MISCELLANEOUS BOOKLET

ASSIGNMENT PROBLEMS

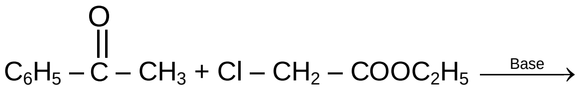
Subjective:

1. Compound (A) $C_{10}H_{13}ON$ was insoluble in dil. HCl and NaOH. It was refluxed for 2 hours with 10% NaOH and the alkaline residue was steam distilled. The distillate contained a water insoluble, acid – soluble compound B which readily formed a tribromoderivative. The residue contained an tribromoderivative. The residue was an organic acid which on heating with soda-lime, gave methane. When B was treated with excess C_2H_5Br, it consumed two moles of C_2H_5Br. What will be the structure of (A)?

2. An organic compound (A), C_4H_9Cl on reaction with aqueous KOH gives (B) and on reaction with alcoholic KOH gives (C) which is also formed by passing vapours of (B) over heated copper. The compound (C) readily decolourises bromine water. Ozonolysis of (C) gives two compounds (D) and (E). Compound (D) reacts with NH_2OH to give (F) and the compound (E) reacts with NaOH to give an alcohol (G) and sodium salt (H) of an acid. (D) can also be prepared from propyne on treatment with water in presence of Hg^{2+} and H_2SO_4. Identify (A) to (H) with proper reasoning.

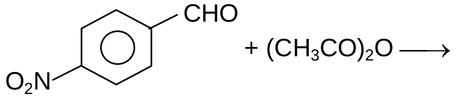
3. Predict products of the following reactions

(a)



$$C_6H_5-\overset{\overset{\displaystyle O}{||}}{C}-CH_3 + Cl-CH_2-COOC_2H_5 \xrightarrow{\text{Base}}$$

(b)



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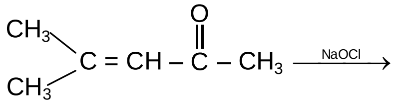
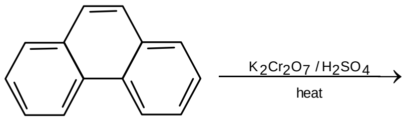


4. Predict products of the following reactions

(a)



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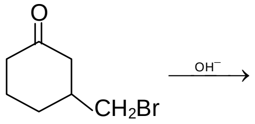

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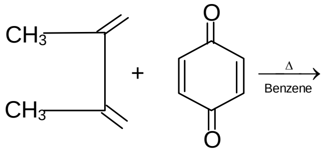


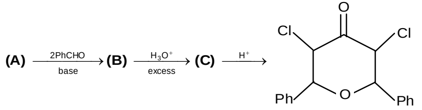
5. A dicarboxylic acid (A), $C_4H_6O_4$, gave a compound (B), $C_6H_{10}O_4$ upon treatment with excess of methanol and a trace of H_2SO_4. Subsequent treatment of (B) with lithium aluminium hydride followed by usual work up afforded (C), $C_4H_{10}O_2$. Pyrolysis of (A) yielded (D), $C_4H_4O_3$. Assign structures to (A), (B), (C) and (D).

6. A neutral compound (A) C_8H_9ON on treatment with sodium hypobromite forms an acid soluble substance C_7H_9N. On addition of aqueous sodium nitrite to a solution of (B) in dil. HCl at 0-5° an ionic compound (C) $C_7H_7N_2Cl$ is obtained. (C) gives a red dye with alkaline β-naphthol solution. When treated with potassium cuprocyanide, (C) yields a neutral substance, (D)C_8H_7N. On hydrolysis (D) gives (E)$C_8H_8O_2$. (E) liberates CO_2 from aqueous sodium bicarbonate. (E) on permanganate oxidation furnishes (F) $C_8H_6O_4$. (F) on nitration yields two isomeric mononitro derivatives (G) and (H) having M.F. $C_8H_5NO_6$. Write the reactions involved in different steps.

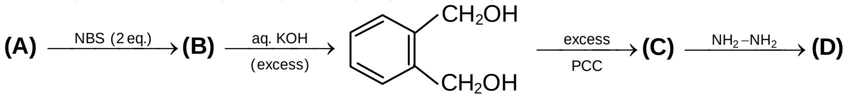
7. An organic compound (A) $C_5H_{13}N$ reacts with 2 moles of CH_3I to give a quaternary salt (B). (B) on treating with moist Ag_2O gives (C) which on heating gives ethylene and a tertiary amine (D) Hoffmann's exhaustive methylation and Hoffmann's elimination of (C) gives propene as main product. What are (A), (B) and (C)?

8. One mole of each of bromo derivative (A) and NH_3 react to give one mole of an organic compound (B). (B) reacts with CH_3I to give (C). Both (B) and (C) react with HNO_2 to give compounds (D) and (E), respectively. (D) on oxidation and subsequent decarboxylation gives 2-methoxy -2-methyl propane. Give structures of (A) to (E) with proper reasoning.

9. Identify the missing reagents (or products)

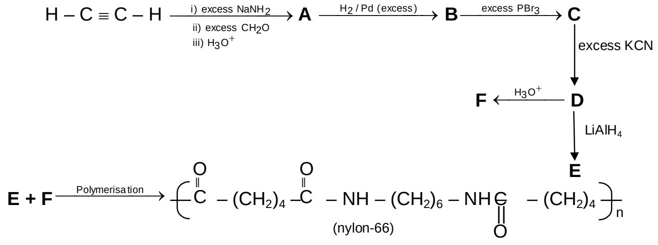


10. Identify the missing reagents (or products)

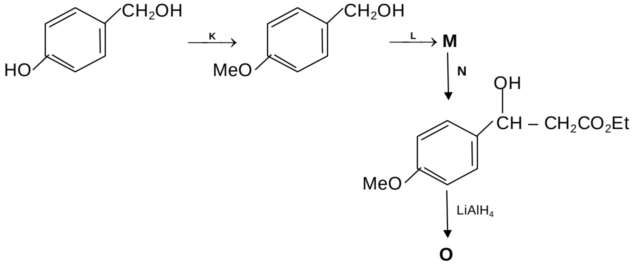


11. Treatment of compound A ($C_8H_{10}O$) with chromic acid/pyridine gives B (C_8H_8O) which reacts with bromine yielding C ($C_8H_6OBr_2$). (C) generates (D) ($C_8H_8O_3$) upon treatment with alkali and subsequent acidification. Oxidation of D with alkaline $KMnO_4$ and subsequent acidification gives benzoic acid. Treatment of (B) with SeO_2 gives E ($C_8H_6O_2$) which also affords D when treated with alkali followed by acidification. Identify A, B, C, D & E with proper reasoning.

12. Identify the missing products (or) reagents in the following sequence of reactions:

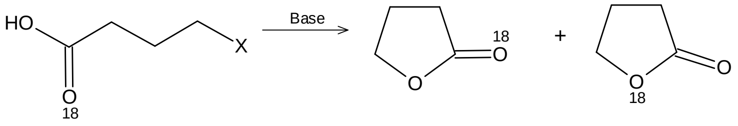


13. Identify the missing products (or) reagents in the following sequence of reactions:



14. Explain the following reactions with a proper mechanism

(a)



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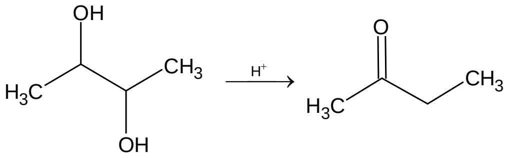

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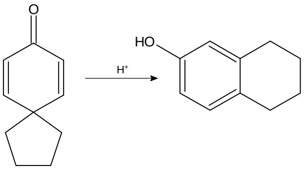


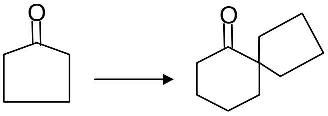
15. Show how Grignard reactions could be used to synthesize each of the following compounds.

(a) 2-Methyl-2-butanol (three ways)
(b) 3-Methyl-3-pentanol (three ways)
(c) 3-Ethyl -2-pentanol (two ways)
(d) Triphenyl methanol (two ways)

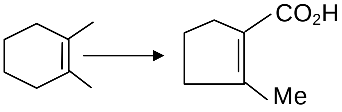
16. An organic compound (A) of molecular C_9H_{10}, in capable of showing geometrical isomerism, but capable of decolourising aq. $KMnO_4$ solution, on treatment with aq. Cl_2 gave a compound (B). (B) on treatment with aqueous solution of Ag^+ gives (C) which rapidly converts into a dehydrated product (D). (D) on treatment with $LiAlH_4$, followed by treatment with hot H_2SO_4 gives (E). If (E), an positional isomer of (A), but capable of exhibiting geometrical isomerism, and (D) capable of forming a thick yellow precipitate with NaOH/I_2 mixture, identify the structures of (A) to (E).

17. (a) Conversion (in minimum possible steps):

i)

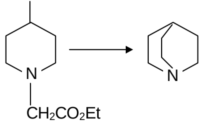


ii)

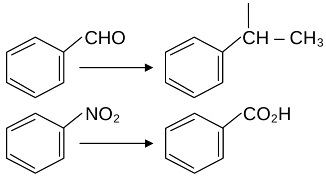


18. Effect the following conversions.

(i)



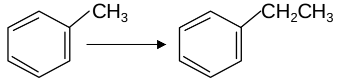
(ii)



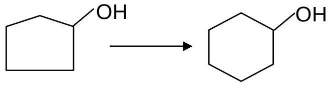
(iii)

19. Effect the following conversions.

(i)



(ii)



20. Give reasons for the following

(i) CH_3COO^- is a bad leaving group.

(ii) Cyclopentadiene is not aromatic, whereas cyclopentadienyl anion is aromatic.

(iii) Grignard reagents doesn't react with the carbonyl group of carboxylic acids though it has a carbonyl group.

(iv) Aldehydes generally undergo nucleophilic addition more readily than ketones.

(v) Aniline is less basic than benzylamine

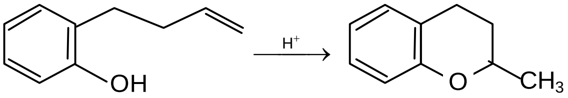
21. An organic compound (A) of m.f. $C_5H_8O_3$ on treatment with an equivalent of CH_3CH_2MgX gives (B), which can't show positive iodoform test. (B) on reduction with $LiAlH_4$ gives (C) which responds to Luca's Test at a moderate rate. (C) on treatment with H^+/HCl gives (D). (D) on treatment with aq. KOH gives (E) and (E) on oxidation with $HCrO_4$ gives (F). If (E) and (F) can show positive iodoform test, (F) can be prepared by treating butyl ethanoate with an eq. of CH_3MgCl, and (B) and (F), (C) and (E) are positional isomeric pairs. Identify the compounds (A) to (F).

22. An organic compound (A) of m.f. C_3H_9N which gives a repulsive odour with $CHCl_3$ and KOH, on treatment with aq. HNO_2, gives two isomeric compounds (B) and (C). (B) on treatment with $H^+/KMnO_4$ gives (D). (C) on reaction with PCl_5 followed by Mg/Ether gives (E). Action of (E) on (D) followed by hydrolysis gives (F). Identify (A) to (F).

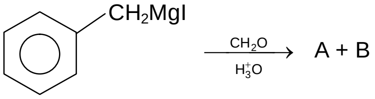
23. Write the intermediate steps for each of the following reaction.

(i) $C_6H_5CH(OH)C \equiv CH \xrightarrow{H^+} C_6H_5CH = CHCHO$

(ii)

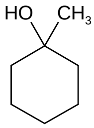


24. Trace out the product for following reaction



25. Show how 1–(bromo methylo) cyclo hexane might be transformed into each of the following compounds. The products should be free of isomers.

a)



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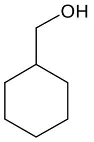
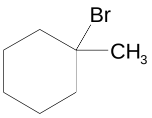


c)



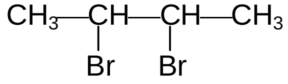
Objective:

MULTI CHOICE SINGLE CORRECT OPTION

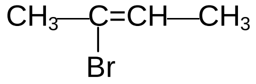
1. Reaction of acetyl chloride with acetic acid in presence of pyridine produces
(A) ethyl acetic acetate (B) acetyl chloride
(C) acetic anhydride (D) methyl acetate

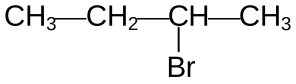
2. The order of basic strength among the following amines in benzene solution is
(A) $CH_3NH_2 > (CH_3)_3N > (CH_3)_2NH$ (B) $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N$
(C) $CH_3NH_2 > (CH_3)_2NH > (CH_3)_3N$ (D) $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2$

3. When 2 butene is treated with N Bromo succinimide the product is

(A)

$CH_3-\underset{Br}{CH}-\underset{Br}{CH}-CH_3$

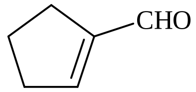
(B) $CH_2BrCH=CHCH_3$

(C)

$CH_3-\underset{Br}{C}=CH-CH_3$

(D)

$CH_3-CH_2-\underset{Br}{CH}-CH_3$

4. Which of the following is a primary alcohol?
(A) Butan –2-ol (B) Butan –1-ol
(C) Propan -2-ol (D) 2-methylbutan-2-ol

5. Cyclohexene on ozonolysis followed by reaction with zinc dust and water gives compound E. Compound E on further treatment with aqueous KOH yields compound F. Compound F is

(A)


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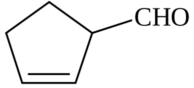

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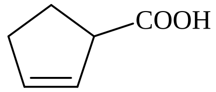

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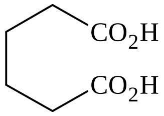
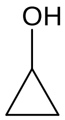
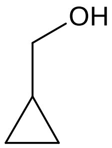


6. Which of the following alcohol shows fastest reaction with H^+?

(A)


(B)


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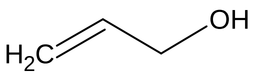
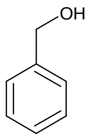
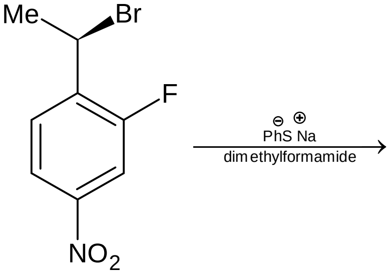
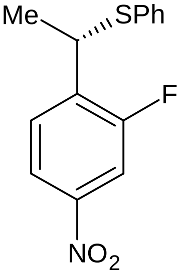


(D)


7. The major product of the following reaction is



(A)


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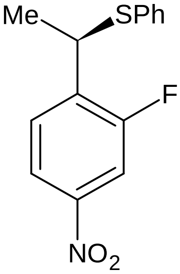

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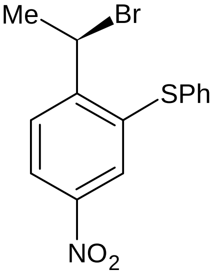
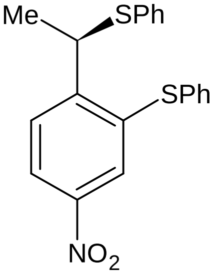
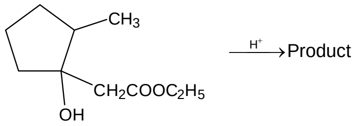
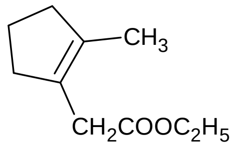


(D)


8. What is the major product for the following reaction?



(A)


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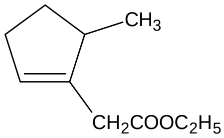
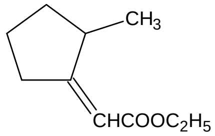
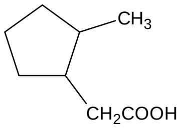
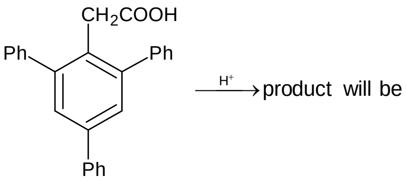


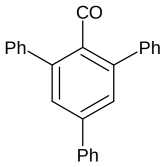
(C)


(D)


9.



(A)



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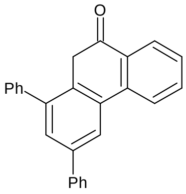
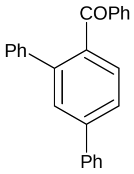


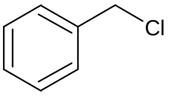
(C)



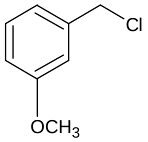
(D) None

10. Which of the following will react fastest with Ag^+

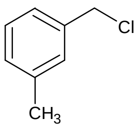
(A)



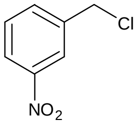
(B)



(C)

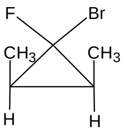


(D)

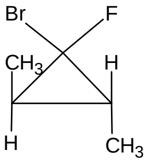


11. $CHF_2Br \xrightarrow{OH^-} A \xrightarrow{\text{trans}-2-\text{butene}} B$, B is

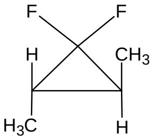
(A)



(B)

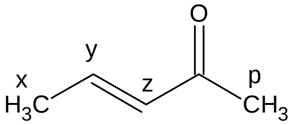


(C)



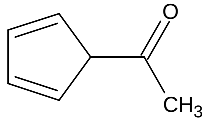
(D) An open chain compounds

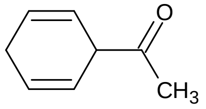
12. The abstraction of proton will be fastest, in which carbon in the following compound,

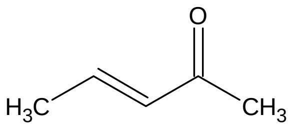


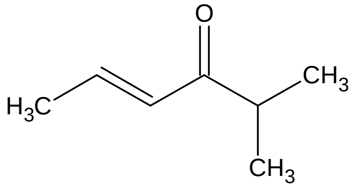
(A) x
(B) y
(C) z
(D) p

13. Which of the following will be most acidic?

(A) 

(B) 

(C) 

(D) 

14. Phenol is less acidic than

(A) ethanol
(B) methanol
(C) o-nitrophenol
(D) p-cresol.

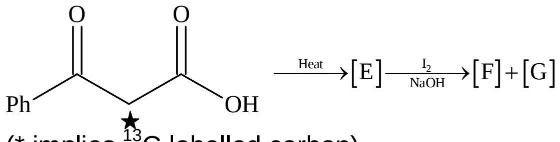
15. The following method cannot be considered suitable for the preparation of alkyl halide:

(A) Halogenation of alkane
(B) ROH and PX_3
(C) ROH and HX
(D) Alkene and HX

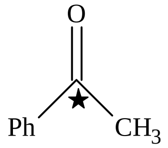
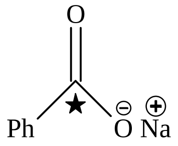
16. Reduction of alkyl halide with nascent hydrogen leads to the formation of:

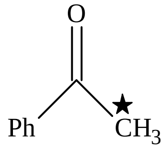
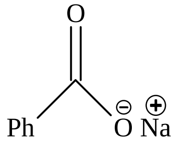
(A) Parent alkane
(B) Alkene
(C) Alkyne
(D) None of the above

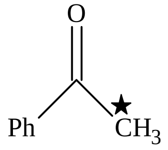
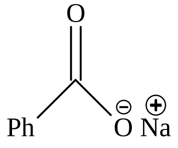
17. In the following reaction sequence, the correct structures of E, F and G are

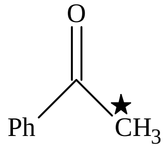
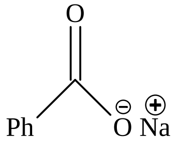


(* implies ^{13}C labelled carbon)

(A) E =  F =  G = CHI_3

(B) E =  F =  G = CHI_3

(C) E =  F =  G = $\overset{\star}{C}HI_3$

(D) E =  F =  G = $\overset{\star}{C}H_3I$

18. A mixture of benzaldehyde and formaldehyde on heating with aqueous NaOH solution gives
(A) Benzyl alcohol and sodium formate.
(B) Sodium benzoate and methylalcohol
(C) Sodium benzoate and sodium formate
(D) None

19. Aldol condensation will not be observed in
(A) Chloral
(B) Phenylacetaldehyde
(C) Hexanal
(D) None of these

20. 1, 2–dibromopropane on treatment with X moles of $NaNH_2$ followed by treatment with ethyl bromide gave a pentyne the value of X is:
(A) One
(B) Two
(C) Three
(D) Four

21. $(CH_3)_3CMgCl$ on reaction with D_2O produces.
(A) $(CH_3)_3CD$
(B) $(CH_3)_3COD$
(C) $(CD)_3CD$
(D) $(CD_3)_3COD$

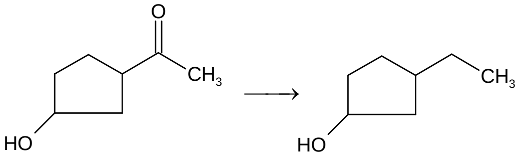
22. A compound shows no optical rotation in a given solvent. Which of the following statement is correct
(A) It may be a racemic mixture
(B) It may be meso compound
(C) It may not have chiral centre
(D) All of the above

23. Ethanal reacts with HCN and the addition product so obtained is hydrolysed to form a new compound. This compound shows
(A) optical isomerism
(B) geometrical isomerism
(C) tautomerism
(D) metamerism

24. Which of the following statement is correct:
(A) Allyl carbonium ion ($CH_2{=}CH{-}\overset{+}{C}H_2$) is more stable than propyl carbonium ion
(B) Propyl carbonium ion is more stable than allyl carbonium ion
(C) Both are equally stable
(D) None

25. The products obtained via oximercuration ($HgSO_4 + H_2SO_4$) of 1–butyne would be
(A) $CH_3 - CH_2 - CO - CH_3$
(B) $CH_3 - CH_2 - CH_2 - CHO$
(C) $CH_3 - CH_2 - CHO + HCHO$
(D) $CH_3 - CH_2 - COOH + HCOOH$

26. The appropriate reagent for the following transformation.

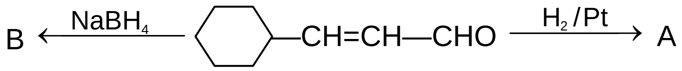


(A) Zn(Hg), HCl
(B) $NH_2 - NH_2 - OH^-$
(C) H_2/Ni
(D) $NaBH_4$

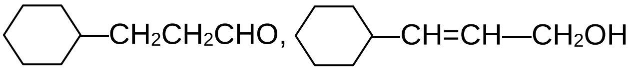
27. Ozonolysis of 2,3–dimethylbut–1–ene followed by reduction with zinc and water gives
(A) methanoic acid and 3–methyl–2–butanone
(B) methanal and 3–methyl–2–butanone
(C) methanal and 2–methyl–3–butanone
(D) methanoic acid and 2–methyl–3–butanone

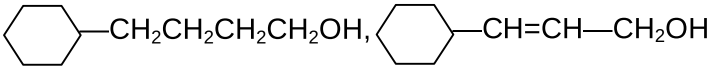
28. Which of the following is strongest nucleophile?
(A) Br^- (B) OH^-
(C) CN^- (D) $C_2H_5O^-$

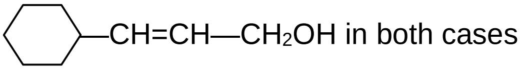
29. Ethanal reacts with HCN and the addition product so obtained is hydrolysed to form a new compound. This compound shows .
(A) optical isomerism (B) geometrical isomerism
(C) tautomerism (D) metamerism

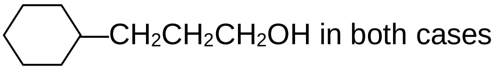
30.


A and B are:

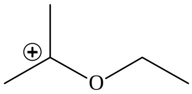
(A)


(B)


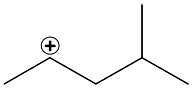
(C)


(D)


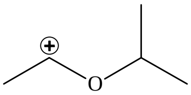
31. The correct stability order for the following species is



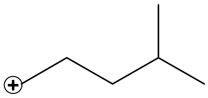
(I)



(II)



(III)



(IV)

(A) (II) > (IV) > (I) > (III) (B) (I) > (II) > (III) > (IV)
(C) (II) > (I) > (IV) > (III) (D) (I) > (III) > (II) > (IV)

32. Phenol can be distinguished from alcohol with
(A) Tollens reagent (B) Schiff's base
(C) Neutral $FeCl_3$ (D) HCl

33. The strongest acid among the following is
(A) p-chlorophenol (B) p-nitrophenol
(C) m-nitrophenol (D) o-nitrophenol

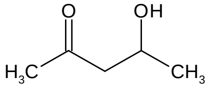
34. Sec. Butyl chloride will undergo alkaline hydrolysis in the polar solvent by hydrolysis.
(A) S_N2 (B) S_N1
(C) S_N1 and S_N2 (D) None of the above

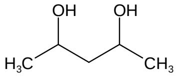
35. In the Cannizzaro reaction given below:

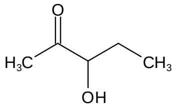
$$Ph-CHO \xrightarrow{OH^-} Ph-CH_2-OH + PhCOO^-$$

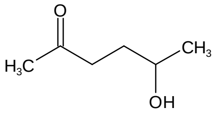
the slowest step is
(A) the attack of OH^- at the carbonyl group.
(B) the transfer of hydride to the carbonyl group
(C) the abstraction of proton from carboxylic acid
(D) the deprotonation of of Ph – COOH

36. Which of the following will be most readily dehydrated in acidic conditions

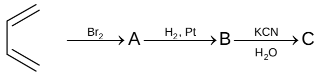
(A)


(B)


(C)


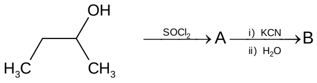
(D)


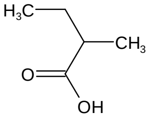
37. The end product of the reaction

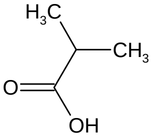


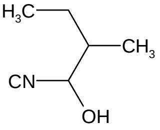
(A) Propanoic acid
(B) Adipic acid
(C) Malonic acid
(D) Succinic acid

38. The product of the reaction



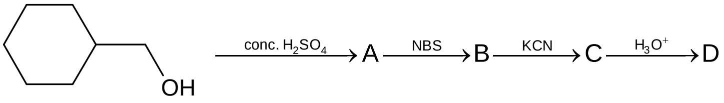
(A)


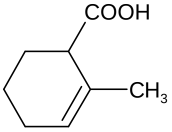
(B)


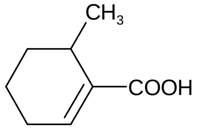
(C)


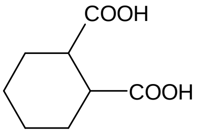
(D) None of these

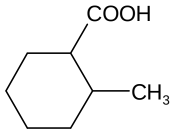
39. Product D of the reaction



(A)


(B)


(C)


(D)


40. Iodoform gives precipitate with $AgNO_3$ on heating but chloroform does not because
(A) iodoform is ionic
(B) chloroform is covalent
(C) C – I bond in iodoform is weak and C – Cl bond in chloroform is strong
(D) none of the above

41. Which compound on reaction with ethyl magnesium bromide and water will form 2-methyl-2-butanol?
(A) CH_3COCH_3
(B) $C_2H_5COOCH_3$
(C) CH_3CH_2CHO
(D) $C_2H_5COCH_3$

42. In the reaction of p-chlorotoluene with KNH_2 in I equivalent NH_3, major product is
(A) o-toluidine
(B) m-toluidine
(C) p-toluidine
(D) p-chloroaniline

REASONING TYPE

This section contains reasoning type questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

1. STATEMENT-1: p-Hydroxybenzoic acid has a lower boiling point than o-hydroxybenzoic acid.
and
STATEMENT-2: o-Hydroxybenzoic acid has intramolecular hydrogen bonding.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(C) Statement-1 is True, Statement -2 is False.
(D) Statement-1 is False, Statement-2 is True.

2. STATEMENT-1: Bromobenzene upon reaction with Br_2/Fe gives 1, 4 – dibromobenzene as the major product.
and
STATEMENT-2: In bromobenzene, the inductive effect of the bromo group is more dominant than the mesomeric effect in directing the incoming electrophile.
(A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is correct explanation for STATEMENT-1
(B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is NOT a correct explanation for STATEMENT-1
(C) STATEMENT-1 is True, STATEMENT-2 is False
(D) STATEMENT-1 is False, STATEMENT-2 is True

3. STATEMENT-1: Benzyl bromide when kept in acetone/water, it produces benzyl alcohol.

and

STATEMENT-2: The reaction follows S_N2 mechanism.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(C) Statement-1 is True, Statement -2 is False.
(D) Statement-1 is False, Statement-2 is True.

4. STATEMENT-1: Formaldehyde is more reactive than benzaldehyde for nucleophilic addition reaction.

and

STATEMENT-2: Formaldehyde is more stable than benzaldehyde.

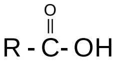
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(C) Statement-1 is True, Statement -2 is False.
(D) Statement-1 is False, Statement-2 is True.

5. STATEMENT-1: Alkyne is more reactive than alkene for catalytic reduction.

and

STATEMENT-2: Structure of alkyne is planar and cylindrical.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(C) Statement-1 is True, Statement -2 is False.
(D) Statement-1 is False, Statement-2 is True.

6. STATEMENT-1: Unlike the >C = O group of aldehydes and ketones, the >C = O of  $R-\overset{\overset{O}{\|}}{C}-OH$ does not undergo nucleophilic addition reactions.

and

STATEMENT-2: Carboxylic acids exist as dimers due to intermolecular hydrogen bonding.

(A) STATEMENT – 1 is True, STATEMENT-2 is True; STATEMENT -2 is correct explanation for STATEMENT-1
(B) STATEMENT – 1 is True, STATEMENT-2 is True; STATEMENT -2 is NOT a correct explanation for STATEMENT-1
(C) STATEMENT – 1 is True, STATEMENT-2 is False
(D) STATEMENT – 1 is False, STATEMENT-2 is True

7. STATEMENT-1: p-Nitrophenol is a stronger acid than o-nitrophenol.

and

STATEMENT-2: Intramolecular hydrogen bondings make the o-isomer weaker than the p-isomer.

(A) STATEMENT – 1 is True, STATEMENT-2 is True; STATEMENT -2 is correct explanation for STATEMENT-1
(B) STATEMENT – 1 is True, STATEMENT-2 is True; STATEMENT -2 is NOT a correct explanation for STATEMENT-1
(C) STATEMENT – 1 is True, STATEMENT-2 is False
(D) STATEMENT – 1 is False, STATEMENT-2 is True

8. STATEMENT-1: Alkyl halide on treatment with AgCN gives alkylisocyanide as the major product.

and

STATEMENT-2: Nitrogen is more electronegative than carbon.

(A) STATEMENT – 1 is True, STATEMENT-2 is True; STATEMENT -2 is correct explanation for STATEMENT-1
(B) STATEMENT – 1 is True, STATEMENT-2 is True; STATEMENT -2 is NOT a correct explanation for STATEMENT-1
(C) STATEMENT – 1 is True, STATEMENT-2 is False
(D) STATEMENT – 1 is False, STATEMENT-2 is True

9. STATEMENT-1: Solubility of n-alcohol in water decreases with increase in molecular weight.

and

STATEMENT-2: The hydrophobic nature of alkyl chain increases.

(A) STATEMENT – 1 is True, STATEMENT-2 is True; STATEMENT -2 is correct explanation for STATEMENT-1
(B) STATEMENT – 1 is True, STATEMENT-2 is True; STATEMENT -2 is NOT a correct explanation for STATEMENT-1
(C) STATEMENT – 1 is True, STATEMENT-2 is False
(D) STATEMENT – 1 is False, STATEMENT-2 is True

10. STATEMENT-1: Addition of KCN solution to carbonyl compounds increases the pH of the solution.

and

STATEMENT-2: KCN in aqueous solution forms a basic solution due to hydrolysis of CN^-. The nucleophilic addition on carbonyl then brings in decrease in H^+ ions or increase in OH^- ions.

(A) STATEMENT – 1 is True, STATEMENT-2 is True; STATEMENT -2 is correct explanation for STATEMENT-1
(B) STATEMENT – 1 is True, STATEMENT-2 is True; STATEMENT -2 is NOT a correct explanation for STATEMENT-1
(C) STATEMENT – 1 is True, STATEMENT-2 is False
(D) STATEMENT – 1 is False, STATEMENT-2 is True

MULTI CHOICE MULTI CORRECT OPTION

1. Oxalic acid is used:
   (A) for removing ink stains
   (B) for the lab preparation of formic acid and allyl alcohol
   (C) in making beverages
   (D) as a mordant in dyeing and calicoprinting

2. Phenyl cyanide can be obtained by:
   (A) $C_6H_5CONH_2 \xrightarrow{P_2O_5,\ \Delta}$
   (B) $C_6H_5 - CH = NOH \xrightarrow{AC_2O,\ \Delta}$
   (C) $C_6H_5Cl \xrightarrow{\text{alc. KOH}}$
   (D) $C_6H_5NH_2 \xrightarrow[\text{(ii) CuCN}]{\text{(i) NaNO}_2\text{/HCl}}$

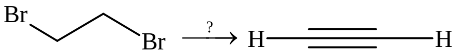
3. Isocyanide test is given by
   (A) ethanol
   (B) acetone
   (C) chloroform
   (D) ethyl amine

4. How much bromine is needed to produce tribromophenol from one mole of phenol?
   (A) 3.0 mole
   (B) 1.5 mol
   (C) 240 g
   (D) 480 g

5. Which reacts with Fehling's solution?
   (A) acetaldehyde
   (B) acetone
   (C) formaldehyde
   (D) formic acid

6. Which can be used to prepare methane?
   (A) Clemmensen reduction
   (B) Wurtz reaction
   (C) Catalytic hydrogenation of methyl iodide
   (D) Reduction of methyl iodide using Zn–Cu couple

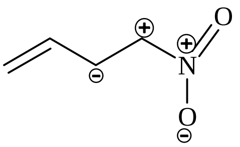
7. The reagent(s) for the following conversion,



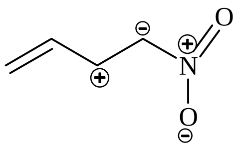
   is/are
   (A) alcoholic KOH
   (B) alcoholic KOH followed by $NaNH_2$
   (C) aqueous KOH followed by $NaNH_2$
   (D) Zn/CH_3OH

8. Among the following, the least stable resonance structure is

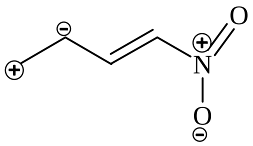
(A)



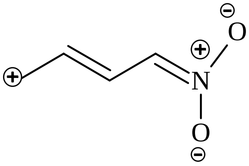
(B)



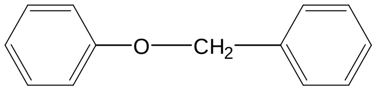
(C)



(D)

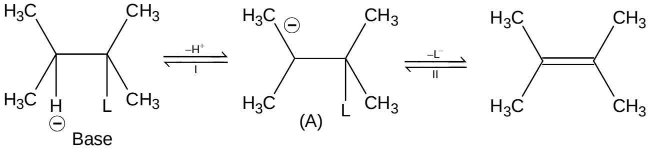


9. For an S_N2 reaction, which of the following statements is/are true?
(A) The rate of reaction is independent of the concentration of the nucleophile
(B) The neucleophile attacks the C–atom on the side of the molecule opposite to the group being displaced
(C) The reaction proceeds with simultaneous bond formation and bond rupture
(D) None of the above

10. The ether 

when treated with HI produce(s):
(A) $C_6H_5CH_2I$ (B) $C_6H_5CH_2OH$
(C) C_6H_5I (D) C_6H_5OH

11. Carbanion (A) loses a leaving group to form alkene;



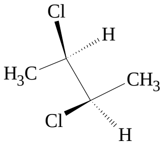
Which is/are correct statement(s)?
(A) It is E1–CB type (B) It is E2 type
(C) It is E1 type (D) Step I is fast and II slow

12. Which of the following do not undergo base–catalysed aldol condensation?
(A) Benzaldehyde (B) 2, 2–dimethylpropionaldehyde
(C) 2–methylpropionaldehyde (D) p–methylbenzaldehyde

13. Aldehydes can be reduced to hydrocarbons by:
(A) Clemmensen reduction (B) Wolff–Kishner reduction
(C) Mg/Hg, H_2O (D) The Huang–Minlon method

14. Toluene when treated with Br_2/Fe gives para-bromo toluene as the major product because CH_3 group:
(A) is para directing (B) is meta directing
(C) activates the ring by hyperconjugation (D) deactivates the ring

15. The correct statement (s) about the compound given below is (are)

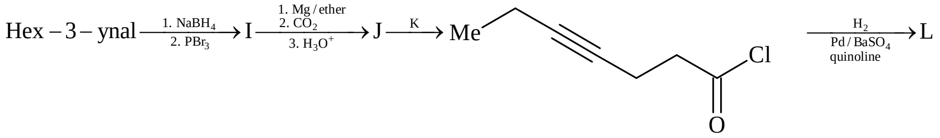


(A) The compound is optically active
(B) The compound possesses centre of symmetry
(C) The compound possesses plane of symmetry
(D) The compound possesses axis of symmetry

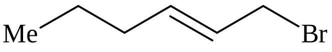
Comprehension – I

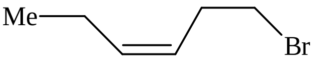
Read the paragraph carefully and answer the following questions:

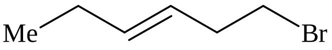
In the following sequence, products I, J and L are formed. K represents a reagent.

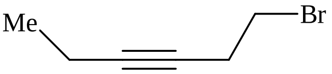


1. The structure of the product I is

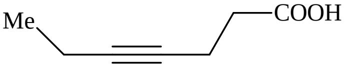
(A)


(B)


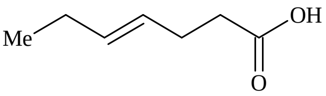
(C)


(D)


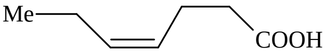
2. The structures of compounds J and K respectively are

(A)


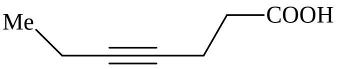
and $SOCl_2$

(B)


and SO_2Cl_2

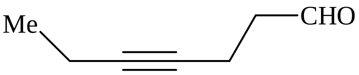
(C)


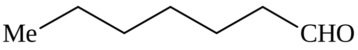
and $SOCl_2$

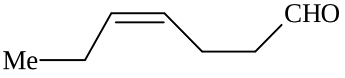
(D)


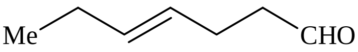
and CH_3SO_2Cl

3. The structure of product L is

(A)


(B)


(C)


(D)


Comprehension – II

Cannizzaro reaction involves hydride transfer from an aldehyde molecule lacking an alpha-hydrogen atom, to a second molecule of either the same aldehyde (disproportionation) or to a molecule of different aldehyde. The reaction requires the presence of strong bases, and rate law is found to be Rate = k [Aldehyde lacking alpha hydrogen]^2. [OH^-].

Mechanism consists of rapid reversible addition of OH^- to aldehyde yielding potential hydride donor followed by slow, rate limiting hydride transfer to carbonyl carbon atom of another aldehyde atom and the reaction is completed by rapid proton exchange to yield more stable pair of acid and alcohol.

4. Which of the following aldehydes will not undergo Cannizzaro reaction?

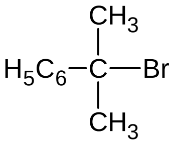
(A) HCHO
(B) R_3CCHO
(C) CH_3CHO
(D) PhCHO

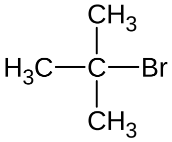
5. When Cannizzaro reaction take place in D_2O, the – CH_2 – of alcohol does not show any incorporation of D. What does it indicate?
(A) The H in alcohol comes from hydroxyl ion.
(B) The H in alcohol comes from aldehyde internally.
(C) Deutirium being heavier than hydrogen cannot be incorporated in the alcohol.
(D) This information is insufficient to conclude anything.

6. When PhCHO undergoes Cannizzaro reaction, products obtained will be
(A) $PhCH_2OH$ and PhCOOH
(B) $PhCH_2COOH$ and $PhCH_2OH$
(C) MePhCOOH and PhCOOH
(D) all of the above

Comprehension – III

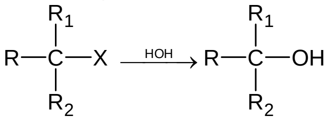
Nucleophilic aliphatic substitution reaction is mainly of two types: S_N1 and S_N2. The S_N1 mechanism is a two step process. Reaction velocity of S_N1 reaction depends only on the concentration of the substrate. Since product formation takes place by the formation of carbocation, optically active substrate gives (+) and (–) forms of the product. In most of the cases the product usually consist of 5-20% inverted product and 80-95% racemised species. The more stable the carbocation, the greater is the proportion of racemisation. The solvolysis reaction, the more nucleophilic the solvent, the greater is the proportion of inversion.

7. Which one of the following compound will give S_N1 reaction?
(A)

$H_5C_6-\underset{CH_3}{\overset{CH_3}{C}}-Br$
(B) $CH_3 - CH_2 - Br$
(C) $CH_3 - Br$
(D) All of the above

8. Which of the following compounds will give S_N1 reaction?
(I) $C_6H_5 - CH_2 - Br$
(II) $CH_2 = CH - CH_2 - Br$
(III) $CH_3 - CH_2 - Br$
(IV)

$H_3C-\underset{CH_3}{\overset{CH_3}{C}}-Br$

Select the correct answer from the codes given below:
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

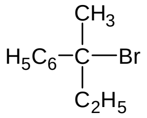
9. For the given reaction



$$R{-}\overset{R_1}{\underset{R_2}{C}}{-}X \xrightarrow{HOH} R{-}\overset{R_1}{\underset{R_2}{C}}{-}OH$$

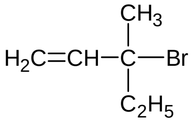
Which substrate will give maximum racemisation?

(A)



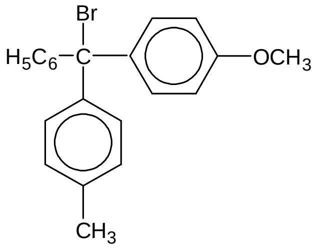
$$H_5C_6{-}\overset{CH_3}{\underset{C_2H_5}{C}}{-}Br$$

(B)

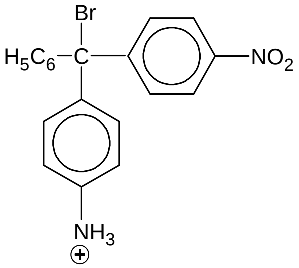


$$H_2C{=}CH{-}\overset{CH_3}{\underset{C_2H_5}{C}}{-}Br$$

(C)



(D)



Comprehension – IV

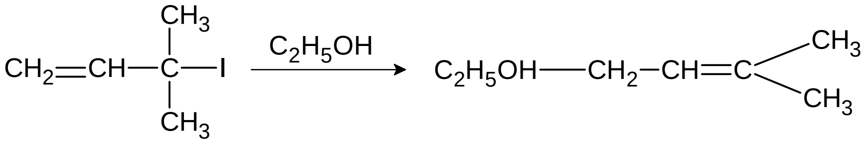
Alkyl halide when treated with nucleophiles gives normal product as well as rearranged product. The rearranged product is formed due to allylic rarrangement.

10. Which mechanism operates in allylic rearrangements?

(A) SN2′ (B) SN1′

(C) *SNi* (D) Any one of the above

11. The mechanism of gives reaction



$$CH_2{=}CH{-}\overset{CH_3}{\underset{CH_3}{C}}{-}I \xrightarrow{C_2H_5OH} C_2H_5OH{-}CH_2{-}CH{=}C(CH_3)_2$$

is

(A) SN2′ (B) SN1′

(C) SN2 (D) SN1

12. Which of the following reagents always gives SN2′ mechanism with allyl chloride?

(A) R—Cu (B) RMgX

(C) R—Li (D) All of these

Comprehension – V

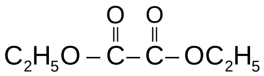
Ester gives nucleophilic addition reaction followed by elimination reaction with carbon nucleophile. When carbon nucleophile is of an ester then the reaction is known as Claisen condensation reaction. This reaction is also carried out between ester and a ketone. A successful Claisen condensation requires an ester with two $\alpha-$hydrogens and an equivalent amount of base rather than a catalytic amount of base.

13. Consider the given reaction

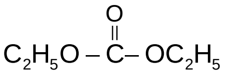
$$CH_3-COOC_2H_5 \xrightarrow[C_2H_5OH]{C_2H_5ONa} \text{enolate ion} \xrightarrow[\text{Claisen condensation}]{\text{ester}(X)} \text{Product}$$

For the above reaction the most reactive ester is:

(A) $C_6H_5COOC_2H_5$

(B) 
$C_2H_5O-\overset{\overset{O}{\|}}{C}-\overset{\overset{O}{\|}}{C}-OC_2H_5$

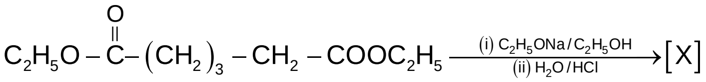
(C) $HCOOC_2H_5$

(D) 
$C_2H_5O-\overset{\overset{O}{\|}}{C}-OC_2H_5$

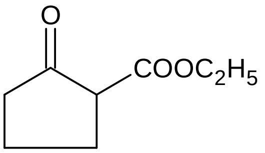
14. Intramolecular Claisen condensation given by diester is known as:

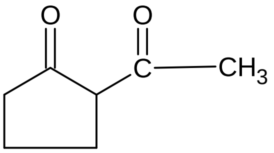
(A) Stobbe condensation
(B) Dieckmann condensation
(C) Mannich reaction
(D) Reformatsky reaction

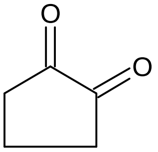
15. In the given reaction:

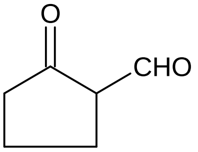

$$C_2H_5O-\overset{\overset{O}{\|}}{C}-(CH_2)_3-CH_2-COOC_2H_5 \xrightarrow[\text{(ii) } H_2O/HCl]{\text{(i) } C_2H_5ONa/C_2H_5OH} [X]$$

[X] is:

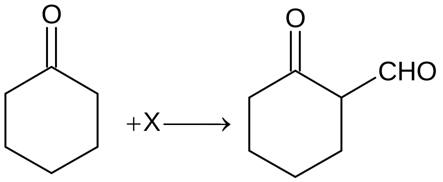
(A)


(B)


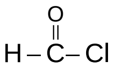
(C)


(D)


16. In the given reaction

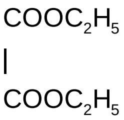


[X] is:

(A) 
$H-\overset{\overset{O}{\|}}{C}-Cl$

(B) HCl + CO

(C) $HCOOC_2H_5$

(D) 
$\begin{array}{l} COOC_2H_5 \\ | \\ COOC_2H_5 \end{array}$

Comprehension – VI

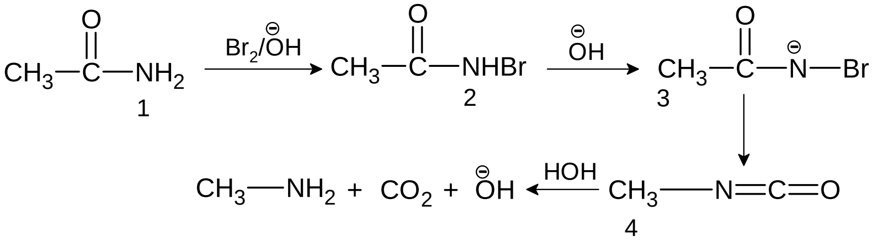
The Hofmann, Curtius, Schmidt and Lossen rearrangements are closely related rearrangements in which carbon migrates from carbon to nitrogen. The final intermediate of these rearrangements is isocyanate which reacts with water to form primary amine. When it reacts with an alcohol, the product is urethane.

17. Intermediate in Hoffmann bromamide reaction are:

(A) N-bromamide (B) anion of N-bromamide

(C) isocyanate (D) all of these

18. In the given sequence of reaction:

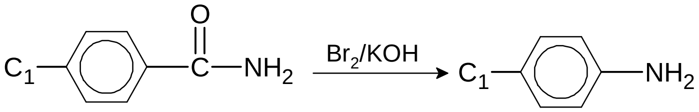


Hydrogen of which group is the most acidic?

(A) 1 (B) 2

(C) 3 (D) 4

19. Hofmann bromide reaction will be speeded for the given compound



When

(A) C_1 is electron withdrawing group

(B) C_1 is electron donating group

(C) C_1 is hydrogen

(D) C_1 has no impact on the speed of the reaction

20. Curtius rearrangement is given by:

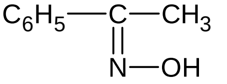
(A) $C_6H_5CONH_2$ (B) $C_6H_5CON_3$

(C) $C_6H_5COOCH_3$ (D) $C_6H_5OCOCH_3$

21. Substrate of Lossen rearrangement may be:

(A) $C_6H_5CONHOH$ (B) $C_6H_5CONHOCOCH_3$

(C) Both (A) and (B) (D)



$C_6H_5-C(=N-OH)-CH_3$

Comprehension – VII

Acid chlorides reacts with sodium salt of phenols to yield aryl esters of aliphatic or aromatic acids. Aryl esters when heated in the presence of anhy. $AlCl_3$ undergoes aromatic rearrangement.

22. Aromatic rearrangement given by aryl esters in the presence of anhy. $AlCl_3$ is called as:

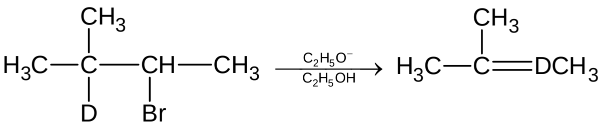
(A) Claisen rearrangement (B) Fries rearrangement

(C) Claisen condensation (D) Favorskii rearrangement

23. Which one of the following statements is NOT correct for Fries rearrangement:
(A) The product of the reaction is aromatic hydroxyl ketone.
(B) At lower temperature, the major product is *o*-hydroxy ketone.
(C) At lower temperature, the major product is *p*- hydroxyl ketone.
(D) At higher temperature, the major product is *p*- hydroxyl ketone.

24. Which one of the following is most reactive for Fries rearrangement?
(A) $CH_3COOC_6H_5$
(B) $C_6H_5OCOC_6H_5$
(C) $C_6H_5OCOOCH_2C_6H_5$
(D) $C_6H_5OCO—CH=CH—C_6H_5$

SINGLE INTEGER ANSWER TYPE QUESTIONS

1.


$$H_3C-\overset{\overset{CH_3}{|}}{\underset{\underset{D}{|}}{C}}-\underset{\underset{Br}{|}}{CH}-CH_3 \xrightarrow[C_2H_5OH]{C_2H_5O^-} H_3C-\overset{\overset{CH_3}{|}}{C}=DCH_3$$

What is the order of reaction?

2. $CH_3CH_2Br + CH_3Br \xrightarrow[\text{Dry ether}]{2Na} \text{Products}$

Find the total number of possible products (major, minor all).

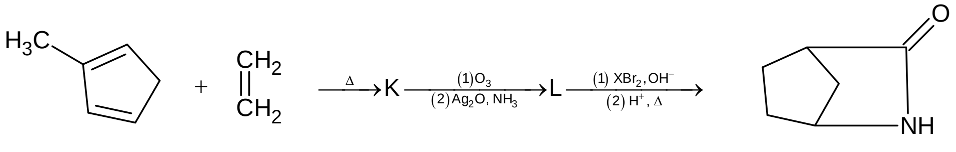
3. How many moles of $NaNH_2$ are required to convert 1 mole of 2, 2-dichlorobutane into 1-butyne completely.

4. How many carbon atoms are present in the simplest alkane which can be optically active.

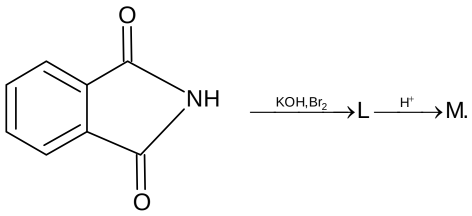
5. Find the total number of possible isomers for $C_4H_{11}N$

6. $A(\text{Amine}) \xrightarrow{KMnO_4} \xrightarrow{H^+} M.$

M gives positive Tollen's test and iodoform test. Find the maximum number of carbon atoms for amine A.

7.


Find the value of X.

8.


If the main product M is treated with Br_2, find the equivalent of Br_2 consumed thereby.

MATRIX - MATCH THE FOLLOWING QUESTIONS

1. Match the Column – I with Column – II:

Column – I	**Column – II**
(A) E_1	(p) Strong base
(B) E_2	(q) Weak base
(C) S_N1	(r) Inversion of configuration
(D) S_N2	(s) Racemisation and partial inversion
	(t) Polar protic solvent

2. Match the Column – I with Column – II:

Column – I	**Column – II**
(A) Williamson's synthesis	(p) Unsymmetrical ether
(B) Phenetole	(q) Estimation of alkoxy group
(C) Halothane	(r) Anaesthetic
(D) Zeisel's method	(s) Ethoxy benzene
	(t) $C_2H_5ONa + C_2H_5Br$

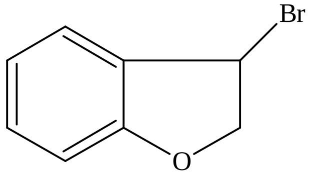
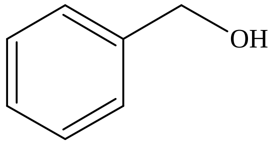
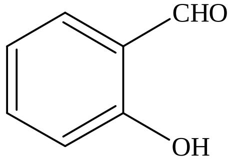
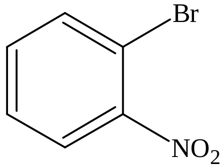
3. Match the Column – I with Column – II:

Column – I	**Column – II**
(A) $CH_3 – CHOH – CH_3$	(p) Friedel –Crafts reaction
(B) $C_6H_5 – CH_3$	(q) Reimer-Tiemann reaction
(C) C_6H_5OH	(r) Wittig reaction
(D) C_6H_5CHO	(s) Haloform reaction
	(t) Fries rearrangement

4. Match each of the compounds in **Column I** with its characteristic reaction(s) in **Column II**.

Column – I	**Column – II**
(A) $CH_3CH_2CH_2CN$	(p) Reduction with Pd–C/H_2
(B) $CH_3CH_2OCOCH_3$	(q) Reduction with $SnCl_2$/HCl
(C) $CH_3–CH=CH–CH_2OH$	(r) Development of foul smell on treatment with chloroform and alcoholic KOH
(D) $CH_3CH_2CH_2CH_2NH_2$	(s) Reduction with diisobutylaluminium hydride (DIBAL-H)
	(t) Alkaline hydrolysis

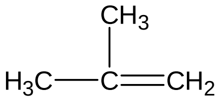
5. Match each of the compounds given in **Column I** with the reaction(s), that they can undergo given in **Column II**.

Column – I		**Column – II**	
(A)		(p)	Nucleophilic substitution
(B)		(q)	Elimination
(C)		(r)	Nucleophilic addition
(D)		(s)	Esterification with acetic anhydride
		(t)	Dehydrogenation

6. Match the List I wiht List II.

Column – I	**Column – II**
(A) Phenol + neutral $FeCl_3$	(p) No reaction
(B) Phenol + Br_2 (aq)	(q) Violet colour
(C) Phenol + $NaHCO_3$	(r) White ppt.
(D) Picric acid + $NaHCO_3$	(s) CO_2 gas is evolved

7. Match the List – I with the List - II

Column – I **(Compounds (Process))**	**Column – II** **(Products)**
(A)  $H_3C-\overset{\overset{\displaystyle CH_3}{|}}{C}=CH_2$ (ozonolysis)	(p) $CH_3-CO-CH_3$
(B) $CH_3-C\equiv CH$ (hydration)	(q) HCHO
(C) $CH_3-C\equiv C-CH_3$ (ozonolysis)	(r) CH_3COOH
(D) $CH_3-C\equiv C-C_2H_5$ (ozonolysis)	(s) C_2H_5COOH

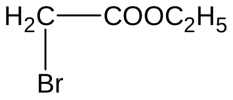
8.

Column – I	**Column – II**
(A) $CH_3COOH \xrightarrow{\text{red P/Br}_2}$	(p) Frankland Reaction
(B) $CH_3COOAg \xrightarrow[\Delta]{Br_2}$	(q) Boradiene Hunsdiecker reaction
(C) $CH_3-CH_2-Cl \xrightarrow[\text{Acetone}]{\text{NaI}}$	(r) HVZ reaction
(D) $R-X \xrightarrow{\text{Zn-Cu}}$	(s) Finkeletein Halide exchange

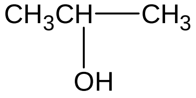
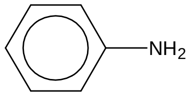
9. Match the List – I with the List - II

Column – I **(Compounds)**	**Column – II** **(Reagent & Reactions of Response)**
(A) Phenol	(p) Bakelite formation
(B) Ethanol	(q) Ceric ammonium nitrate
(C) Benzyl alcohol	(r) Haloform test
(D) Formaldehyde	(s) $FeCl_3$

10. Match List – I (name of reaction) and List – II (Product) and select the correct answer from the code given below the list.

Column – I	**Column – II**
(A) Perkin reaction	(p) $CH_3 – CH_2 – COOC_2H_5$
(B) Reformatsky reaction	(q)  $H_2\underset{\displaystyle Br}{\underset{|}{C}}—COOC_2H_5$
(C) Aldol condensation	(r) $C_6H_5 – CH = CH – CHO$
(D) Tischenko reaction	(s) $C_6H_5 – CH = CH – COOH$

11. Match the List – I with the List - II

Column – I	**Column – II**
(A) Iodoform test	(p) CH_3CHO
(B) Fehling solution test	(q)  $CH_3\underset{\displaystyle OH}{\underset{|}{CH}}—CH_3$
(C) Tollen's test	(r) 
(D) Carbylamine test	(s) $CH_3CH_2CH_2NH_2$

12. Match the List – I with the List - II

Column – I	**Column – II**
(A) Fries rearrangement	(p) $\text{Resorcinol} + \underset{\text{anhydride}}{\text{phthalic}} \xrightarrow{\text{conc. } H_2SO_4} \text{Fluorescein}$
(B) Elbs persulphate oxidation	(q) $\text{Phenyl ethanoate} \xrightarrow[\Delta]{AlCl_3} p-\text{Hydroxy acetophenone}$
(C) Coupling reaction	(r) $\text{Phenol} \xrightarrow{K_2S_2O_8} \text{Quinol}$
(D) Phthalein reaction	(s) $\text{Phenol} + \text{Benzene diazonium chloride} \rightarrow p-\text{hydroxy azobenzne}$

13. Match List I with List II:

List I	**List II**
(A) HCHO + Water 60%	(p) Urotropin
(B) HCHO + NH_3	(q) Bakelite
(C) HCHO + Phenol	(r) CH_3OH
(D) HCHO + NaOH	(s) HCOONa

14. Match List I with List II:

Column I **(Reaction/Reagents)**	**Column II** **(Metals involved)**
(A) Fehling's solution	(p) Zn
(B) Benedict's reagent	(q) Hg
(C) Tollen's reagent	(r) Cu
(D) Clemmensen reduction	(s) Ag

15. Match the compounds of List I with the distinction reagents of List II:

Column I **(compounds)**	**Column II** **(reagents)**
(A) HCOOH	(p) Effervescence of CO_2 with $NaHCO_3$
(B) CH_3COOH	(q) Colour with $FeCl_3$
(C) Benzoic acid	(r) Decolourise Br_2 water
(D) Cinnamic acid	(s) Give silver mirror with Tollen's reagent

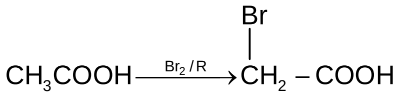
16. Match List I with List II:

Column I **(compounds/reaction)**	**Column II** **(products)**
(A) Wood alcohol	(p) CH_3OH
(B) Grain alcohol	(q) C_2H_5OH
(C) Rectified spirit contains	(r) Petrol
(D) Power alcohol contains	(s) 4.13% water

17. Match the List – I with the List - II

Column – I	**Column – II**
(A) HCHO	(p) Haloform reaction
(B) CH_3CHO	(q) Aldol condensation
(C) C_6H_5CHO	(r) Perkin reaction
(D) $CCl_3 - CHO$	(s) Cannizzaro reaction

18. Match the following question

Column – I	**Column – II**
(A)  $CH_3COOH \xrightarrow{Br_2/R} \overset{Br}{\overset{\mid}{CH_2}} - COOH$	(p) Schmidt Reaction
(B) $CH_3COOH \xrightarrow[\Delta]{Br_2} CH_3Br$	(q) HVZ reaction
(C) $CH_3COOH \xrightarrow{N_3H/H_2SO_4} CH_3 - NH_2$	(r) Hunsdiecker reaction
(D) $R - COOR \xrightarrow{NaOH} RCOONa + ROH$	(s) Saponification

MATCHING LIST TYPE QUESTIONS

This section contains **multiple choice questions. Each question has matching lists.** The codes for the lists have choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

1. Match List –I (reaction) with List-II (name of the reaction) and select the correct answer using the codes given below the lists:

List – I	**List – II**
(P) $2C_6H_5CHO \xrightarrow{20\%\ NaOH}$	(1) Benzoin condensation
(Q) $C_6H_5CHO + HCHO \xrightarrow{20\%\ NaOH}$	(2) Cannizzaro reaction
(R) $2C_6H_5CHO \xrightarrow{KCN/C_2H_5OH}$	(3) Cross cannizzaro reaction
(S) $C_6H_5CHO + \left(CH_3CO\right)_2O \xrightarrow[\Delta]{CH_3COONa}$	(4) Perkin reaction

Codes:

	P	Q	R	S
(A)	1	3	2	4
(B)	2	3	1	4
(C)	1	3	4	2
(D)	2	3	4	1

2.

List-I	**List-II**
(P) Walden inversion	(1) *Cis*-addition
(Q) Racemic mixture	(2) *Trans* addition
(R) $\text{Alkene} \xrightarrow[\text{Reagent}]{\text{Baeyer}}$	(3) S_N1 reaction
(S) $\text{Alkene} \xrightarrow{Br_2}$	(4) S_N2 reaction

Codes:

	P	Q	R	S
(A)	3	4	2	1
(B)	3	4	1	2
(C)	4	3	1	2
(D)	4	3	1	1

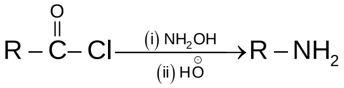
3.

List-I	**List-II**
(A) $R-X+R-ONa \longrightarrow R-O-R$	(1) Conant-Finkelstein reaction
(B) $R-Cl+KI \longrightarrow RI$	(2) Williamsons synthesis
(C) $R-OH \xrightarrow{SOCl_2} R-Cl$	(3) Wurtz-Fittig reaction
(4) $C_6H_5-X+R-X \xrightarrow{Na} C_6H_5-R$	(4) Darzen's reaction

Codes:

	P	Q	R	S
(A)	3	4	1	2
(B)	2	4	1	3
(C)	2	1	4	3
(D)	3	1	4	2

4.

	List-I	**List-II**
(A)	$RCONH_2 \xrightarrow{Br_2/KOH} R-NH_2$	(1) Curtius rearrangement
(B)	$RCOOH \xrightarrow[H_2SO_4]{N_3H} R-NH_2$	(2) Lossen rearrangement
(C)	$RCOCl \xrightarrow[\Delta]{N_3Na} R-NH_2$	(3) Schmidt rearrangement
(4)	 $R-\overset{\overset{O}{\parallel}}{C}-Cl \xrightarrow[(ii)\ H\overset{\ominus}{O}]{(i)\ NH_2OH} R-NH_2$	(4) Hoffmann rearrangement

Codes:

	P	Q	R	S
(A)	2	4	3	1
(B)	2	4	1	3
(C)	2	1	3	4
(D)	2	3	1	4

ANSWERS TO ASSIGNMENT PROBLEMS

Objective:

MULTI CHOICE SINGLE CORRECT OPTION

1.	**C**	2.	**D**	3.	**B**
4.	**B**	5.	**A**	6.	**B**
7.	**A**	8.	**C**	9.	**B**
10.	**C**	11.	**C**	12.	**A**
13.	**A**	14.	**C**	15.	**A**
16.	**A**	16.	**C**	17.	**C**
18.	**A**	19.	**D**	20.	**C**
21.	**A**	22.	**D**	23.	**A**
24.	**A**	25.	**B**	26.	**B**
27.	**B**	28.	**D**	29.	**A**
30.	**B**	31.	**D**	32.	**C**
33.	**B**	34.	**B**	35.	**A**
36.	**A**	37.	**B**	38.	**A**
39.	**A**	40.	**B**	41.	**A**
42.	**B**				

REASONING TYPE

1.	**D**	2.	**C**	3.	**C**
4.	**C**	5.	**A**	6.	**C**
7.	**A**	8.	**B**	9.	**A**
10.	**A**				

MULTI CHOICE MULTI CORRECT OPTION

1.	**A, B, D**	2.	**A, B, D**	3.	**C, D**
4.	**A, D**	5.	**A, C, D**	6.	**A, B, C, D**
7.	**B**	8.	**A**	9.	**B, C**
10.	**A, D**	11.	**A**	12.	**A, B, D**
13.	**A, B, D**	14.	**A, C**	15.	**A, D**

PARAGRAPH BASED QUESTIONS

Comprehension – I

1.	**D**	2.	**A**	3.	**C**

Comprehension – II

4.	**C**	5.	**B**	6.	**A**

Comprehension – III

7.	A	8.	B	9.	C

Comprehension – IV

10.	**B**	11.	B	12.	A

Comprehension – V

13.	B	14.	B	15.	A
16.	C				

Comprehension – VI

17.	D	18.	B	19.	A
20.	B	21.	C		

Comprehension – VII

22.	B	23.	C	24.	A

SINGLE INTEGER TYPE QUESTIONS

1.	**1**	2.	**5**	3.	**3**
4.	**7**	5.	**8**	6.	**2**
7.	**4**	8.	**3**		

MATRIX - MATCH THE FOLLOWING QUESTIONS

1. **A → (q, t) B → (p) C → (s, t) D → (r)**
2. **A → (t) B → (p, s) C → (p) D → (r)**
3. **A → (s) B → (p) C → (q, t) D → (r)**
4. **A → (p, q, s, t) B → (s, t) C → (p) D → (r)**
5. **A → (p, q, t) B → (p, s, t) C → (r, s) D → (p)**
6. **A → (q) B → (r) C → (p) D → (s)**
7. **A → (p, q) B → (p) C → (r) D → (r, s)**
8. **A → (r) B → (q) C → (s) D → (p)**
9. **A → (p, s) B → (q, r) C – (q) D → (p)**
10. **A → (s) B → (q) C → (r) D → (p)**
11. **A → (p, q) B → (p) C → (p) D → (r, s)**
12. **A → (q) B → (r) C → (s) D → (p)**
13. **A→ (s) B→ (p) C→ (q) D→ (r, s)**
14. **A→ (r) B → (r) C→ (s) D→ (p,q)**
15. **A→ (p,s) B→ (p,q) C→ (p,q) D→ (p,r)**
16. **A→ (p) B → (q) C→ (q, s) D→ (q, s)**
17. **A → (s) B → (q) C → (r) D → (p, q)**
18. **A → (q) B → (r) C → (p) D → (s)**

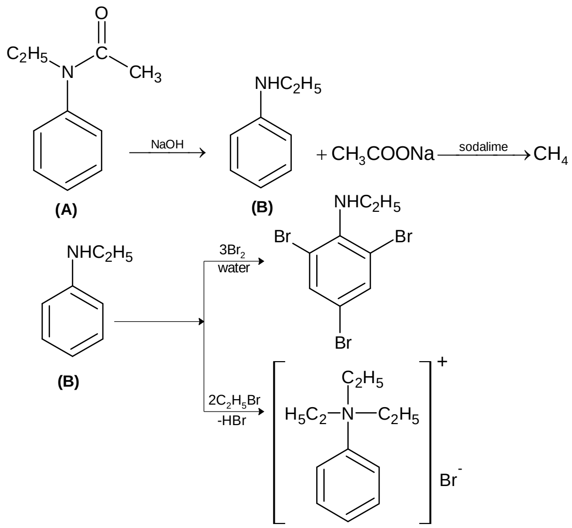
MATCHING LIST TYPE QUESTIONS

1. **B**
2. **C**
3. **C**
4. **C**

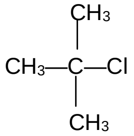
SOLUTIONS TO ASSIGNMENT PROBLEMS

Subjective

1.

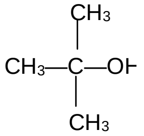


2. (A)



$$CH_3-\overset{CH_3}{\underset{CH_3}{C}}-Cl$$

(B)



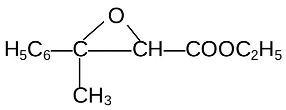
$$CH_3-\overset{CH_3}{\underset{CH_3}{C}}-OH$$

(C) $(CH_3)_2C = CH_2$ (D) $(CH_3)_2C = O$

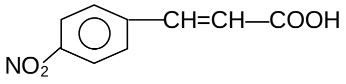
(E) HCHO (F) $(CH_3)_2$ C= NOH

(G) CH_3OH (H) HCOONa

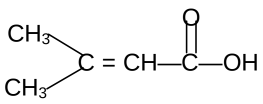
3. (a)



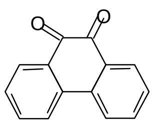
(b)



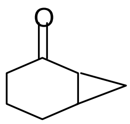
(c)



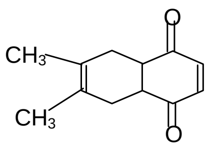
4. (a)



(b)



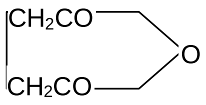
(c)



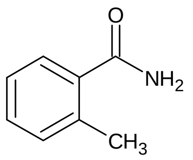
5. (A) CH_2COOH
|
CH_2—COOH

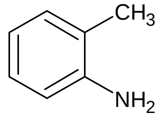
(B) CH_2COOCH_3
|
CH_2—COoCH

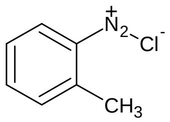
(C) CH_2—CH_2OH
|
CH_2—CH_2OH

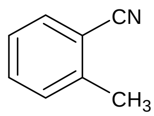
(D)


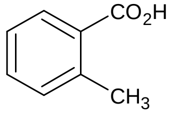
6.

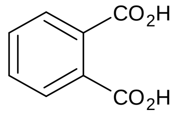
A =


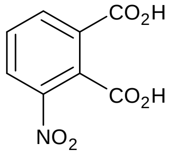
B =


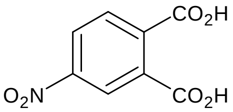
C =


D =


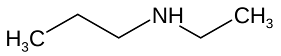
E =


F =


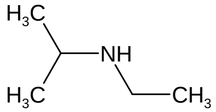
G =


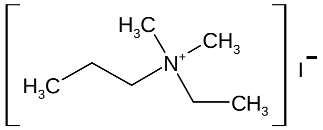
H =


7.

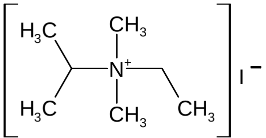
A =


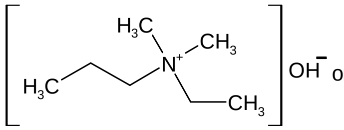
or



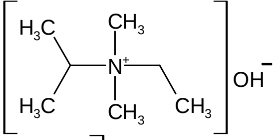
B =


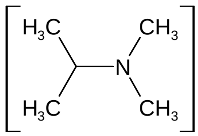
or



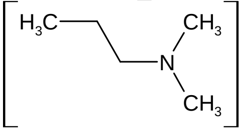
C =


or

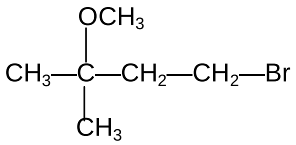


D =


or

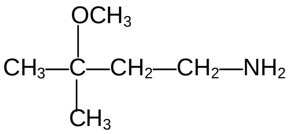


8. A =



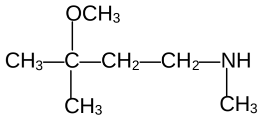
$CH_3-\overset{OCH_3}{\underset{CH_3}{C}}-CH_2-CH_2-Br$

B =



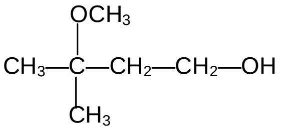
$CH_3-\overset{OCH_3}{\underset{CH_3}{C}}-CH_2-CH_2-NH_2$

C =



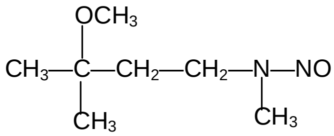
$CH_3-\overset{OCH_3}{\underset{CH_3}{C}}-CH_2-CH_2-\underset{CH_3}{NH}$

D =



$CH_3-\overset{OCH_3}{\underset{CH_3}{C}}-CH_2-CH_2-OH$

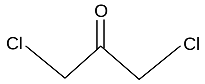
E =



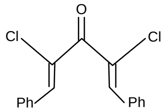
$CH_3-\overset{OCH_3}{\underset{CH_3}{C}}-CH_2-CH_2-\underset{CH_3}{N}-NO$

9.

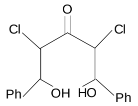
A =



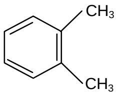
B =



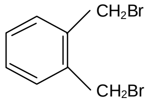
C =



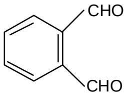
10. A =



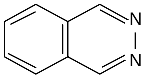
B =



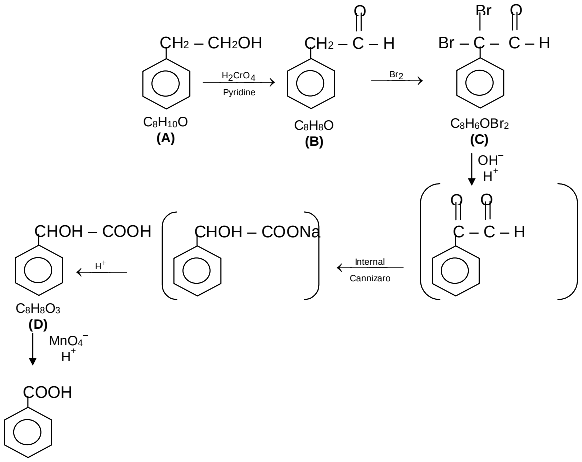
C =

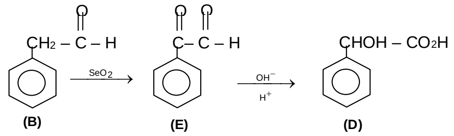


D =



11.





12. A = HO – CH_2 – C ≡ C – CH_2 – OH

B = HO – CH_2 – CH_2 – CH_2 – CH_2 – OH

C = Br – CH_2 – CH_2 – CH_2 – CH_2 – Br

D = CN – CH_2 – CH_2 – CH_2 – CH_2 – CN

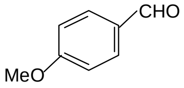
E = H_2N – CH_2 – CH_2 – CH_2 – CH_2 – CH_2 – CH_2 – NH_2

F = HO_2C – CH_2 – CH_2 – CH_2 – CH_2 – CO_2H

13. K = CH_3I/Base

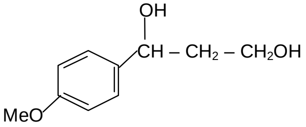
L = PCC

M =

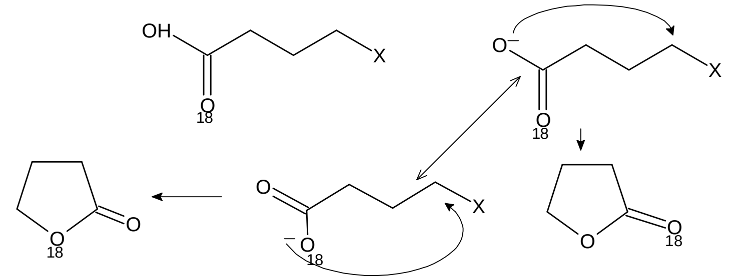


N = (i) $BrCH_2CO_2Et$/Zn (ii) H_3O^+

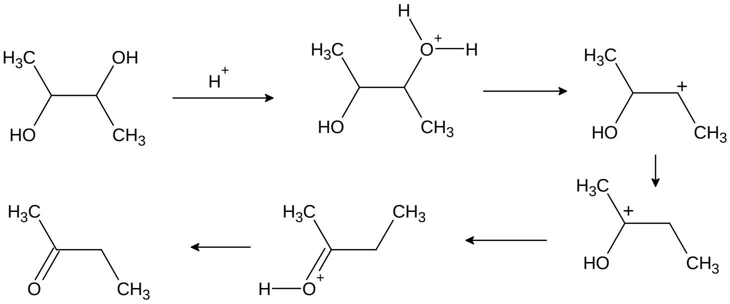
O =



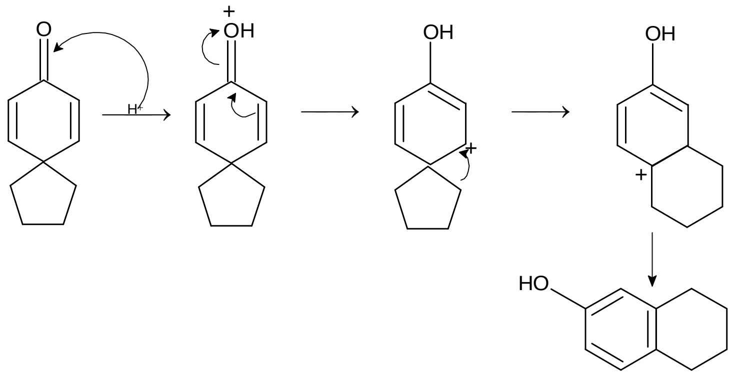
14. (a)



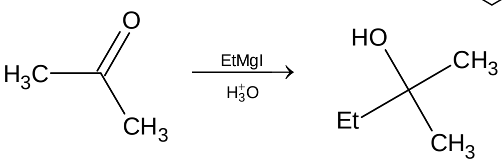
(b)



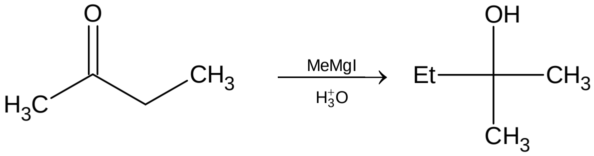
(c)



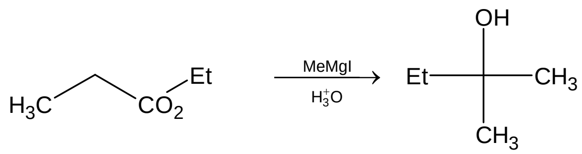
15. (a) (i)



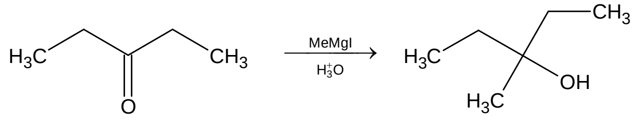
(ii)



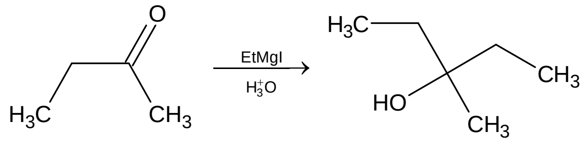
(iii)



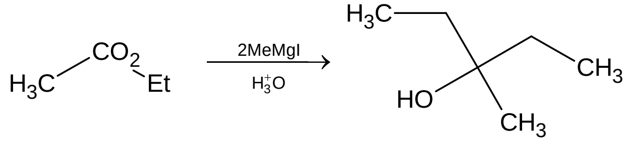
(b) (i)



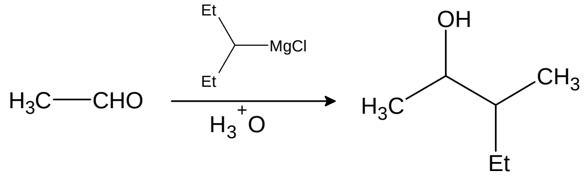
(ii)



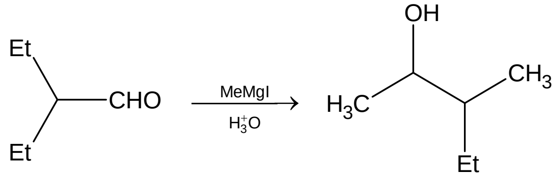
(iii)



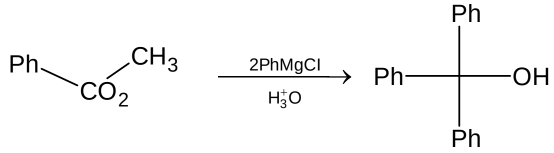
(c) (i)



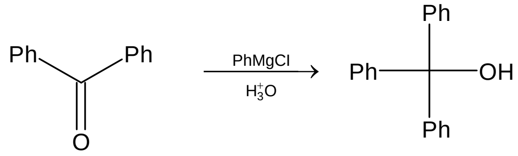
(ii)



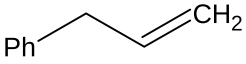
(d) (i)



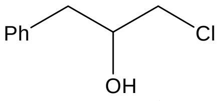
(ii)



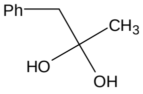
16. A =



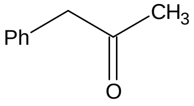
B =



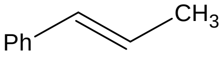
C =



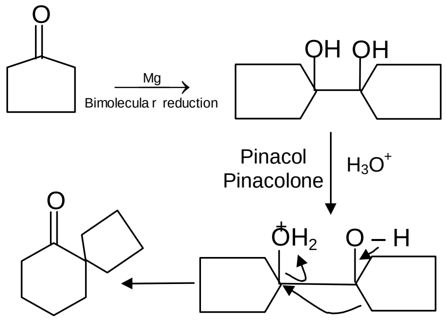
D =



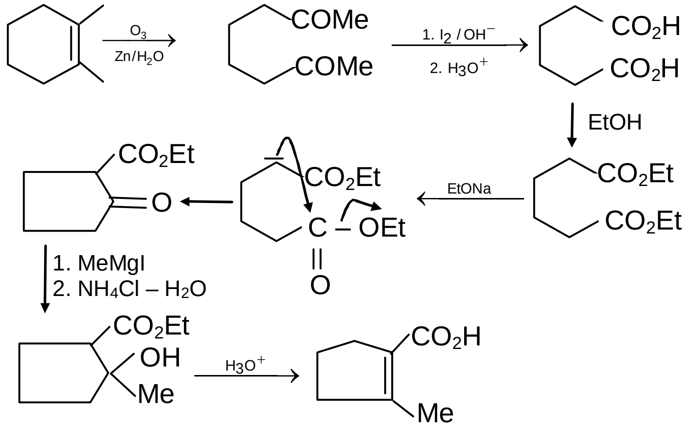
E =



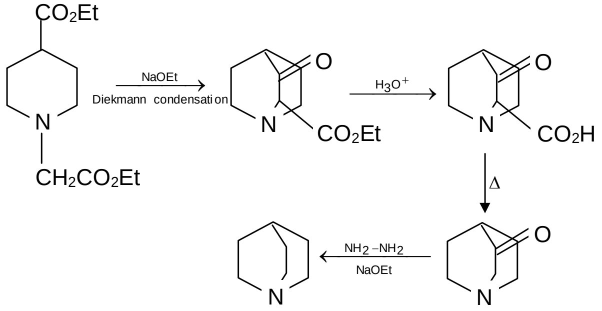
17. (a) (i)



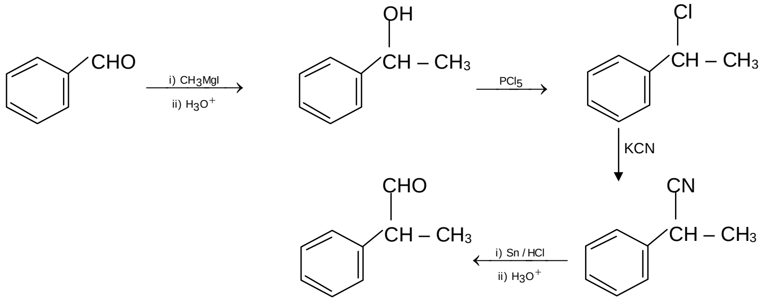
(ii)



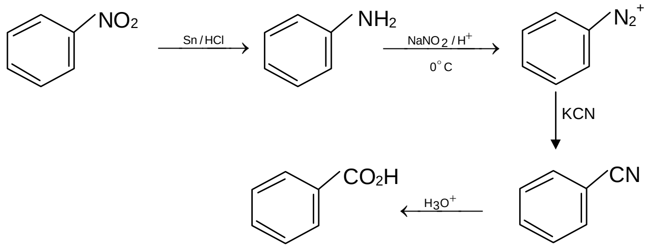
18. (i)



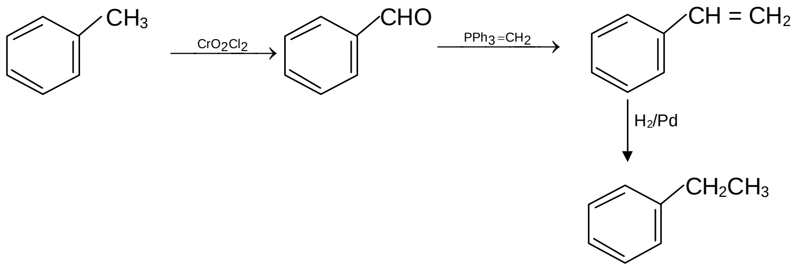
(ii)



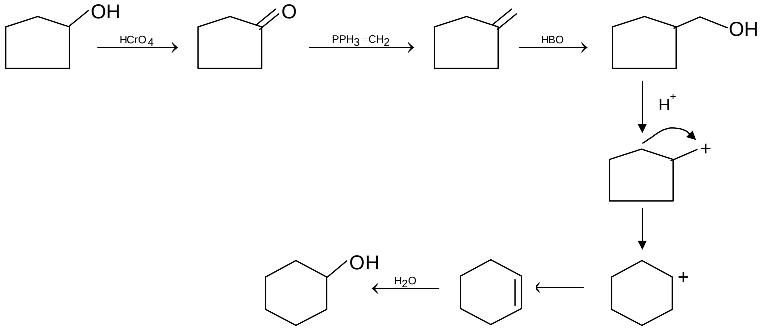
(iii)



19. (i)



(ii)



20. (i) $CH_3CO_2^-$ is a strong base and strong bases are bad leaving groups.

(ii) Cyclopenta dienyl anion has 6π electrons and they are in conjugation. Cyclopentadienyl anion is also flat. So it is aromatic. Cyclopenta diene has only 4π electrons which doesn't satisfy the Hückel's rule. So it is not aromatic.

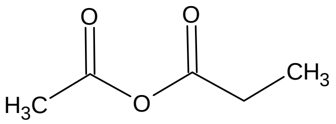
(iii) Carboxylic acids have an acidic hydrogen. The R^- generated from grignard reagent can also act as a base. Here R^- acts as a base and abstracts the acidic proton from the acid. Thus the reagent itself is decomposed and the reaction stops there.

(iv) A ketone contains a second alkyl (or) aryl group where an aldehyde contains an hydrogen atom. A second alkyl (or) aryl group of a ketone is larger than the hydrogen of an aldehyde and resists more strongly the crowding in the transition state. Also, an alkyl group releases electrons, and thus destabilises the transition state by intensifying the negative charge developing on oxygen.

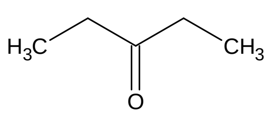
(v) In aniline the lone pair of electrons on the nitrogen are involved in delocalisation and it is not readily available, so that it can act as a base. In benzylamine, the lone pair of electrons are readily available and thus it acts as a base.

21.

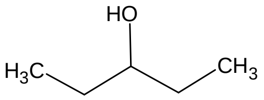
A =



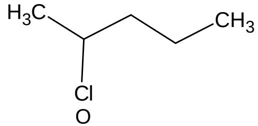
B =



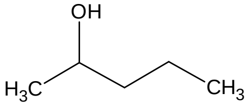
C =



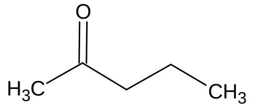
D =



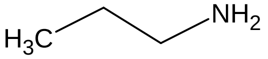
E =

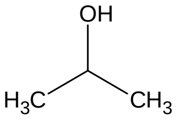


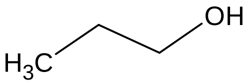
F =

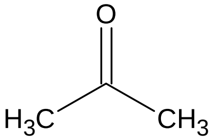


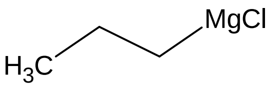
22.

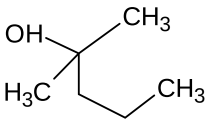
A = 

B = 

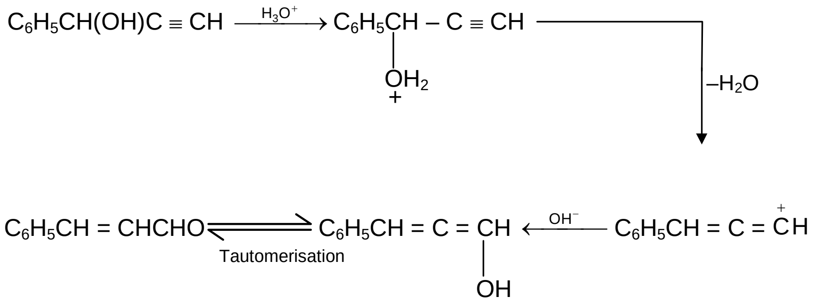
C = 

D = 

E = 

F = 

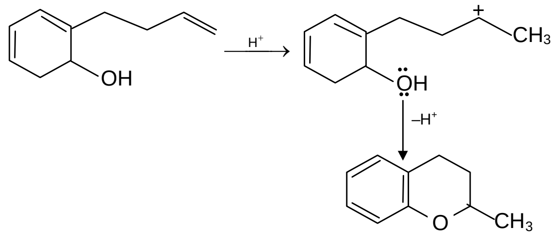
23. (i)



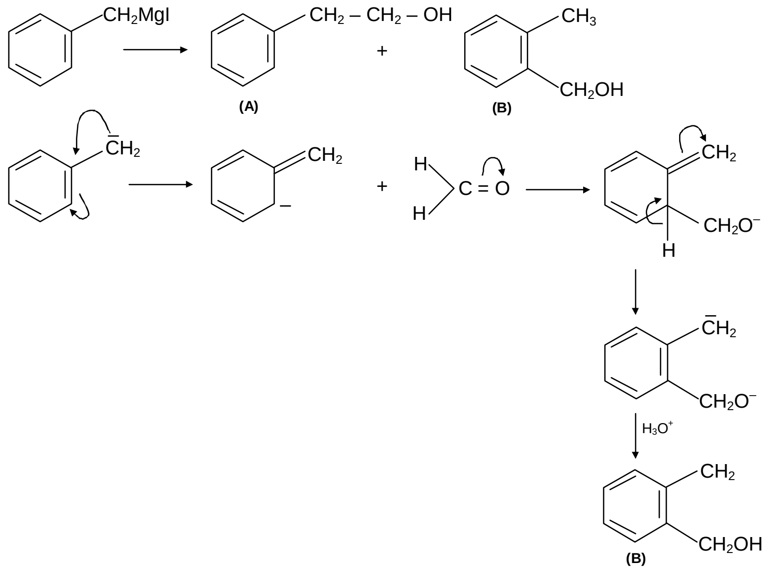
$$C_6H_5CH(OH)C\equiv CH \xrightarrow{H_3O^+} C_6H_5\underset{\underset{+}{O}H_2}{CH} - C\equiv CH \xrightarrow{-H_2O} C_6H_5CH = C = \overset{+}{C}H$$

$$C_6H_5CH = CHCHO \underset{\text{Tautomerisation}}{\rightleftharpoons} C_6H_5CH = C = \underset{OH}{CH} \xleftarrow{OH^-} C_6H_5CH = C = \overset{+}{C}H$$

(ii)

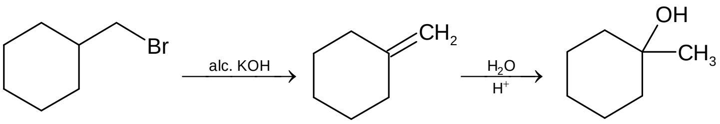


24.

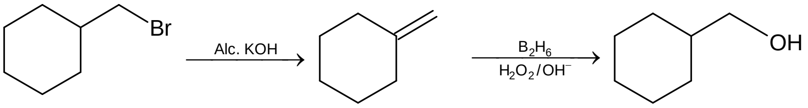


(A) is the normal product

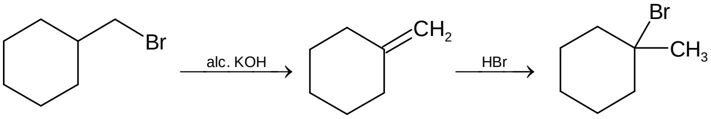
25. a)


Br
alc. KOH
CH2
H2O
H+
OH
CH3

b)

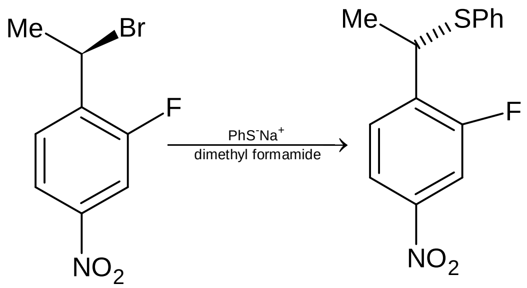

Br
Alc. KOH
B2H6
H2O2/OH−
OH

c)

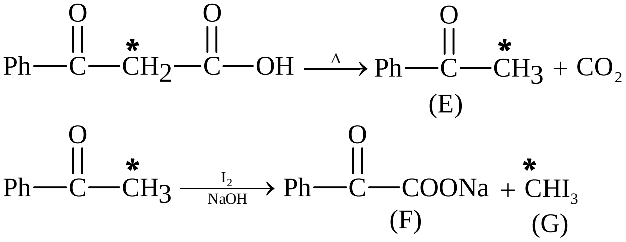

Br
alc. KOH
CH2
HBr
Br
CH3

Objective

MULTI CHOICE SINGLE CORRECT OPTION

7. 

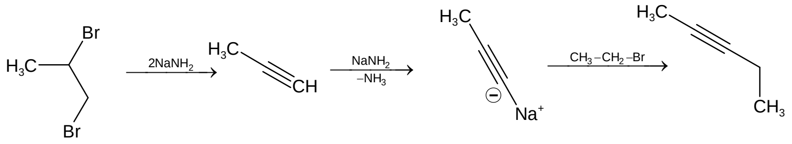
It is easier to do nucleophilic substitution on alkyl halides than on aryl halides.
Hence, **(A)** is the correct answer.

17. 

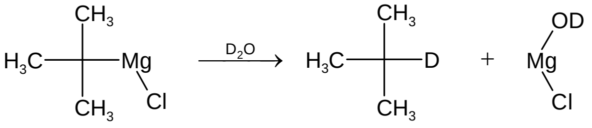
$$Ph-\overset{O}{\overset{||}{C}}-\overset{*}{C}H_2-\overset{O}{\overset{||}{C}}-OH \xrightarrow{\Delta} Ph-\underset{(E)}{\overset{O}{\overset{||}{C}}-\overset{*}{C}H_3} + CO_2$$

$$Ph-\overset{O}{\overset{||}{C}}-\overset{*}{C}H_3 \xrightarrow[NaOH]{I_2} Ph-\underset{(F)}{\overset{O}{\overset{||}{C}}-COONa} + \underset{(G)}{\overset{*}{C}HI_3}$$

Hence, **(C)** is the correct answer.

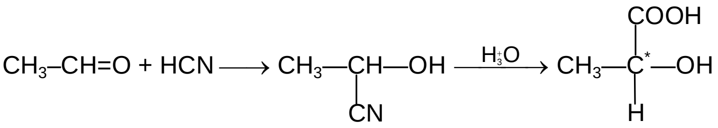
20. 

Thus X is three.
Hence, **(C)** is the correct answer.

21. 

Hence, **(C)** is the correct answer.

22. In all cases optical activity will be zero.
Hence, **(D)** is the correct answer.

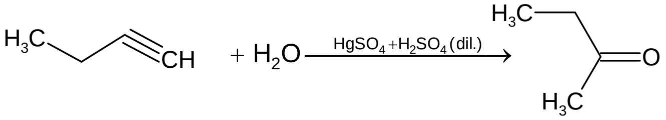
23. 

$$CH_3-CH=O + HCN \longrightarrow CH_3-\underset{CN}{\underset{|}{C}}H-OH \xrightarrow{H_3O} CH_3-\overset{COOH}{\overset{|}{\underset{H}{\underset{|}{C^*}}}}-OH$$

The asterisked carbon is chiral
Hence, **(A)** is the correct answer.

24. Allyl carbonium ion undergoes resonance stabilization.
Hence, **(A)** is the correct answer.

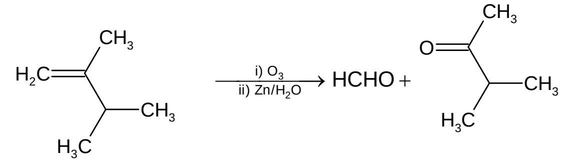
25. Oxymercuration of terminal alkynes always gives methyl ketones as the major products.



Hence, **(A)** is the correct answer.

26. The Wolf Kishner reduction takes place in strongly basic condition and can be used for the compounds which are sensitive to acid.
Hence, **(B)** is the correct answer.

27.

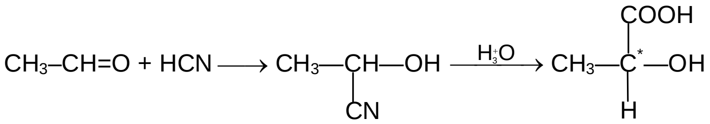


2,3-dimethylbut-1-ene

Hence, **(B)** is the correct answer.

28. The order of nucleophilicity depends upon the nature of alkyl group 'R' on which a nucleophile to attack as well as on nature of solvent. However if these are same, then weaker is acid stronger is base i.e. stronger is nucleophilicity. The acidic character is
$\because$ $HBr > HCN > H_2O > C_2H_5OH$
$\therefore Br^- < CN^- < OH^- < C_2H_5O^-$
Hence, **(D)** is the correct answer.

29.

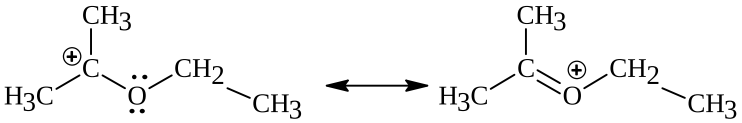


$$CH_3\text{–}CH{=}O + HCN \longrightarrow CH_3\text{—}\underset{CN}{\underset{|}{C}}H\text{—}OH \xrightarrow{H_3O} CH_3\text{—}\overset{COOH}{\overset{|}{\underset{H}{\underset{|}{C^*}}}}\text{—}OH$$

The asterisked carbon is chiral

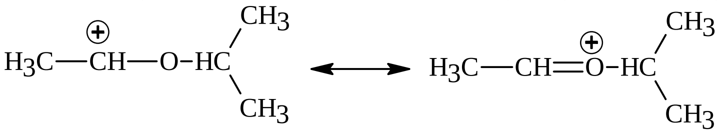
30. $NaBH_4$ clearly reduces carbonyl group, protecting the double bond.
Hence, **(B)** is the correct answer.

31. (I)



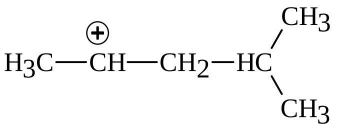
Stabilizes by resonance and have six α - hydrogen atoms (hyperconjugation)

(III)

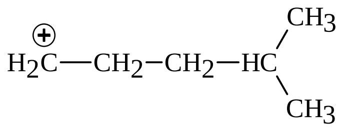


Stabilizes by resonance and have only three α - hydrogen atoms.

(II)



have five α - hydrogen atoms.

(IV) 

$\overset{\oplus}{H_2C}-CH_2-CH_2-HC\begin{smallmatrix}CH_3\\CH_3\end{smallmatrix}$

have only two α - hydrogen atoms.

$\therefore$ I > III > II > IV

Hence, **(D)** is the correct answer.

32. Phenol gives violet colour with neutral $FeCl_3$

Hence, **(C)** is the correct answer.

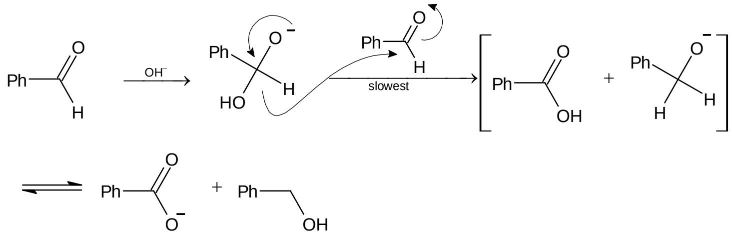
33. Nitro is strongly electron withdrawing group, at ortho position intra-molecular hydrogen bond reduces the acidic strength.

Hence, **(B)** is the correct answer.

34. As already mentioned before, that in polar medium sec. Alkyl halide undergo S_N1 mechanism.

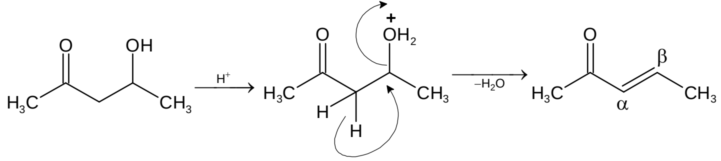
Hence, **(B)** is the correct answer.

35. Transfer of hydride ion to the carbonyl group is the slowest or the rate determining step.

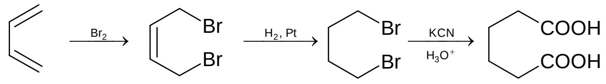


Hence, **(B)** is the correct answer.

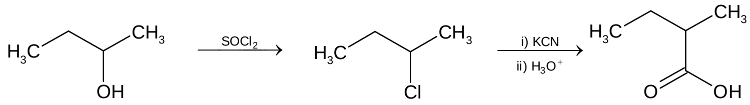
36. Aldols, i.e. β–hydroxyaldehydes or β–hydroxyketones readily undergo dehydration to form α, β unsaturated aldehydes or ketones.



Hence, **(A)** is the correct answer.

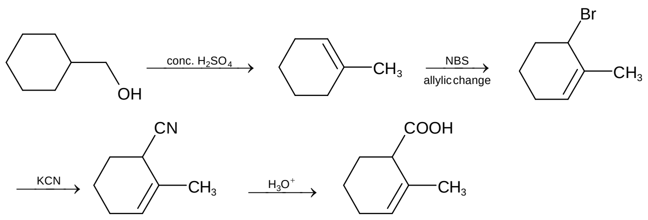
37. 

Hence, **(B)** is the correct answer.

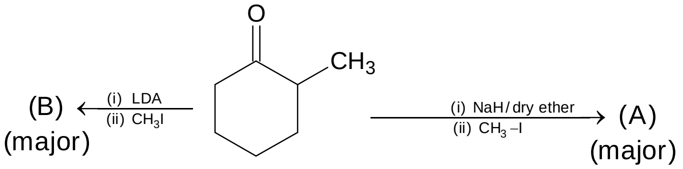
38. 

2-methylbutanoic acid

39.

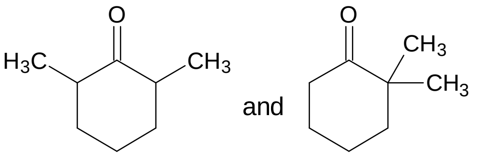


40.

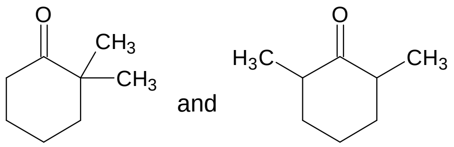


Hence, A and B are

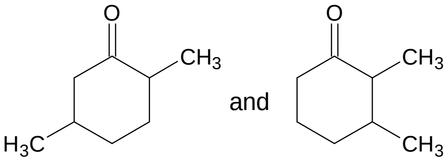
(A)



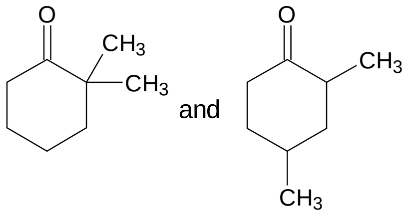
(B)



(C)



(D)

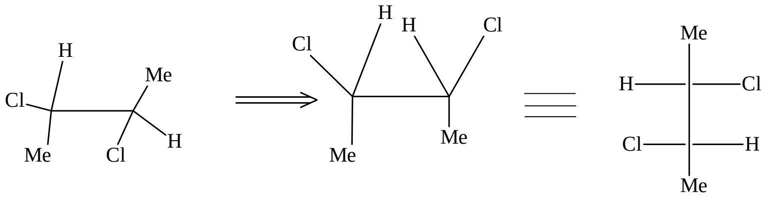


REASONING TYPE

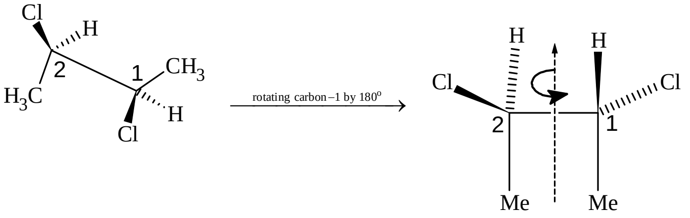
2. In bromobenzene, it is the mesomeric effect which directs the incoming electrophile. Hence, **(C)** is the correct answer.

MULTI CHOICE MULTI CORRECT OPTION

15.



The molecule is optically active.



The molecule possesses an axis of symmetry (C_2) perpendicular to the C – C bond. Hence, **(A)** and **(D)** are correct answers.

Comprehension – I

1. $CH_3-CH_2-C\equiv C-CH_2-CHO \xrightarrow[\text{2. PBr}_3]{\text{1. NaBH}_4} CH_3-CH_2-C\equiv C-CH_2-CH_2Br$

Hence, **(D)** is the correct answer.

2. $CH_3-CH_2-C\equiv C-CH_2-CH_2Br \xrightarrow[\text{3. } H_3O^+]{\text{1. Mg/Ether} \;\; \text{2. } CO_2} J \xrightarrow{K} CH_3-CH_2-C\equiv C-CH_2-COCl$

$J = CH_3-CH_2-C\equiv C-CH_2-COOH$

$K = SOCl_2$

Hence, **(A)** is the correct answer.

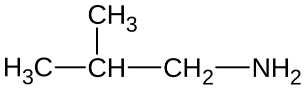
SINGLE INTEGER TYPE QUESTIONS

1. The reaction involves rearrangement hence E_1.

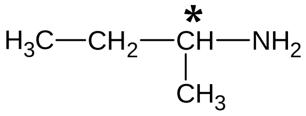
2. $CH_3CH_2Br + CH_3Br \xrightarrow[\text{Dry ether}]{\text{Na}} CH_3CH_2CH_3 + CH_3CH_2CH_2CH_3 + CH_3CH_3 + CH_2 = CH_2 + CH_4$

4. C_7H_{16}

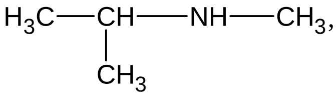
5. $CH_3-CH_2-CH_2-CH_2-NH_2$,



$H_3C-\underset{}{\overset{CH_3}{\overset{|}{C}H}}-CH_2-NH_2$,

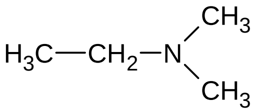


$H_3C-CH_2-\overset{*}{\underset{CH_3}{\underset{|}{C}H}}-NH_2$



$H_3C-\underset{CH_3}{\underset{|}{C}H}-NH-CH_3$, $CH_3CH_2CH_2NH-CH_3$

$CH_3-CH_2-NH-CH_2-CH_3$,



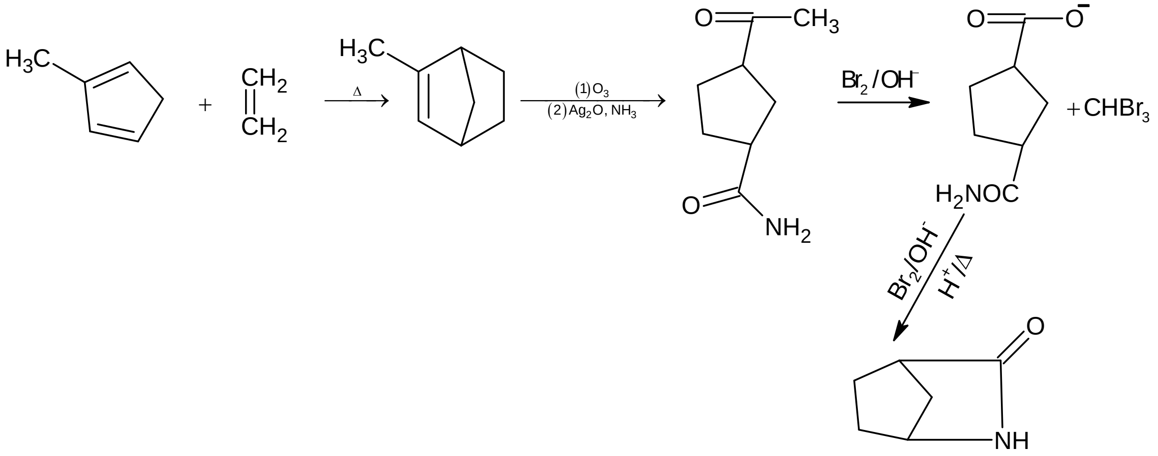
$H_3C-CH_2-N(CH_3)_2$

6. M gives positive Tollen's test M is aldehyde. Thus A = $CH_3-CH_2-NH_2$

$CH_3-CH_2-NH_2 \xrightarrow{KMnO_4} CH_3-CH=NH \xrightarrow{H^+} CH_3-CHO$

Amongst aldehyde only acetaldehyde give iodoform test so, maximum number of carbon atoms which can be possessed by A is 2.

7.



Three equivalents of Br_2 for broform and 1 equivalent of Br_2 for Hoffmann's degradation, so total mole of Br_2 is 4.

8.