Exercise-1

✍ **Marked questions are recommended for Revision.**

PART - I : SUBJECTIVE QUESTIONS

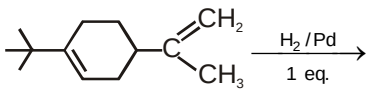
Section (A) : Reduction-1

A-1. Write the hydrogenation product of following species with H_2/Pd.

(a) 1,2-Butadiene $\xrightarrow{H_2/Pd}$

(b) *trans*-2-butene $\xrightarrow{H_2/Pd}$

(c) Benzaldehyde $\xrightarrow{H_2/Pd}$

(d)  $\xrightarrow[1\text{ eq.}]{H_2/Pd}$

(Limonene)

A-2. ✍ Write the hydrogenation product of following species

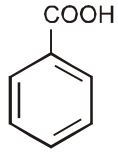
(a) $CH_2=CH-CH_2-CH_2-C\equiv C-CH_3 \xrightarrow[Pd]{H_2(excess)}$

(b) $CH_2=CH-CH_2-CH_2-C\equiv C-CH_3 \xrightarrow{H_2/Pd-BaSO_4}$

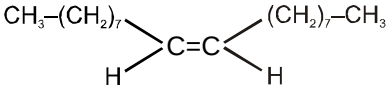
(c) Benzoylchloride $\xrightarrow{H_2/Pd/BaSO_4}$

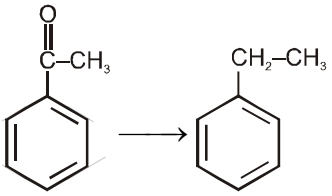
A-3. ✍ Complete the following reactions :

(i) $CH_3-CH_2-C\equiv C-CH_2-(CH_2)_6-CH_2OH \xrightarrow[(ii)\ H_2O]{(i)\ Na/NH_3\ (l)}$

(ii)  $\xrightarrow[(ii)\ H_2O]{(i)\ Na/NH_3\ (l)}$

A-4. Give reaction conditions (reagents and/or catalyst) for effecting the following conversions :

(i) $CH_3-(CH_2)_7-C\equiv C-(CH_2)_7-CH_3 \longrightarrow$ 

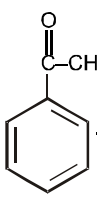
(ii) 

Section (B) : Reduction-2

B-1. What is the product of each reaction

(i) PhCHO → $LiAlH_4$ followed by H_2O

PhCHO → $NaBH_4$ followed by H_2O

(ii) 

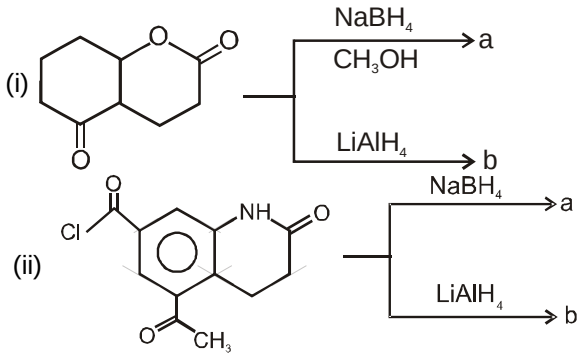
→ $LiAlD_4$ followed by H_2O

→ $LiAlH_4$ followed by D_2O

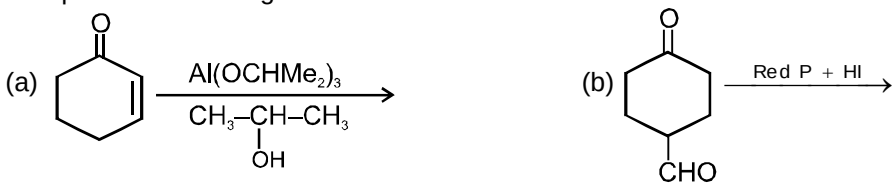
→ $NaBD_4$ followed by EtOH

→ D_2/Pt, room temperature

B-2. Identify a and b, in the following reactions :



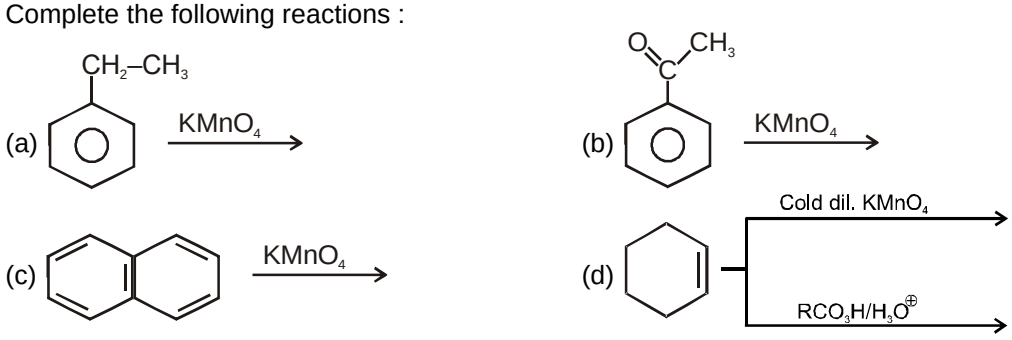
B-3. Complete the following reactions :



Section (C) : Oxidation-1

C-1. Write the structural formulas for the products formed when 3-heptyne reacts with $KMnO_4$ under ?
(i) neutral condition at room temp.
(ii) alkaline or acidic condition at higher temp.

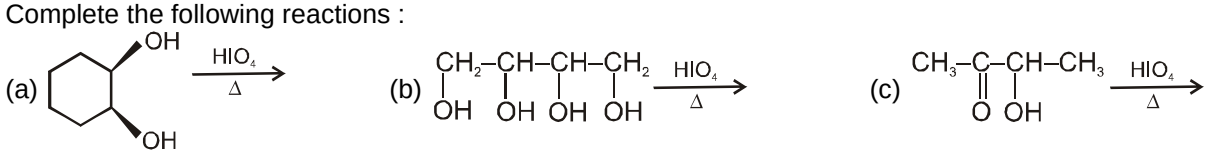
C-2. Complete the following reactions :



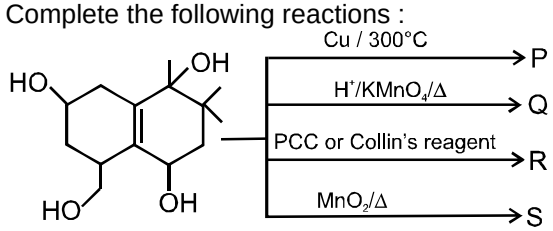
C-3. When t-Butanol and n-Butanol are separately treated with a few drops of dilute $KMnO_4$ in one case only, the purple colour disappears and a brown precipitate is formed. Which of the two alcohols gives the above reaction and which is the brown precipitate. **[IIT-JEE, 1994]**

Section (D) : Oxidation-2

D-1. Complete the following reactions :



D-2. Complete the following reactions :

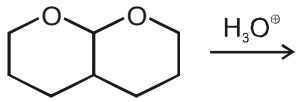


D-3. Complete the following reactions :

(a) $Ph–CH_2–CH_2–OH \xrightarrow{Cu/\Delta}$; (b) $Ph–\underset{\underset{OH}{|}}{CH}–CH_3 \xrightarrow{Cu/\Delta}$; (c) $Ph–\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}–OH \xrightarrow{Cu/\Delta}$

Section (E) : Hydrolysis

E-1. Write the products of following reaction



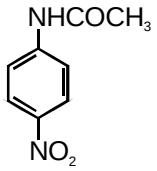
E-2. Write the products of following reaction

(a) $CH_3–C\equiv N \xrightarrow{H_3O^+}$ (b) $CH_3NC \xrightarrow{H_3O^+}$

E-3. Reactant $\xrightarrow{H_3O^+} CH_3COOH + HCl$

E-4. $CH_3CONH_2 \xrightarrow{H_3O^+}$ Product is :

E-5. The hydrolysis of acid anhydride produces .....

E-6.  $\xrightarrow{H_3O^+}$ Product is :

E-7. Reactant (C_3H_6O) $\xrightarrow{H_3O^+} CH_3CHO + CH_3OH$

PART - II : ONLY ONE OPTION CORRECT TYPE

Section (A) : Reduction-1

A-1. The relative rates of hydrogenation is in the order of :

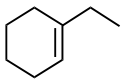
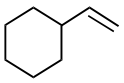
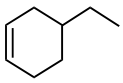
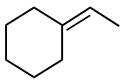
(A) $CH_2 = CH_2 > RCH = CH_2 > RCH = CHR > R_2C = CHR$

(B) $R_2C = CHR > RCH = CHR > RCH = CH_2 > CH_2 = CH_2$

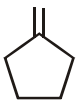
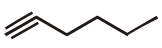
(C) $RCH = CHR > R_2C = CHR > RCH = CH_2 > CH_2 = CH_2$

(D) $R_2C = CHR > CH_2 = CH_2 > RCH = CHR > RCH = CH_2$

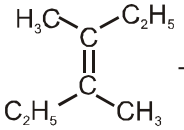
A-2. In which case the reaction is most exothermic with H_2 / Ni.

(A)  (B)  (C)  (D) 

A-3. An organic compound with molecular formula C_6H_{10} is not reduced by H_2 / Pd / $BaSO_4$. From the given options, the compounds may be :

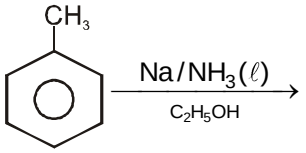
 I  II  III  IV

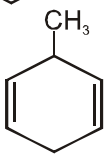
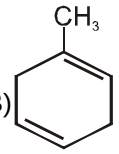
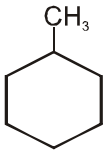
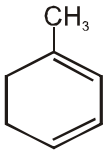
(A) I, II (B) I, III (C) II, IV (D) II, II

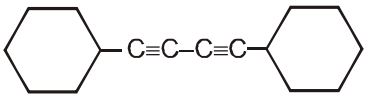
A-4.  $\xrightarrow{H_2/Pt}$ x, x is :

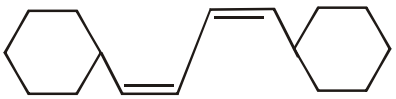
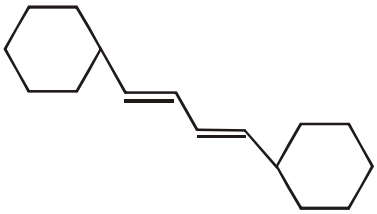
(A) Only (R,R) product (B) Only (S,S) product

(C) Meso compound (D) Racemic mixture

A-5.  P, the product can be :

(A)  (B)  (C)  (D) 

A-6.  product

(A)  (B) 

(C) Both (A) and (B) (D) None of these

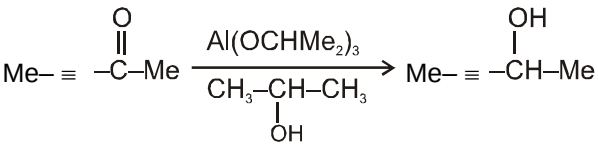
A-7. Which of the following reagents converts both acetaldehyde and acetone to alkanes ?
(A) Ni/H_2 (B) $LiAlH_4$ (C) $I_2/NaOH$ (D) Zn–Hg/conc.HCl

A-8. Stephen reduction ($SnCl_2$ / HCl) converts cyanides to
(A) Aldehydes (B) Ketones (C) Amines (D) Acids

Section (B) : Reduction-2

B-1. When benzoic acid is treated with $LiAlH_4$, it forms
(A) Benzaldehyde (B) Benzyl alcohol (C) Benzene (D) Toluene

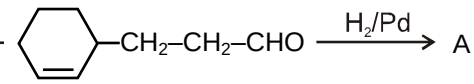
B-2. Name the reaction



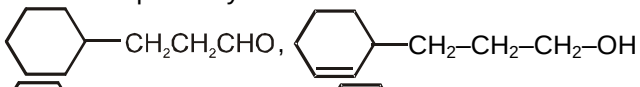
(A) Meervein-Ponndorf-verley reduction (B) Wolff-kishner reduction
(C) Bouveault-Blanc reduction (D) Stephen's reduction

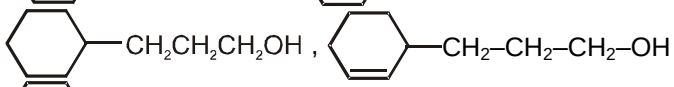
B-3. $R–C\equiv N \xrightarrow[-40^oC]{DIBAL-H,\ H_2O}$ Product

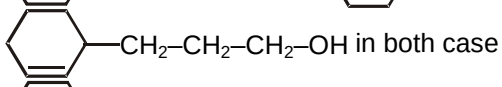
The product formed is :
(A) $R–CO–NH_2$ (B) $R–CH_2–NH_2$ (C) R–CHO (D) $R–CH_2–NO_2$

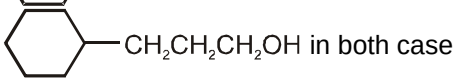
B-4. B  A

A and B are respectively :

(A) 

(B) 

(C)  in both case

(D)  in both case

B-5. In the following reaction $C_2H_5OC_2H_5 + 4H \xrightarrow{\text{Red P + HI}} 2X + H_2O$, X is

(A) Ethane (B) Ethylene (C) Butane (D) Propane

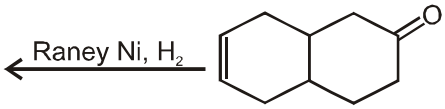
B-6. $R–CO–O–R' \xrightarrow[\text{aluminium hydride}]{\text{diisobutyl}} Y + R' –OH$

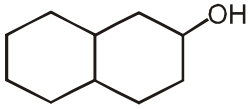
– 78°C

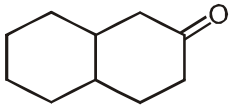
The product Y is

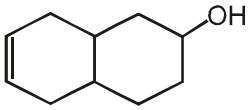
(A) $R–CH_2–OH$ (B) R–CHO (C) R–COOH (D) $R–CH_3$

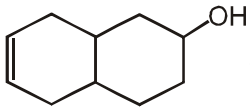
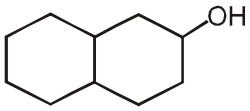
B-7. What are A and B in the following ?

Q  P

(A)  in all cases

(B)  in all cases

(C)  in all cases

(D) P =  and Q= 

Section (C) : Oxidation-1

C-1. Baeyer's reagent decolourises which of the following :

(A) Alkane (B) Alkene only

(C) Alkene and alkyne both (D) Benzene

C-2. Ethanol on reaction with alkaline $KMnO_4$ gives:

(A) Ethanal (B) Glyoxal (C) Acetic acid (D) Acrolein.

C-3. 1-Butyne $\xrightarrow{KMnO_4/\Delta}$ X + Y

Identify X and Y ?

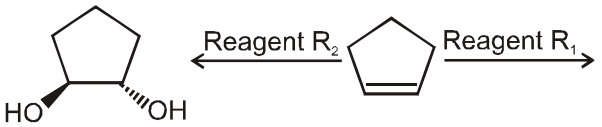
(A) $CH_3CH_2CH_2COOH + O_2$ (B) CH_3CH_2COOH

(C) $CH_3CH_2COOH + CO_2 + H_2O$ (D) $CH_3CH_2COCH_3 + HCOOH$

C-4. An alkyne C_7H_{12} when reacted with alkaline $KMnO_4$ followed by acidification by HCl, yielded a mixture of $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-COOH$ & CH_3CH_2COOH. The alkyne is -

(A) 3-hexyne (B) 2-methyl-2-hexyne

(C) 2-methyl-3-hexyne (D) 3-methyl-2-hexyne

C-5.  ; R_1 and R_2 are

(A) Cold alkaline $KMnO_4$, OsO_4/H_2O_2 (B) Cold alkaline $KMnO_4$, HCO_3H & H_3O^+

(C) Cold alkaline $KMnO_4$, $C_6H_5CO_3H$ (D) $C_6H_5CO_3H$, HCO_3H

Section (D) : Oxidation-2

D-1. Glucose as well as fructose are oxidized by periodic acid. The number of moles of HCOOH formed from each mole of glucose and fructose are

(A) 5 and 5 (B) 5 and 4 (C) 5 and 3 (D) 4 and 3

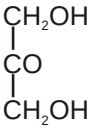
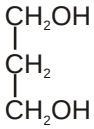
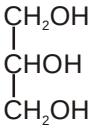
D-2. Secondary alcohols on heating with copper at 300ºC give

(A) Alkenes (B) Aldehydes (C) Ketones (D) tert-alcohols

D-3. The reagent, with which both acetaldehyde and acetone react easily is :

(A) Tollens reagent (B) Schiffs reagent (C) H_2 / Ni (D) Fehling's solution

D-4. Which of the following compounds is resistant to periodic acid oxidation ?

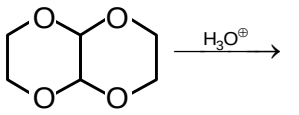
(A)  (B)  (C)  (D) 

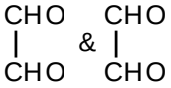
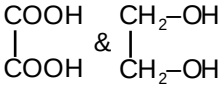
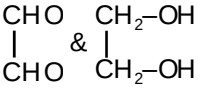
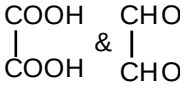
Section (E) : Hydrolysis

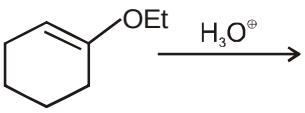
E-1. What product is obtained when Benzenecarbonitrile is hydrolysed.

(A) Benzoylchloride (B) Benzenecarboxamide
(C) Benzaldehyde (D) Benzoic acid

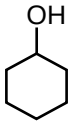
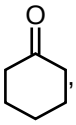
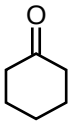
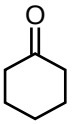
E-2. The acid catalysed hydrolysis products in the following reaction are -



(A)  (B)  (C)  (D) 

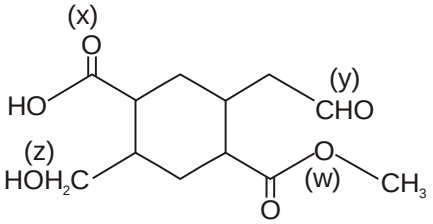
E-3. 

Product obtained in above reaction are :

(A) EtOH,  (B)  , CH_3–CHO (C) CH_3COOH,  (D) EtOH, 

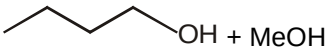
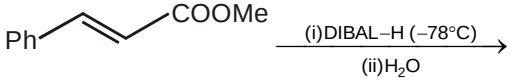
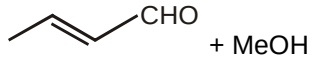
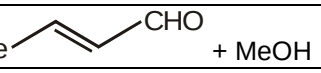
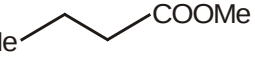
PART - III : MATCH THE COLUMN

1. Observe the following compound and match the reagents of List-I and List-II



	Reagents-I		**Functional group oxidised / reduced-II**
(A)	CrO_3 / Pyridine / CH_2Cl_2	(p)	W
(B)	$NaBH_4$	(q)	Z
(C)	Na / C_2H_5OH	(r)	X
(D)	CrO_3 / H^+	(s)	Y

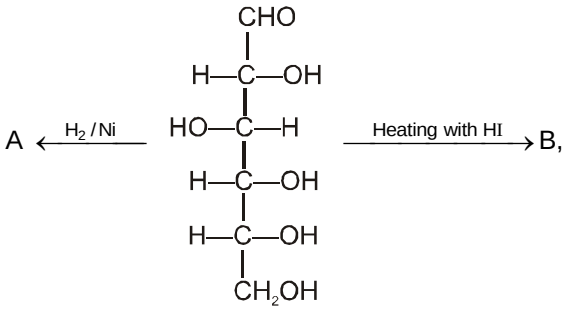
2. Match the following column:

	Column-I		**Column-II**
	Reactant and reagents		**Products**
(A)		(p)	
(B)		(q)	
(C)		(r)	
(D)		(s)	
		(t)	No reaction

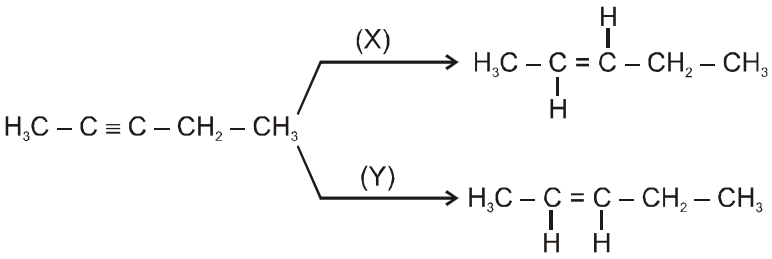
Exercise-2

Marked questions are recommended for Revision.

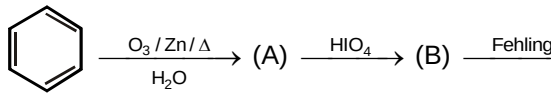
PART - I : ONLY ONE OPTION CORRECT TYPE

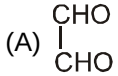
1. 

A and B can be :
(A) Both are n-Hexane
(B) Both are Hexan-1,2,3,4,5,6-hexaol
(C) A is n-Hexane B is Hexan-1,2,3,4,5,6-hexaol
(D) A is Hexan-1,2,3,4,5,6-hexaol and B is n-Hexane

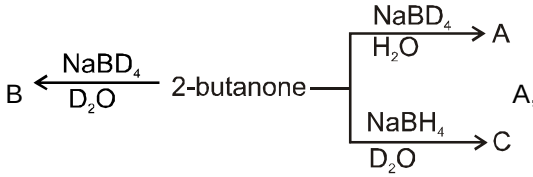
2. 

In the above reaction the using reagents X and Y are ;
(A) Na/ liq. NH_3 for X
(B) H_2, Pd/ $BaSO_4$ for Y
(C) BH_3-THF + CH_3COOH for Y
(D) All of these are correct.

3.  (C) Red colour ; (B) is :

(A)  (B) CH_3–CHO (C) CH_3–COOH (D) H–COOH

4. Consider reduction of 2-butanone.



A, B and C are respectively.

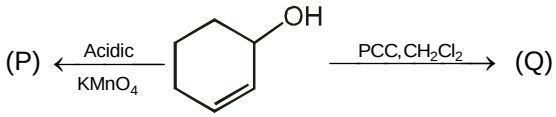
(A) $CH_3\underset{\underset{OH}{|}}{C}HCH_2CH_3$ in all cases

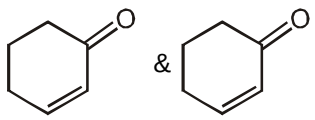
(B) $CH_3\underset{\underset{D}{|}}{\overset{\overset{OH}{|}}{C}}CH_2CH_3$, $CH_3\underset{\underset{D}{|}}{\overset{\overset{OD}{|}}{C}}CH_2CH_3$, $CH_3\underset{\underset{H}{|}}{\overset{\overset{OD}{|}}{C}}CH_2CH_3$

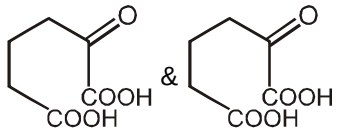
(C) $CH_3\underset{\underset{D}{|}}{\overset{\overset{OH}{|}}{C}}CH_2CH_3$ in all case

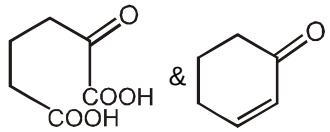
(D) $CH_3\underset{\underset{D}{|}}{\overset{\overset{OH}{|}}{C}}CH_2CH_3$, $CH_3\underset{\underset{H}{|}}{\overset{\overset{OH}{|}}{C}}CH_2CH_3$, $CH_3\underset{\underset{H}{|}}{\overset{\overset{OD}{|}}{C}}CH_2CH_3$

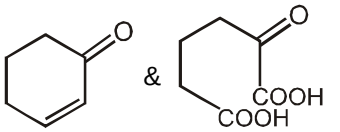
5. Identify (P) and (Q) respectively in the given reaction :



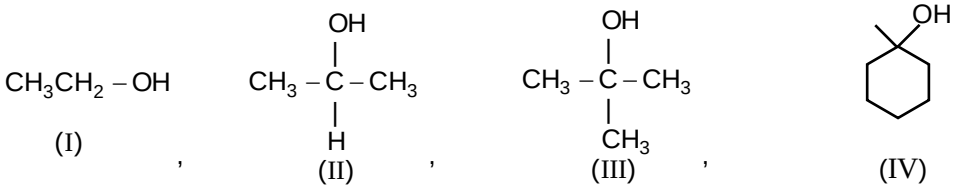
(A) 

(B) 

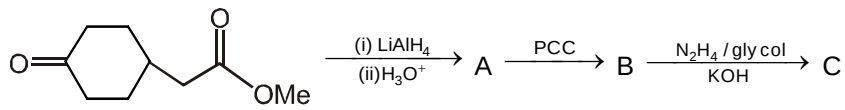
(C) 

(D) 

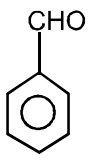
6. Which of the following sets of compounds cannot turn clear orange solution of CrO_3 / aq. H_2SO_4 to greenish opaque solution

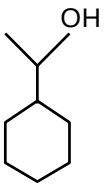


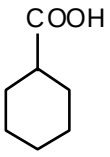
(A) I, IV (B) II, III (C) I, II (D) III, IV

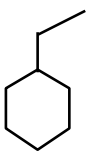
7. 

Product C is :

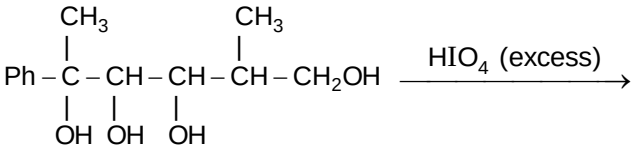
(A) 

(B) 

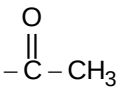
(C) 

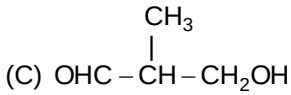
(D) 

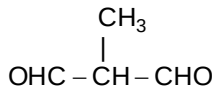
8. The product which is not formed in the following reaction :



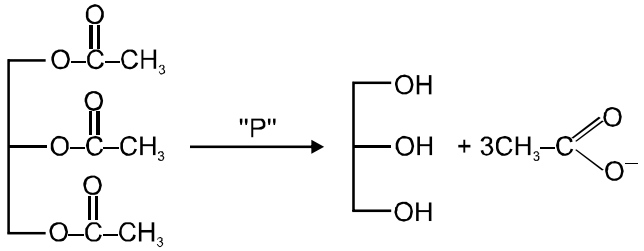
(A) HCOOH

(B) 

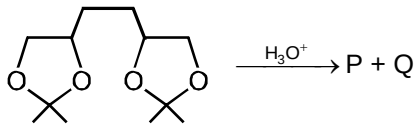
(C) 

(D) 

9. Reagent "P" in the given reaction is :



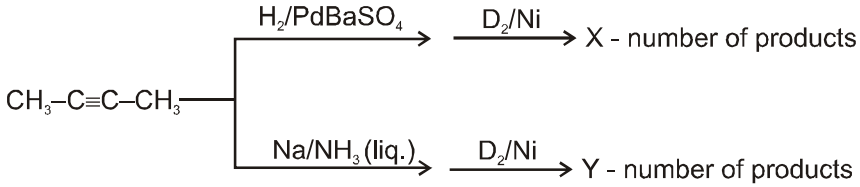
(A) $LiAlH_4$ (B) $NaBH_4$ (C) DIBAl-H (D) OH^-

10. 

P and Q are respectively.

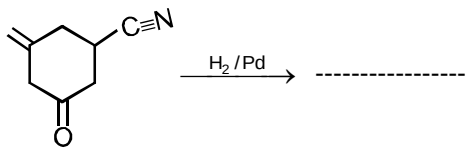
(A) Acetone and Hexane-1,2,5,6-tetraol.
(B) Acetaldehyde and Acetone.
(C) Acetaldehyde and Hexane-1,2,5,6-tetraol.
(D) Acetone and Formaldehyde.

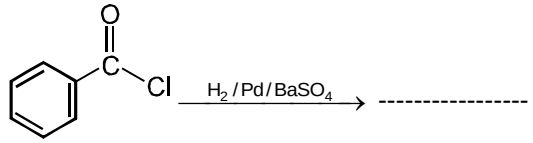
PART - II : SINGLE AND DOUBLE VALUE INTEGER TYPE

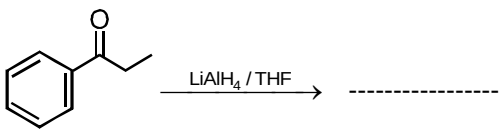
1. 

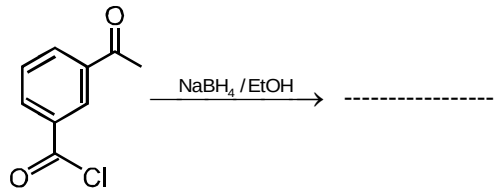
Find the value of x + y.

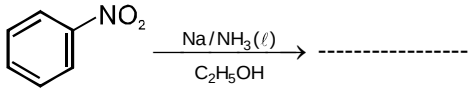
2. Number of reactions which give alcohol as product.

(a) 

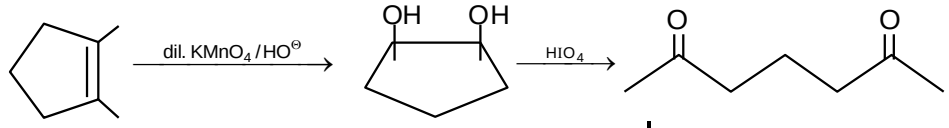
(b) 

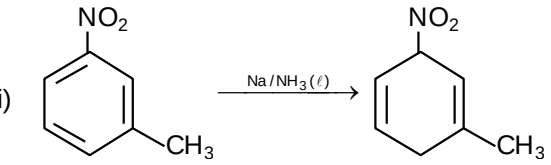
(c) 

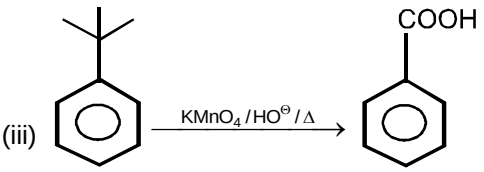
(d) 

(e) 

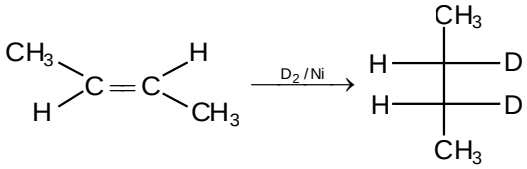
3. How many reactions are correct ?

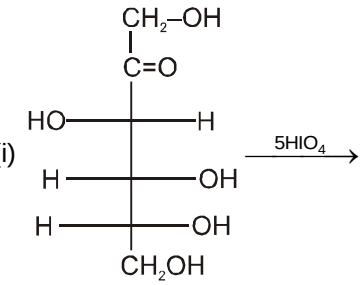
(i) 

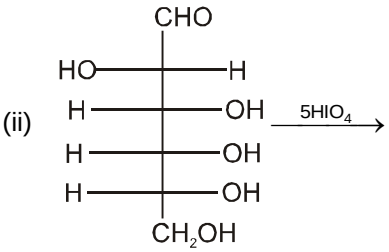
(ii) 

(iii) 

(iv) 

(v) 

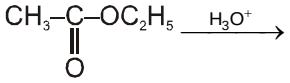
4. (i) 

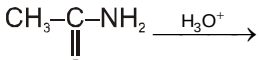
(ii) 

Sum of moles of formaldehyde obtained in the reaction (i) and reaction (ii) ?

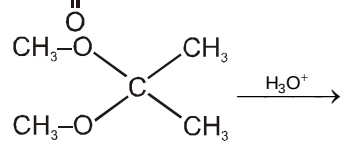
5. How many of following reactions are hydrolysis reactions ?

(1) $CH_3–COOH + C_2H_5OH \xrightarrow{H^+}$

(2) 

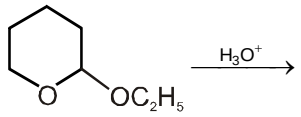
(3) 

(4) $CH_3–C\equiv N \xrightarrow{H_3O^+}$

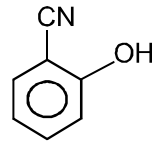
(5) 

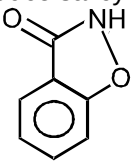
(6) $CH_3–CH=NH \xrightarrow{H_3O^+}$

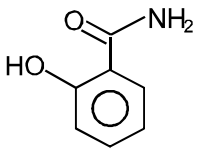
(7) $CH_2=CH–O–C_2H_5 \xrightarrow{H_3O^+}$

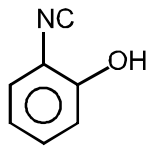
(8) 

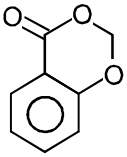
6. How many of the following may produce salicylic acid on hydrolysis under appropriate conditions ?

(i) 

(ii) 

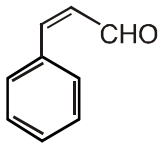
(iii) 

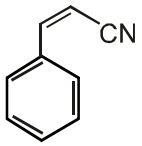
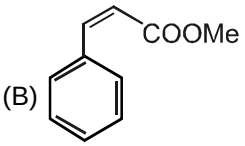
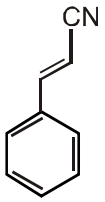
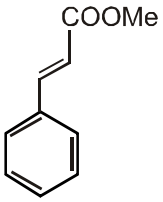
(iv) 

(v) 

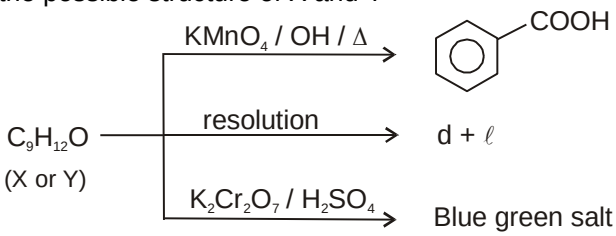
PART - III : ONE OR MORE THAN ONE OPTIONS CORRECT TYPE

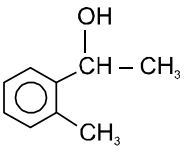
1. Which of the following catalysts is/are used for partial reduction of alkyne ?
(A) Na/NH_3(□)
(B) Ni_2B or P-2catalyst
(C) Lindlar catalyst
(D) Rossenmund catalyst

2. X $\xrightarrow[2.\ H_2O]{1.\ DiBAL-H}$  X is

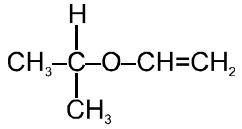
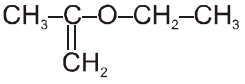
(A) 
(B) 
(C) 
(D) 

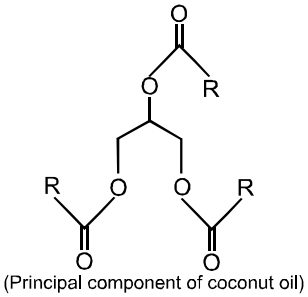
3. Identify the possible structure of X and Y



	X	Y
(A)	Ph – CH(OH) – CH_2 – CH_3	Ph – CH_2 – CH(OH) – CH_3
(B)	Ph – CH(CH_3) – CH_2 – OH	Ph – C(CH_3)$_2$ – OH
(C)		Ph – CH_2 – CH(OH) – CH_3
(D)	Ph – C(CH_3)(H) – CH_2 – OH	Ph – CH(OH) – CH_2 – CH_3

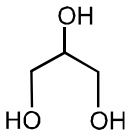
4. $C_5H_{10}O \xrightarrow{H_3O^{\oplus}}$ B + C; (B) and (C) both give +ve iodoform test. Compound (A) is :
(A)

(A) CH_3–CH=CH–O–CH_2–CH_3
(B) 
(C) 
(D) None of these

5. 

(Principal component of coconut oil)

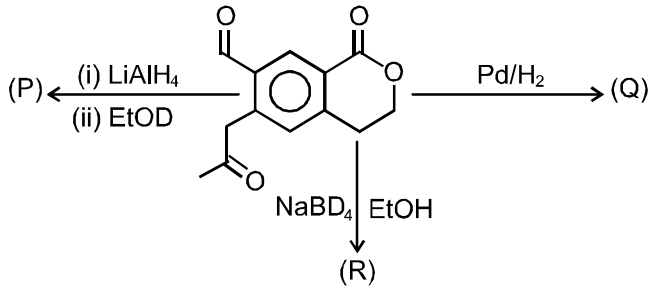
Product is obtained in the above reaction is :

(A) $R–CO_2Na$ (B)  (C) RCHO (D) None of these

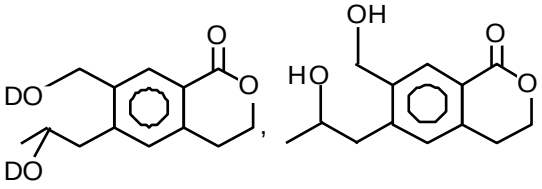
PART - IV : COMPREHENSION

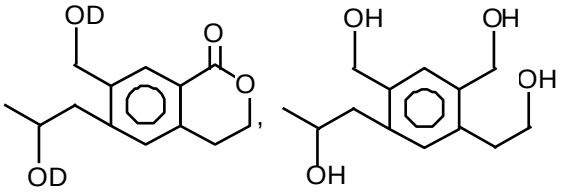
Read the following passage carefully and answer the questions.

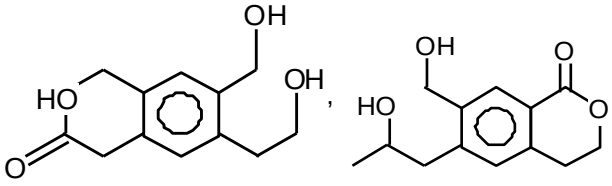
Comprehension # 1

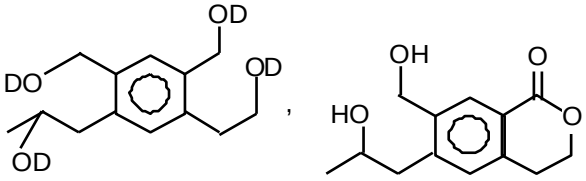


1. (P) and (Q) respectively are

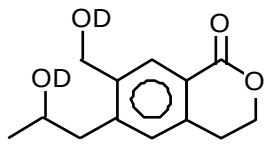
(A) 

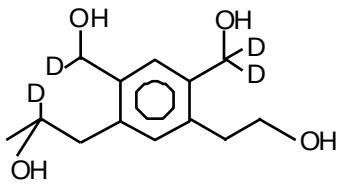
(B) 

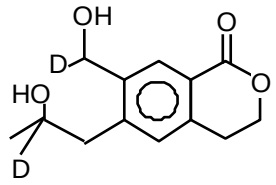
(C) 

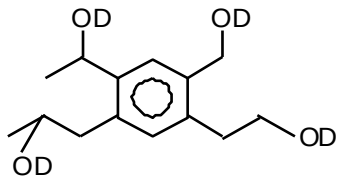
(D) 

2. (R) is :

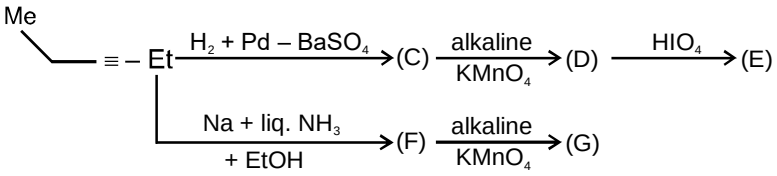
(A) 

(B) 

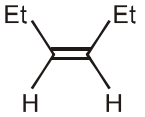
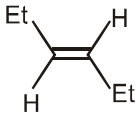
(C) 

(D) 

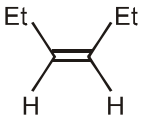
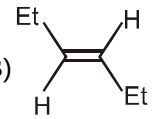
Comprehension # 2



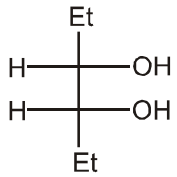
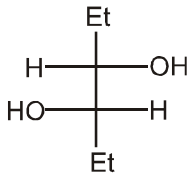
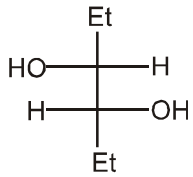
3. The compound (C) is :

(A)  (B)  (C) Et – ≡ – Et (D) Both (A) and (B)

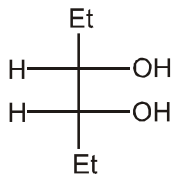
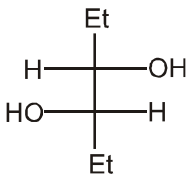
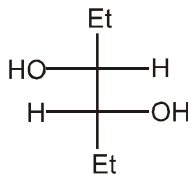
4. The compound (F) is :

(A)  (B)  (C) Et – ≡ – Et (D) Both (A) and (B)

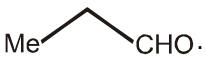
5. The compound (D) is :

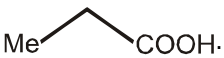
(A)  (B)  (C)  (D) Both (B) and (C)

6. The compound (G) is :

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

7. The compound (E) is :

(A) Two moles of  .

(B) Two moles of  .

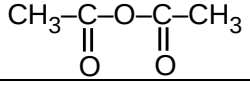
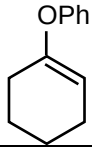
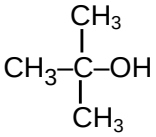
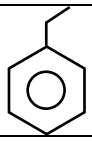
(C) One mole of (A) and one mole of (B)

(D) No reaction.

Comprehension # 3

Answer Q.8, Q.9 and Q.10 by appropriately matching the information given in the three columns of the following table.

Column-1, 2 and 3 contains starting material, reaction condition and type of reaction respectively.

	Column-1		**Column-2**		**Column-3**
(I)		(i)	$KMnO_4$	(P)	Oxidation
(II)		(ii)	Cu/Δ	(Q)	Reduction
(III)		(iii)	H_3O^+	(R)	Hydrolysis
(IV)		(iv)	$LiAlH_4$	(S)	Dehydration

8. Which of the following combination of reaction result in formation of an alkene.
(A) (I) (iv) Q (B) (III) (i) S (C) (III) (ii) S (D) (II), (iii) R

9. The only correct combination in which product gives position test with sodium bicarbonate is -
(A) (III) (ii) P (B) (I) (iii) Q (C) (II) (iii) R (D) (IV) (i) P

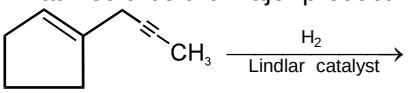
10. The reaction and condition which obey bimolecular nucleophilic substitution reaction with respect to tetrahedral intermediate is -
(A) (IV) (i) P (B) (I) (iv) Q (C) (II) (iii) R (D) (III) (ii) S

Exercise-3

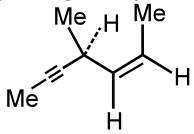
*** Marked Questions may have more than one correct option.**

PART - I : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

1. What would be the major product in the following reaction ? **[IIT-JEE 2000(M), 1/100]**



2. Hydrogenation of the adjoining compound in the presence of poisoned palladium catalyst gives.



[IIT-JEE 2001(S), 1/35]

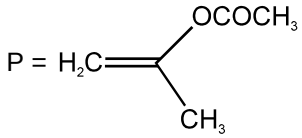
(A) an optically active compound (B) an optically inactive compound
(C) a racemic mixture (D) a diastereomeric mixture

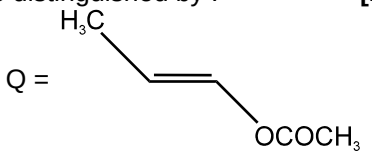
3. 1-Propanol and 2-Propanol can be best distinguished by : **[IIT-JEE 2001(S), 1/35]**
(A) oxidation with alkaline $KMnO_4$ followed by reaction with Fehling solution
(B) oxidation with acidic dichromate followed by reaction with Fehling solution
(C) oxidation by heating with copper followed by reaction with Fehling solution
(D) oxidation with concentrated H_2SO_4 followed by reaction with Fehling solution

4. **Assertion :** Dimethylsulphide is commonly used for the reduction of an ozonide of an alkene to get the carbonyl compounds **[IIT-JEE-2001(S), 1/35]**
Reason : It reduces the ozonide giving water soluble dimethyl sulphoxide and excess of it evaporates
(A) Assertion is True, Reason is True; Reason is a correct explanation for Assertion.
(B) Assertion is True, Reason is True; Reason is NOT a correct explanation for Assertion.
(C) Assertion is True, Reason is False.
(D) Assertion is False, Reason is True.

5. Five isomeric para-disubstituted aromatic compounds A to E with molecular formula $C_8H_8O_2$ were given for identification. Based on the following observations, give structures of the compounds.
(i) Both A and B form a silver mirror with Tollen's reagent; also B gives a positive test with $FeCl_3$ solution.
(ii) C gives positive iodoform test.
(iii) D is readily extracted in aqueous $NaHCO_3$ solution.
(iv) E on acid hydrolysis gives 1, 4–dihydroxybenzene. **[IIT-JEE-2002(M), 5/60]**

6. The product of acid hydrolysis of P and Q can be distinguished by : **[IIT-JEE 2003(S), 3/84]**

P = 

Q = 

(A) Lucas reagent
(B) 2,4–DNP
(C) Fehling's solution
(D) $NaHSO_3$

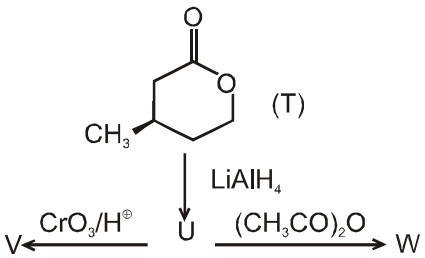
7. Amongst the following the reagent that would convert 2-hexyne into trans-2-hexene is **[IIT-JEE 2004(S), 3/84]**
(A) H_2 .Pt / O_2
(B) H_2 .Pd / SO_4^{2-}
(C) Li / NH_3 / C_2H_5OH
(D) $NaBH_4$

8. A compound P($C_5H_{10}O$) reacts with dilute sulfuric acid to give Q and R as the final products. This reaction is about 10^{15} times faster than of ethylene. Both Q and R give positive iodoform test.
(a) Identify the structures of P, Q and R.
(b) Rationalize the extraordinary reactivity of P. **[IIT-JEE-2004(M), 2/60]**

9. Match each of the compounds in **Column I** with its characteristic reaction(s) in **Column II.** **[IIT-JEE 2009, 8/160]**

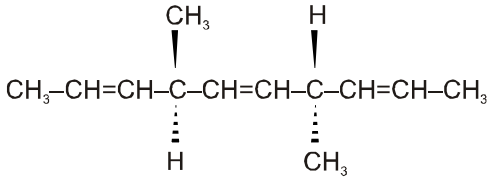
	Column I		**Column II**
(A)	$CH_3CH_2CH_2CN$	(p)	Reduction with Pd-C/H_2
(B)	$CH_3CH_2OCOCH_3$	(q)	Reduction with $SnCl_2$/HCl
(C)	CH_3–CH=CH–CH_2OH	(r)	Development of foul smell on treatment with chloroform and alcoholic KOH.
(D)	$CH_3CH_2CH_2CH_2NH_2$	(s)	Reduction with diisobutylaluminium hydride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

10.* With reference to the scheme given, which of the given statments(s) about T, U, V and W is (are) correct? **[IIT-JEE 2012, 4/136]**



(A) T is soluble in hot aqueous NaOH
(B) U is optically active
(C) Molecular formula of W is $C_{10}H_{18}O_4$
(D) V gives effervescence on treatment with aqueous $NaHCO_3$

11. The number of optically active products obtained from the **complete** ozonolysis of the given compound is :

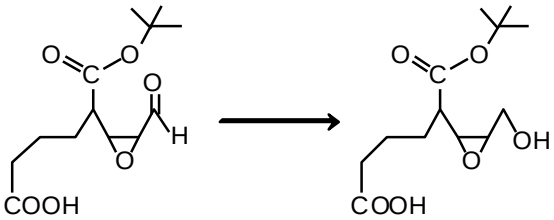


[JEE-2012, 3/70]

(A) 0 (B) 1 (C) 2 (D) 4

12. Consider all possible isomeric ketones, including stereoisomers of MW = 100. All these isomers are idependently reacted with $NaBH_4$ (**Note:** stereoisomers are also reacted separately). The total number of ketones that give a racemic product(s) is/are **[JEE(Advance)-2014, 3/120]**

13.* Reagent(s) which can be used to bring about the following transformation is(are) : **[JEE(Advance)-2016, 3/124]**



(A) $LiAlH_4$ in $(C_2H_5)_2O$ (B) BH_3 in THF
(C) $NaBH_4$ in C_2H_5OH (D) Raney Ni/H_2 in THF

PART - II : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

JEE(MAIN) OFFLINE PROBLEMS

1. But-1-ene may be converted to butane by reaction with : **[AIEEE-2003, 3/225]**
(1) Zn–HCl (2) Sn–HCl (3) Zn–Hg (4) Pd/H_2

2. When CH_2=CH–COOH is reduced with $LiAlH_4$, the compound obtained will be: **[AIEEE-2003, 3/225]**
(1) CH_3–CH_2–COOH (2) CH_2=CH–CH_2OH (3) CH_3–CH_2–CH_2OH (4) CH_3–CH_2–CHO.

3. Which one of the following is reduced with Zn, Hg and HCl acid to give the corresponding hydrocarbon? **[AIEEE-2004, 3/225]**
(1) Ethyl acetate (2) Butan-2-one (3) Acetamide (4) Acetic acid

4. The best reagent to convert pent-3-en-2-ol into pent-3-ene-2-one is **[AIEEE-2005, 3/225]**
(1) Pyridinium chloro-chromate (2) Chromic anhydride in glacial acetic acid
(3) Acidic dichromate (4) Acidic permanganate

5. The hydrocarbon which can react with sodium in liquid ammonia is: **[AIEEE-2008, 3/105]**
(1) $CH_3CH_2C{\equiv}CH$ (2) $CH_3CH{=}CHCH_3$
(3) $CH_3CH_2C{\equiv}CCH_2CH_3$ (4) $CH_3CH_2CH_2C{\equiv}CCH_2CH_2CH_3$

6. In the following sequence of reactions, the alkene affords the compound 'B' **[AIEEE-2008, 3/105]**

$CH_3CH{=}CHCH_3 \xrightarrow{O_3} A \xrightarrow[Zn]{H_2O} B$, The compound B is :

(1) CH_3COCH_3 (2) $CH_3CH_2COCH_3$ (3) CH_3CHO (4) CH_3CH_2CHO

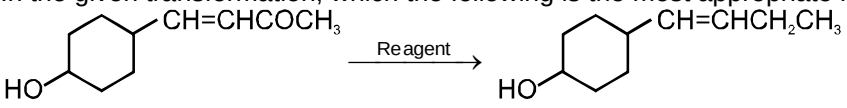
7. One mole of a symmetrical alkene on ozonolysis gives two moles of an aldehyde having a molecular mass of 44 u. The alkene is : **[AIEEE-2010, 4/144]**
(1) propane (2) 1-butene (3) 2-butene (4) ethene

8. Ozonolysis of an organic compound gives formaldehyde as one of the products. This confirms the presence of :
(1) two ethylenic double bonds (2) a vinyl group **[AIEEE-2011, 4/120]**
(3) an isopropyl group (4) an acetylenic triple bond

9. 2-Hexyne gives trans-2-Hexene on treatment with : **[AIEEE-2012, 4/120]**

(1) Pt/H_2 (2) Li / NH_3 (3) $Pd/BaSO_4$ (4) $Li AlH_4$

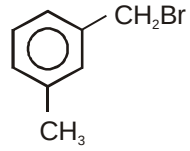
10. In the given transformation, which the following is the most appropriate reagent ? **[AIEEE-2012, 4/120]**

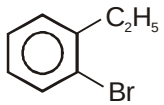


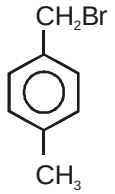
(1) $NH_2NH_2, \overset{\ominus}{O}H$ (2) Zn–Hg/HCl (3) Na, Liq, NH_3 (4) $NaBH_4$

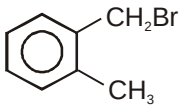
11. Compound (A), C_8H_9Br, gives a white precipitate when warmed with alcoholic $AgNO_3$. Oxidation of (A) gives an acid (B), $C_8H_6O_4$. (B) easily forms anhydride on heating. Identify the compound (A).

[JEE(Main)-2013, 4/120]

(1) 

(2) 

(3) 

(4) 

12. The most suitable reagent for the conversion of $R–CH_2–OH \rightarrow R–CHO$ is : **[JEE(Main)-2014, 4/120]**

(1) $KMnO_4$ (2) $K_2Cr_2O_7$

(3) CrO_3 (4) PCC (Pyridinium Chlorochromate)

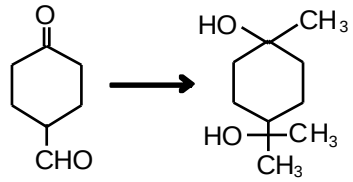
13. In the following sequence of reactions :

Toluene $\xrightarrow{KMnO_4}$ A $\xrightarrow{SOCl_2}$ B $\xrightarrow[BaSO_4]{H_2/Pd}$ C

the product C is : **[JEE(Main)-2015, 4/120]**

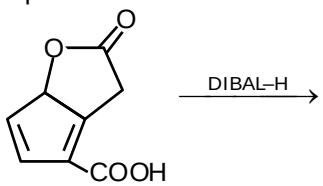
(1) C_6H_5COOH (2) $C_6H_5CH_3$ (3) $C_6H_5CH_2OH$ (4) C_6H_5CHO

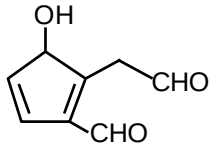
14. The correct sequence of reagents for the following conversion will be : **[JEE(Main)-2017, 4/120]**

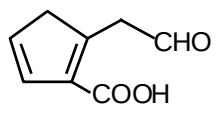


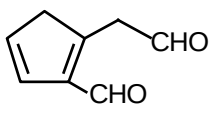
(1) $CH_3MgBr, H^+/CH_3OH, [Ag(NH_3)_2]^+OH^-$
(2) $CH_3MgBr, [Ag(NH_3)_2]^+OH^-, H^+/CH_3OH$
(3) $[Ag(NH_3)_2]^+OH^-, CH_3MgBr, H^+/CH_3OH$
(4) $[Ag(NH_3)_2]^+OH^-, H^+/CH_3OH, CH_3MgBr$

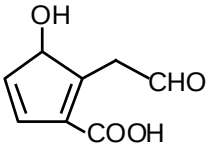
15. The major product obtained in the following reaction is : **[JEE(Main)-2017, 4/120]**



(1) 

(2) 

(3) 

(4) 

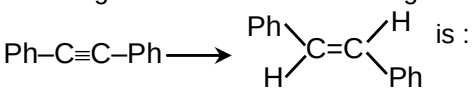
16. The trans-alkenes are formed by the reduction of alkynes with : **[JEE(Main)-2018, 4/120]**

(1) Na/liq. NH_3 (2) Sn - HCl

(3) H_2–Pd/C, $BaSO_4$ (4) $NaBH_4$

JEE(MAIN) ONLINE PROBLEMS

1. The reagent needed for converting



is : **[JEE(Main) 2014 Online (11-04-14), 4/120]**

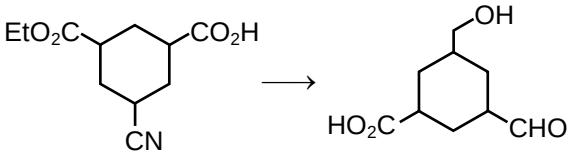
(1) Cat. Hydrogenation (2) H_2/Lindlar Cat.
(3) Li/NH_3 (4) $LiAlH_4$

2. The gas liberated by the electrolysis of Dipotassium succinate solution is : **[JEE(Main) 2014 Online (11-04-14), 4/120]**

(1) Ethane (2) Ethyne (3) Ethene (4) Propene

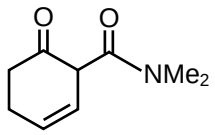
3. Bouveault-Blanc reduction reaction involves: **[JEE(Main) 2016 Online (09-04-16), 4/120]**
(1) Reduction of an anhydride with $LiAlH_4$.
(2) Reduction of an ester with Na/C_2H_5OH.
(3) Reduction of a carbonyl compound with Na/Hg and HCl.
(4) Reduction of an acyl halide with H_2/Pd.

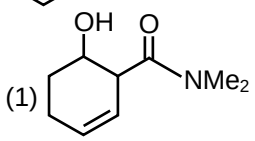
4. The reagent(s) required for the following conversion are: **[JEE(Main) 2018 Online (15-04-18), 4/120]**



(1) (i) $NaBH_4$ (ii) Raney Ni/H_2 (iii) H_3O^+ (2) (i) $LiAlH_4$ (ii) H_3O^+
(3) (i) B_2H_6 (ii) DIBAL-H (iii) H_3O^+ (4) (i) B_2H_6 (ii) $SnCl_2/HCl$ (iii) H_3O^+

5. The main reduction product of the following compound with $NaBH_4$ in methanol is : **[JEE(Main) 2018 Online (15-04-18), 4/120]**



(1)


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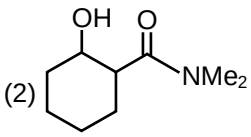

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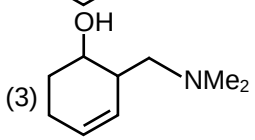

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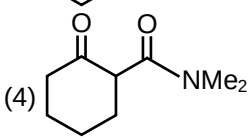
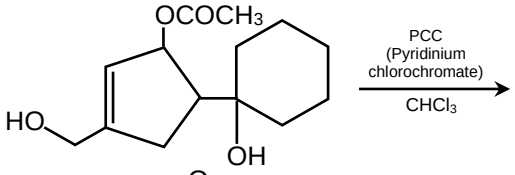
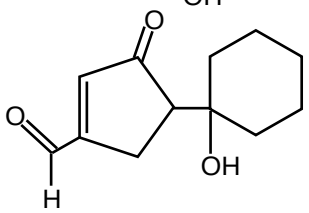
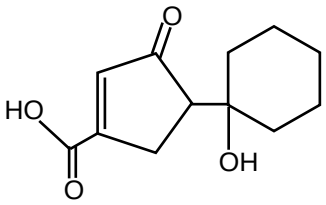


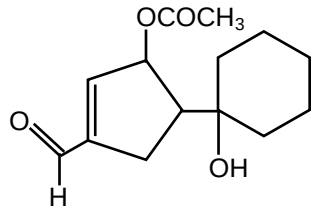
6. When 2-butyne is treated with H_2/Lindlar's catalyst, compound X is produced as the major product and when treated with Na/liq. NH_3 it produces Y as the major product. Which of the following statements is correct? **[JEE(Main) 2018 Online (15-04-18), 4/120]**
(1) X will have higher dipole moment and higher boiling point than Y.
(2) Y will have higher dipole moment and higher boiling point than X.
(3) X will have lower dipole moment and lower boiling point than Y.
(4) Y will have higher dipole moment and lower boiling point than X.

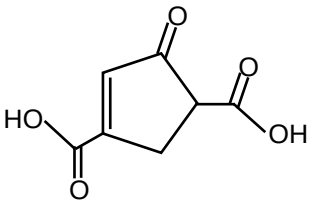
7. The major product formed in the following reaction is : **[JEE(Main) 2018 Online (15-04-18), 4/120]**



(1) 

(2) 

(3) 

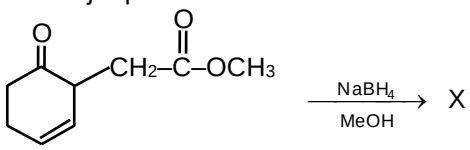
(4) 

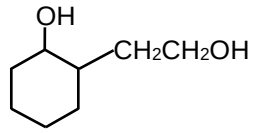
8. The major product of following reaction is : **[JEE(Main) 2019 Online (09-01-19), 4/120]**

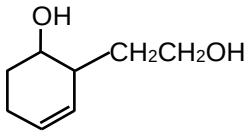
$R–C\equiv N \xrightarrow[(2)H_2O]{(1)AlH(i-Bu)_2} ?$

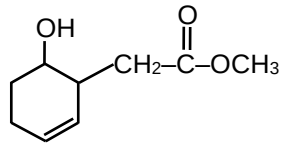
(1) $RCONH_2$ (2) RCH_2NH_2 (3) RCHO (4) RCOOH

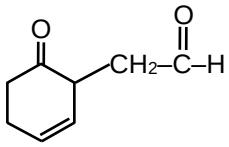
9. The major product 'X' formed in the following reaction is: **[JEE(Main) 2019 Online (10-01-19), 4/120]**



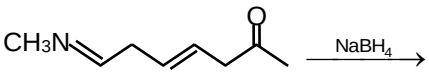
(1) 

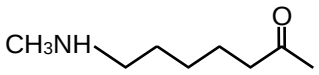
(2) 

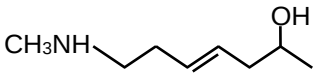
(3) 

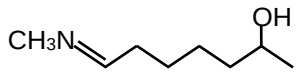
(4) 

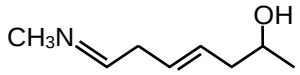
10. The major product of the following reaction is: **[JEE(Main) 2019 Online (10-01-19), 4/120]**



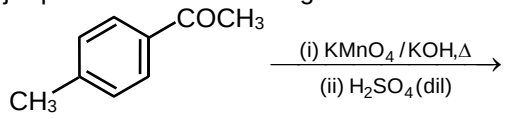
(1) 

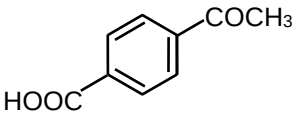
(2) 

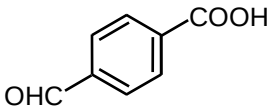
(3) 

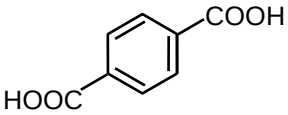
(4) 

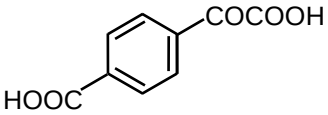
11. The major product of the following reaction is: **[JEE(Main) 2019 Online (11-01-19), 4/120]**



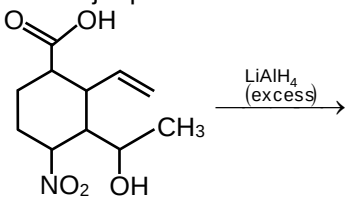
(1) 

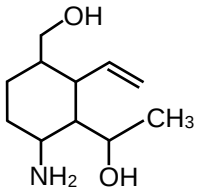
(2) 

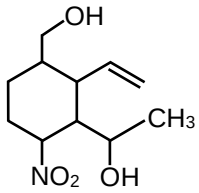
(3) 

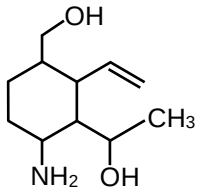
(4) 

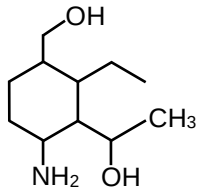
12. The major product obtained in the following reaction is : **[JEE(Main) 2019 Online (11-01-19), 4/120]**



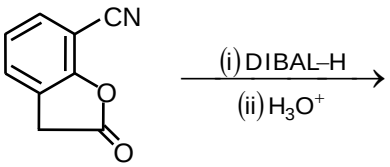
(1) 

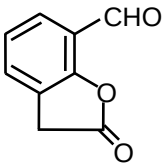
(2) 

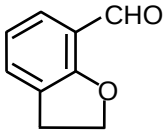
(3) 

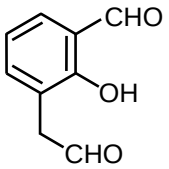
(4) 

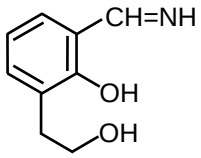
13. The major product of the following reaction is : **[JEE(Main) 2019 Online (12-01-19), 4/120]**



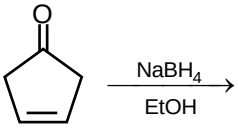
(1) 

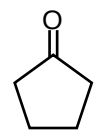
(2) 

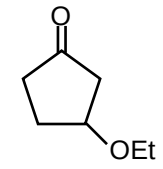
(3) 

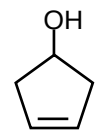
(4) 

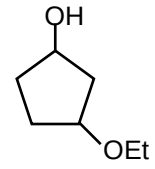
14. The major product of the following reaction is : **[JEE(Main) 2019 Online (12-01-19), 4/120]**



(1) 

(2) 

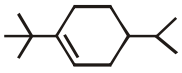
(3) 

(4) 

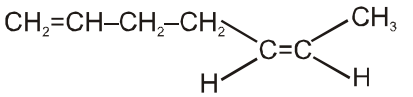
Answers

EXERCISE - 1

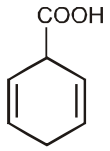
PART - I

A-1. (a) Butane (b) Butane (c) $Ph–CH_2–OH$ (d) 

A-2. (a) $CH_2=CH–CH_2–CH_2–C\equiv C–CH_3 \xrightarrow[Pd]{H_2(excess)} CH_3–CH_2–CH_2–CH_2–CH_2–CH_2–CH_3$

(b) $CH_2=CH–CH_2–CH_2–C\equiv C–CH_3 \xrightarrow{H_2/Pd\text{-}BaSO_4}$ 
(cis isomer)

(c) Benzaldehyde (Benzene carbaldehyde)

A-3. (i) $CH_3–CH_2–\underset{trans}{CH=CH}–(CH_2)_7–CH_2–OH$ (ii) 

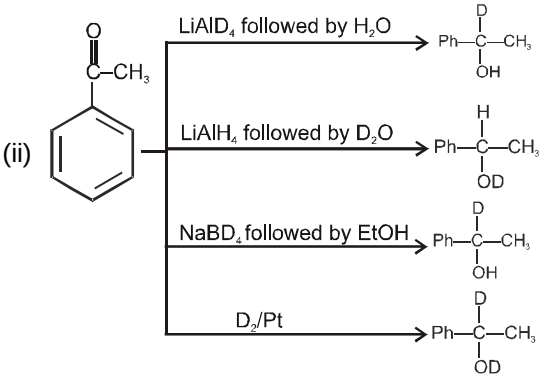
A-4. (i) $H_2/Pd\text{-}BaSO_4$

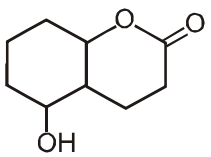
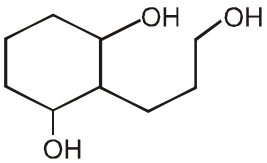
(ii) In this conversion –CO– converts into $–CH_2–$ which can be achieved by any one of the following reagents :

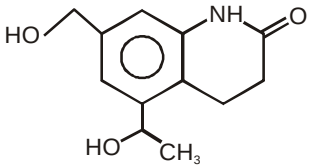
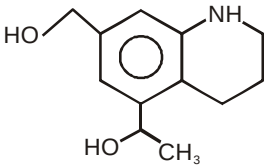
(a) $NH_2–NH_2/KOH/\Delta$ (b) Zn-Hg, Conc HCl, Δ (c) Red P + HI

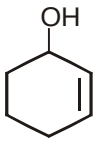
B-1. $LiAlH_4$ and $NaBH_4$ both gives same products with carbonyl compounds.

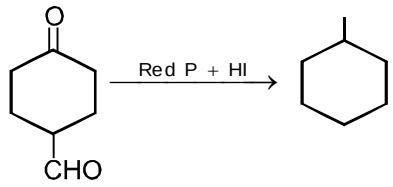
(i) $Ph–CH_2–OH$

(ii) 

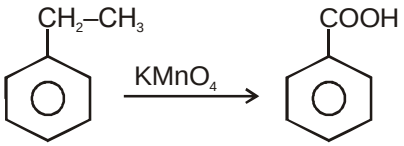
B-2. (i) a :  ; b : 

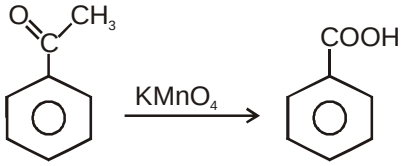
(ii) a :  ; b : 

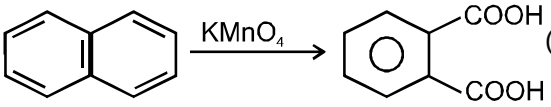
B-3. (a) 

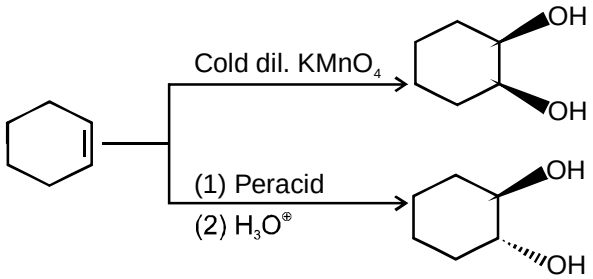
(b) 

C-1. (i) $CH_3CH_2\,C(=O)\,C(=O)\,CH_2CH_2CH_3$ (ii) $CH_3CH_2COOH + HOOCCH_2CH_2CH_3$

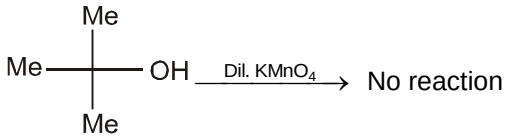
C-2. (a) 

(b) 

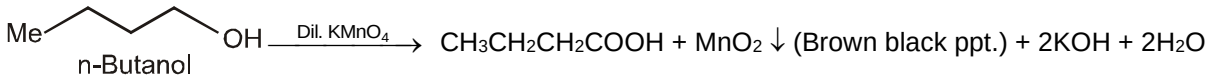
(c) 

(d) 

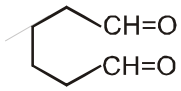
C-3. t-Butanol is not oxidised by dilute $KMnO_4$, so it does not give brown-black precipitate of MnO_2. n-Butanol is oxidised with dil $KMnO_4$ and MnO_4^- is converted to brown-black precipitate of MnO_2.

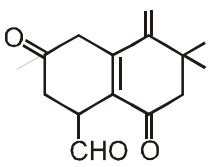
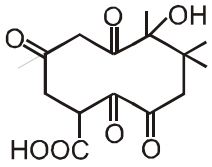
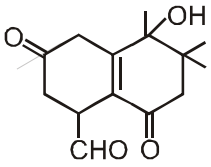
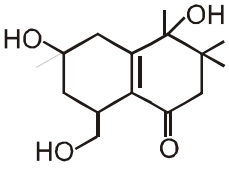


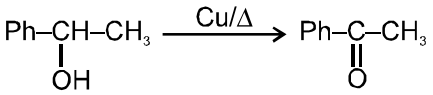
t-Butanol

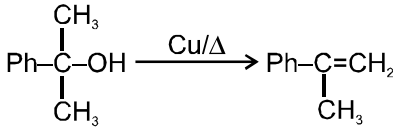


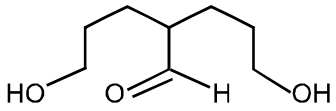
n-Butanol

D-1. (a)  (b) $2\,HCHO + 2\,HCOOH$ (c) $CH_3COOH + CH_3CHO$

D-2. (P)  (Q)  (R)  (S) 

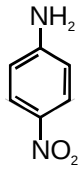
D-3. (a) $Ph–CH_2–CH_2–OH \xrightarrow{Cu/\Delta} Ph–CH_2–CH=O$ (b) 

(c) 

E-1. 

E-2. (a) $CH_3–C\equiv N \xrightarrow{H_3O^{\oplus}} CH_3COOH$ (b) $CH_3NC \xrightarrow{H_3O^{\oplus}} CH_3–\overset{+}{N}H_3$ + HCOOH

E-3. CH_3COCl **E-4.** $CH_3COOH + NH_3$ **E-5.** Two carboxylic acids

E-6.  **E-7.** $CH_2=CH–O–CH_3$

PART – II

A-1.	(A)	**A-2.**	(B)	**A-3.**	(B)	**A-4.**	(D)	**A-5.**	(B)
A-6.	(B)	**A-7.**	(D)	**A-8.**	(A)	**B-1.**	(B)	**B-2.**	(A)
B-3.	(C)	**B-4.**	(B)	**B-5.**	(A)	**B-6.**	(B)	**B-7.**	(D)
C-1.	(C)	**C-2.**	(C)	**C-3.**	(C)	**C-4.**	(C)	**C-5.**	(B)
D-1.	(C)	**D-2.**	(C)	**D-3.**	(C)	**D-4.**	(B)	**E-1.**	(D)
E-2.	(C)	**E-3.**	(D)						

PART – III

1. (A) – (q) ; (B) – (s) ; (C) – (p, s) ; (D) – (q, s)

2. (A) – (p) ; (B) – (q) ; (C) – (t) ; (D) – (s).

EXERCISE - 2

PART - I

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

PART - II

1.	3	**2.**	3	**3.**	3 (i, ii, iv)	**4.**	3	**5.**	7
6.	4 (i, ii, iii, v)								

PART - III

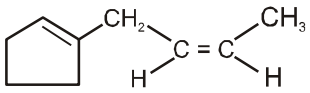
1.	(ABCD)	**2.**	(AB)	**3.**	(AD)	**4.**	(BC)	**5.**	(AB)

PART - IV

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

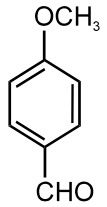
EXERCISE - 3

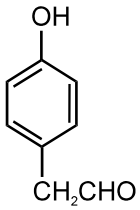
PART - I

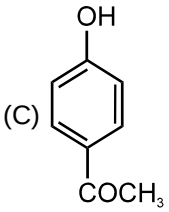
1. 

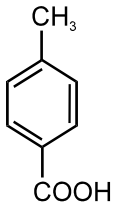
cis-isomer

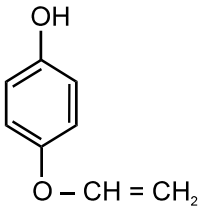
2. (B) **3.** (C) **4.** (A)

5. (A) 

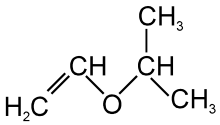
(B) 

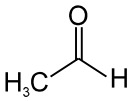
(C) 

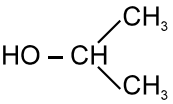
(D) 

(E) 

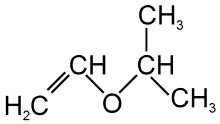
6. (C) **7.** (C)

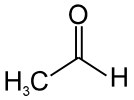
8. (a) P = 

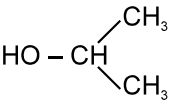
; Q = 

; R = 

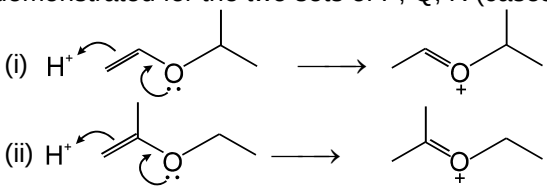
or

P = 

; Q = 

; R = 

(b) The greater stability of the oxonium ion intermediate is responsible for the extraordinary reactivity. This is demonstrated for the two sets of P, Q, R (cases i and ii above) as follows.



9. (A) – p, q, s, t ; (B) – s, t ; (C) – p ; (D) – r

10. (ACD) **11.** (A) **12.** 5 **13.** (CD)

PART - II

JEE(MAIN) OFFLINE PROBLEMS

1.	(4)	**2.**	(2)	**3.**	(2)	**4.**	(1)	**5.**	(1)
6.	(3)	**7.**	(3)	**8.**	(2)	**9.**	(2)	**10.**	(1)
11.	(4)	**12.**	(4)	**13.**	(4)	**14.**	(4)	**15.**	(4)
16.	(1)								

JEE(MAIN) ONLINE PROBLEMS

1.	(3)	**2.**	(3)	**3.**	(2)	**4.**	(4)	**5.**	(1)
6.	(1)	**7.**	(3)	**8.**	(3)	**9.**	(3)	**10.**	(2)
11.	(3)	**12.**	(1)	**13.**	(3)	**14.**	(3)		