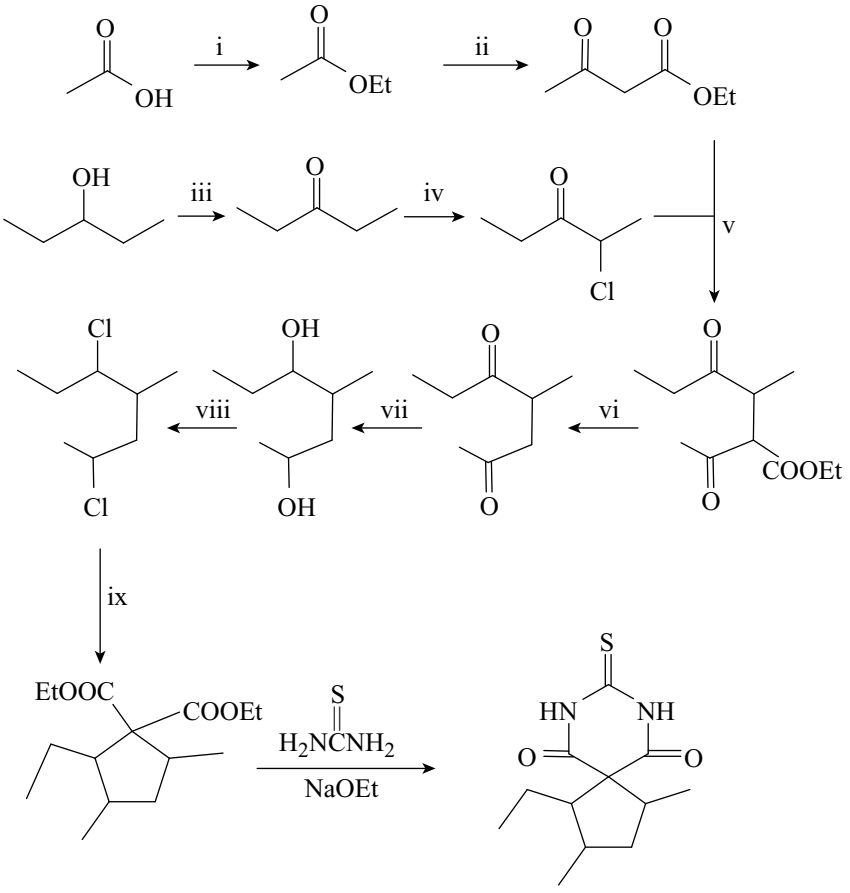
(S) CH_2=CH–CH_2MgBr

(T) NaOEt then CH_2=CH–CH_2Br

EXERCISE 3

Identify reagents (1 to 10) used in the following conversion from reagent present in second Column II (A to P).

Column I (Conversion)



Spirothiobarbital

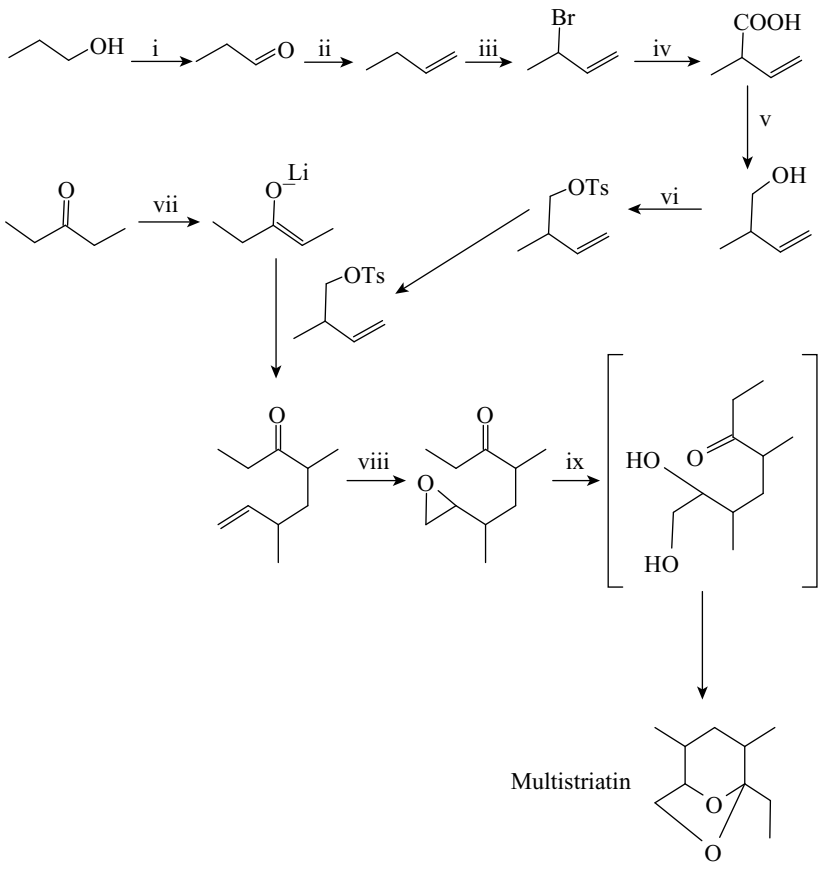
Column II (Reagent)

(A) NaH
(B) Na / THF then MeOH
(C) H_2 / Pd
(D) NaOH /Cl_2
(E) HCl / Cl_2
(F) PCl_3
(G) 1 mol. eq. $LiAlH_4$ then H_3O^+
(H) Pyridinium chlorochromate
(I) H_2O_2
(J) H_3O^+ / Δ
(K) Conc. H_2SO_4 / Δ
(L) EtOH / H^+ / Δ
(M) NaOEt / EtOH
(N) $LiNiPr_2$ / THF
(O) Aq. NaOH / Δ
(P) NaOEt / EtOH / $CH_2(CO_2Et)_2$

EXERCISE 4

Identify reagents (1 to 10) used in the following conversion from reagent present in second Column II (A to O).

Column I (Conversion) **Column II (Reagent)**



(A) 1 eq $NaBH_4$ then H_3O^+

(B) 1 eq $LiAlH_4$ then H_3O^+

(C) Ph_3PCH_2

(D) NaTs / DMSO

(E) MCPBA

(F) Br_2 /hν

(G) PBr_3

(H) Pyridinium chlorochromate

(I) Mg then CO_2 then H_3O^+

(J) Conc. H_2SO_4 /Δ

(K) TsCl / pyridine

(L) NaOEt / EtOH

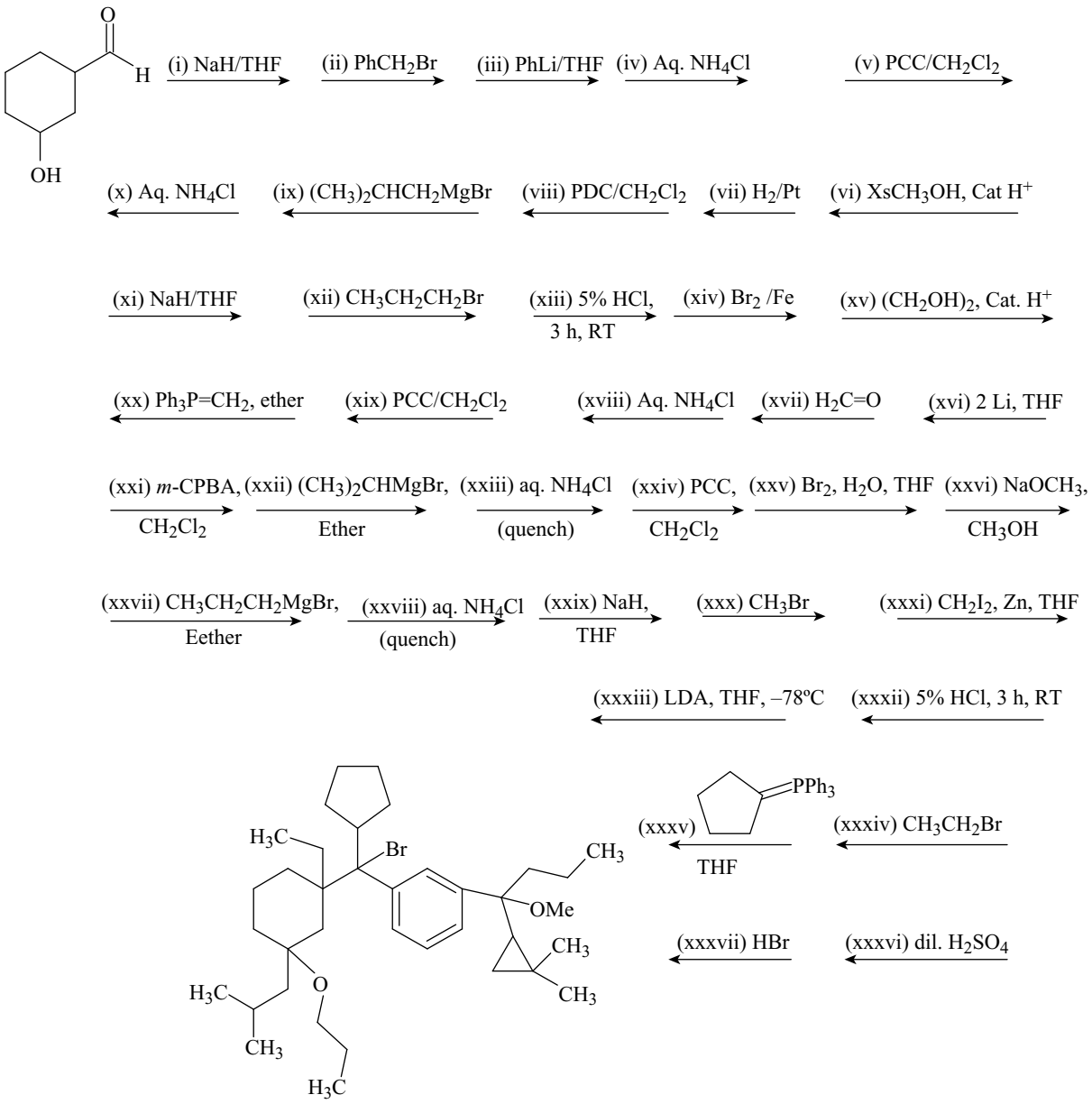
(M) $LiNiPr_2$ / THF

(N) LiCl / DMF

(O) NaOH then CrO_3 / pyridine

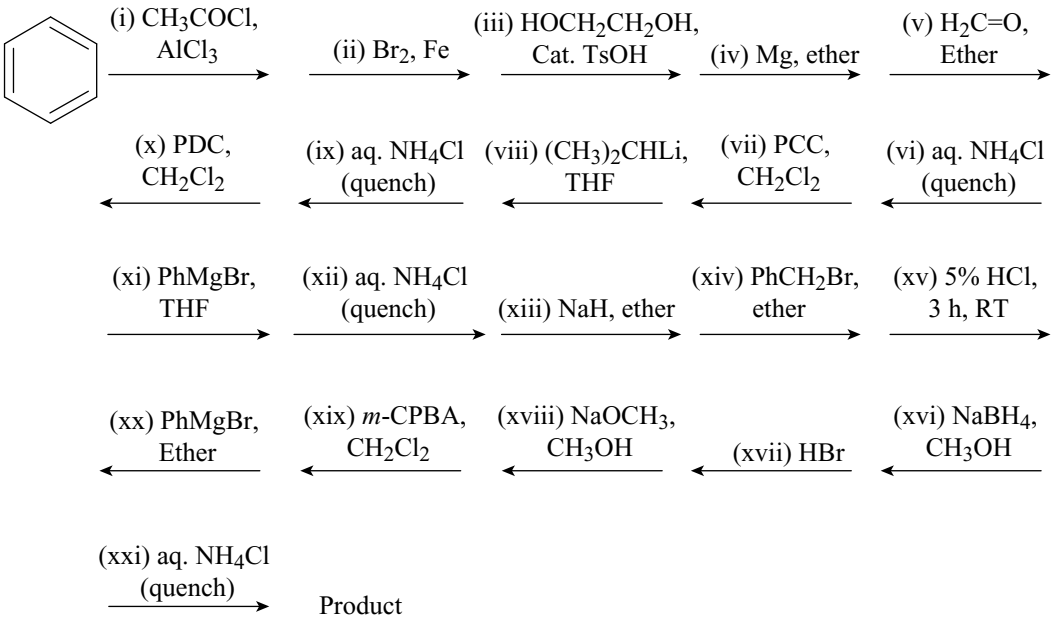
EXERCISE 5

Identify the intermediate product in the following conversion



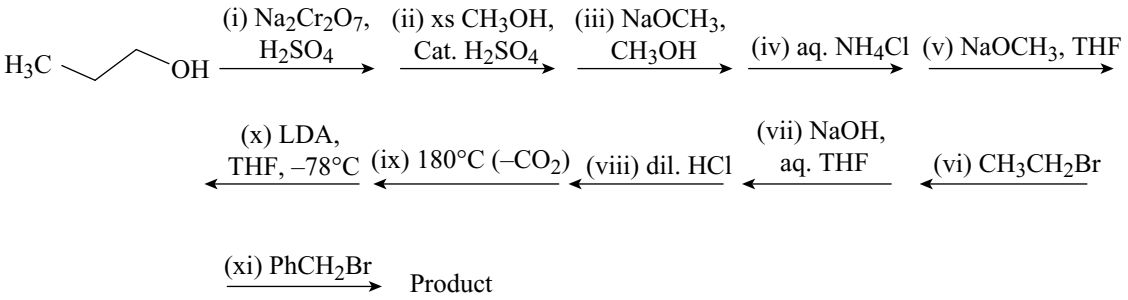
EXERCISE 6

Identify the intermediate product in the following conversion



EXERCISE 7

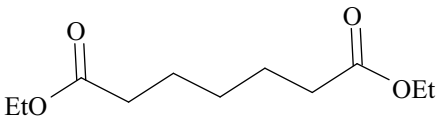
Identify the intermediate product in the following conversion



EXERCISE 8

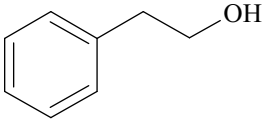
Identify the final product in the following reaction sequence

(a)



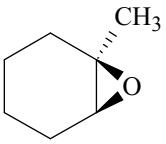
(i) NaOEt, EtOH
(ii) dilute HCl (quench)
(iii) $NaOCH_3$, THF
(iv) $PhCH_2Br$
(v) NaOH, aq. THF
(vi) dilute HCl (quench)
(vii) 180°C ($-CO_2$)
→ Product

(b)



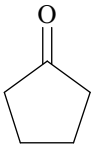
(i) $Na_2Cr_2O_7$, H_2SO_4
(ii) xs CH_3OH, Cat. HCl
(iii) $NaOCH_3$, CH_3OH
(iv) dilute HCl (quench)
(v) NaOH, aq. THF
(vi) dilute HCl (quench)
→ Product

(c)



(i) PhLi, THF, 0°C
(ii) H_3O^+ (quench)
(iii) H_3PO_4, heat
(iv) OsO_4, H_2O_2, NaOH
→ Product

(d)

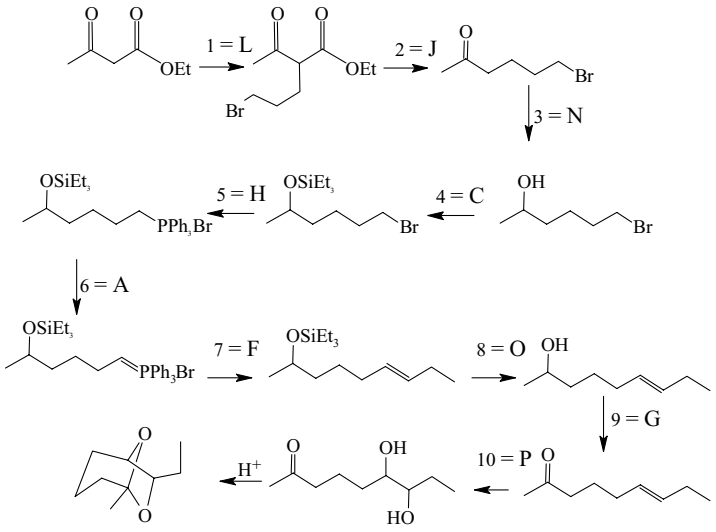


(i) NaOH, CH_3OH, Δ
(ii) $(CH_3)_2CuLi$, THF
(iii) aq. NH_4Cl (quench)
→ Product

SOLUTION FOR WORKBOOK EXERCISES

EXERCISE 1

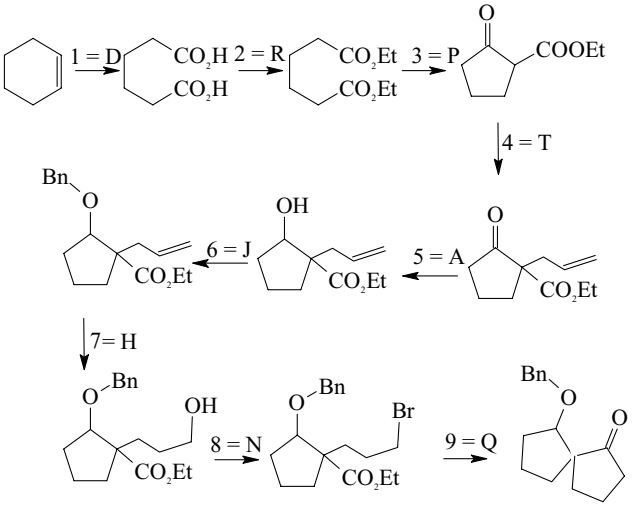
Conversion



Reagent

(A) $CH_3CH_2CH_2CH_2Li$ / THF
(B) $CH_3CH_2CH_2Br$
(C) Et_3SiCl / Et_3N
(D) Et_3SiH / pyridine
(E) CH_3CHO
(F) CH_3CH_2CHO
(G) PDC
(H) PPh_3
(I) CH_2= $CHCH_2Br$
(J) H_3O+ / Δ
(K) Conc. H_2SO_4 / Δ
(L) NaOEt then $Br(CH_2)_3Br$
(M) Et_3N
(N) $NaBH_4$ then H_3O_+
(O) Bu_4NF then H_2O
(P) $KMnO_4$ / aq NaOH / 0ºC

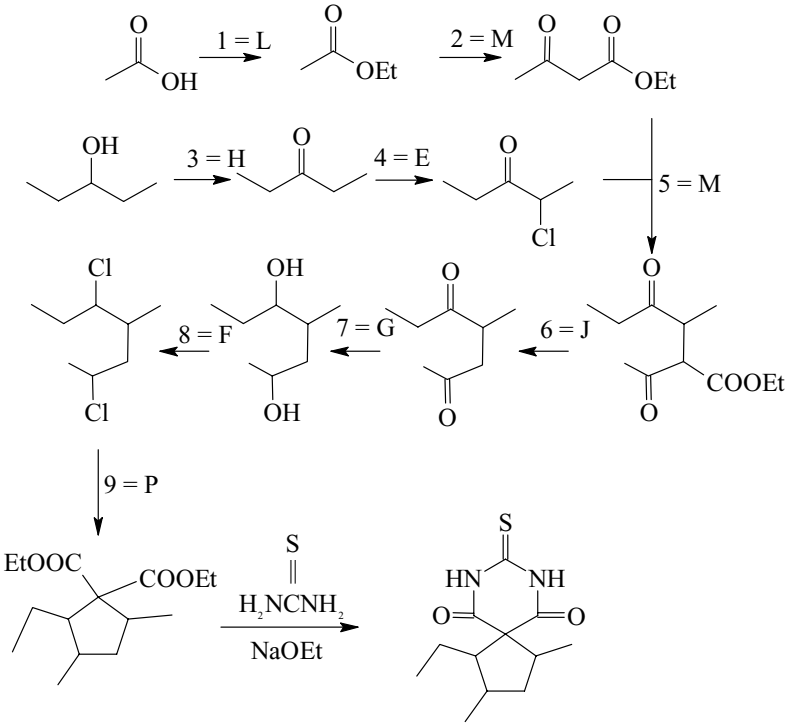
EXERCISE 2



NOTE: Bn = Benzyl group, $PhCH_2^-$

(A) $NaBH_4$ then H_3O^+
(B) $LiAlH_4$ then H_3O^+
(C) O_3 then Zn / CH_3CO_2H
(D) O_3 then H_2O_2
(E) NaOH
(F) Na dissolved in EtOH
(G) AC. H_3O^+
(H) BH_3 then NaOH / H_2O_2
(I) Na then add PhBr
(J) Na then add $PhCH_2Br$
(K) Pyridinium chlorochromate
(L) $Na_2Cr_2O_7$ / H_3O^+
(M) NaBr / acetone
(N) PBr_3
(O) Br_2 / hv
(P) LDA / THF / –78°C
(Q) Mg / Et_2O
(R) EtOH / H^+ / heat
(S) CH_2=CH–CH_2MgBr
(T) NaOEt then CH_2=CH–CH_2Br

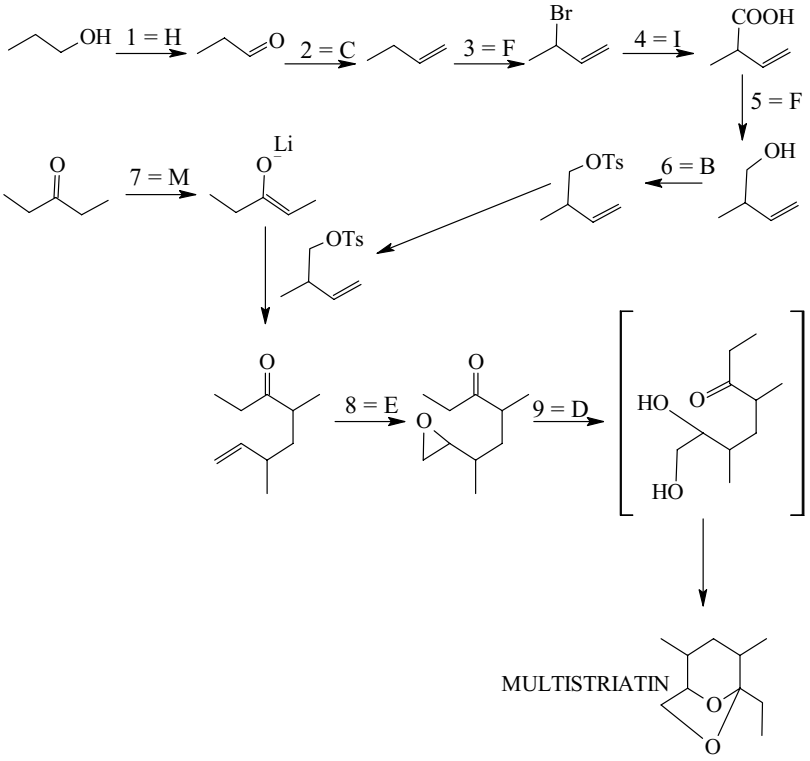
EXERCISE 3



SPIROTHIOBARBITAL

(A) NaH
(B) Na / THF then MeOH
(C) H_2 /Pd
(D) NaOH /Cl_2
(E) HCl / Cl_2
(F) PCl_3
(G) 1 mol. eq. $LiAlH_4$ then H_3O^+
(H) Pyridinium chlorochromate
(I) H_2O_2
(J) H_3O^+ / Δ
(K) Conc. H_2SO_4 / Δ
(L) EtOH / H^+ / Δ
(M) NaOEt / EtOH
(N) Li $NiPr_2$ / THF
(O) Aq. NaOH / Δ
(P) NaOEt / EtOH / $CH_2(CO_2Et)_2$

EXERCISE 4



(A) 1 eq $NaBH_4$ then H_3O^+

(B) 1 eq $LiAlH_4$ then H_3O^+

(C) Ph_3PCH_2

(D) NaOH / DMSO/ H_2O

(E) MCPBA

(F) Br_2 /hν

(G) PBr_3

(H) Pyridinium chlorochromate

(I) Mg then CO_2 then H_3O^+ BC. H_3O^+

(J) Conc. H_2SO_4 / Δ

(K) TsCl / pyridine

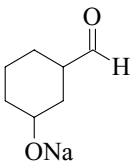
(L) NaOEt / EtOH

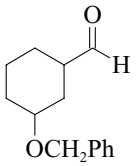
(M) Li $NiPr_2$ / THF

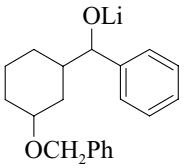
(N) LiCl / DMF

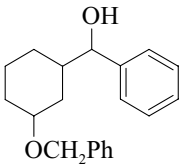
(O) NaOH then CrO_3 / pyridine

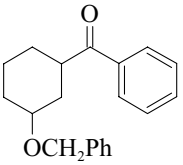
EXERCISE 5

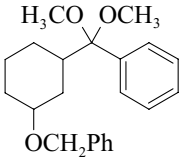
1. 

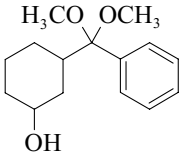
2. 

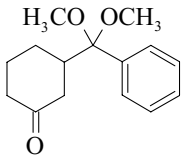
3. 

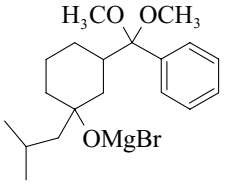
4. 

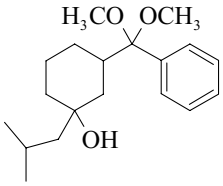
5. 

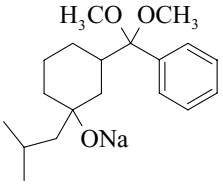
6. 

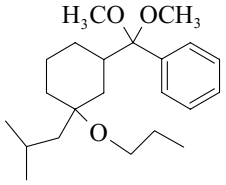
7. 

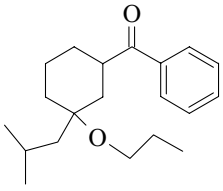
8. 

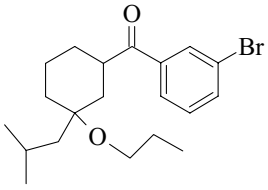
9. 

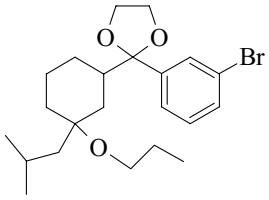
10. 

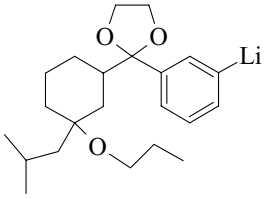
11. 

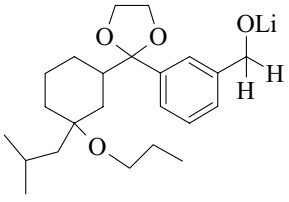
12. 

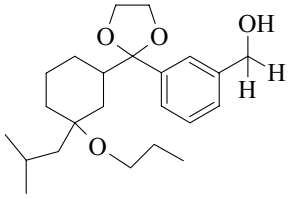
13. 

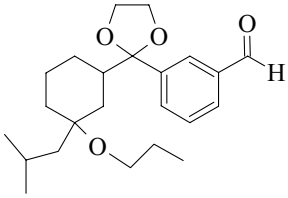
14. 

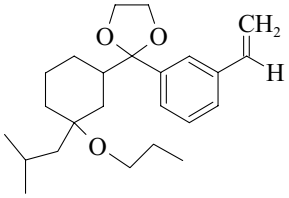
15. 

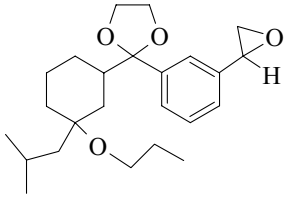
16. 

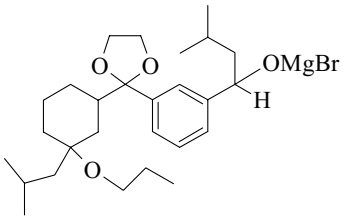
17. 

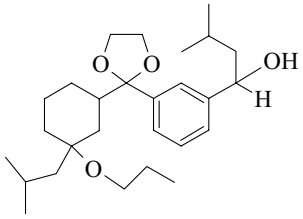
18. 

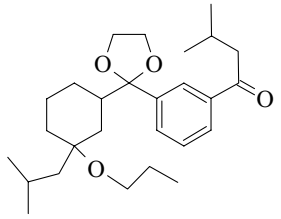
19. 

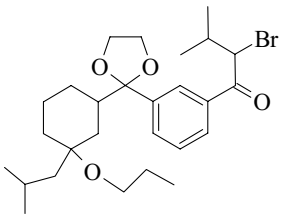
20. 

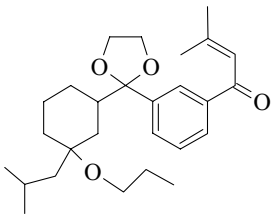
21. 

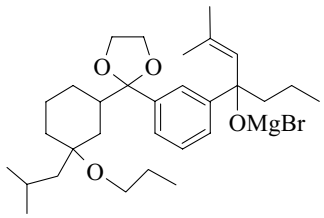
22. 

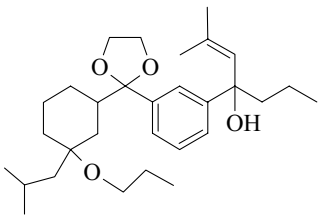
23. 

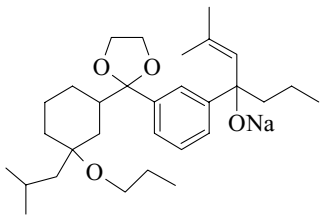
24. 

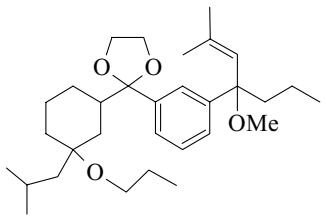
25. 

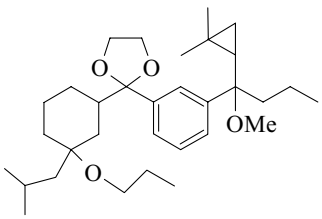
26. 

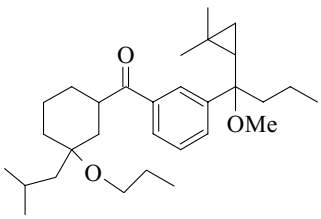
27. 

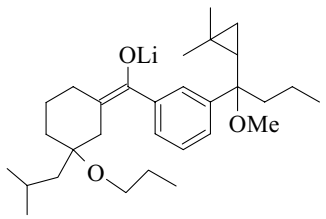
28. 

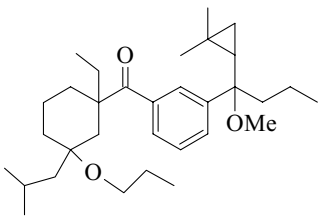
29. 

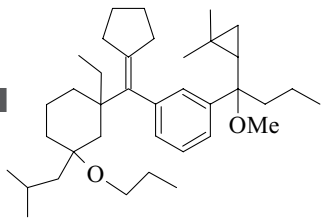
30. 

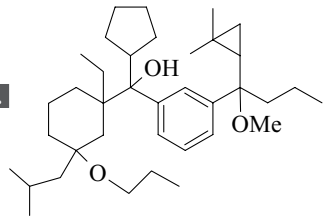
31. 

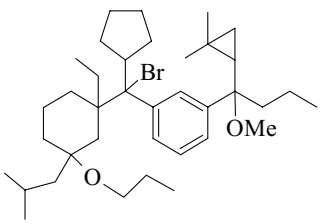
32. 

33. 

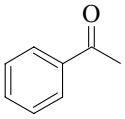
34. 

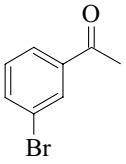
35. 

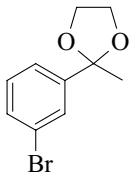
36. 

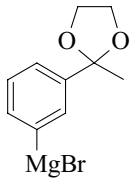
37. 

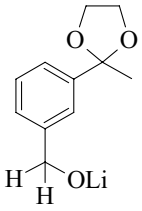
EXERCISE 6

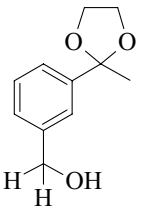
1. 

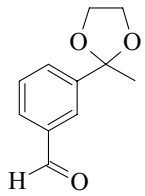
2. 

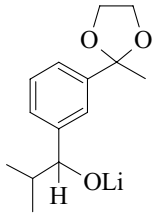
3. 

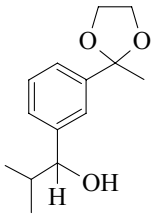
4. 

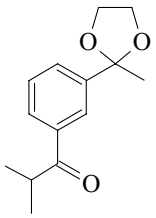
5. 

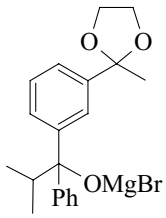
6. 

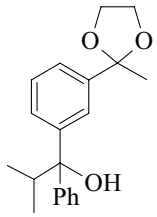
7. 

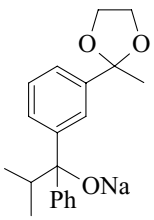
8. 

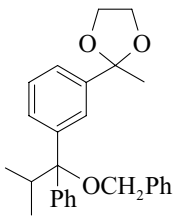
9. 

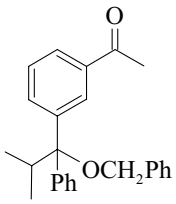
10. 

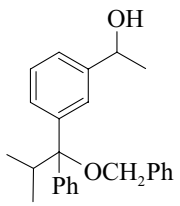
11. 

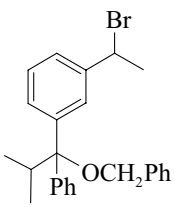
12. 

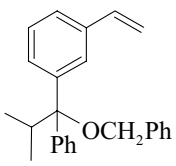
13. 

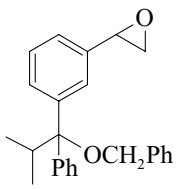
14. 

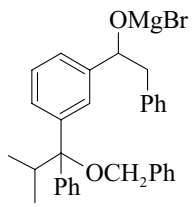
15. 

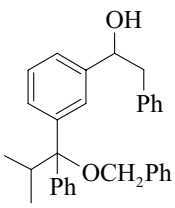
16. 

17. 

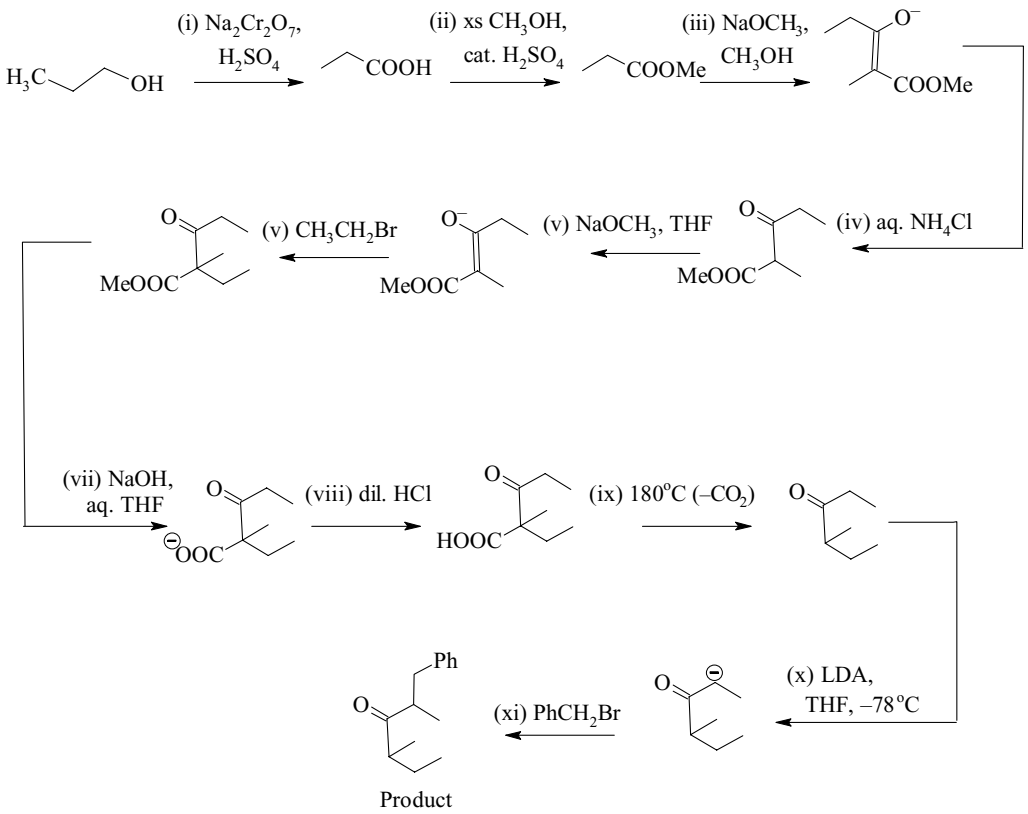
18. 

19. 

20. 

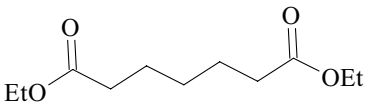
21. 

EXERCISE 7


(i) $Na_2Cr_2O_7$, H_2SO_4
(ii) xs CH_3OH, cat. H_2SO_4
(iii) $NaOCH_3$, CH_3OH
(iv) aq. NH_4Cl
(v) $NaOCH_3$, THF
(v) CH_3CH_2Br
(vii) NaOH, aq. THF
(viii) dil. HCl
(ix) 180°C (–CO_2)
(x) LDA, THF, –78°C
(xi) $PhCH_2Br$
Product

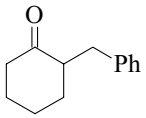
EXERCISE 8

(A)

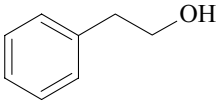


(i) NaOEt, EtOH
(ii) dilute HCl (quench)
(iii) $NaOCH_3$, THF

(iv) $PhCH_2Br$
(v) NaOH, aq. THF
(vi) dilute HCl (quench)
(vii) 180^oC ($-CO_2$)

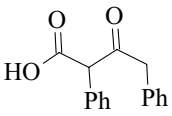


(B)

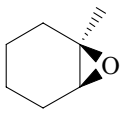


(i) $Na_2Cr_2O_7$, H_2SO_4
(ii) xs CH_3OH, cat. HCl
(iii) $NaOCH_3$, CH_3OH

(iv) dilute HCl (quench)
(v) NaOH, aq. THF
(vi) dilute HCl (quench)

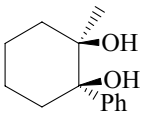


(C)

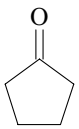


(i) PhLi, THF, 0^oC
(ii) H_3O^+ (quench)

(iii) H_3PO_4, heat
(iv) OsO_4, H_2O_2, NaOH



(D)



(i) NaOH, CH_3OH, Δ
(ii) $(CH_3)_2CuLi$, THF
(iii) aq. NH_4Cl (quench)