OXIDATION

INDEX

1. Oxidation of alkane:

(a) Complete oxidation or combustion : Burn readily with non-luminous flame in presence of air or oxygen to give CO_2 and water with evolution of heat. Therefore, alkanes are used as fuels.

$$C_nH_{2n+2} + \left(\frac{3n+1}{2}\right)O_2 \longrightarrow nCO_2 + (n+1)H_2O + Q : (\Delta H = -\text{ve})$$

(b) Incomplete oxidation : In limited supply of air gives carbon black and CO .

$$2CH_4 + 3O_2 \longrightarrow 2CO + 4H_2O$$
$$CH_4 + O_2 \longrightarrow C + 2H_2O$$

C-black (used in printing)

(c) Catalytic oxidation :

(i) Alkanes are easily converted to alcohols and aldehydes under controlled catalytic oxidation.

$$2CH_4 + O_2 \xrightarrow[High\ P\ and\ T]{Red\ hot\ Cu\ F\ Fe\ tube} 2CH_3OH \quad CH_4 + O_2 \xrightarrow[230^\circ C, 100\ atm]{Mo_3O_3} HCHO + H_2O$$

(ii) Alkanes on oxidation in presence of manganese acetate give fatty acids.

$$CH_3\left(CH_2\right)_n CH_3 \xrightarrow[highTemp]{\left(CH_3COO\right)_2 Mn} CH_3\left(CH_2\right)_n COOH$$

(iii) Tertiary alkanes are oxidized to give tertiary alcohols by $KMnO_4$.

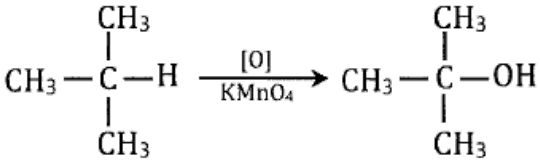


Illustration 1:

How many litre of Oxygen required for complete combustion of 6.0 g ethane at NTP ?

Solution:

$$2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$$

60 g ethane required O_2 (at NTP) $= 7 \times 22.4$ litre

1 g ethane required O_2 (at NTP) $= \frac{7\times22.4}{2\times30}$ litre

6 g ethane required O_2 (at NTP) $= \frac{7\times22.4}{2\times30} \times 6 = 15.68$ litre

2. Oxidation of alkenes:

Alkenes are easily oxidised by oxidising agents. Oxidising agents attack on double bond and product formed during oxidation depends on oxidising agents.

(a) alkene on combustion gives CO_2 and H_2O

$$C_nH_{2n} + \frac{3n}{2}O_2 \longrightarrow nCO_2 + nH_2O$$

One mole of alkene requires $\frac{3n}{2}$ moles of O_2 for complete combustion.

Illustration 2 :

90 mL of oxygen is required for complete combustion of unsaturated 20 mL gaseous hydrocarbon, hydrocarbon is?

Solution:

Following two formula can be used for solution of the above asked question.

$$\frac{Volume\ of\ Hydrocarbon}{Volume\ of\ O_2} = \frac{2}{3n} \quad \text{(for Alkene)}$$

$$\frac{Volume\ of\ Hydrocarbon}{Volume\ of\ O_2} = \frac{2}{3n-1} \quad \text{(for Alkyne)}$$

By putting the values in above formula, we can find the hydrocarbon for which n is natural number.

$$\frac{20}{90} = \frac{2}{3n}\ n\ =\ 3\ So\ hydrocarbon\ is\ Propene\ \left[C_3H_6\right]$$

Illustration 3:

How many mole of oxygen is required for complete combustion of 1 mole of Alkene.

Solution:

$2C_nH_{2n} + 3nO_2 \longrightarrow 2nCO_2 + 2nH_2O$

keeping in mind, the above equation.

∵ for 2 mole of Alkene, $3n$ mole of O_2 is required for combustion.

∴ for 1 mole of Alkene, $\frac{3n}{2}$ mole of O_2 is required for combustion.

$= 1.5n$ mole of O_2

Illustration 4 :

30 mL mixture of ethylene and Butylene is burnt in presence of oxygen then 150 mL of oxygen is required, what is the volume of Ethylene & Butylene in mixture.

Solution:

Let the volume of $C_2H_4 = xmL$

So volume of Butylene $= (30 - x)mL$

For C_2H_4, $C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$

from equation

∵ for 1 volume C_2H_4, 3 volume of O_2 is required.

∵ for x ml vol. of C_2H_4, $3xml$ volume of O_2 is required.

For C_4H_8, $C_4H_8 + 6O_2 \longrightarrow 4CO_2 + 4H_2O$

∵ for 1 volume C_4H_8, 6 volume of O_2 is required.

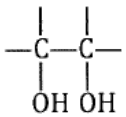
∵ for $(30 - x)ml$ volume C_4H_8 ", $6(30 - x)ml$ of O_2 is required.

Total volume of $O_2 = 3x + 6(30 - x)ml = 150ml$ (Given)

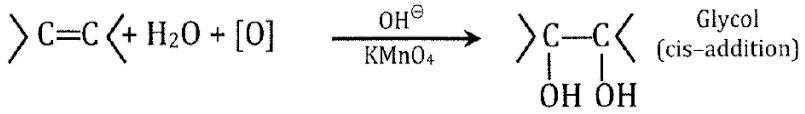
$x = 10$

∵ Volume of C_2H_4 in mixture is 10 ml

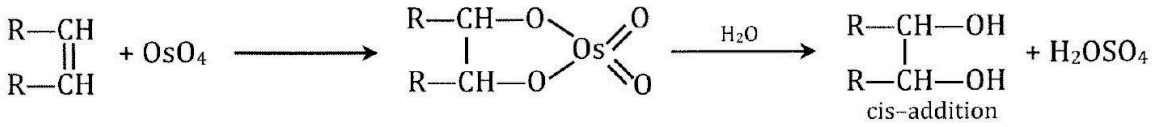
∵ Volume of C_2H_4 in mixture is 20 ml

(b) Hydroxylation : Oxidation of carbon-carbon double bond to  is is mown as hydroxylation.

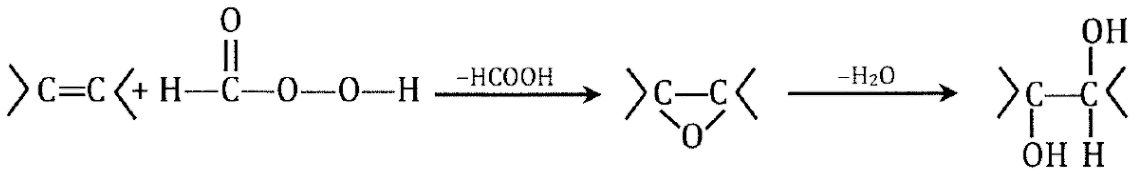
(i) Oxidation by Baeyer's reagent (A test for unsaturation) : Alkenes on passing through dilute alkaline 1% cold $KMnO_4$ (i.e., Baeyer's reagent) decolourise the pink colour of $KMnO_4$ and gives brown ppt MnO_2 and glycol.



(ii) By OsO_4 :

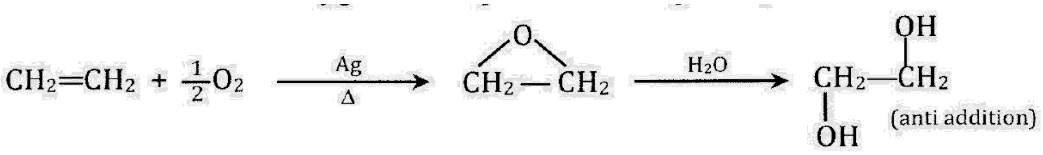


(iii) By peracid:



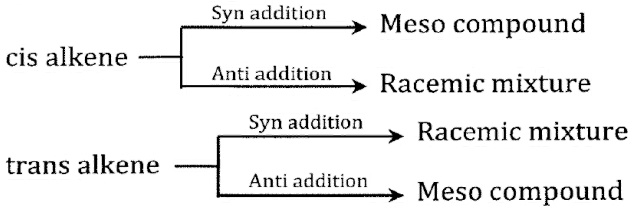
(c) Epoxidation :

(i) Alkenes reacts with oxygen in the presence of Ag catalyst at $250^{\circ} - 400^{\circ}C$ to form epoxide.



(ii) When an alkene is treated with perbezoic acid an epoxide is formed.

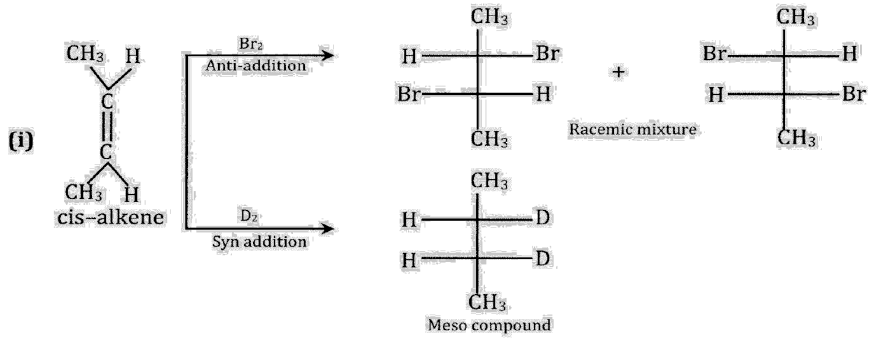
Emmons have found that perbenzoic oxy trifluoroacetic acid (CF_3COOH) is a very good reagent for epoxidation and hydroxylation.

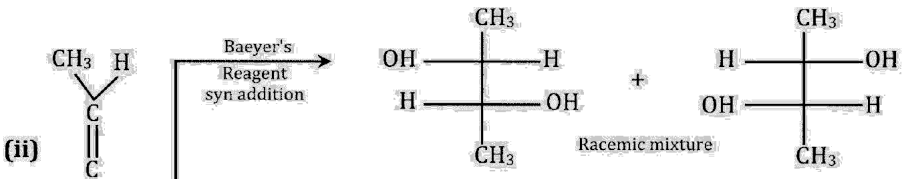


Syn addition on alkene $\longrightarrow H_2O_2$, Baeyer's reagent, OsO_4/H_2O

~~Anti addition on alkene $\longrightarrow X_2, HOX, RCOOH/H_2O, Ag_2O/H_2O$~~

Example :





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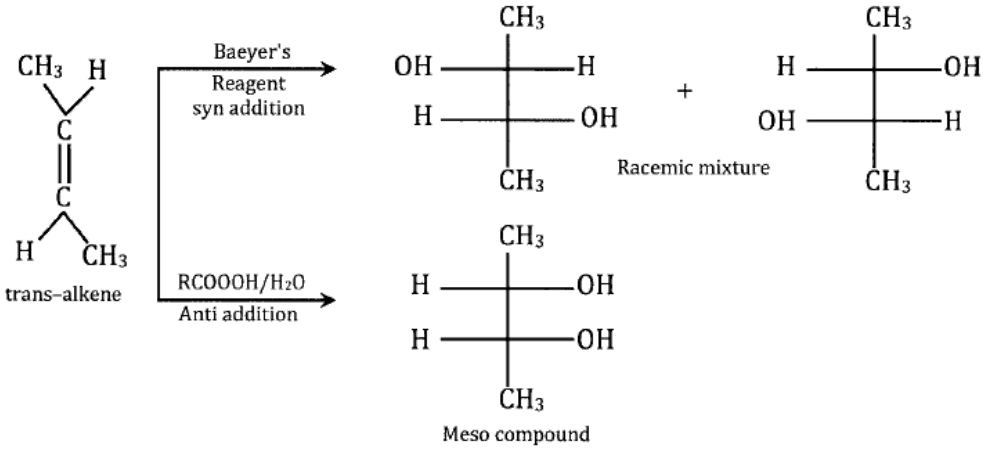
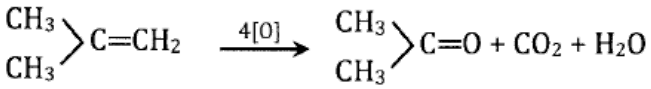


(d) Oxidation by strong oxidising agent (Oxidative cleavage) : The alkenes themselves are readily oxidised to acid or ketone by means of acid permanganate or acid dichromate. If HCOOH is formed, it further oxidized to CO_2 and H_2O. Keep it in mind that no further oxidation of ketones will takes place.

$$CH_2 = CH_2 + 4[O] \longrightarrow 2HCOOH \rightarrow^{2[0]} 2CO_2 + H_2O$$

$$CH_3CH = CH_2 \rightarrow^{5[0]} CH_3COOH + CO_2 + H_2O$$

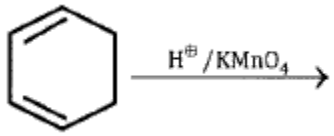
$$CH_3CH = CHCH_3 \rightarrow^{4[0]} 2CH_3COOH$$



(e) Oxidation with retention of Carbon-Carbon bond - (Waker process) :

$$CH_2 = CH_2 + H_2O_2 \rightarrow_{CuCl_2}^{PdCl_2} CH_3CHO$$

Illustration 5 :



Solution:

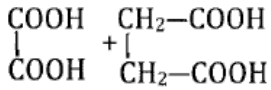
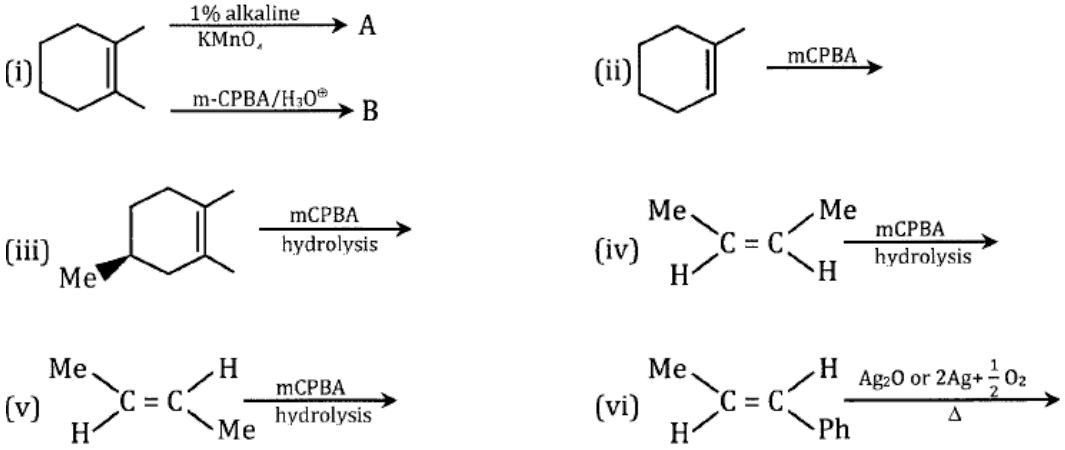
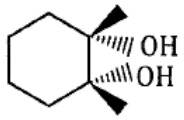
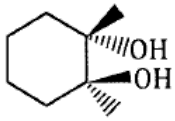


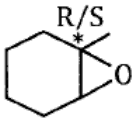
Illustration 6 :

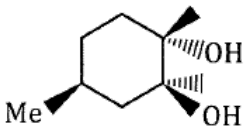


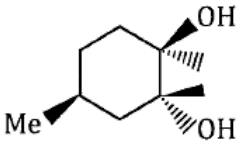
Solution:

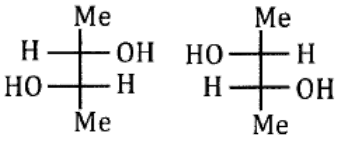
(i) (A) 

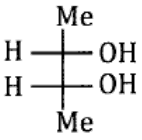
(B) 

(ii) 

(iii) 



(iv) 

(v) 

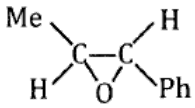
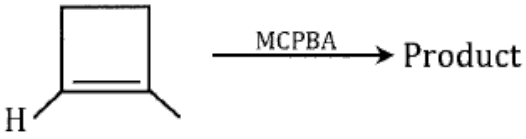
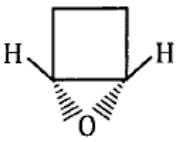
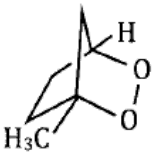
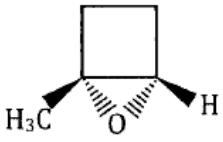
(vi) 

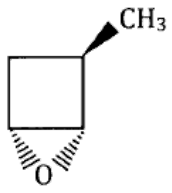
Illustration 7 :



(A) 

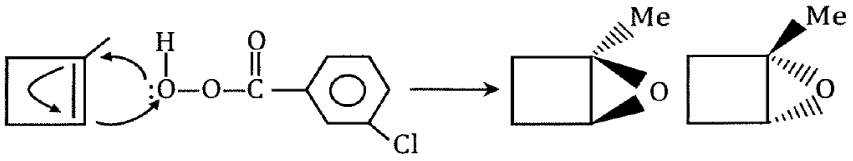
(B) 

(C) 

(D) 

Ans. (C)

Solution:



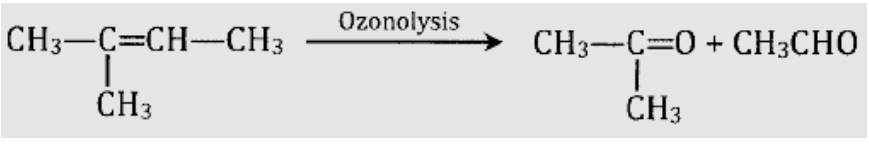
3. Ozonolysis: (A test for unsaturation in molecule) :

(i) The addition of ozone on the double bonds and subsequent a reductive hydrolysis of the ozonide formed is termed as ozonolysis.

(ii) When ozone is passed through an alkene in an inert solvent, it adds across the double bond to form an ozonide. Ozonides are explosive compound they are not isolated.

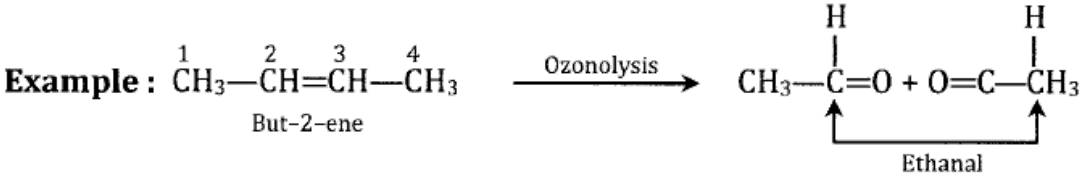
(iii) On warming with Zn and H_2O, ozonides cleave at the site of the double bond, the products are carbonyl compound (aldehyde or ketone) depending on the nature of the alkene.

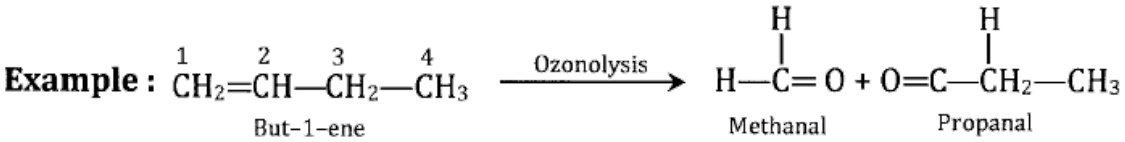
Example :

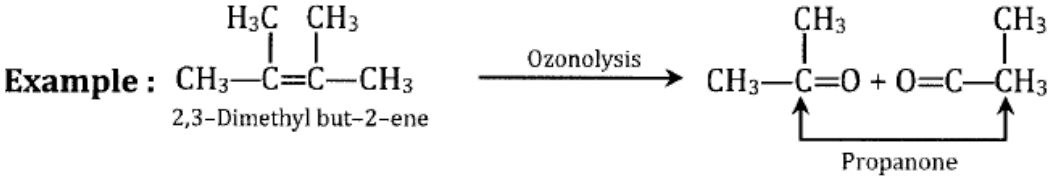


(iv) Ozonolysis of alkenes helps in locating the position of double bond in an alkene. It can be achieved by joining together the carbon atoms of the two carbonyl compounds formed as the products of ozonolysis with double bond.

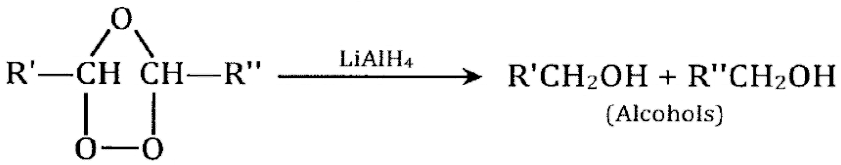
Example :







It may be noted that reaction with bromine water or Baeyer's reagent detects the presence of double bond (or unsaturation) in an alkene while ozonolysis helps in locating the position of the double bond. In an reduction of ozonide by $LiAlH_4$ or $NaBH_4$ gives corresponding alcohols.



4. Oxidation of Alkyne :

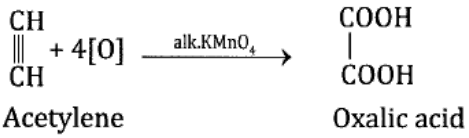
(a) Combustion :

$C_nH_{2n-2} + \left(\frac{3n-1}{2}\right)O_2 \longrightarrow nCO_2 + (n-1)H_2O$ + Heat

$2HC \equiv CH + 5O_2 \longrightarrow 4CO_2 + 2H_2O + 312\ K.ccal$

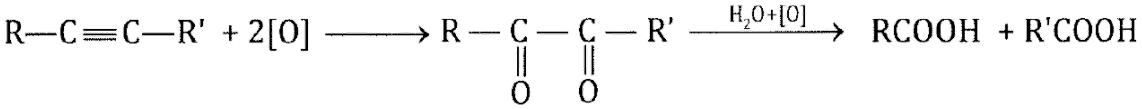
The combustion of acetylene is used for welding and cutting of metals in which oxy-acetylene flame having high temp $\left(3000^{\circ}C\right)$ is produced.

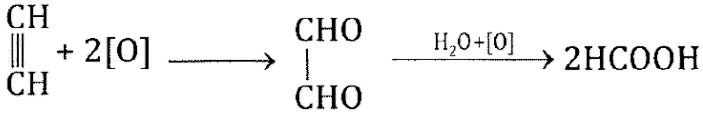
(b) Oxidation with alkaline $KMnO_4$: Oxidation with alkaline $KMnO_4$ gives carboxylic acids.



$CH_3 - C \equiv CH + 4[O] \rightarrow^{alk.\,KMnO_4} CH_3 - COOH + HCOOH$

(c) Oxidation with acidic $KMnO_4$ or $K_2Cr_2O_7$: In presence of acidic $KMnO_4$ or acidic $K_2Cr_2O_7$. Alkynes are oxidised to monocarboxylic acids.





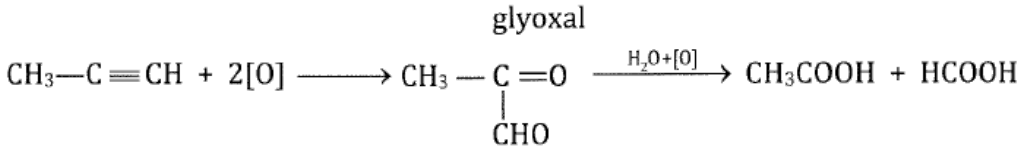
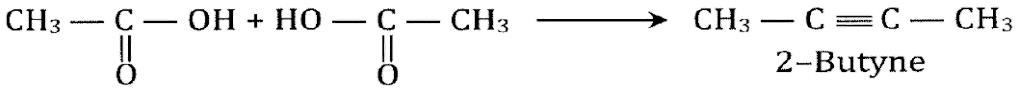


Illustration 8 :

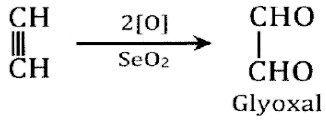
An alkyne on oxidation with acidic $KMnO_4$, only acetic acid is obtained what is given alkynes ?

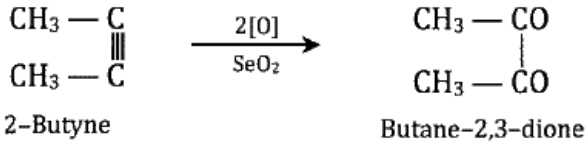
Solution:

In Oxidation of alkynes two moles of mono carboxylic acids are obtained.

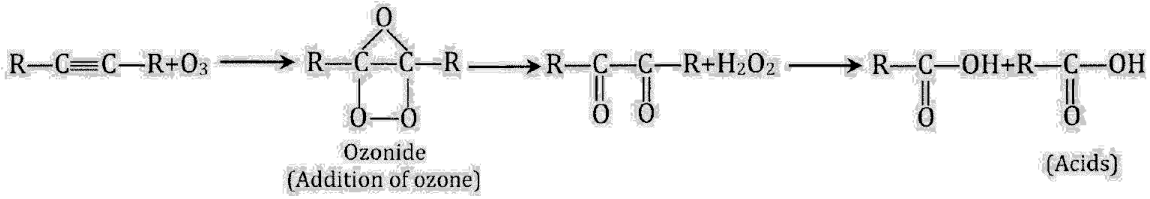


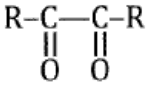
(d) Oxidation with selenium dioxide : Selenium dioxide oxidises alkynes to the dicarbonyl compounds.





(e) Oxidation with ozone ((O_3): In the ozonolysis both $sp-C$-atoms are converted into $-C-C-$ group.

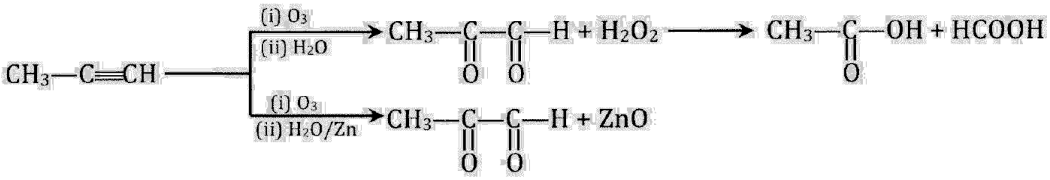


In this reaction H_2O_2 is oxidant which oxidize  nto acids.

But if we use some amount of Zn as reductant with H_2O then it reduce H_2O_2 so oxidation does not take place

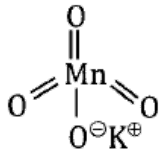
$H_2O_2 + Zn \rightarrow ZnO + H_2O$

Example:



5. Oxidation of alcohols:

(a) Oxidation of alcohol by $KMnO_4$:

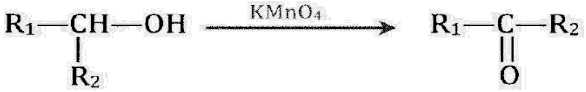


1. $KMnO_4$ is a very strong oxidising agent.
2. It never depends upon the type of medium used.

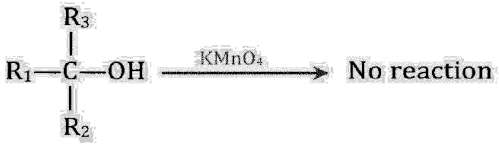
i. Primary alcohol

$RCH_2OH \rightarrow^{KMnO_4} RCOOH$

ii. Secondary alcohol



iii. Tertiary alcohol



(b) Oxidation of alcohol by $\left(CrO_3 + H_2SO_4\right)$:

3. $\left(CrO_3 + H_2SO_4\right)$ is called of Jones reagent.

It is strong oxidising agent.

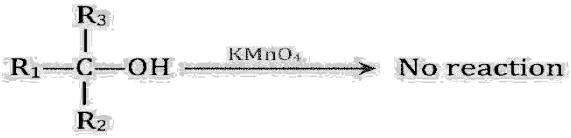
i. Primary alcohol

$RCH_2OH \rightarrow^{KMnO_4} RCOOH$

4.

ii. Secondary alcohol

iii. Tertiary alcohol

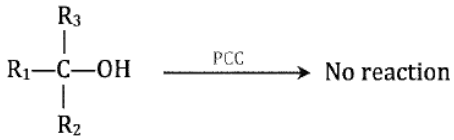


(c) Oxidation of alcohol by PCC (Pyridinium chloro chromate) :

1. It is milder oxidising agent.
2. It is efficient reagent to produce aldehydes/ketones from primary/secondary alcohols.
   i. Primary alcohol

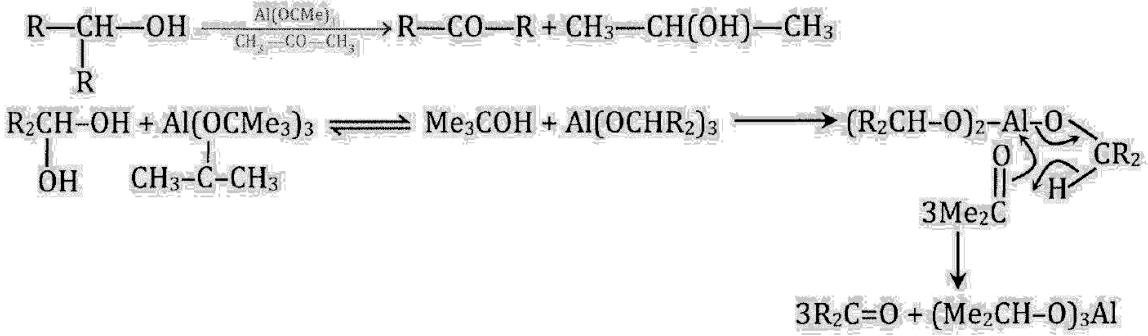
ii. Secondary alcohol

iii. Tertiary alcohol



(d) Oppenaur oxidation

The reaction involves the oxidation of secondary alcohols with a ketone and a base to the corresponding ketone of the alcohol.



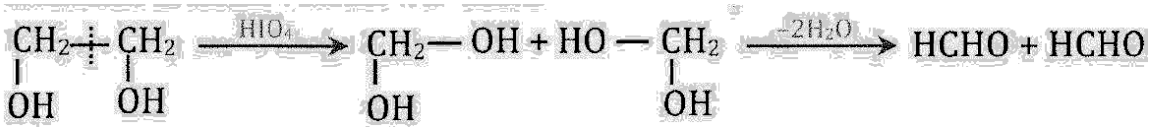
Oxidation of alcohol with aluminium tertiary butoxide is Openaur oxidation
Two structural requirements for the oxidation to carbonyl products are
i. The carbon atom bonded to oxygen must also bear a hydrogen atom. Tertiary alcohols $\left(R_3C - OH\right)$ cannot be oxidized in this fashion.
ii. The oxygen atom must be bonded to a hydrogen atom so that a chromate ester intermediate (or other suitable

leaving group) may be formed. Ethers ($R - O - R$) cannot be oxidized in this fashion.

(e) Oxidation by HIO_4 [per iodic acid] :

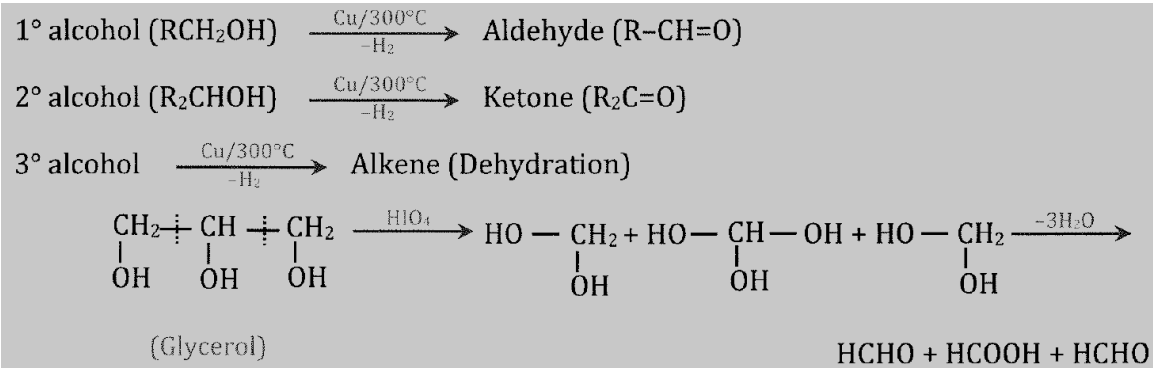
When diols reacts with HIO_4 [Periodic acid]. Those diols/ Polyols in which -OH group attached to vicinal C-atom after reaction with HIO_4 forms aldehyde and ketone.

This reaction is also used in identification of no. of OH group in polyol.
Reaction is observed for Vic-diols

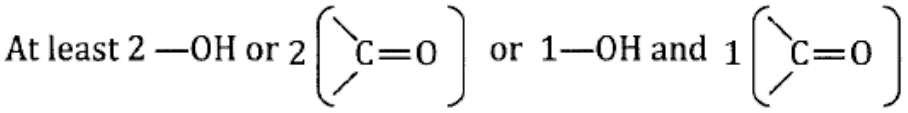


(f) By dehydrogenation of $\left(1^{\circ}82^{\circ}\right)$ alcohols:

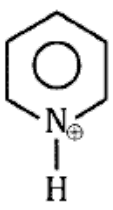
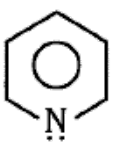
Dehydrogenation means removal of hydrogen and reagent used is heated copper or silver. The alcohol vapours are passed over heavy metal catalyst to yield the following products.

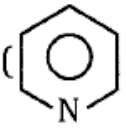
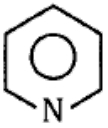
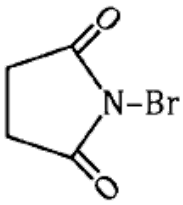


Condition for oxidation by HIO_4 :

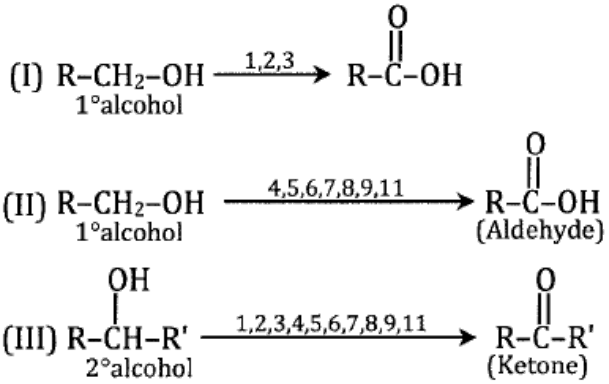


should be at adjacent carbons.

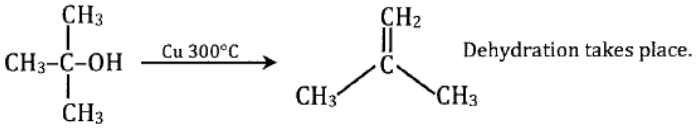
SUMMARY		
S. No.	**Oxidising agents**	**Type**
1.	$H^{\oplus}/K_2Cr_2O_7, \Delta$	Strong
2	$H^{\oplus}/K_2Cr_2O_7, \Delta$ (Strong oxidising agent)	Strong
3.	**Jones reagent:** CrO_3/H_2SO_4 treated with alcohol usually taken in acetone	Strong
4.	PCC (Pyridinium chloro chromate)  $CrO_3Cl^{\ominus}$ or  $CrO_3 + HCl$	Milder

5.	Collin's reagent ( (2 mol) + CrO_3 + CH_2Cl_2)	Milder
6.	Sarett reagent (i.e. PCC in CH_2Cl_2)  + CrO_3 + HCl + CH_2Cl_2	Milder
7.	PDC (Pyridinium dichromate) 	Milder
8.	$TsCl + DMSO + NaHCO_3\ RCH_2OH \rightarrow^{Ts-Cl} RCH_2OTs \rightarrow^{DMSO}_{NaHCO_3} RCHO\ R_2CHOH \rightarrow^{Ts-Cl} R_2CH$	Milder
9.	NBS (N-Bromosuccinamide) 	Milder

Ex. Different oxidising agents are used to oxidise alcohols in corresponding carbonyl compounds and carboxylic acids.
e.g.



(IV)



(V) Double bond or Tripple bond is not affected by 4,5,6,7,8,9,10

(VI) No effect on 3° alcohol by 1, 2, 3, 5, 6, 7, 8, 9, 10, 12, 13

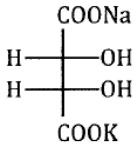
6. Oxidation of Carbonyl compounds:

1. Tollen's Test (Silver mirror test)

   $RCHO + \left[Ag\left(NH_3\right)_2\right]OH$ (Tollen's Reagent) $\rightarrow^{\Delta} RCOOH + NH_3 + Ag \downarrow$ (Silver mirror)

   Aldehyde acts as reducing agent, they can reduce mild oxidizing agents like Tollen's Reagent. Tollen's test gentle Heating for 20 to 25 mins.

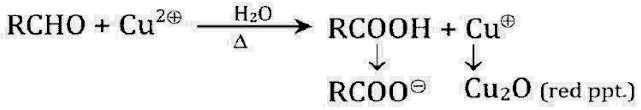
2. Fehling's Solutions



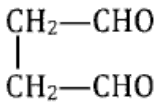
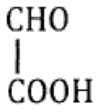
Fehling's A
aq. $CuSO_4$

Fehling's B
Alkaline solution of Roschelye salt (sodium potassium tartrate)

It act's a carrier for $Cu^{2\oplus}$ as it make reversible complex with $Cu^{2\oplus}$
This test is also used is Blood and Urine test.

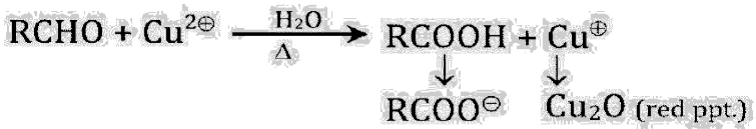


Note: Aromatic aldehyde shows negative test with fehling reagent.

S.No.	Reactant	Fehling solution	Tollen's Reagent
1.	Glucose, Fructose	+	+
2.	α-hydroxy aldehyde	+	+
3.	α-hydroxy ketone	+	+
4.	Formic acid	+	+
5.	Succinaldehyde 	+CHO	+
6.	Pyruvaldehyde CH_3COCHO	+	+
7.	Glyoxal	-	+
8.	Benzaldehyde and other aromatic aldehyde	-	+
9.	Glyoxylic acid 	-	+

3. Benedict's solution

Sodium Citrate + $NaOH$ + $NaHCO_3$ + $CuSO_4$



It is similar to Fehling test

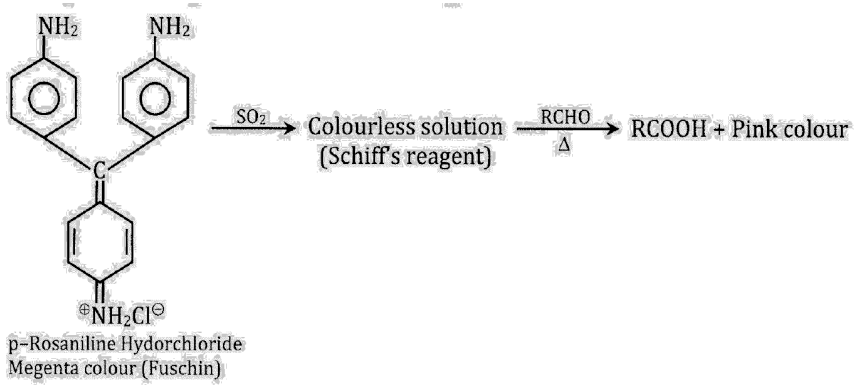
4. $RCHO + HgCl_2 + H_2O \xrightarrow[\Delta]{} RCOOH + 2HCl + Hg_2Cl_2$ (white)

$RCHO + Hg_2Cl_2 + H_2O \xrightarrow[\Delta]{} RCOOH + 2HCl + 2Hg \downarrow$ greyish black

5. Schiff's Reagent

Schiff's Reagent is aq. solution of following base decolourised by passing SO_2.

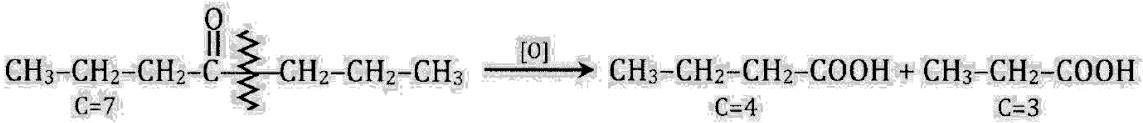
Aldehyde restore pink colour of Schiff's reagent.



Ketones are not easy to oxidize so they do not give these 5 tests. These five tests can be used to distinguish aldehyde and ketones. Both gives 2,4 DNP test.

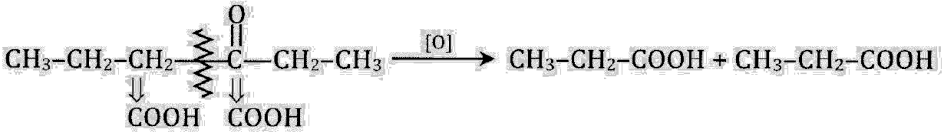
Oxidation of ketones: Ketones undergo oxidation only in drastic conditions.
During the oxidation of ketones there is breaking of carbon-carbon bond between α-carbon and carbonyl carbon. In this process both carbons convert into carboxylic groups. This leads to the formation of two moles of monocarboxylic acids.

Case - I : Oxidation of Symmetrical ketones:

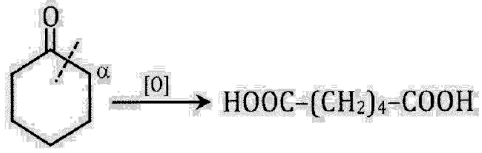


Total number of C'S $= 4 + 3 = 7$?
Thus number of carbons in any product is less than the number of carbons in ketone.

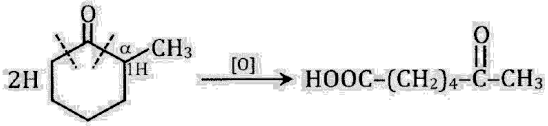
Case - II : Oxidation of unsymmetrical ketones : In case of unsymmetrical ketones, those break in which alkyl group has more number of carbons. This rule is known as Poff's rule.



Case- III : Oxidation of cyclic ketones : Formation of dibasic acid takes place from cyclic ketones. In this case number of carbons in ketone and dibasic carboxylic acid is always same.

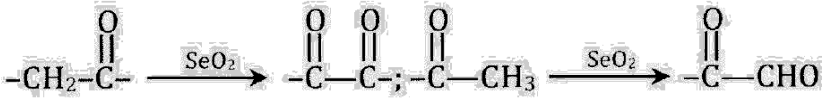


Note : If both α-carbons are not identical then;



Allylic oxidation

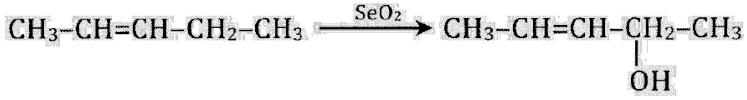
SeO_2 is a selective oxidizing agent with converts $-CH_2$ - group adjacent to carbonyl group into carbonyl group. The reagent, in general, oxidises active methylene and methyl groups to ketonic and aldehydic groups respectively.

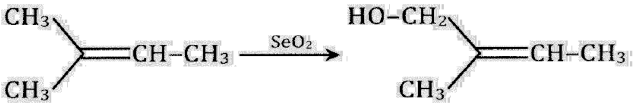


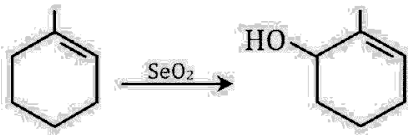
Double bonds, triple bonds and aromatic rings may also activate the methylene group. The methylene or methyl group α to the most highly substituted end of the double bond is hydroxylated according to the order of preference of oxidation $CH_2 > CH_3 > CH$ groups.

$2^{\circ}C - H > 1^{\circ}C - H > 3^{\circ}C - H$

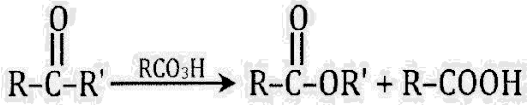
Rate of reactivity order







Baeyer villager oxidation

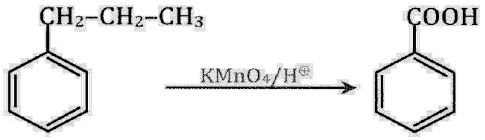


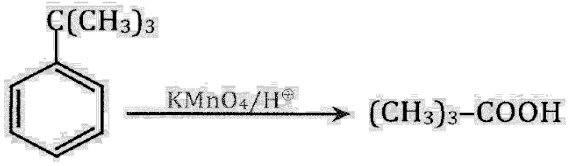
Migratory order for above reaction

$-H > 3^{\circ} > 2^{\circ} > -Ph > 1^{\circ} > -Me$

7. Oxidation of Aromatic Compounds :

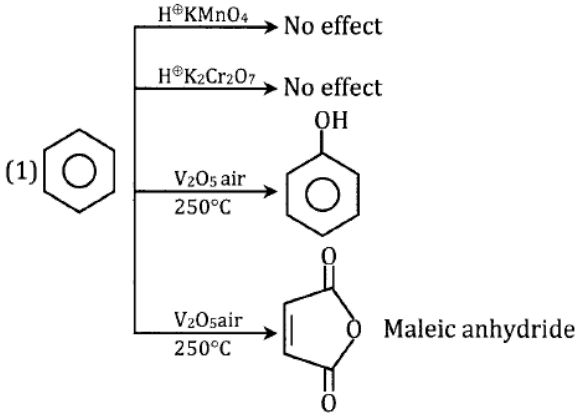
Alkyl group having no $\alpha - H$ atom will not be oxidized to - COOH . Any alkyl group containing at least one $\alpha - H$ atom will be oxidized to -COOH . The product of oxidation will be benzoic acid.

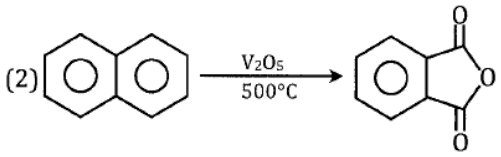


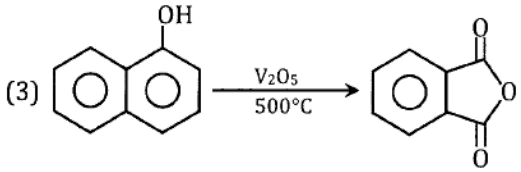


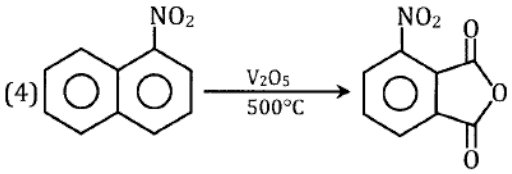
The order of benzoic acid formation by oxidation of alkyl benzene.

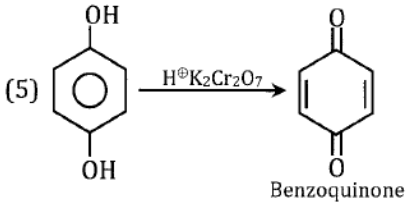
Methyl benzene > 1° alkyl benzene > 2° alkyl benzene

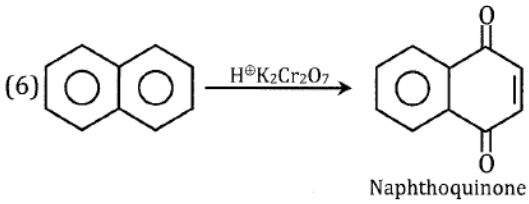


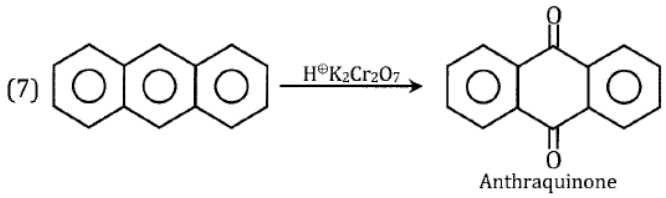


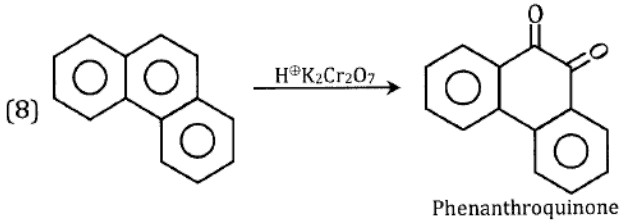


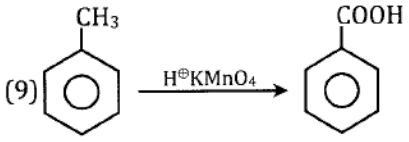


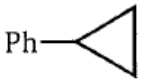




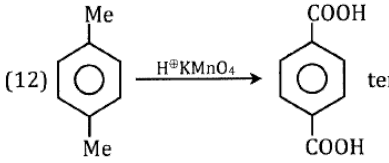




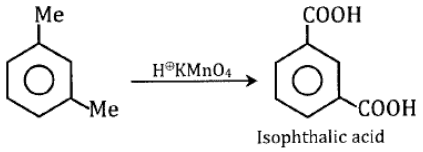


(10) $Ph(CH_2)CH_3, PhCHMe2, Ph-CH_2OH, Ph-CH_2Br, PhCHCl_2, PhCHO,$  & all the compounds having at least one αH give PhCOOH .

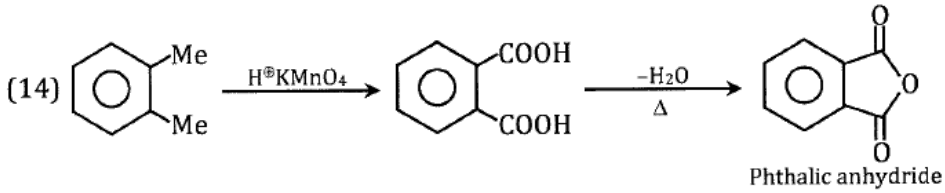
(11) $Ph-CMe_3 \xrightarrow[\Delta]{H^{\oplus}KMnO_4} Me_3C-COOH$



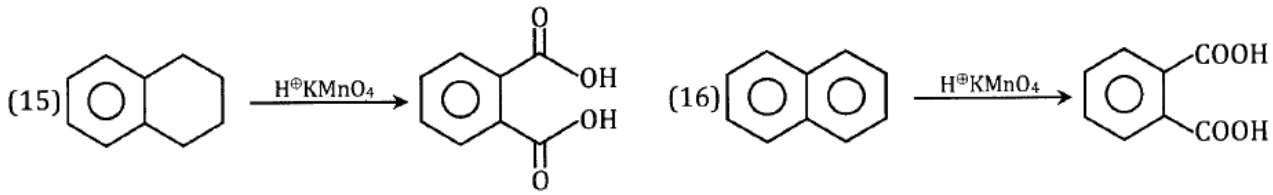
terephthalic

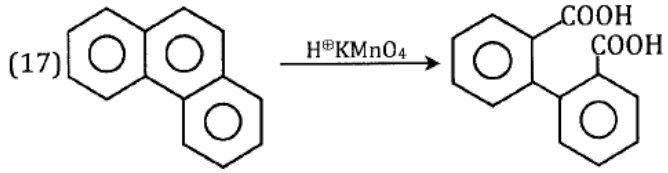


Isophthalic acid

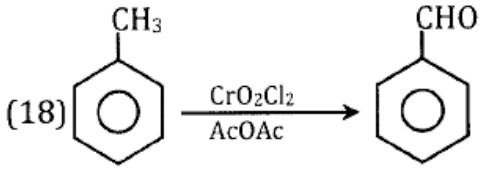


Phthalic anhydride

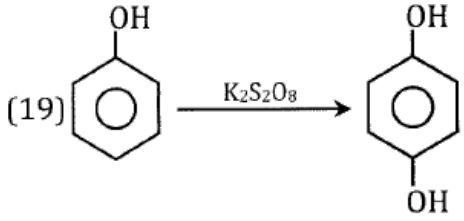




Etard oxidation



Elb's persulphate oxidatin

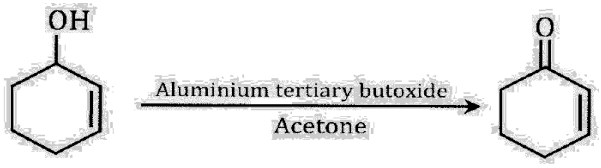


EXERCISE - 0

SINGLE CORRECT TYPE QUESTIONS

Oxidation of Alcohol

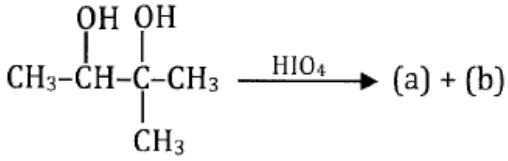
1. The given reaction



is knows as :

(A) Kolbe reaction
(B) Tischenko reaction
(C) MPV reaction
(D) Oppeneur oxidation

2. In the given reaction :



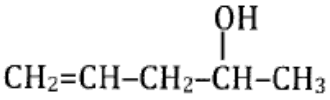
(a) and (b) respectively be :

(A) CH_3CHO and CH_3CHO
(B) CH_3COCH_3 and CH_3CHO
(C) CH_3COCH_3 and CH_3COCH_3
(D) CH_3COOH and CH_3COCH_3

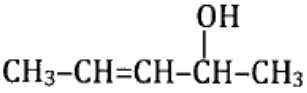
3. Which one of the following alcohols are oxidised by MnO_2 ?

(A) $C_6H_5 - CH_2 - CH_2 - OH$

(B)



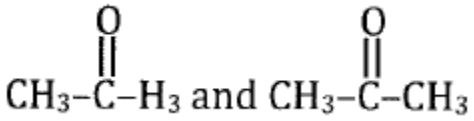
(C)



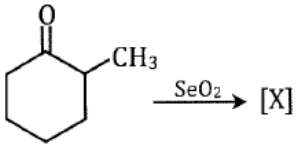
(D) $CH_3 - CH_2 - CH_2 - OH$

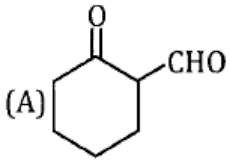
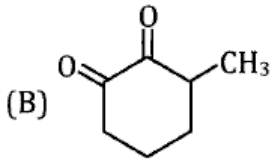
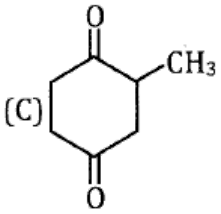
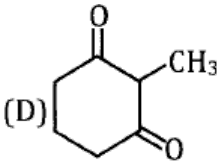
4. Which of the following can be oxidised by MnO_2 :

Oxidation of Aldehyde and ketone

5. 

is differentiated by
(A) Tollen's reagent (B) Lucas test (C) Iodoform test (D) $NaHSO_3$ test

6. In the given reaction 
[X]will be :

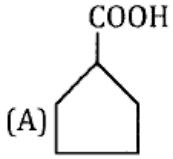
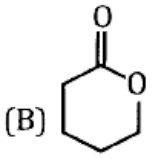
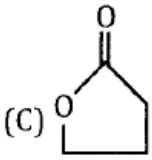





7. Which will give silver mirror test with Tollens reagent :
(A) C_6H_5CHO
(B) $CH_3 - CHO$
(C) HCOOH
(D) All of these

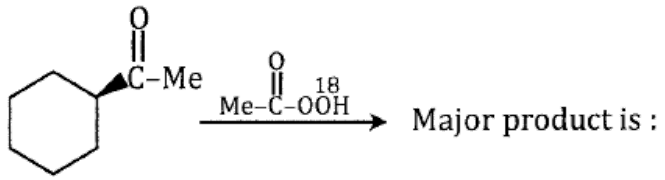
8. Which one of the following compounds will give dimethyl glyoxal with SeO_2 :
(A) Acetone
(B) Acetophenone
(C) Ethyl methyl ketone
(D) Propanaldehyde

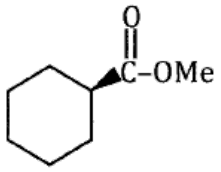
Miscellaneous Oxidising agent

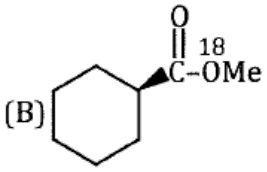
9.  Major product is :

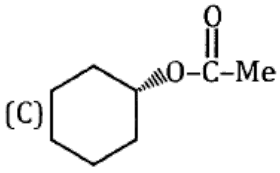




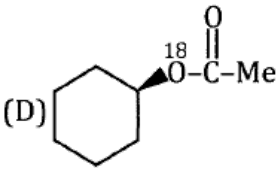

10.



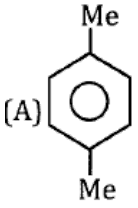
(A) 

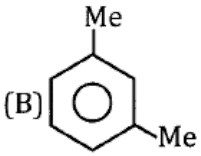
(B) 

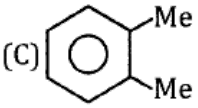
(C) 

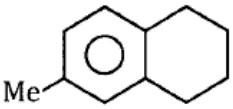
(D) 

11. $A\ H^{\oplus}/KMnO_4 \rightarrow B\ \Delta \rightarrow$ Phthalic Anhydride ; A is :

(A) 

(B) 

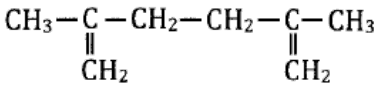
(C) 

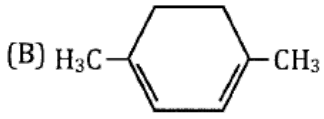
(D) 

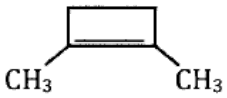
MULTIPLE CORRECT TYPE QUESTIONS

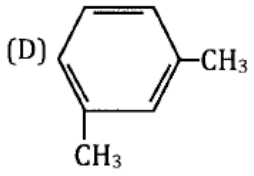
Oxidation of Alkene

12. An organic compound on reaction with O_3 followed by Zn and H_2O gives $CH_3COCH_2CH_2COCH_3$. The structure(s) is/are

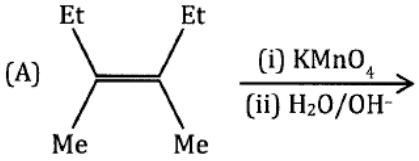
(A) 

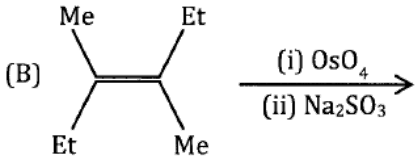
(B) 

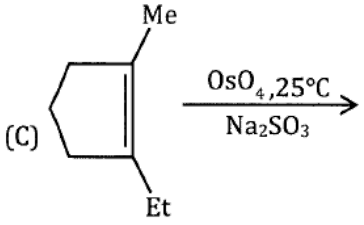
(C) 

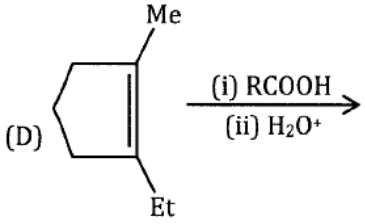
(D) 

13. Which of the following give syn addition?

(A) 

(B) 

(C) 

(D) 

14. On oxidation, an unknown alkane C_8H_{16} gives a mixture of propanoic acid and pentanoic acid. The unknown alkene can be

(A) cis-3-octene (B) trans-3-octene
(C) cis-4-octene (D) trans-4-octene

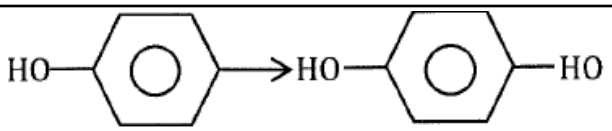
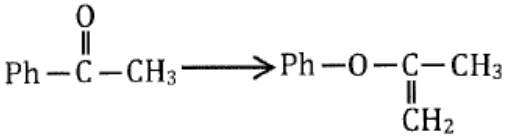
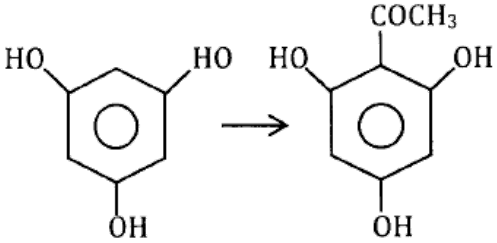
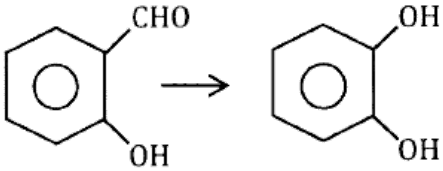
Oxidation of Alcohol

15. Propan-1-ol and Propan-2-ol can be best distinguished by
(A) oxidation with alkaline $KMnO_4$ followed by reaction with H_2O
(B) oxidation with PCC followed by reaction with Tollen's reagent
(C) oxidation by heating with copper followed by reaction with iodoform test
(D) reaction with cone. H_2SO_4 followed by reaction with Fehling solution.

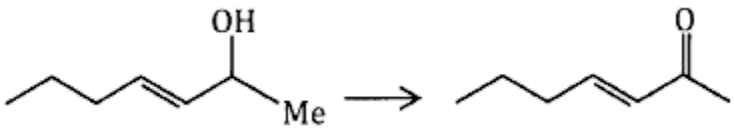
MATRIX MATCH TYPE QUESTION

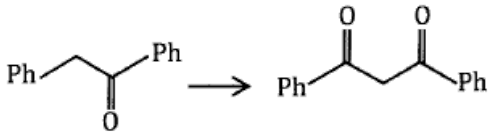
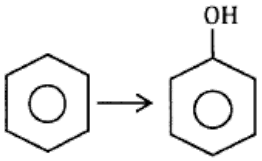
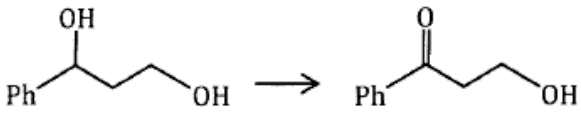
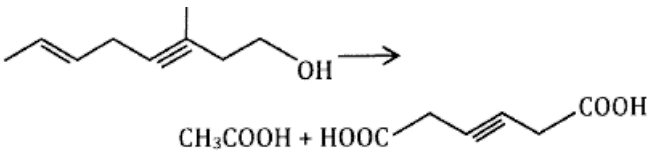
Oxidation of Alcohol

16. Match the items given in column I with those in column II.

Column I		**Column II**		**Column III**	
a.		p.	$H_2O_2 + NaOH$	i.	Elbs persulphate oxidation
b.		q.	$CH_3 - C \equiv N$, $ZnCl_2/HCl$	ii.	BaeyerVilliger oxidation
c.		r.	$K_2S_2O_8 + NaOH$	iii.	HoubenRoesch synthesis
d.		s.	Per acid	iv.	Dakin reaction

17. Match the items given in column I with those in column II.

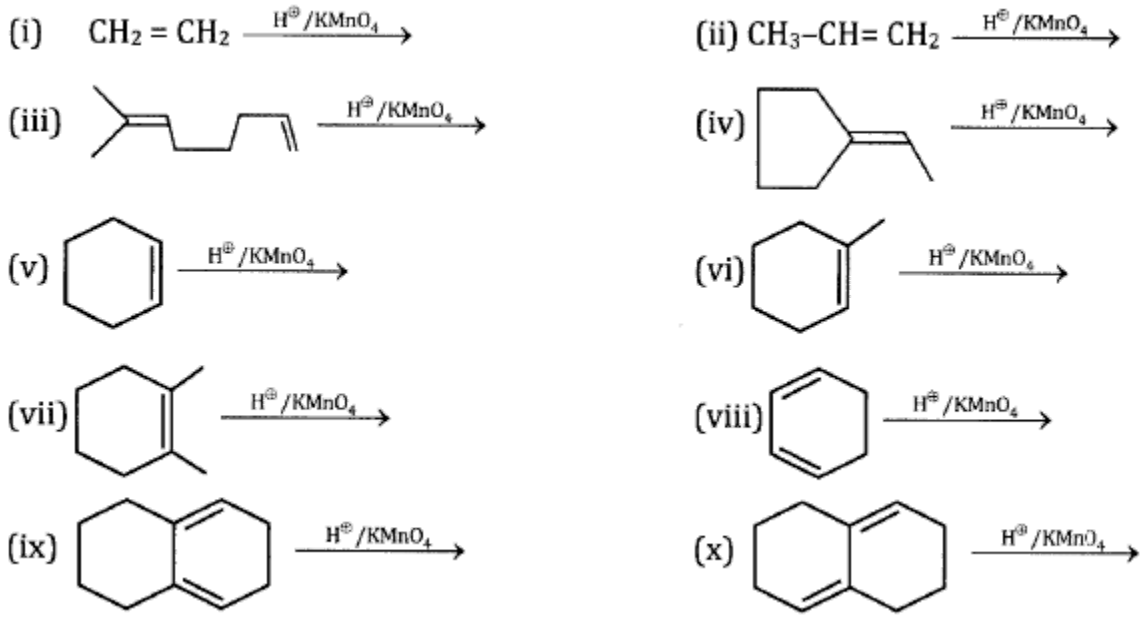
Column I			Column II
a		p.	MnO_2

b		q.	$FeSO_4\ and\ H_2O_2\ \ (fenton's\ \ reagent)$
c		r.	Jones reagent (H_2CrO_4 in aq. acetone)
d		s.	$CrCO_3$ in glacial acetic acid
e		t.	$SeO_2/MeCOOH$

EXERCISE - S

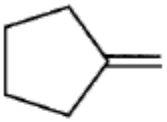
Oxidation of Alkene

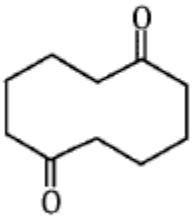
1.



2. A to D alkenes with minimum possible carbon.

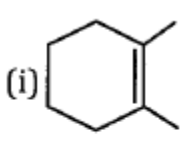
(i) A $\xrightarrow[\Delta]{H^{\oplus}/KMnO_4}$ MeCOOH as the only product

(ii) B $\xrightarrow[\Delta]{H^{\oplus}/KMnO_4}$  as the only product

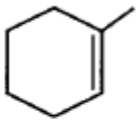
(iii) C $\xrightarrow[\Delta]{H^{\oplus}/KMnO_4}$ 

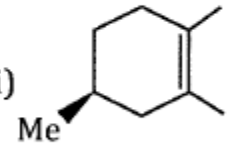
(iv) D $\xrightarrow[\Delta]{H^{\oplus}/KMnO_4}$ Acetone + Ethanoic acid

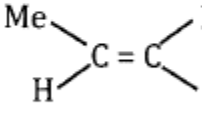
3.

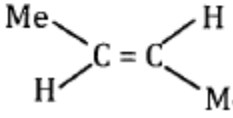
(i)  $\xrightarrow[KMnO_4]{1\%\text{ alkaline}}$ A

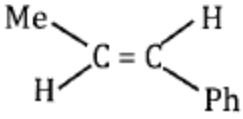
 $\xrightarrow{m\text{-CPBA}/H_3O^+}$ B

(ii)  $\xrightarrow{m\text{-CPBA}}$

(iii)  $\xrightarrow[\text{hydrolysis}]{m\text{-CPBA}}$

(iv)  $\xrightarrow[\text{hydrolysis}]{m\text{-CPBA}}$

(v)  $\xrightarrow[\text{hydrolysis}]{m\text{-CPBA}}$

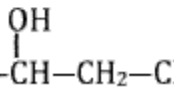
(vi)  $\xrightarrow[\Delta]{Ag_2O \text{ or } 2Ag\frac{1}{2}O_2}$

Oxidation of Alcohol

4.

(i) $CH_3-CH_2-CH_2-OH \xrightarrow{KMnO_4/OH^-,\Delta}$?

$\xrightarrow[\text{or conc. } HNO_3, \Delta \text{ or } KMnO_4 / H^+, \Delta]{K_2Cr_2O_7 / H^+, \Delta}$

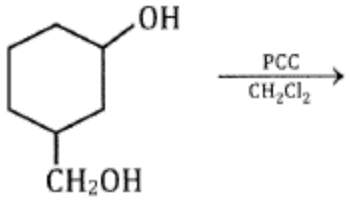
(ii)  $\xrightarrow[\text{or}K_2Cr_2O_7,H^{\oplus}]{KMnO_4,H^{\oplus}}$?

5.

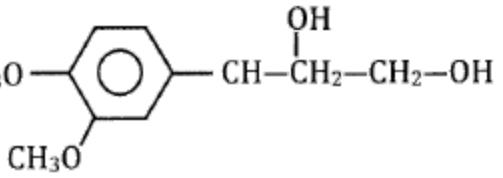
(i) $CH_2 = CH - (CH_2)_3 - CH_2 - OH \xrightarrow[\text{in glacial acetic acid}]{\text{Chromic anhydride}}$

(ii) $C_6H_5 - CH = CH - CH_2 - OH \xrightarrow[\text{in glacial acetic acid}]{\text{Chromic anhydride}}$

(iii) $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-CH_2-CH_2-OH \xrightarrow[CH_2Cl_2]{PCC}$ (A)

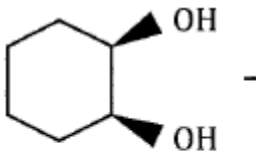
(iv)  $\xrightarrow[CH_2Cl_2]{PCC}$

(v) $CH_2 = CH - CH_2-OH \xrightarrow{MnO_2}$?

(vi)  $\xrightarrow[\text{Acetone}]{MnO_2}$?

6.

(i) $Me-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-OH \xrightarrow[\Delta]{HIO_4}$

(ii)  $\xrightarrow[\Delta]{HIO_4}$

(iii) $HO-CH_2-CH_2-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-OH \xrightarrow[\Delta]{HIO_4}$

(iv) $\underset{\displaystyle OH}{\underset{|}{CH_2}}-\underset{\displaystyle OH}{\underset{|}{CH}}-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3 \xrightarrow[\Delta]{HIO_4}$

(v) $\underset{\displaystyle OH}{\underset{|}{CH_2}}-\underset{\displaystyle OH}{\underset{|}{CH}}-\underset{\displaystyle OH}{\underset{|}{CH}}-\underset{\displaystyle OH}{\underset{|}{CH_2}} \xrightarrow[\Delta]{HIO_4}$

(vi) $Me-\underset{\displaystyle O}{\underset{||}{C}}-\underset{\displaystyle OH}{\underset{|}{CH}}-Me \xrightarrow[\Delta]{HIO_4}$

(vii) $Me-\underset{\displaystyle O}{\underset{||}{C}}-\underset{\displaystyle O}{\underset{||}{C}}-Me \xrightarrow[\Delta]{HIO_4}$

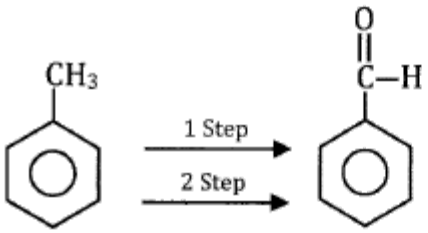
Oxidation of Aldehyde and ketone

7.

(a) $CH_3-CHO \xrightarrow[\Delta]{SeO_2}$

(b) $Me_2CO \xrightarrow[\Delta]{SeO_2}$

(c) $CH_3-CH=CH_2 \xrightarrow{?}$ Acrolein

(d) 

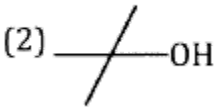
(e) $CH_3-\overset{O}{\overset{\|}{C}}-H \xrightarrow{SeO_2} P_1 \xrightarrow{\text{Conc. NaOH}} \underset{\underset{COO^-Na^+}{|}}{CH_2OH} \xrightarrow{H^+/\Delta} P_2$

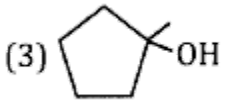
8. (a) How will you differentiate HCHO and PhCHO ?
(b) How will you differentiate HCHO and MeCHO ?

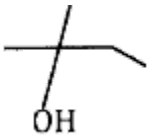
EXERCISE - JEE (Main) PYQ

1. Which of the following will change the colour of acidic dichromate solution. [JEE (Main) 2013]

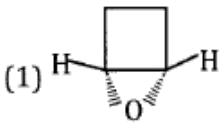
(1) 

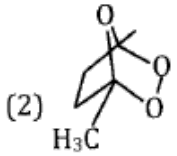
(2) 

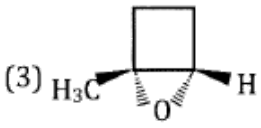
(3) 

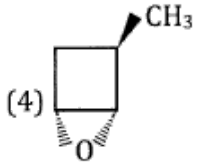
(4) 

2. [JEE (Main) 2013]

(1) 

(2) 

(3) 

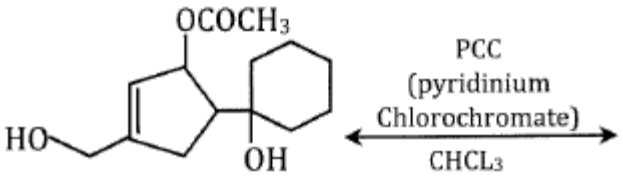
(4) 

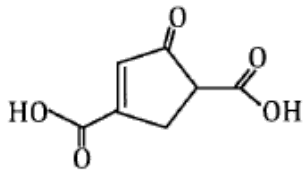
3. The most suitable reagent for the conversion of $R-CH_2-OH \rightarrow R-CHO$ is :- [JEE (Main) 2014]

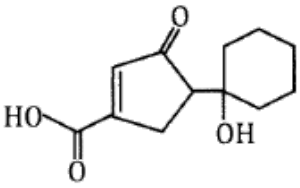
(1) CrO_3 (2) PCC (Pyridinium chlorochromate)

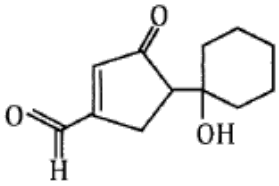
(3) $KMNO_4$ (4) $K_2Cr_2O_7$

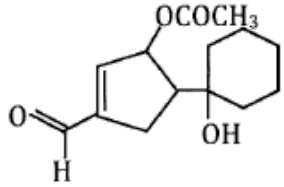
4. The major product formed in the following reaction is :- [JEE (Main) 2018]



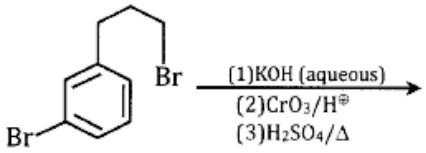
(1) 

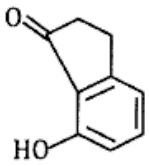
(2) 

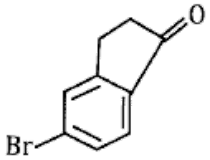
(3) 

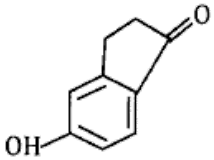
(4) 

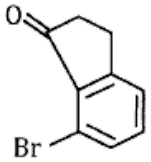
5. The major product of the following reaction is: [JEE (Main) 2019]



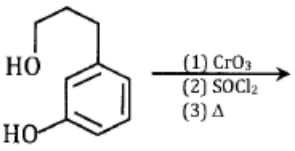
(1) 

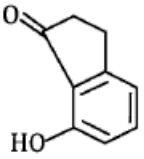
(2) 

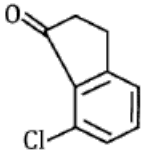
(3) 

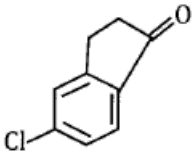
(4) 

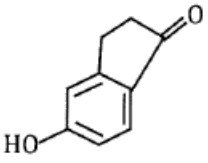
6. The major product of the following reaction [JEE (Main) 2019]



(1) 

(2) 

(3) 

(4) 

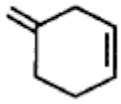
An unsaturated hydrocarbon X absorbs two hydrogen molecules on catalytic hydrogenattion, and also gives following reaction : [JEE (Main) 2020]

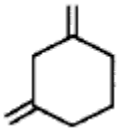
$$X \quad O_3 \rightarrow \underset{Zn/H_2O}{} A \left[Ag\left(NH_3\right)_2\right]^{\oplus} \rightarrow$$

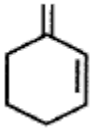
7.

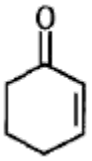
B (3-oxo-hexanedicarboxylic acid)

X will be :-

(1) 

(2) 

(3) 

(4) 

Which of the following reagent is used for the following reaction? [JEE (Main) 2021]

$CH_3CH_2CH_3 \rightarrow^{?} CH_3CH_2CHO$

8.

(1) Manganese acetate
(2) Copper at high temperature and pressure
(3) Molybdenum oxide
(4) Potassium permanganate

9. Which one of the following reactions will not form acetaldehyde? [JEE (Main) 2021]

(1) $CH_3CH_2OH \rightarrow^{\underset{573\ K}{Cu}}$

(2) $CH_3CN \rightarrow^{\underset{(ii)\ H_2O}{(i)\ DiBL-H}}$

(3) $CH_2CN\ (i)pd[ii]/Cu(ii) \rightarrow_{(ii)\ H_2O}$

(4) $CH_3CH_2OH \rightarrow^{CrO_3-H_2SO_4}$

10. Given below are two statements : [JEE (Main) 2021]

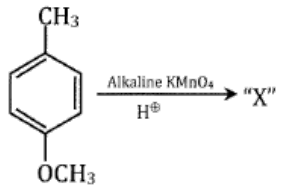
Statement-I : 2-methylbutane on oxidation with $KMnO_4$ gives 2-methylbutan-2-ol.

Statement-II : n-alkanes can be easily oxidised to corresponding alcohols with $KMnO_4$.

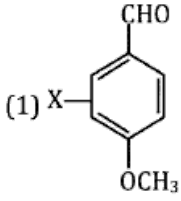
Choose the correct option :

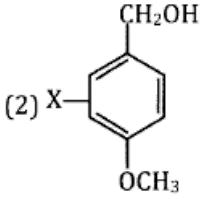
(1) Both statement I and statement II are correct
(2) Both statement I and statement II are incorrect
(3) Statement I is correct but Statement II is incorrect
(4) Statement I is incorrect but Statement II is correct

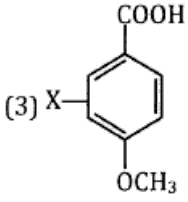
11. [JEE (Main) 2021]

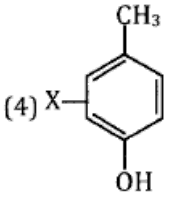


Considering the above chemical reaction, identify the product " X " :

(1) 

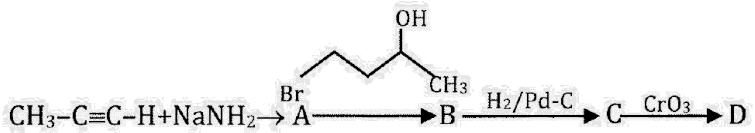
(2) 

(3) 

(4) 

12. In the following sequence of reactions, the final product D is : [JEE (Main) 2021]

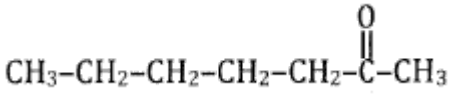
(1)



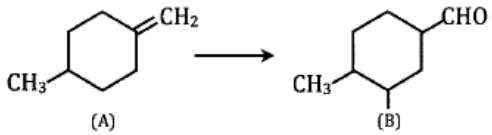
(2) $CH_3 - CH = CH - CH_2 - CH_2 - CH_2 - COOH$

(3) $H_3C - CH = CH - CH(OH) - CH_2 - CH_2 - CH_3$

(4)



13. Which of the following reagents/reactions will convert ' A ' to ' B '? [JEE (Main) 2022]



(1) PCC oxidation

(2) Ozonolysis

(3) $BH_3, H_2O_2/ - OH$ followed by PCC oxidation

(4) HBr , hydrolysis followed by oxidation by $K_2Cr_2O_7$

14. ' A ' and ' B ' respectively are: [JEE (Main) 2022]

A $(i)O_3 \xrightarrow[(2)Zn-H_2O]{}$ Ethane-1,2-dicarbaldehyde + Glyoxal/Oxaldehyde

B $(i)O_3 \xrightarrow[(2)Zn-H_2O]{}$ 5-oxohexanal

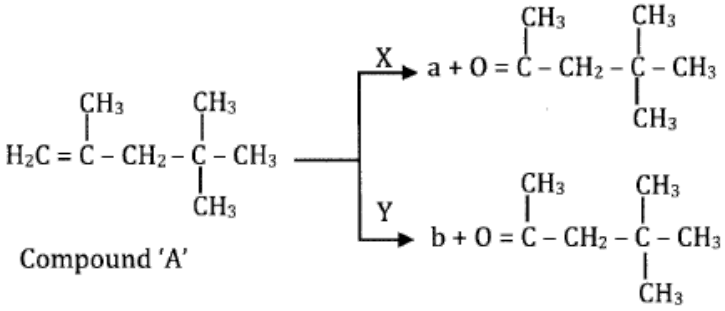
(1) 1-methylcyclohex-1, 3-diene & cyclopentene

(2) Cyclohex-1, 3-diene & cyclopentene

(3) 1-methylcyclohex-1,4-diene & 1-methylcyclopent-1-ene

(4) Cyclohex-1,3-diene & 1-methylcyclopent-1-ene

15. A compound ' A ' on reaction with ' X ' and ' Y produces the same major product but different by product 'a' and 'b'. Oxidation of 'a' gives a substance produced by ants. [JEE (Main) 2022]



' X ' and ' Y ' respectively are :

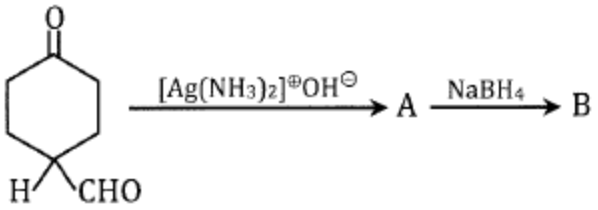
(1) $KMnO_4/H^{\oplus}$ and dil. $KMnO_4$, 273 K

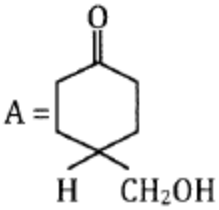
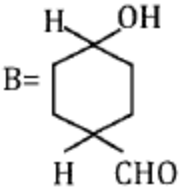
(2) $KMnO_4$,(dilute), 273 K and $KMnO_4/H^{\oplus}$

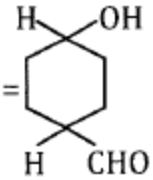
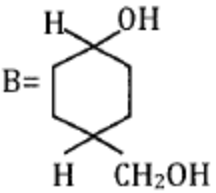
(3) $KMnO_4/H^{\oplus}$ and $O_3, H_2O/Zn$

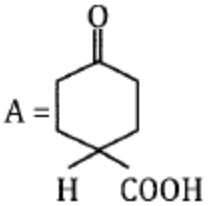
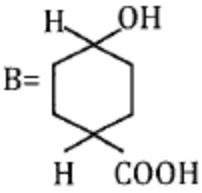
(4) $O_3, H_2O/Zn$ and $KMnO_4/H^{\oplus}$

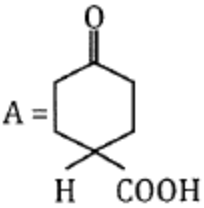
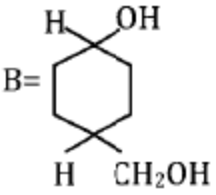
16. The products formed in the following reaction, A and B are [Jee (main)2022)]



(1) A =  B= 

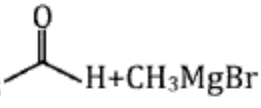
(2) A =  B= 

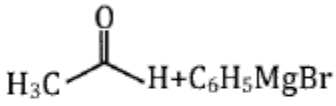
(3) A =  B= 

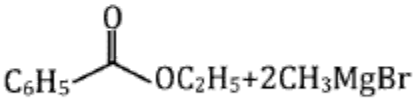
(4) A =  B= 

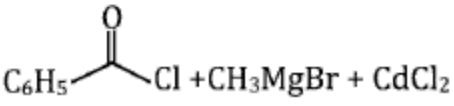
17. Hex-4-ene-2-ol on treatment with PCC gives ' A '. ' A ' on reaction with sodium hypoiodite gives ' B ', which on further heating with soda lime gives ' C '. The compound ' C ' is [JEE (Main) 2022]
(1) 2-pentene (2) proponaldehyde (3) 2-butene (4) 4-methylpent-2-ene

18. Which of the following conditions or reaction sequence will NOT give acetophenone as the major product? [JEE (Main) 2022]

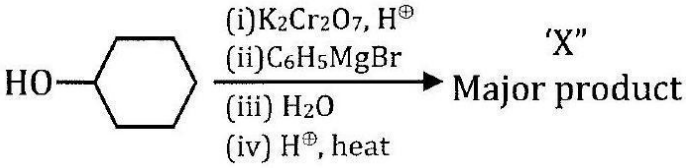
(1) (a)  (b) $Na_2Cr_2O_7$, $H^{\oplus}$

(2) (a)  (b) PCC, DCM

(3) 

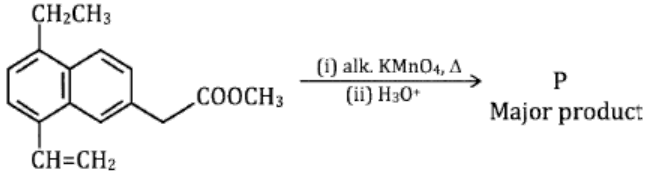
(4) 

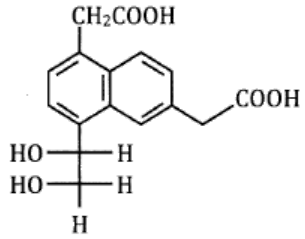
19. In the given reaction

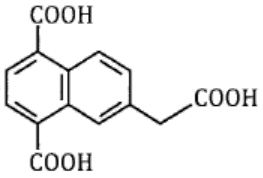


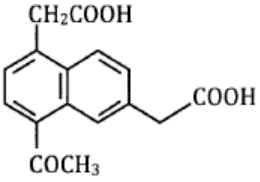
the number of sp^2 hybridised carbon (s) in compound ' X ' is _____ . [JEE (Main) 2022]

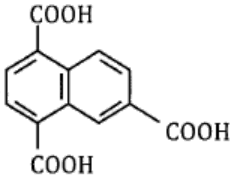
20. The major product ' P ' formed in the given reaction is



(1) 

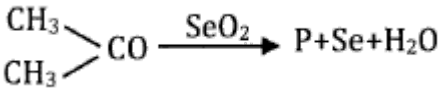
(2) 

(3) 

(4) 

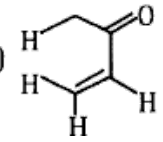
EXERCISE - JEE (Advanced) PYQ

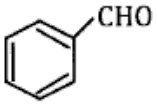
1. In the reaction, P is [IIT 1995]

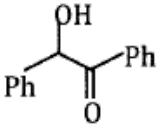


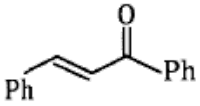
(A) CH_3COCHO (B) CH_3COOCH_3 (C) CH_3COCH_2OH (D) None

2. Positive Tollen's test is observed for [Jee(Advanced)2016)]

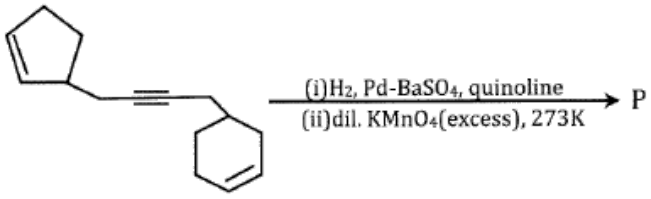
(A) 

(B) 

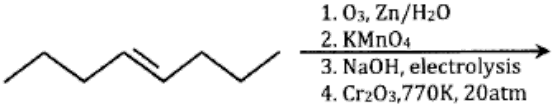
(C) 

(D) 

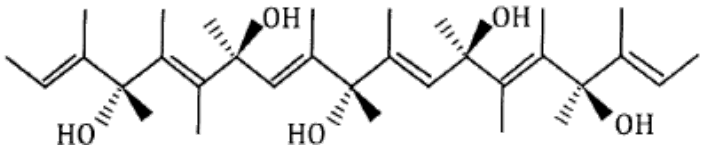
3. Total number of hydroxyl groups present in a molecule of the major product P is [JEE (Advanced) 2019]



4. The number of $-CH_2$ - (methylene) groups in the product formed from the following reaction sequence is _____ . [JEE (Advanced) 2022]



5. The total number of chiral molecules formed from one molecule of *P* on complete ozonolysis $\left(O_3, Zn/H_2O\right)$ is _____ . [JEE (Advanced) 2022]



JEE (Main) Practice Paper

(This paper is for yourself practice and assessment the discussion of this paper is optional though you can) see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

SECTION-A

- This section contains TWENTY questions.
- Each question has FOUR options (1), (2), (3) and (4). ONLY ONE of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories

  Full Marks : + 4, if only the bubble corresponding to the correct option is darkened.
  Zero Marks : 0, if none of the bubbles is darkened.
  Negative Marks : -1 in all other cases

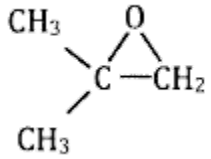
1. $\left(CH_3\right)CHOH \;\; Mild\ oxid \rightarrow X\ (1)CH_3Mgr\rightarrow \underset{(2)H_3O^{\oplus}}{\quad} Y$. Here Y is

   (1) Isobutyl alcohol (2) tert-Buiyl alcohol
   (3) Isobutylene (4) sec-Butyl alcohol

2. $CH_3)_3\ CCl\ alc.\ KOH\rightarrow \underset{\Delta}{\quad} X\ CF_3CO_3H \rightarrow Y$ The product ' Y ' is

   (1) $CH_2 = CH - CH_2OH$

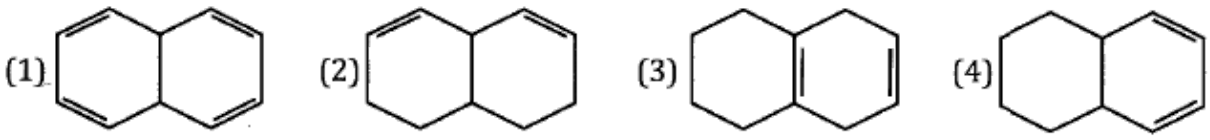
   (2)



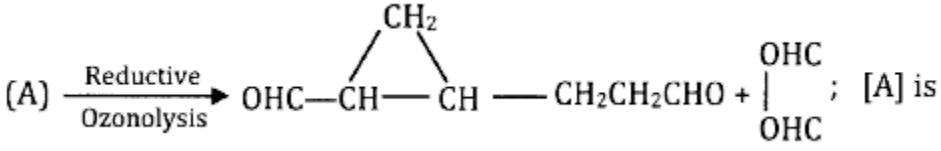
   (3) $CH_3COCH_2CH_3$

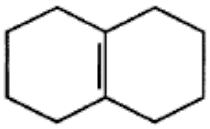
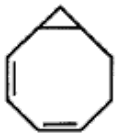
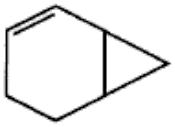
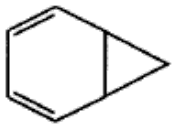
   (4) $\left(CH_3\right)_2 CHCH_2OH$

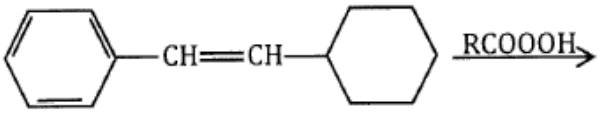
3. An unknown compound decolorizes bromine in carbon tetrachloride, and it undergoes catalytic reduction to give decalin. When treated with warm, conc. Potassium permanganate, this compound give cis-cyclohexane-1, 2-dicarboxylic acid and oxalic acid. A possible structure for the unknown compound is

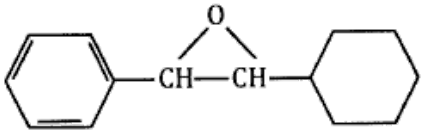
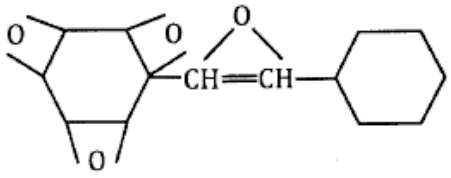


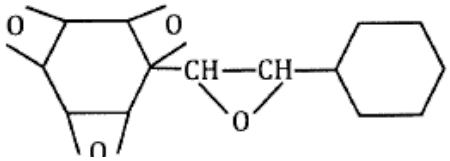
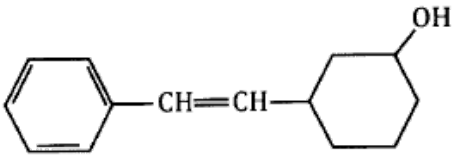
4.

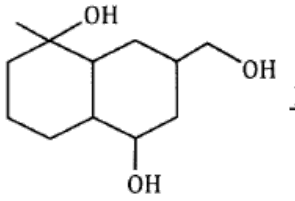


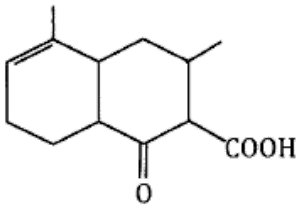
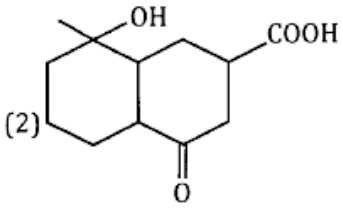
(1)  (2)  (3)  (4) 

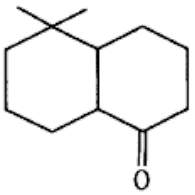
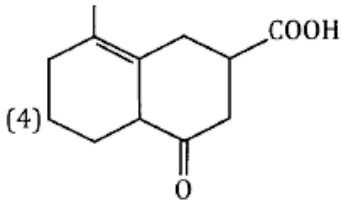
5. 

(1)  (2) 

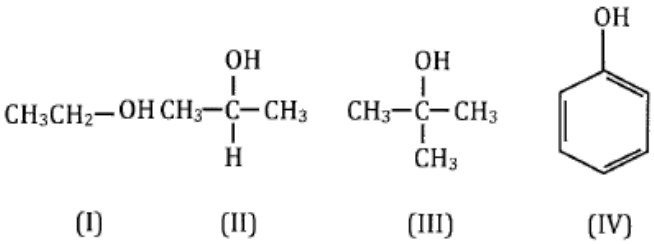
(3)  (4) 

6.  $\xrightarrow{KMnO_4/H^+}$ (P), product (P) is

(1)  (2) 

(3)  (4) 

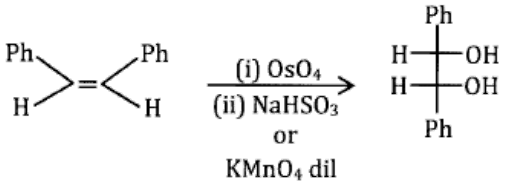
7. Which of the following sets of compounds cannot turn clear orange solution of $CrO_3/aq.\ H_2SO_4$ to greenish opaque solution?



(I) (II) (III) (IV)

(1) I, IV (2) II, III (3) I, II (4) III, IV

8. The given reaction,

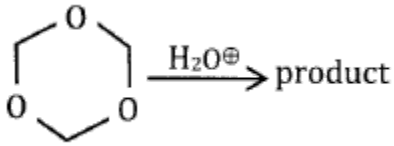


is an example of

(1) Stereospecific reaction (2) Stereoselective reaction

(3) Both (1) and (2) (4) Ordinary reaction

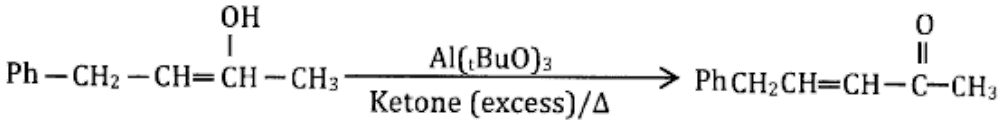
9.



Product obtained in the above reaction is

(1) $3CH_3CHO$ (2) 3 HCHO (3) 3 HCOOH (4) $3CH_3OH$

10. The reaction,



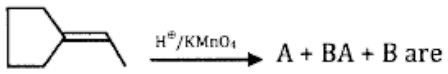
is known as

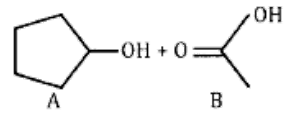
(1) Wolff-Kishner reduction (2) Oppenauer oxidation

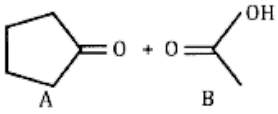
(3) Meerwein-Ponndorf reaction (4) Clemmensen reduction

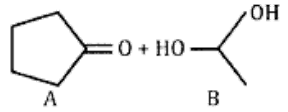
11. Which of the folloiwng can be oxidised to aldehyde or ketone by Jones reagent.

12.



(1) 

(2) 

(3) 

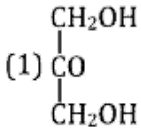
(4) None of these

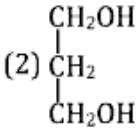
13. Glucose as well as fructose are oxidized by periodic acid. The number of moles of HCOOH formed from each mole of glucose and fructose are
(1) 5 and 5 (2) 5 and 4 (3) 5 and 3 (4) 4 and 3

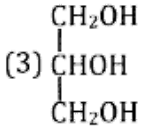
14. Secondary alcohols on heating with copper at $300^{\circ}C$ give
(1) Alkenes (2) Aldehydes (3) Ketones (4) tert-alcohols

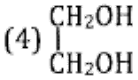
15. The reagent, with which both acetaldehyde and acetone react easily is :
(1) Tollens reagent (2) Schiff's reagent (3) H_2/Ni (4) Fehling's solution

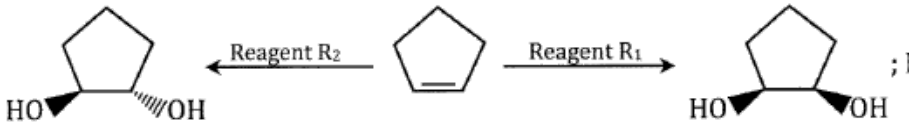
16. . Which of the following compounds is resistant to periodic acid oxidation ?

(1) 

(2) 

(3) 

(4) 

17. 

R_1 and R_2 are

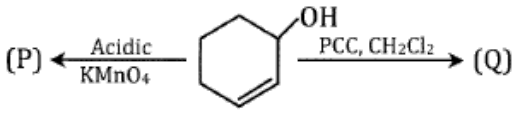
(1) Cold alkaline $KMnO_4$, OsO_4/H_2O_2

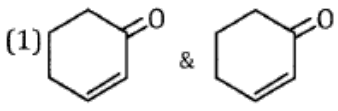
(2) Cold alkaline $KMnO_4$, HCO_3H & H_3O^+

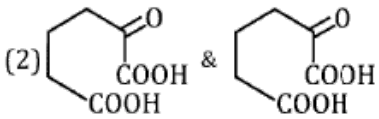
(3) Cold alkaline $KMnO_4$, $C_6H_5CO_3H$

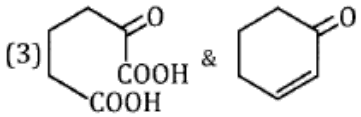
(4) $C_6H_5CO_3H$, HCO_3H

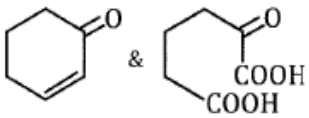
18. Identify (P) and (Q) respectively in the given reaction :



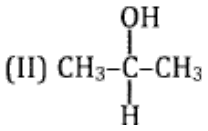
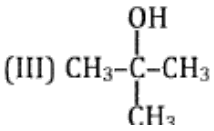
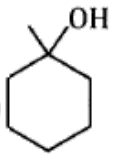
(1) 

(2) 

(3) 

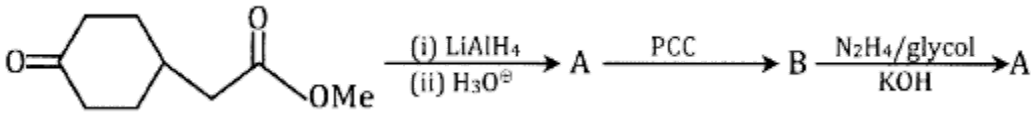
(4) 

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

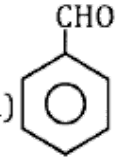
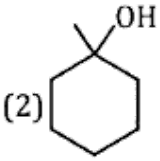
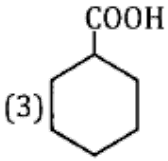
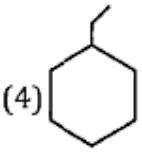
(I) CH_3CH_2-OH (II)  (III)  (IV) 

(1) I, IV (2) II, III (3) I, II (4) III, IV

20.



Product C is :

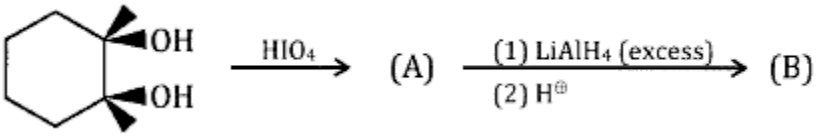
(1)  (2)  (3)  (4) 

SECTION-B

- This section will have SIX questions. Candidate can choose to attempt any 5 questions out of these 10 questions. In case if candidate attempts more than 5 questions, first 5 attempted questions will be considered for marking.
- The answer to each question is a NUMERICAL VALUE.
- For each question, enter the correct numerical value (Answer should be rounded off to the nearest integer).
- Answer to each question will be evaluated according to the following marking scheme:

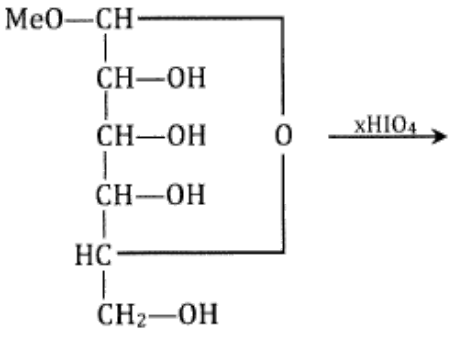
  Full Marks : + 4, if only correct answer is given.
  Zero Marks : 0, if no answer is given.
  Negative Marks : -1 , for incorrect answer

1.



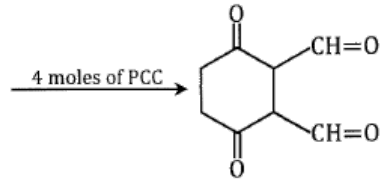
Total number of stereoisomers of product (B) will be :

2.



What is the maximum value of (x) ?

3.

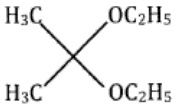
(A) 

Maximum number of moles of Ac_2O consumed by reactant (A) is :

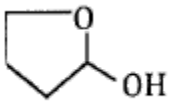
4. Out of the following compounds given below, the number of compounds which given positive test with Tollen's reagent are :

I. CH_3CHO II. PhCHO III. HCOOH

IV. CH_3COOH VI. V. $CH_3CH(OH)OC_2H_5$



VII. $CH_3C \equiv CH$ VIII IX. CH_3COCH_3



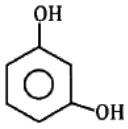
5. Out of the following compounds given below, the number of compounds which given positive iodoform test are :

I. CH_3CHO II. CH_3COCH_3 III. $C_2H_5COC_2H_5$

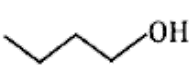
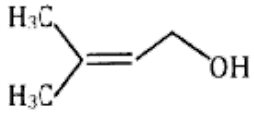
IV. $PhCOC_2H_5$ V. VI. $PhCOCH_2COPh^2$

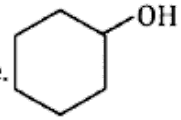
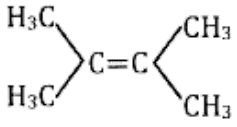
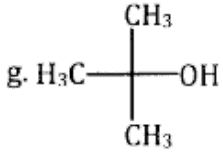
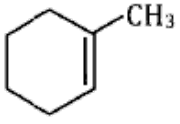
VII. VIII. $PhCOCH_3$ IX. $CH_3COC_2H_5$

X.



6. How many of the following can be oxidised to aldehyde or ketone by jones reagent or PCC.

a. $H_6C_6—CH_2OH$ b.  c. C_6H_6 d. 

e.  f.  g.  h. 

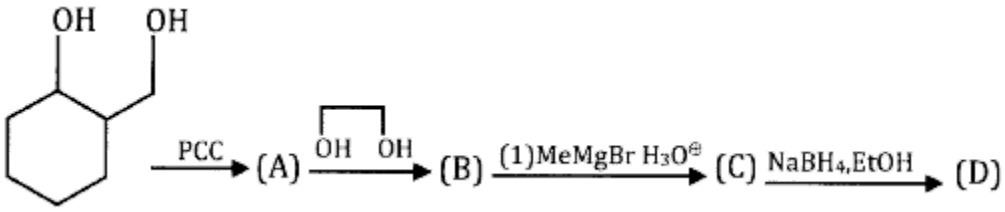
[*This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDI*

SECTION-I

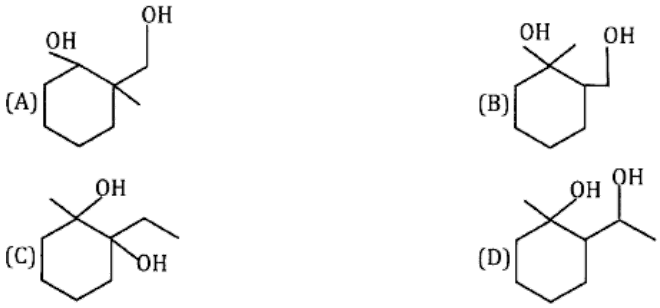
- This section contains SEVEN questions.
- Each question has FOUR options (A), (B), (C) and (D). ONLY ONE of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories:

  Full Marks : + 3, if only the bubble corresponding to the correct option is darkened.
  Zero Marks : 0, if none of the bubbles is darkened.
  Negative Marks : -1 , in all other cases

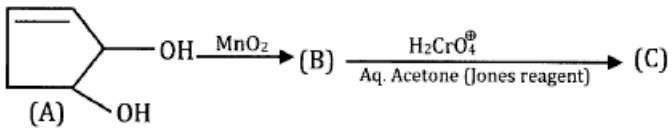
1.



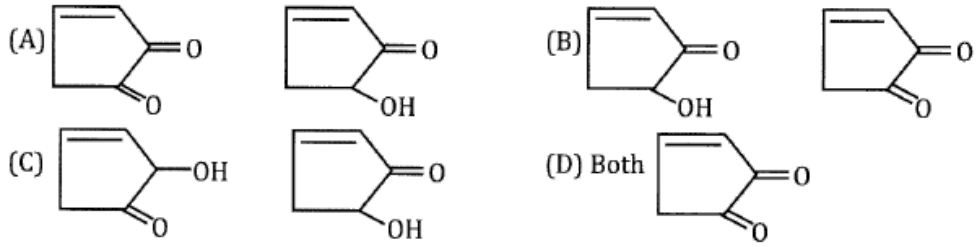
Product (D) in above reaction is :



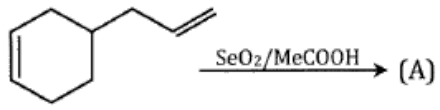
2.



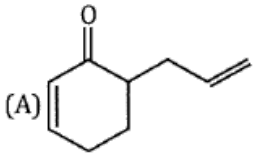
The compounds (B) and (C), respectively, are :

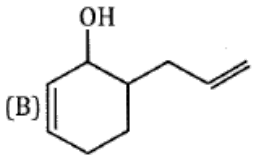


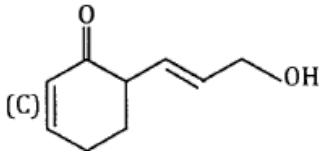
3.

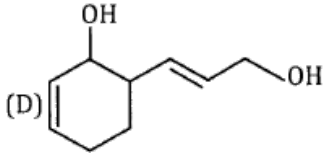


The compound (A) is

(A) 

(B) 

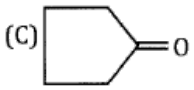
(C) 

(D) 

4. Acid-catalysed hydration, oxymercuration- demercuration, and hydroboration oxidation reaction will give the same product with

(A) But-2-ene

(B) But-l-ene

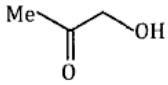
(C) 

(D) 

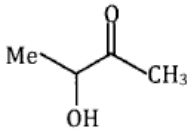
5. Fehling's solution can make distinction between:

(A) MeCHO and PhCHO

(B)

MeCHO and 

(C)

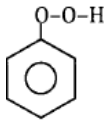
 and HCHO

(D) MeCHO and HCHO

6. Fenton's reagent $\left(Fe^{2\oplus} + H_2O_2\right)$ with benzene gives

(A) No reaction

(B)

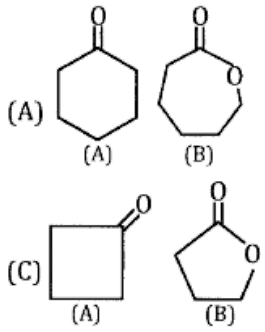


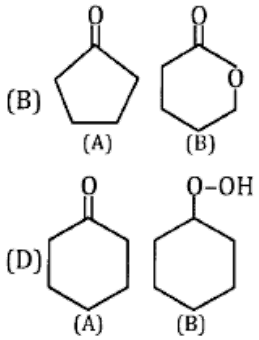
(C)

(D) $3(HOOC - COOH)$

7. Barium adipate $\xrightarrow{Dry\ distillation} (A)\ MeCO_3H \rightarrow (B)$

The compounds (A) and (B), respectively, are ;





SECTION-II

- This section contains SIX questions.
- Each question has FOUR options for correct answer(s). ONE OR MORE THAN ONE of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme:

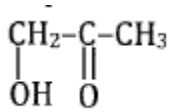
  Full Marks : + 4, if only (all) the correct option(s) is (are) chosen.
  Partial Marks : + 3, if all the four options are correct but ONLY three options are chosen.
  Partial Marks : + 2, if three or more options are correct but ONLY two options are chosen, both of which are correct options.
  Partial Marks : + 1, if two or more options are correct but ONLY one option is chosen and it is a correct option.
  Zero Marks : 0, if none of the options is chosen (i.e. the question is unanswered).
  Negative Marks : -2 in all other cases.

8. Which one of the following alcohols can be oxidised by K_2CrO_4 ?

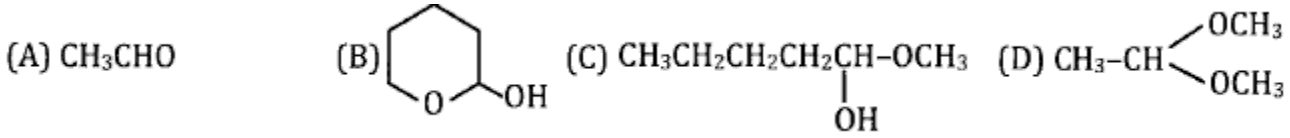
   (A) Ethanol (B) Tert butyl alcohol
   (C) Isopropyl alcohol (D) Allyl alcohol

9. Fehling solution gives red precipitate with :

   (A) Aromatic aldehyde (B) Aliphatic aldehyde
   (C) Ketones
   (D)



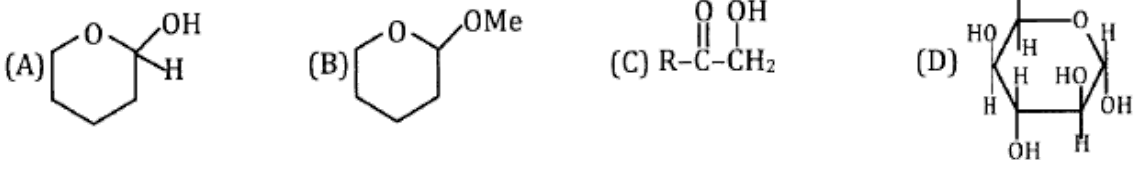
10. Which of the following compound will give positive Tollens test



11. Schiff's reagent gives pink colour with :

   (A) Acetaldehyde (B) Formic acid (C) Acetic acid (D) Methyl acetate

12. Which will give the Tollen test.



13. Which of the following is an example of oxidation reaction :

(A) $CH_3 - CH_2 - OH \xrightarrow{PCl_3}$ (B) $CH_3 - CH = CH_2 \xrightarrow{Ni/N_2}$

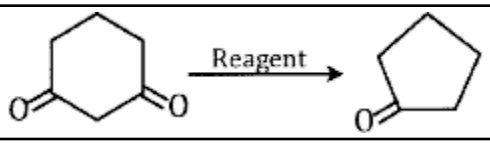
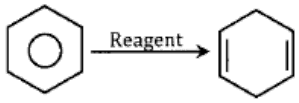
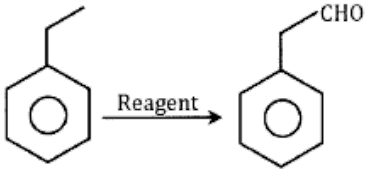
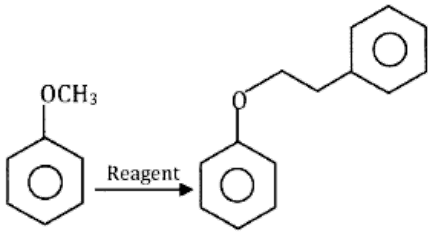
(C) $CH_3 - CH = CH_2 \xrightarrow[CCl_4]{Br_2}$ (D) $CH_2 = CH_2 \xrightarrow[KMnO_4]{H^{\oplus}}$

SECTION-III

- This section contains TWO question.
- Each question has matching lists. The codes for the lists have choices (A), (B), (C) and (D) out of which ONLY ONE is correct
- For each question, marks will be awarded in one of the following categories :

  Full Marks : + 3, if only the bubble corresponding to the correct option is darkened.
  Zero Marks : 0, if none of the bubbles is darkened.
  Negative Marks: − 1, in all other cases

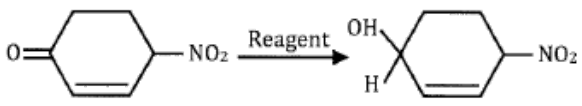
14. Match the items given in column I with that in column II and III.

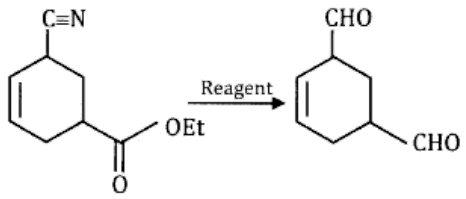
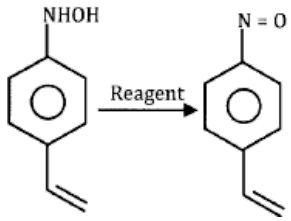
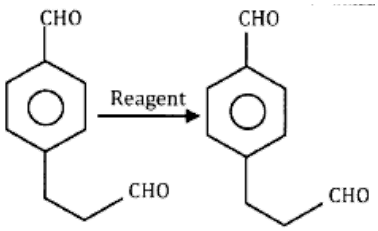
			Regents		Characteristics
a		i	Birch reduction	p	Formed via brown complex
b		ii	Etard reaction	q	Formed via a diradical with subsequent intramolecular (C-C) bond formation
c		iii	Fenton's reagent	r	Formed via a stable intermediate redical anion
d		iv	Clemenson's reduction	s	Formed by radical formation

(A) ($a \rightarrow iv, q; b \rightarrow i, r; c \rightarrow ii, p; d \rightarrow iii, s$) (B) (a $\rightarrow ii, q; b \rightarrow i, r; c \rightarrow ii, p; d \rightarrow iii, s$)

(C) (a $\rightarrow iv, q; b \rightarrow i, r; c \rightarrow i, p; d \rightarrow iii, s$) (D) ($a \rightarrow iii, q; b \rightarrow i, r; c \rightarrow ii, p; d \rightarrow iii, s$)

15. Match the items given in column I with that in column II and III.

	Reactions		**Regents**		**Characteristics**
a.		i	DIBAL-H	p	Silver mirror

b		ii	Tollen's reagent	q	Involves a imine salt
c.		iii	MPV reduction	r	Forms solvent complex
d.		iv	Fehling's reagent	s	Involves a cycle transition state with $H \ominus$ ion migration

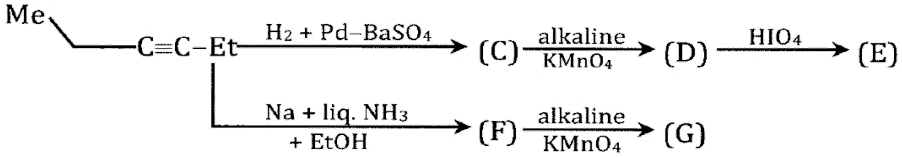
(A) $(a \rightarrow iv, s; b \rightarrow I, q; c \rightarrow ii, p; d \rightarrow iv, r)$
(B) (a → iii, s; $b \rightarrow I, q$; $c \rightarrow ii, p$; $d \rightarrow iv, r$)
(C) (a → ii, s; $b \rightarrow I, q$; $c \rightarrow ii, p$; $d \rightarrow iv, r$)
(D) $(a \rightarrow iii, s; b \rightarrow I, q; c \rightarrow ii, p; d \rightarrow iii, r)$

SECTION-IV

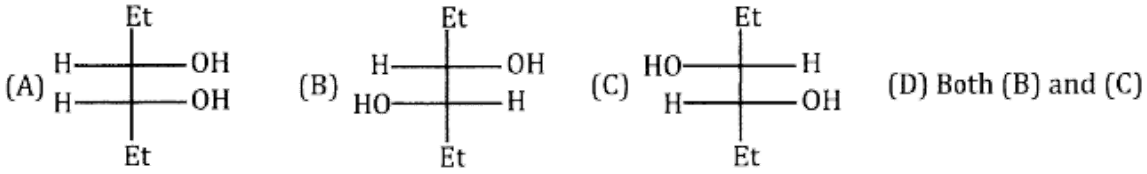
- This section contains ONE paragraph.
- Based on each paragraph, there are THREE questions.
- Each question has FOUR options (A), (B), (C) and (D) ONLY ONE of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :

  Full Marks : + 3, if only the bubble corresponding to the correct answer is darkened.
  Zero Marks : 0, in all other cases.

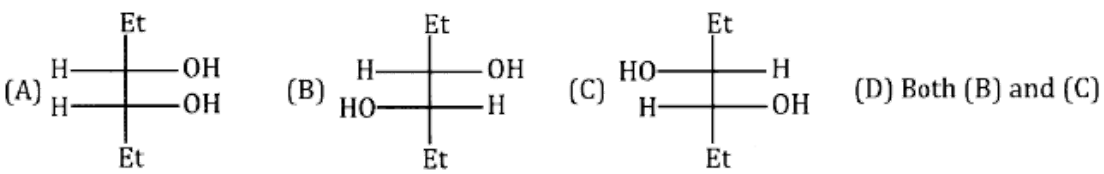
Paragraphs for Q. 16 to 18



16. The compound (D) is :

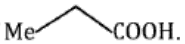


17. The compound (G) is :



18. The compound (E) is :

(A) Two moles of 

(B) Two moles of 

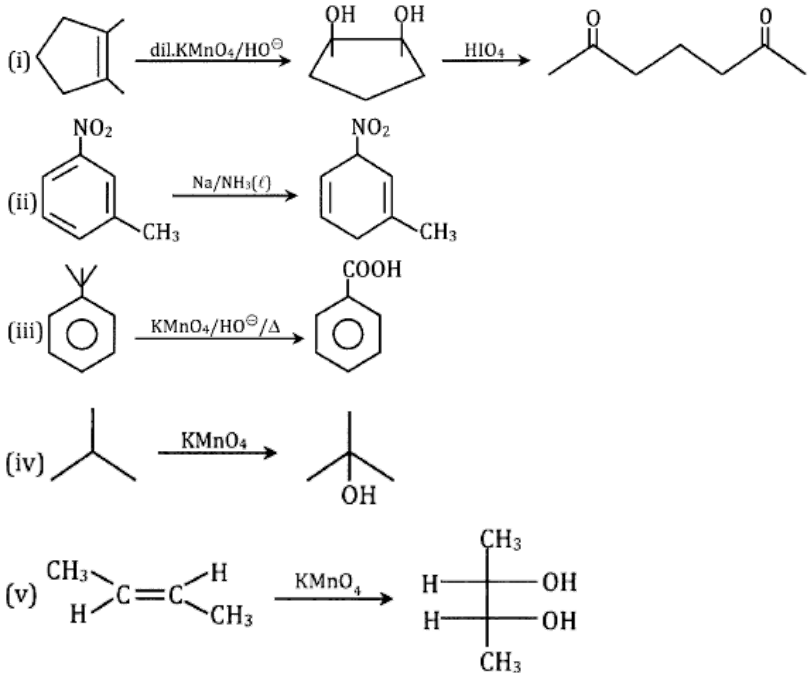
(C) One mole of (A) and one mole of (B)

(D) No reaction.

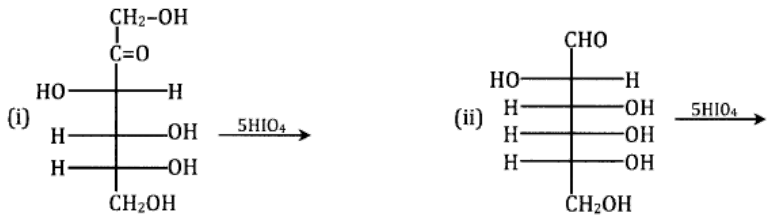
SECTION-V

- This section contains TWO question.
- The answer to each question is a NUMERICAL VALUE.
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 6. 25, 7. 00, − 0. 33, −. 30, 30. 27, − 127. 30, if answer is 11. 36777.... . then both 11.36 and 11.37 will be correct) by darken the corresponding bubbles in the ORS.
  For Example : If answer is − 77. 25, 5. 2 then fill the bubbles as follows:
- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : + 3 if ONLY the correct numerical value is entered as answer.
  Zero Marks : 0 in all other cases.

19. How many reactions are correct?



20.



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

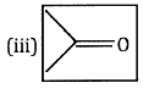
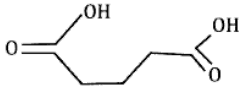
ANSWER KEY

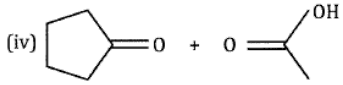
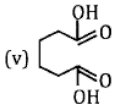
EXERCISE – 0

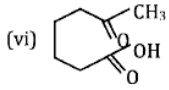
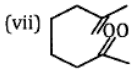
Que.	1	2	3	4	5	6	7	8	9	10
Ans.	D	B	C	C	A	B	D	C	B	D
Que.	11	12	13	14	15					
Ans.	C	ABC	ABC	AB	BC					
Que.	16	**17**								
Ans.	$(A \to r, i), (B \to s, ii), (C \to q, iii), (D$	$(A \to r), (B \to t), (C \to q), (d \to p)$								

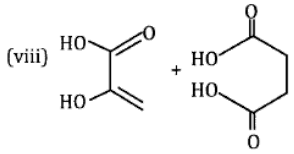
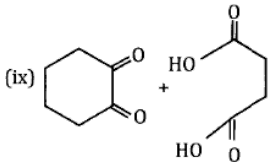
EXERCISE-S

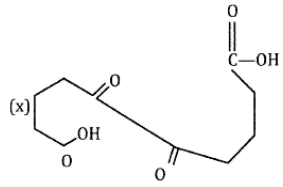
1. (i) $CO_2 + H_2O$ (ii) $O = C = O + H_2O$

(iii)  ,  , $CO_2 + H_2O$

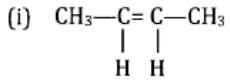
(iv)  (v) 

(vi)  (vii) 

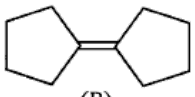
(viii)  (ix) 

(x) 

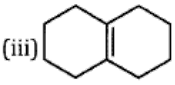
2.

(i) 

(A)

(ii) 

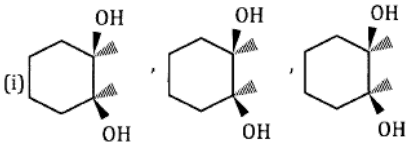
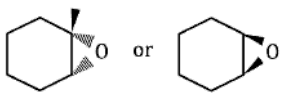
(B)

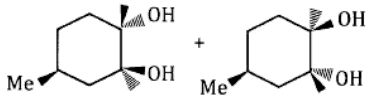
(iii) 

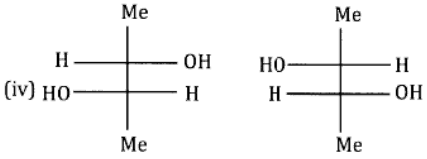
(C)

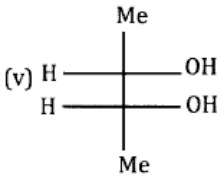
(iv) 

(D)

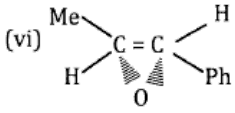
3. (i)  (ii) 

(iii) 

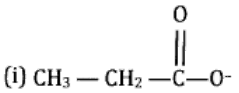
(iv) 



(Erythro)

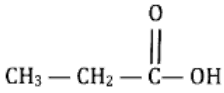
(vi) 

4.

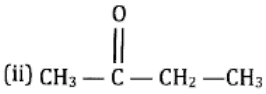
(i) 

(Salt for due to Basic Medium)

,



Carboxylic Acid

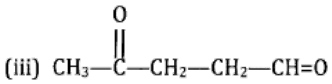
(ii) 

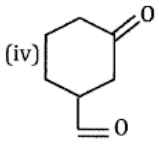
(Ketone)

5.

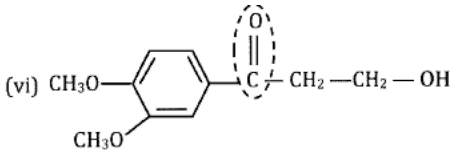
(i) $CH_2 = CH-(CH_2)_3-CHO$

(ii) $C_6H_5 - CH = CH - CHO$

(iii) 

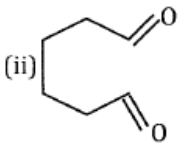
(iv) 

(v) $CH_2 = CH - CHO$

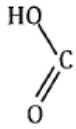
(vi) 

6.

(i) $Me—CH=O + O=CH_2$

(ii) 

(iii) $CH_2(OH)—CH_2—C(=O)—H + O=CH_2$

(iv) OCH_2  $O=CH-CH_3$

(v) $O=CH_2$, $O=CH(OH)$, $O=CH(OH)$, $O=CH_2$

(vi) $Me-C(=O)-OH$, $O=CH-M$

(vii) $Me-C(=O)-OH$, $HO-C(=O)-Me$

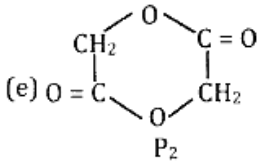
7.

(a) $H-C(=O)-CHO$

(b) $H-C(=O)-C(=O)-Me$

(c) $CH_2(OH)-CH=CH_2$ (Acrolein)

(d) Step-1: SeO_2; Step-2: MnO_2

(e) 

8. (i) + Ve Fehling test -Ve Fehling test
(ii) + *V* Benedict -Ve Benedict

EXERCISE - JEE (Main) PYQ

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	1	3	2	4	2	4	1	3	4	3
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	3	4	3	4	4	3	3	3	8	4

EXERCISE - JEE (Advanced) PYQ

Que	1	2	3	4	5
Ans	A	ABC	6	0	2

JEE (Main) Practice Paper

Section-A	**Q.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	A.	2	2	4	2	1	2	4	1	2	2
	Q.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**

	A.	1	2	3	3	3	2	2	3	4	4
Section-B	**Q.**	**1**	**2**	**3**	**4**	**5**	**6**				
	A.	3	2	4	6	7	4				

JEE (Advanced) Practice Paper

Section-I	**Q.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
	A.	B	B	C	A	A	C	B	
Section-II	**Q.**	**8**	**9**	**10**	**11**	**12**	**13**		
	A.	ACD	BD	ABC	AB	ACD	CD		
Section-III	**Q.**	**14**	**15**						
	A.	A	B						
Section-IV	**Q.**	**16**	**17**	**18**					
	A.	A	D	A					
Section-V	**Q.**	**19**	**20**						
	A.	3	3						