HYDROCARBON

REACTION CHART FOR ALKANES

GMP

(1) $R-C\equiv CH$ or $R-CH=CH_2$ $\xrightarrow[200-300^\circ C]{H_2, Ni}$ Sabatier senderens rx^n

(2) $R-X$ $\xrightarrow[\text{Red P/HI or } LiAlH_4]{Zn-Cu + HCl \text{ or}}$

(3) $R-Mg-X$ $\xrightarrow[\text{or } NH_3 \text{ or } RNH_2]{HOH \text{ or } ROH}$

(4) RX $\xrightarrow[\text{Wurtz reaction}]{Na/\text{ dry ether}}$

(5) RX $\xrightarrow[\text{Frankland's reaction}]{Zn}$

(6) $R-\underset{\underset{O}{\|}}{C}-Cl \text{ or } ROH$ or $R-\underset{\underset{O}{\|}}{C}-R$ or $RCHO$ $\xrightarrow{\text{Red P/HI}}$

(7) $R-\underset{\underset{O}{\|}}{C}-R$ $\xrightarrow[\text{Clemension reduction}]{Zn-Hg/\text{Conc. HCl}}$

(8) $R-\underset{\underset{R}{|}}{C}=O$ or $(RCH_2CH_2)_3B$ $\xrightarrow[\text{Wolf Kishner reduction}]{H_2N-NH_2}$ $\xrightarrow{H_2O}$

(9) $RCOONa$ $\xrightarrow[\Delta]{NaOH + CaO}$

(10) $RCOONa$ $\xrightarrow{\text{Kolbe's electrolytic synthesis}}$

(11) Al_4C_3 $\xrightarrow{H_2O}$

$R-H$ or $R-R$ or C_nH_{2n+2}

GR

(1) $\xrightarrow{X_2, h\nu \text{ or UV light or } 400^\circ C}$ RX

(2) $\xrightarrow{\text{Nitration}}$ $R-N\begin{matrix}O\\ \\ O\end{matrix}$

(3) $\xrightarrow{\text{Sulphonation } H_2S_2O_7}$ Alkyl Sulphonic acid

(4) $\xrightarrow[h\nu]{SO_2Cl_2 \text{ Reed reaction}}$ RSO_2Cl

(5) $\xrightarrow[\text{Isomerisation}]{AlCl_3/HCl}$ Branched alkanes

(6) $\xrightarrow[500-700^\circ C]{\text{Pyrolysis}}$ Alkenes + CH_4 or C_2H_6

(7) $\xrightarrow[500^\circ C]{(Cr) \text{ or } (Mo) \text{ or } Al_2O_3}$ Aromatic compound

(8) $\xrightarrow[\text{step up rx}^n]{CH_2N_2}$ Higher alkane

(9) $\xrightarrow[\Delta]{O_2}$ $CO_2 + H_2O$

Combustion

REACTION CHART FOR ALKENES

GMP

(1) $R–CH_2–CH_2–OH \xrightarrow[\Delta/-H_2O]{\text{conc. } H_2SO_4}$

(2) $R–CH_2–CH_2–X \xrightarrow[-HX]{\text{alc. KOH}}$

(3) $R–CH_2–CH\langle^{X}_{X} \xrightarrow[\text{for higher alkene}\ -X_2]{\text{Zn dust}/\Delta}$

(4) $\underset{\underset{X}{|}}{R-CH}-\underset{\underset{X}{|}}{CH_2} \xrightarrow[\Delta]{\text{Zn dust}}$

(5) $R–C\equiv CH \xrightarrow[BaSO_4/CaCO_3]{H_2/Pd}$

(6) $\underset{\underset{RCH-COOK}{|}}{RCH-COOK} \xrightarrow{\text{Kolbe's electrolytic synthesis}}$

(7) $(C_2H_5)_4N^+OH \xrightarrow{\Delta}$

(8) $R–\underset{\underset{O}{\|}}{CO}–CH_2–CH_2–R \xrightarrow{\text{Pyrolysis}}$

(9) $R–H \xrightarrow{\text{Pyrolysis}}$

(10) $CH_2=CHCl \xrightarrow[(ii)\ Me–I]{(i)\ Mg}$

(11) $R–CH=O \xrightarrow[\text{wittig reaction}]{CH_2=PPh_3}$

$R–CH=CH_2$ or C_nH_{2n}

GR

(1) $\xrightarrow[200–300°C]{H_2,\ Ni} R–CH_2–CH_3$

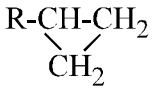
(2) $\xrightarrow{X_2} R–CHX–CH_2X$

(3) $\xrightarrow{HX} R–CHX–CH_3$

(4) $\xrightarrow{HBr,\ Peroxide} R–CH_2–CH_2Br$

(5) $\xrightarrow{HOCl} R–CH(OH)–CH_2Cl$

(6) $\xrightarrow[+H_2O]{dil.\ H_2SO_4} R–CH_2(OH)–CH_3$

(7) $\xrightarrow{+CH_2N_2}$ 

(8) $\xrightarrow{BH_3} (RCH_2CH_2)_3B$

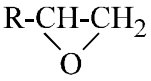
(9) $\xrightarrow[HCo(CO)_4]{CO+H_2}$ $\underset{\underset{CHO}{|}}{R-CH-CH_3}$ + $\underset{\underset{CHO}{|}}{R-CH_2-CH_2}$

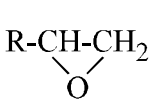
(10) $\xrightarrow[\Delta]{O_2} CO_2 + H_2O$

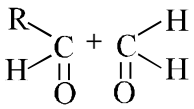
(11) $\xrightarrow[(ii)\ NaHSO_3/H_2O]{(i)\ OsO_4}$ $\underset{\underset{OH}{|}}{R-CH}-\underset{\underset{OH}{|}}{CH_2}$

(12) $\xrightarrow[1\%\ alkaline\ KMnO_4]{\text{Baeyer's reagent}}$ $\underset{\underset{OH}{|}}{R-CH}-\underset{\underset{OH}{|}}{CH_2}$

(13) $\xrightarrow{\text{strong oxidant}}$ $\underset{\underset{O}{\|}}{R-C-OH} + CO_2 + H_2O$

(14) $\xrightarrow[\text{Priles–chalev's reaction}]{\text{Per acid}}$ 

(15) $\xrightarrow[Ag\ 300°C]{1/2\ O_2}$ 

(16) $\xrightarrow[\text{ozonolysis}]{O_3/Zn,H_2O}$ 

(17) $\xrightarrow[200°C\ high\ P]{O_2}$ Polyalkene

(18) $\xrightarrow[500°C]{Cl_2}$ Substitution product

(19) $\xrightarrow[200–300°C]{Al_2(SO_4)_3}$ Isomerisation

(20) $\xrightarrow[\Delta]{\text{acetic anhydride}} R–CH=CH–COCH_3$
Methyl alkenyl ketone

REACTION CHART FOR ALKYNES

GMP

(1) $CH_2Br–CH_2Br \xrightarrow{alc.KOH,\ NaNH_2}$

(2) $CH_3–CHBr_2 \xrightarrow{alc.KOH,\ NaNH_2}$

(3) $CHCl_3 \xrightarrow[\Delta]{Ag\ powder}$

(4) $CHBr_2–CHBr_2 \xrightarrow[\Delta]{Zn\ dust}$

(5) $\begin{matrix}CHBr\\ \|\\ CHBr\end{matrix} \xrightarrow{Zn}$

(6) $CH_2=CH–Cl \xrightarrow{alc.KOH,\ NaNH_2}$

(7) $\begin{matrix}HC-COONa\\ \|\\ HC-COONa\end{matrix} \xrightarrow{Kolbe's\ electrolytic\ synthesis}$

(8) $CaC_2 \xrightarrow{H_2O}$

(9) $2C + H_2 \xrightarrow[Berthelot's\ process]{electric\ arc,1200°C}$

(10) $CH_3–C\equiv CH \xrightarrow{(i)Na\ (ii)R–X} CH_3–C\equiv CR$

(11) $CH_3–C\equiv CH \xrightarrow{(i)CH_3MgI\ (ii)R–X} CH_3–C\equiv CR$

(12) $Mg_2C_3 \xrightarrow{H_2O} CH_3–C\equiv CH$

C_2H_2

GR

(1) $\xrightarrow[Ni]{H_2} C_2H_4,\ C_2H_6$

(2) $\xrightarrow{X_2} C_2H_2X_4$

(3) $\xrightarrow[Peroxide]{HBr} CH_2BrCH_2Br$

(4) $\xrightarrow[No\ peroxide]{HBr} CH_3–CHBr_2$

(5) $\xrightarrow{HOCl} Cl_2CH–COOH$

(6) $\xrightarrow{HCN,\ Ba(CN)_2} CH_2=CHCN$

(7) $\xrightarrow{CH_3COOH,\ Hg^{+2}} CH_3CH(OCOCH_3)_2$

(8) $\xrightarrow[(Kucherov's\ reaction)]{Hg^{+2},\ 80°C,\ dil.\ H_2SO_4} CH_3CHO$

(9) $\xrightarrow[Kucherov's\ reaction]{Dil.\ H_2SO_4\ /\ HgSO_4} CH_3CHO$

(10) $\xrightarrow[Ni(CO)_4]{CO+HOH} CH_2=CH–COOH$

(11) $\xrightarrow[Ni,160°C]{CO+EtOH} CH_2=CH–COOEt$

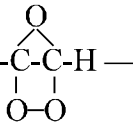
(12) $\xrightarrow{NaNH_2} NaC\equiv CNa$

(13) $\xrightarrow[(Tollen's\ Reagent)]{AgNO_3+NH_4OH} AgC\equiv CAg$ white ppt.

(14) $\xrightarrow{Cu_2Cl_2+NH_4OH} CuC\equiv CCu$ red ppt.

(15) $\xrightarrow[\Delta]{Combustion\ O_2} CO_2 + H_2O$

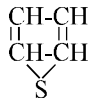
(16) $\xrightarrow{Baeyer's\ Reagent} \begin{matrix}CHO\\ |\\ CHO\end{matrix} \longrightarrow HCOOH$

(17) $\xrightarrow[Ozonolysis]{O_3}$  $\xrightarrow{+H_2O}$ 2 HCOOH

(18) $\xrightarrow[(Red\ hot\ iron\ tube)]{Trimerisation}$ benzene

(19) $\xrightarrow[[Ni(CN)_2]]{Tetramerisation} C_8H_8$ or 1,3,5,7-cyclo octa tetraene

(20) $\xrightarrow[[Cu(NH_3)_2]^+\ or\ Cu_2Cl_2.NH_4Cl]{Dimerisation}$ butenyne

(21) $\xrightarrow[\Delta]{S}$ 

(22) $\xrightarrow[(BF_3–HgO)]{CH_3OH} \begin{matrix}CH(OCH_3)_2\\ |\\ CH_3\end{matrix}$ methylal

EXERCISE # O-1

1. During the preparation of ethane by Kolbe's electrolytic method using inert electrodes the pH of the electrolyte –

(A) Increases progressively as the reaction proceeds

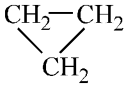
(B) Decreases progressively as the reaction proceeds

(C) Remains constant throughout the reaction

(D) May decrease of the the concentration of the electrolyte is not very high

HC0001

2. $BrCH_2–CH_2–CH_2Br$ reacts with Na in the presence of ether at 100 °C to produce –

(A) $BrCH_2–CH=CH_2$ (B) $CH_2=C=CH_2$ (C)  (D) All of these

HC0002

3. How many products will be formed excluding stereo when cis-1,3,5-trimethyl cyclohexene reacts with NBS?

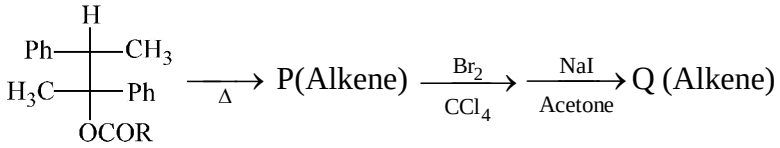
(A) 3 (B) 4 (C) 5 (D) 6

HC0003

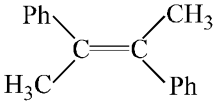
4. How many dibromo derivatives are formed when bromine is added to 3-Methyl Cyclohexene in 1,2-dichloroethane.

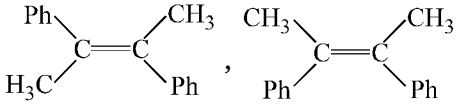
(A) 2 (B) 3 (C) 4 (D) 6

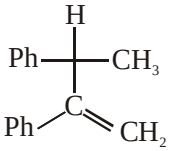
HC0004

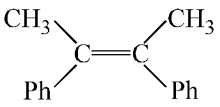
5. 

Alkene (P) & (Q) respectively are

(A) Both 

(B) 

(C) Both 

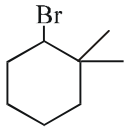
(D) Both 

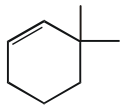
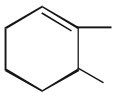
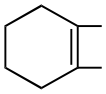
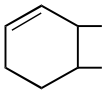
HC0005

6. Anti–Markownikoff's addition of HBr is not observed in –

(A) Propene (B) But–2–ene (C) But–1–ene (D) Pent–2–ene

HC0006

7.  $\xrightarrow[\Delta]{\text{alcoholic KOH}}$ Product ; Product is:

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

HC0007

8. Which is expected to react most readily with bromine –

(A) $CH_3CH_2CH_3$ (B) $CH_2=CH_2$ (C) $CH\equiv CH$ (D) $CH_3–CH=CH_2$

HC0008

9. For the ionic reaction of hydrochloric acid with the following alkenes, predict the correct sequence of reactivity as measured by reaction rates:

(I) $ClCH=CH_2$ (II) $(CH_3)_2.C=CH_2$ (III) $OHC.CH=CH_2$ (IV) $(NC)_2C=C(CN)_2$

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

HC0009

10. $CH_3–CH=CH–CH_3 \xrightarrow{x}$ Product is Y (non–resolvable) then X can be –

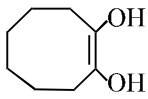
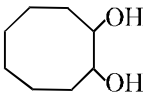
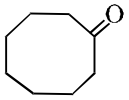
cis

(A) Br_2 water (B) HCO_3H / H_3O^+

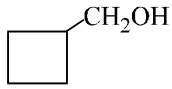
(C) Cold alkaline $KMnO_4$ (D) all of the above

HC0010

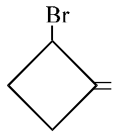
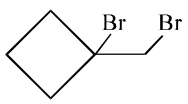
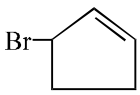
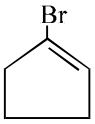
11. The reaction of cyclooctyne with $HgSO_4$ in the presence of a H_2SO_4 gives

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

HC0011

12.  $\xrightarrow[\Delta]{H_2SO_4}$ P (Major) $\xrightarrow{NBS}$ Q (Major)

The structure of Q is

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

HC0012

13. Acetylene may be prepared using Kolbe's electrolytic method employing –

(A) Pot. acetate (B) Pot. succinate (C) Pot. fumarate (D) None of these

HC0013

14. B $\xleftarrow[H_2O_2,\ OH^-]{BH_3\ THF}$ $CH_3–C\equiv CH$ $\xrightarrow{HgSO_4/H_2SO_4}$ A

A and B are –

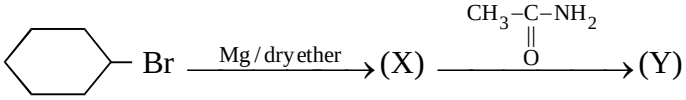
(A) CH_3CH_2CHO, $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$

(B) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ CH_3CH_2CHO

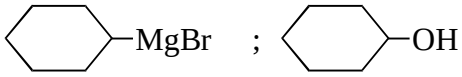
(C) CH_3CH_2CHO (both)

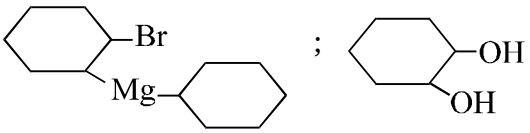
(D) $CH_3-\underset{\underset{O}{\|}}{C}-CH_3$ (both)

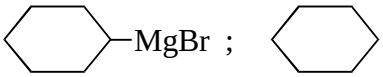
HC0014

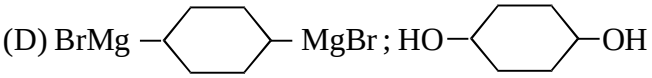
15. 

The structures of (X) and (Y) respectively are

(A) 

(B) 

(C) 

(D) 

HC0015

EXERCISE # O-2

1. $CH_3CH=CH_2 \xrightarrow[H_2O_2/OH^-]{B_2D_6}$ product X ; X is –

(A) $CH_3-\underset{\underset{OH}{|}}{CH}-CH_2D$ (B) $CH_3-\underset{\underset{D}{|}}{CH}-CH_2OH$

(C) $CH_3-\underset{\underset{OD}{|}}{CH}-CH_3$ (D) none is correct

HC0016

2. Aqueous solution of potassium propanoate is electrolysed. Possible organic products are:

(A) n-Butane (B) $C_2H_5COOC_2H_5$

(C) $CH_3–CH_3$ (D) $CH_2=CH_2$

HC0017

3. $CH_2 = CHCH_2CH = CH_2 \xrightarrow{NBS}$ A, A can be

(A) $CH_2=CH\underset{\underset{Br}{|}}{CH}CH=CH_2$ (B) $CH_2=CHCH=CH–CH_2Br$

(C) $CH_2 = CHCH_2CH = CHBr$ (D) $CH_2=CHCH_2\underset{\underset{Br}{|}}{C}=CH_2$

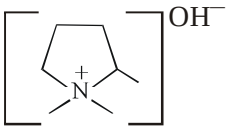
HC0018

4. Which of the following elimination reactions will occur to give but-1-ene as the major product?

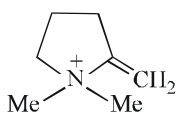
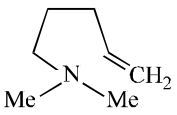
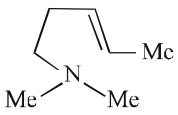
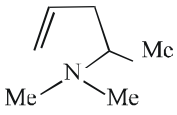
(A) $CH_3.CHCl.CH_2.CH_3 + KOH \xrightarrow{EtOH}$ (B) $CH_3.\underset{\underset{\overset{+}{N}Me_3}{|}}{CH}.CH_2.CH_3 + NaOEt \xrightarrow[\Delta]{EtOH}$

(C) $CH_3.CH_2.CHCl.CH_3 + Me_3COK^+ \xrightarrow{\Delta}$ (D) $CH_3.CH_2.CH(OH).CH_3 + \text{conc. } H_2SO_4 \xrightarrow[\Delta]{}$

HC0019

5. 

The above compound undergoes elimination on heating can yield which of the following products?

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

HC0020

6. Which of the following will give same product with HBr in presence or absence of peroxide.

(A) Cyclohexene (B) 1-methylcyclohexene

(C) 1,2-dimethylcyclohexene (D) 1-butene

HC0021

7. The ionic addition of HCl to which of the following compounds will produces a compound having Cl on carbon next to terminal.

(A) $CF_3.(CH_2)_3.CH=CH_2$ (B) $CH_3.CH=CH_2$

(C) $CF_3.CH=CH_2$ (D) $CH_3.CH_2CH=CH.CH_3$

HC0022

8. $C \xleftarrow[H_2O_2/OH^-]{BH_3/THF} A \xrightarrow[H_2SO_4]{HgSO_4} B$

B & C are identical when A is –

(A) HC≡CH (B) CH_3–C≡CH (C) CH_3–C≡C–CH_3 (D) CH_3–CH_2–C≡CH

HC0023

9. Match List-I with List-II and select the correct answer using the codes given below the lists:

List-I (Reaction)	**List-II (Reagents)**
(A) CH_3–CH=CH_2→CH_3–CHBr–CH_3	(P) HBr
(B) CH_3–CH=CH_2→CH_3–CH_2–CH_2Br	(Q) Br_2 / CCl_4
(C) CH_3–CH=CH_2→BrCH_2–CH=CH_2	(R) HBr / Peroxide
(D) CH_3–CH=CH_2→CH_3–CHBr–CH_2Br	(S) NBS

HC0024

10.

Column I (Reaction)	**Column II (Major product)**
(A) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}=CH_2 \xrightarrow[(ii)\ H_2O_2/\overset{\ominus}{O}H]{(i)\ BH_3/THF}$	(P) CH_3–CH_2–CH=CH_2
(B) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}=CH_2 \xrightarrow[(ii)\ NaBH_4]{(i)\ Hg(OAc)_2/HOH}$	(Q) CH_3–CH=CH–CH_3
(C) $CH_3-CH_2-\overset{\displaystyle Cl}{\overset{\displaystyle |}{C}}H-CH_3 \xrightarrow{CH_3ONa/\Delta}$	(R) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}H-CH_2OH$
(D) $CH_3-CH_2-\overset{\displaystyle Cl}{\overset{\displaystyle |}{C}}H-CH_3 \xrightarrow[\Delta]{(CH_3)_3CONa}$	(S) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle OH}{\overset{\displaystyle |}{\underset{\displaystyle |}{C}}}}-CH_3$

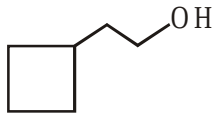
HC0025

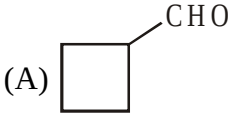
EXERCISE # S-1

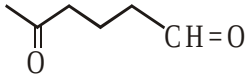
1. When n-butane is heated in the presence of $AlCl_3$/HCl it will be converted into –

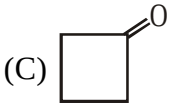
(A) Ethane (B) Propane (C) Butene (D) Isobutane

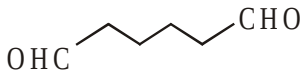
HC0026

2.  $\xrightarrow[\Delta]{H^{\oplus}}$ A $\xrightarrow[(ii)Zn/H_2O]{(i)O_3}$ Product(s). Product is/are?

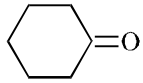
(A)  + HCHO

(B) 

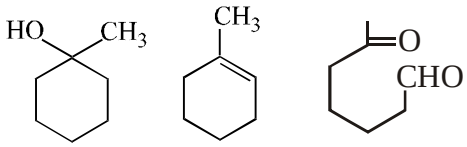
(C)  + CH_3CHO

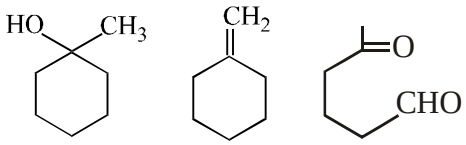
(D) 

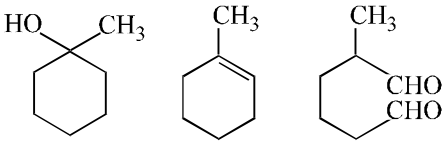
HC0027

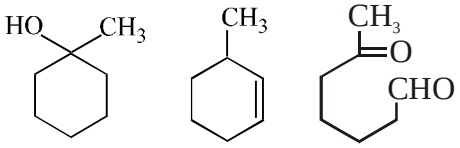
3.  + $CH_3MgBr \xrightarrow{H_3O^+}$ A $\xrightarrow[\Delta]{Con.\ H_2SO_4}$ B $\xrightarrow[(ii)\ Zn,H_2O]{(i)\ O_3}$ C ; A, B and C are –

A B C

(A) 

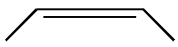
(B) 

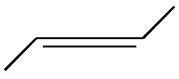
(C) 

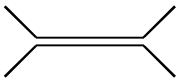
(D) 

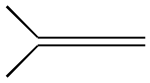
HC0028

4. Which has least heat of hydrogenation –

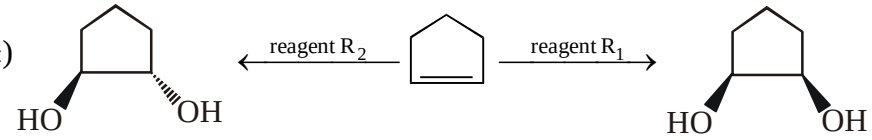
(A) 

(B) 

(C) 

(D) 

HC0029

5. (±) 

R_1 and R_2 respectively are –

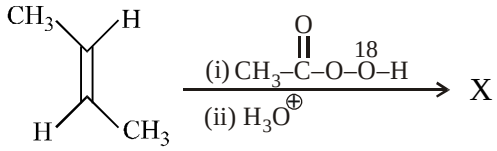
(A) Cold alkaline $KMnO_4$, OsO_4/H_2O_2

(B) Cold alkaline $KMnO_4$, HCO_3H / H_3O^+

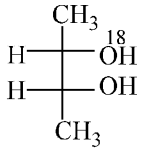
(C) Cold alkaline $KMnO_4$, $CH_3–O–O–CH_3$

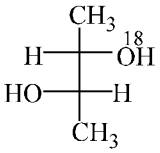
(D) $C_6H_5CO_3H$, HCO_3H / H_3O^+

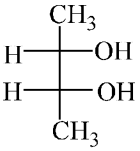
HC0030

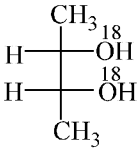
6. 

The probable structure of 'X' is

(A) 

(B) 

(C) 

(D) 

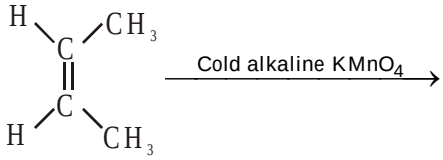
HC0031

7. Which alkene on heating with alkaline $KMnO_4$ solution gives acetone and a gas, which turns lime water milky –

(A) 2–Methyl–2–butene (B) Isobutylene

(C) 1–Butene (D) 2–Butene

HC0032

8. 

A, which is true about this reaction?

(A) A is meso 2, 3–butanediol formed by *syn* addition

(B) A is meso 2, 3–butanediol formed by *anti* addition

(C) A is a racemic mixture of d and *l*, 2, 3–butanediol formed by anti addition

(D) A is a racemic mixture of d and *l* 2,3–butanediol formed by syn addition

HC0033

9. Mixture of one mole each of ethene and propyne on reaction with Na will form H_2 gas at S.T.P. –

(A) 22.4 L (B) 11.2 L (C) 33.6 L (D) 44.8 L

HC0034

10. $B \xleftarrow{\text{Lindlar's catalyst}} R–C\equiv C–R \xrightarrow{Na/NH_3} A$

A and B are geometrical isomers –

(A) A is trans, B is cis (B) A and B both are cis

(C) A and B both are trans (D) A is cis, B is trans

HC0035

11. A mixture of CH_4, C_2H_4 and C_2H_2 gaseous are passed through a Wolf bottle containing ammonical cuprous chloride. The gas coming out is

(A) Methane (B) Acetylene

(C) Mixture of methane and ethylene (D) original mixture

HC0036

12. Which of the following reagents cannot be used to locate the position of triple bond in $CH_3–C\equiv C–CH_3$

(A) Br_2/CCl_4 (B) O_3/H_2O (C) Cu_2Cl_2/NH_4OH (D) $KMnO_4/H^{\oplus}$

HC0037

13. In the presence of strong bases, triple bonds will migrate within carbon skeletons by the

(A) removal of protons (B) addition of protons

(C) removal and readdition of protons (D) addition and removal of protons.

HC0038

14. $CH_3–CH_2–C\equiv CH \underset{B}{\overset{A}{\rightleftharpoons}} CH_3C\equiv C–CH_3$; A and B are –

(A) alcoholic KOH and $NaNH_2$ (B) $NaNH_2$ and alcoholic KOH

(C) $NaNH_2$ and Lindlar catalyst (D) Lindlar and $NaNH_2$ catalyst

HC0039

15. If a mixture of iso-octane (70%) & n-heptane (30%) is present in sample. The octane number of this sample is :

(A) 40 (B) 70 (C) 30 (D) 85

HC0040

16. $HC\equiv CH \xrightarrow[Cu_2Cl_2]{NH_4Cl}$ Product

Product is –

(A) Cu–C≡C–Cu (B) $H_2C=CH–C\equiv CH$ (C) HC≡C–Cu (D) Cu–C≡C–NH_4

HC0041

17. Which of the following process is not good for the preparation of open chain alkane having odd number of carbons :

(A) Wurtz process (B) Kolbe electrolysis

(C) Corey house synthesis (D) Both (A) & (B)

HC0042

18. How many moles of O_2 required for complete combustion of one mole of propane –

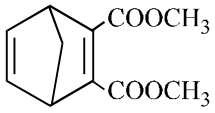
(A) 7 (B) 5 (C) 16 (D) 10

HC0043

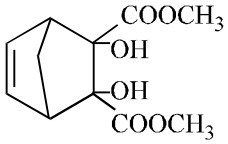
19. How much volume of air will be needed for complete combustion of 10 lit. of ethane –
(Assuming that approx 20% O_2 is present in air)

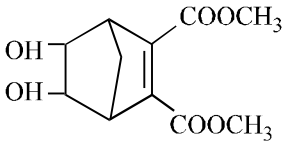
(A) 135 lit. (B) 35 lit. (C) 175 lit. (D) 205 lit.

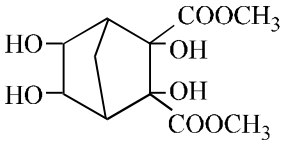
HC0044

20.  $\xrightarrow[H_2O/\text{Acetone}]{O_sO_4\ (1eq)}$ X.

Identify 'X'.

(A) 

(B) 

(C) 

(D) Reaction will not occur

HC0045

21. $Ph-\underset{\underset{O}{\|}}{C}-CH_3 \xrightarrow{A} Ph-CH_2-CH_3$

A could be:

(A) NH_2NH_2, glycol/OH^-, Δ (B) Zn(Hg)/conc. HCl

(C) Red P/HI (D) $\underset{SH}{\overset{|}{CH_2}}-\underset{SH}{\overset{|}{CH_2}}$; Raney Ni, H_2, Δ

HC0046

22. (A) $C_4H_6 \xrightarrow{H_2/Pt}$ (B) $C_4H_8 \xrightarrow{O_3/H_2O} CH_3COOH$

Hence A and B are

(A) $CH_3C \equiv CCH_3$, $CH_3CH = CHCH_3$

(B) $CH_2 = CHCH = CH_2$, $CH_3CH = CHCH_3$

(C)  , $CH_3CH = CHCH_3$

(D) None

HC0047

23. An alkene on ozonolysis yields only ethanal. The ozonolysis of isomer of this alkene yields :

(A) Propanone (B) Ethanal (C) Methanal (D) Only propanal

HC0048

24. Which is / are true statements/ reactions?

(A) $Al_4C_3 + H_2O \longrightarrow CH_4$ (B) $CaC_2 + H_2O \longrightarrow C_2H_2$

(C) $Mg_2C_3 + H_2O \longrightarrow CH_3C \equiv CH$ (D) $Me_3C–H + KMnO_4 \xrightarrow[\Delta]{H^+} Me_3C–OH$

HC0049

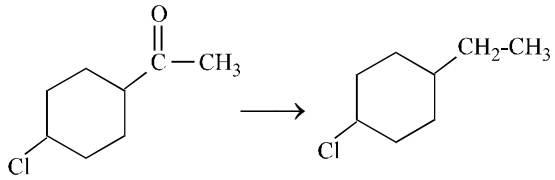
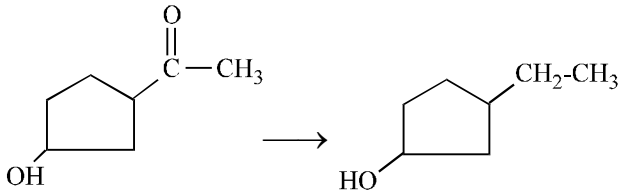
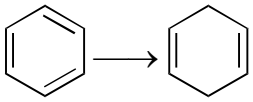
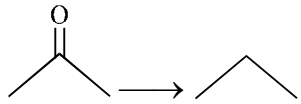
25. Which reagent is the most useful for distinguishing compound I from the rest of the compounds

$CH_3CH_2C\equiv CH$	$CH_3C\equiv CCH_3$	$CH_3CH_2CH_2CH_3$	$CH_3CH=CH_2$
I	II	III	IV

(A) Alk. $KMnO_4$ (B) Br_2/CCl_4 (C) Br_2/CH_3COOH (D) Ammonical $AgNO_3$

HC0050

26. Match the column

Column I	**Column II**
(A) 	(P) Birch reduction
(B) 	(Q) Stephen's reduction
(C) 	(R) Wolf-Kishner reduction
(D) 	(S) Clemmensen reduction

HC0051

27. Match the column

Column I	**Column II**
(A) $RCOONa \xrightarrow{electrolysis} R–R$	(P) Correy-House reaction
(B) $R–CH_2–COOH \xrightarrow[\Delta]{NaOH,CaO} R–CH_3$	(Q) Kolbe electrolysis
(C) $RCOOH \xrightarrow[(ii)\,Cl_2/\Delta]{(i)\,AgNO_3} R–Cl$	(R) Oakwood degradration / Soda lime process
(D) $R'–X + R_2CuLi \longrightarrow R–R'$	(S) Hunsdiecker reaction

HC0052

28.

Column I	**Column II**
(A) $CH_3–C\equiv C–CH_3 \longrightarrow$ cis-2-butene	(P) $Na/NH_3(l)$
(B) $CH_3 - C \equiv C - CH_3 \longrightarrow$ trans-2-butene	(Q) $H_2/Pd/BaSO_4$
(C) $CH_3C\equiv C–CH_3 \longrightarrow$ 1-Butyne	(R) alc. KOH, Δ
(D) $CH_3–CH_3–C\equiv CH \longrightarrow$ 2-Butyne	(S) $NaNH_2$, Δ

HC0053

EXERCISE # (J-MAINS)

1. 2-Methylbutane on reacting with bromine in the presence of sunlight gives mainly **[AIEEE-2005]**

(1) 2–bromo-2–methylbutane (2) 1–bromo-2–methylbutane

(3) 1–bromo-3–methylbutane (4) 2–bromo-3–methylbutane

HC0054

2. Alkyl halides react with dialkyl copper reagent to give **[AIEEE-2005]**

(1) alkyl copper halides (2) alkenes

(3) alkenyl halides (4) alkanes

HC0055

3. Reaction of one molecule of HBr with one molecule of 1,3–butadiene at 40°C gives predominantly

(1) 1–bromo–2–butene under thermodynamically controlled conditions **[AIEEE-2005]**

(2) 3–bromobutene under kinetically controlled conditions

(3) 1–bromo–2–butene under kinetically controlled conditions

(4) 3–bromobutene under thermodynamically controlled conditions

HC0056

4. Acid catalyzed hydration of alkenes except ethene leads to the formation of **[AIEEE-2005]**

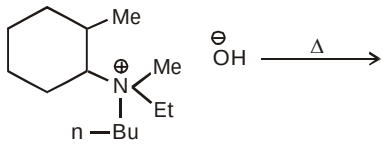
(1) secondary or tertiary alcohol

(2) primary alcohol

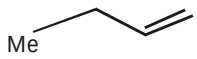
(3) mixture of secondary and tertiary alcohols

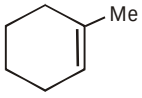
(4) mixture of primary and secondary alcohols

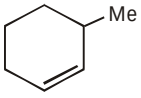
HC0057

5. 

The alkene formed as a major product in the above elimination reaction is- **[AIEEE-2006]**

(1) 

(2) $CH_2=CH_2$ (3) 

(4) 

HC0058

6. Reaction of trans-2-phenyl-1-bromocyclo pentane on reaction with alcoholic KOH produces-

(1) 4-phenyl cyclopentene (2) 2-phenyl cyclopentene **[AIEEE-2006]**

(3) 1-phenyl cyclopentene (4) 3-phenyl cyclopentene

HC0059

7. Phenyl magnesium bromide reacts with methanol to give- **[AIEEE-2006]**

(1) A mixture of anisole and Mg(OH)Br

(2) A mixture of benzene and Mg(OMe)Br

(3) A mixture of toluene and Mg(OH)Br

(4) A mixture of phenol and Mg(Me)Br

HC0060

8. Which of the following reactions will yield, 2, 2-dibromopropane **[AIEEE-2007]**

(1) $CH_3—C\equiv CH + 2HBr \longrightarrow$ (2) $CH_3CH=CHBr + HBr \longrightarrow$

(3) $CH\equiv CH + 2HBr \longrightarrow$ (4) $CH_3 — CH = CH_2 + HBr \longrightarrow$

HC0061

9. In the following sequence of reactions, the alkene affords the compound 'B' :- **[AIEEE-2008]**

$CH_3CH=CHCH_3 \xrightarrow{O_3} A \xrightarrow[Zn]{H_2O} B.$

The compound B is

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

HC0062

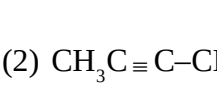
10. The hydrocarbon which can react with sodium in liquid ammonia is **[AIEEE-2008]**

(1) $CH_3CH_2CH_2C\equiv CCH_2CH_2CH_3$ (2) $CH_3CH_2C\equiv CH$

(3) $CH_3CH=CHCH_3$ (4) $CH_3CH_2C\equiv CCH_2CH_3$

HC0063

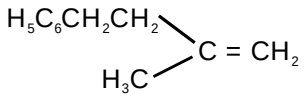
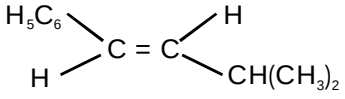
11. The treatment of CH_3MgX with $CH_3C\equiv C–H$ produces **[AIEEE-2008]**

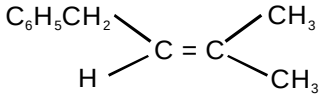
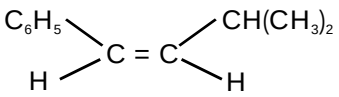
(1) $CH_3–CH=CH_2$ (2) $CH_3C\equiv C–CH_3$ (3)  (4) CH_4

HC0064

12. The main product of the following reaction is **[AIEEE-2010]**

$C_6H_5CH_2CH(OH)CH(CH_3)_2 \xrightarrow{\text{Conc. } H_2SO_4} ?$

(1)  (2) 

(3)  (4) 

HC0065

13. One mole of a symmetrical alkene on ozonolysis gives two moles of an aldehyde having a molecular mass of 44 u. The alkene is :- **[AIEEE-2010]**

(1) Ethene (2) Propene (3) 1-Butene (4) 2-Butene

HC0066

14. Ozonolysis of an organic compound gives formaldehyde as one of the products. This confirms the presence of :- **[AIEEE-2011]**

(1) an isopropyl group (2) an acetylenic triple bond

(3) two ethylenic double bonds (4) a vinyl group

HC0067

15. Ozonolysis of an organic compound 'A' produces acetone and propionaldehyde in equimolar mixture. Identify 'A' from the following compounds :- **[AIEEE-2011]**

(1) 2-Methyl-1-pentene (2) 1-Pentene

(3) 2-Pentene (4) 2-Methyl-2-pentene

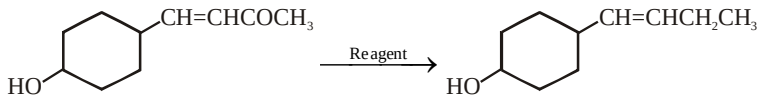
HC0068

16. 2–Hexyne gives trans–2–Hexene on treatment with :- **[AIEEE-2012]**

(1) $LiAlH_4$ (2) Pt/H_2 (3) Li/NH_3 (4) $Pd/BaSO_4$

HC0069

17. In the given transformation, which of the following is the most appropriate reagent ? **[AIEEE-2012]**



(1) $NaBH_4$ (2) $NH_2\ NH_2, \overset{\ominus}{O}H$ (3) Zn – Hg / HCl (4) Na, Liq.NH_3

HC0070

18. The major organic compound formed by the reaction of 1, 1, 1–trichloroethane with silver powder is :- **(JEE MAIN OFFLINE 2013)**

(1) 2-Butyne (2) 2-Butene (3) Acetylen (4) Ethene

HC0071

19. The number and type of bonds in C_2^{2-} ion in CaC_2 are: **(JEE MAIN ONLINE 2014)**

(1) Two σ bonds and one π – bond (2) Two σ bonds and two π – bonds

(3) One σ bond and two π – bonds (4) One σ bond and one π – bond

HC0072

20. In the hydroboration - oxidation reaction of propene with diborane, H_2O_2 and NaOH, the organic compound formed is : **(JEE MAIN ONLINE 2014)**

(1) $CH_3CH_2CH_2OH$ (2) $(CH_3)_3COH$ (3) $CH_3CHOHCH_3$ (4) CH_3CH_2OH

HC0073

21. Which one of the following class of compounds is obtained by polymerization of acetylene ?

(JEE MAIN ONLINE 2014)

(1) Poly-ene (2) Poly-yne (3) Poly-amide (4) Poly-ester

HC0074

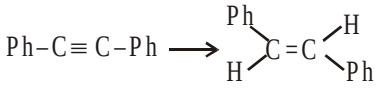
22. The gas liberated by the electrolysis of Dipotassium succinate solution is :

(JEE MAIN ONLINE 2014)

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

HC0075

23. The reagent needed for converting **(JEE MAIN ONLINE 2014)**

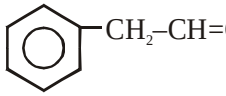


is :

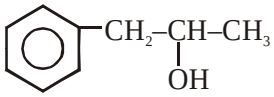
(1) H_2/Lindlar Cat. (2) Cat. Hydrogenation

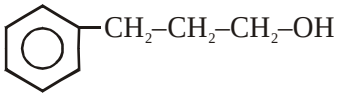
(3) $LiAlH_4$ (4) Li/NH_3

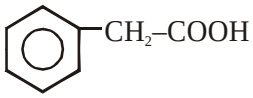
HC0076

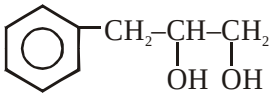
24.  on mercuration- demercuration produces the major product :-

(Jee Main online 2014)

(1) 

(2) 

(3) 

(4) 

HC0077

25. The major product obtained in the photo catalysed bromination of 2-methylbutane is :-

(Jee Main online 2014)

(1) 2-bromo-2-methylbutane (2) 2-bromo-3-methylbutane

(3) l-bromo-2-methylbutane (4) l-bromo-3-methylbutane

HC0078

26. In the presence of peroxide, HCℓ and HI do not give anti-Markownikoff s addition to alkenes because

(1) All the steps are exothermic in HCl and HI **(Jee Main online 2014)**

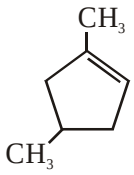
(2) One of the steps is endothermic in HCl and HI

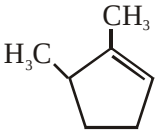
(3) HCl is oxidizing and the HI is reducing

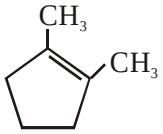
(4) Both HCl and HI are strong acids

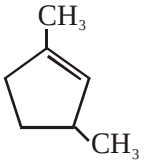
HC0079

27. Which compound would give 5-keto-2-methyl hexanal upon ozonlysis? **(Jee Main offline 2015)**

(1) 

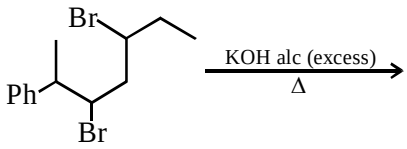
(2) 

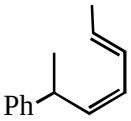
(3) 

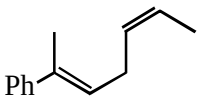
(4) 

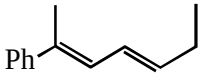
HC0080

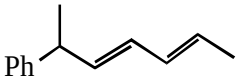
28. The major product of the following reaction is **(Jee Main (Jan) 2019)**



(1) 

(2) 

(3) 

(4) 

HC0081

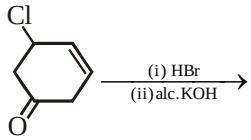
29. Which hydrogen in compound (E) is easily replaceable during bromination reaction in presence of light: **(Jee Main (Jan) 2019)**

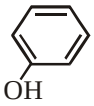
$\underset{\delta}{CH_3}-\underset{\gamma}{CH_2}-\underset{\beta}{CH}=\underset{\alpha}{CH_2}$

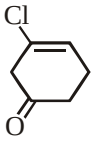
(1) β – hydrogen (2) γ – hydrogen (3) δ – hydrogen (4) α – hydrogen

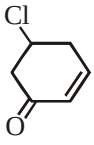
HC0082

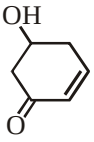
30. The major poduct of the following reaction is: **(Jee Main (Jan) 2019)**



(1) 

(2) 

(3) 

(4) 

HC0083

31. The major product of the following reaction is: **(Jee Main (Jan) 2019)**

$CH_3CH_2\underset{Br}{CH}-\underset{Br}{CH_2} \xrightarrow[\text{(ii) } NaNH_2 \text{ in liq } NH_3]{\text{(i) KOH alc.}}$

(1) $CH_3CH_2C{\equiv}CH$

(2) $CH_3CH_2\underset{NH_2}{CH}-\underset{NH_2}{CH_2}$

(3) $CH_3CH{=}C{=}CH_2$

(4) $CH_3CH{=}CHCH_2NH_2$

HC0084

32. Which one of the following alkenes when treated with HCl yields majorly an anti Markovnikov product? **(Jee Main (April) 2019)**

(1) $F_3C - CH = CH_2$ (2) $Cl - CH = CH_2$

(3) $CH_3O - CH = CH_2$ (4) $H_2N - CH = CH_2$

HC0085

33. The mojor product of the following reaction is : **(Jee Main (April) 2019)**

$$CH_3C{\equiv}CH \xrightarrow[\text{(ii) DI}]{\text{(i) DCl (1 equiv.)}}$$

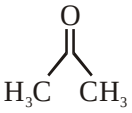
(1) $CH_3CD(Cl)CHD(I)$ (2) $CH_3CD_2CH(Cl)(I)$

(3) $CH_3CD(I)CHD(Cl)$ (4) $CH_3C(I)(Cl)CHD_2$

HC0086

34. The major product of the following addition reaction is : **(Jee Main (April) 2019)**

$$H_3C - CH = CH_2 \xrightarrow{Cl_2/H_2O}$$

(1) $CH_3 - \underset{Cl}{CH} - \underset{OH}{CH_2}$ (2) $H_3C - \underset{OH}{CH} - \underset{Cl}{CH_2}$ (3) $H_3C -$  (4) 

HC0087

35. But-2-ene on reaction with alkaline $KMnO_4$ at elevated temperature followed by acidification will give : **(Jee Main (April) 2019)**

(1) one molecule of CH_3CHO and one molecule of CH_3COOH

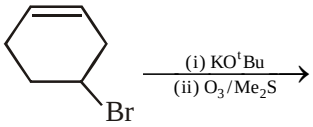
(2) $CH_3{-}\underset{OH}{CH}{-}\underset{OH}{CH}{-}CH_3$

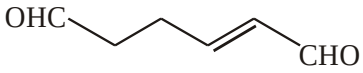
(3) 2 molecules of CH_3COOH

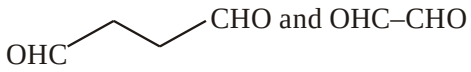
(4) 2 molecules of CH_3CHO

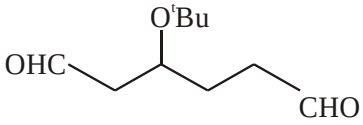
HC0088

36. The major product(s) obtained in the following reaction is/are : **(Jee Main (April) 2019)**



(1) 

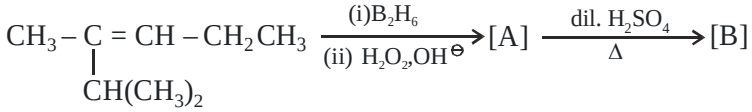
(2) 

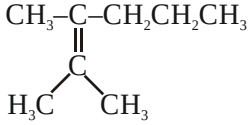
(3) 

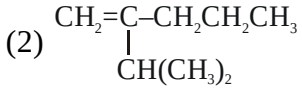
(4) 

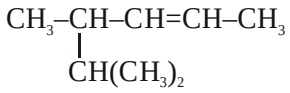
HC0089

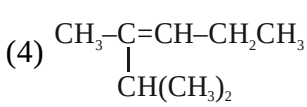
37. The major product [B] in the following sequence of reactions is :- **(Jee Main (April) 2020)**



(1) 

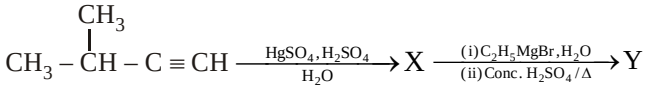
(2) 

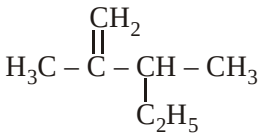
(3) 

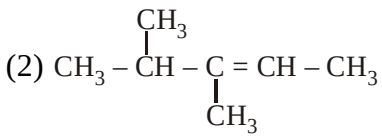
(4) 

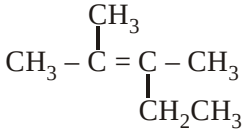
HC0090

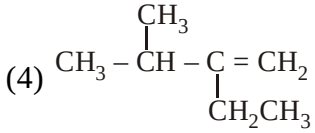
38. The major product (Y) in the following reactions is : **(Jee Main (April) 2020)**



(1) 

(2) 

(3) 

(4) 

HC0091

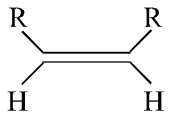
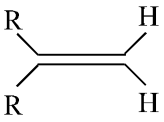
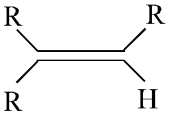
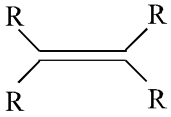
EXERCISE # JEE ADVANCE

1. Propyne and propene can be distinguished by – **[IIT -2000]**

(A) conc. H_2SO_4 (B) Br_2 in CCl_4 (C) dil. $KMnO_4$ (D) $AgNO_3$ in ammonia

HC0092

2. Which one of the following alkenes will react fastest with H_2 under catalytic hydrogenation condition **[IIT -2000]**

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

HC0093

3. In the presence of peroxide, hydrogen chloride and hydrogen iodide do not give anti–Markovnikov addition to alkene because – **[IIT -2001]**

(A) both are highly ionic (B) one is oxidising and the other is reducing

(C) one of the step is endothermic in both the cases (D) All the steps are exothermic in both cases

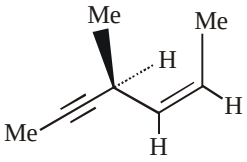
HC0094

4. The reaction of propene with HOCl proceeds via the addition of – **[IIT '2001]**

(A) H^+ in first step (B) Cl^+ in first step

(C) OH^- in first step (D) Cl^+ and OH^- in single step

HC0095

5. 

Hydrogenation of the above compound in the presence of poisoned paladium catalyst gives – **[IIT '2001]**

(A) An optically active compound (B) An optically inactive compound

(C) A racemic mixture (D) A diastereomeric mixture

HC0096

6. Consider the following reactions – **[IIT '2002]**

$$H_3C-\underset{\underset{D}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-CH_3 + \overset{\bullet}{Br} \rightarrow \text{'X'} + HBr$$

Identify the structure of the major product 'X'

(A) $H_3C-\underset{\underset{D}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-\dot{C}H_2$ (B) $H_3C-\underset{\underset{D}{|}}{CH}-\underset{\underset{CH_3}{|}}{C}-CH_3$

(C) $H_3C-\underset{\underset{D}{|}}{\dot{C}}-\underset{\underset{CH_3}{|}}{CH}-CH_3$ (D) $H_3C-\dot{C}H-\underset{\underset{CH_2}{|}}{CH}-CH_3$

HC0097

7. The nodal plane in the π–bond of ethene is located in – **[IIT '2002]**

(A) The molecular plane

(B) A plane parallel to the molecular plane

(C) A plane perpendicular to the molecular plane which contains the carbon–carbon σ–bond at right angle

(D) A plane perpendicular to the molecular plane which contains the carbon–carbon σ–bond

HC0098

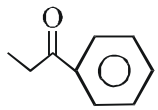
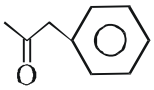
8. Identify a reagent from the following list which can easily distinguish between 1–butyne and 2-butyne- **[IIT '2002]**

(A) Bromine, CCl_4 (B) H_2, Lindlar catalyst

(C) Dilute H_2SO_4, $HgSO_4$ (D) Ammonical Cu_2Cl_2 solution

HC0099

9. $C_6H_5–C\equiv C–CH_3 \xrightarrow[H_2SO_4]{HgSO_4} A$ **[IIT '2003]**

(A)  (B)  (C) $C_6H_5-\underset{\underset{OH}{|}}{C}=CHCH_3$ (D) $C_6H_5-CH=\underset{\underset{OH}{|}}{C}-CH_3$

HC0100

10.  $\xrightarrow[-H_2O]{H^+}$ X (mixture) $\xrightarrow{Br_2}$ 5 compounds of molecular formula $C_4H_8Br_2$

Number of compounds in X will be: **[IIT '2003]**

(A) 2 (B) 3 (C) 4 (D) 5

HC0101

11. 2–hexyne can be converted into trans–2–hexene by the action of : **[IIT '2004]**

(A) H_2–Pd-$BaSO_4$ (B) Li in liq. NH_3 (C) H_2–PtO_2 (D) $NaBH_4$

HC0102

12. Cyclohexene is best prepared from cyclohexanol by which of the following: **[IIT '2004]**

(A) conc. H_3PO_4 (B) conc. HCl/$ZnCl_2$ (C) conc. HCl (D) conc. HBr

HC0103

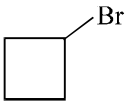
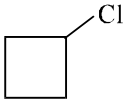
13. When Phenyl Magnesium Bromide reacts with tert. butanol, which of the following is formed?

(A) Tert. butyl methyl ether (B) Benzene **[IIT '2005]**

(C) Tert. butyl benzene (D) Phenol

HC0104

14. 1–Bromo–3–chlorocyclobutane when treated with two equivalents of Na, in the presence of ether which of the following will be formed? **[IIT '2005]**

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

HC0105

15. $CH_3–CH=CH_2 + NOCl \rightarrow P$ **[IIT 2006]**

Identify the adduct.

(A) $CH_3-\underset{Cl}{CH}-\underset{NO}{CH_2}$ (B) $CH_3-\underset{NO}{CH}-\underset{Cl}{CH_2}$ (C) $CH_3-CH_2-\underset{Cl}{\overset{NO}{CH}}$ (D) $\underset{NO}{CH_2}-CH_2-\underset{Cl}{CH_2}$

HC0106

16. The number of stereoisomers obtained by bromination of trans-2-butene is **[IIT 2007]**

(A) 1 (B) 2 (C) 3 (D) 4

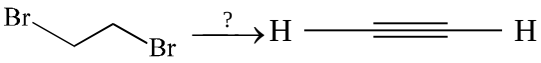
HC0107

17. The number of structural isomers for C_6H_{14} is **[IIT 2007]**

(A) 3 (B) 4 (C) 5 (D) 6

HC0108

18. The reagent(s) for the following conversion, **[IIT 2007]**



is / are

(A) alcoholic KOH

(B) alcoholic KOH followed by $NaNH_2$

(C) aqueous KOH followed by $NaNH_2$

(D) Zn / CH_3OH

HC0109

19. The synthesis of 3-octyne is achieved by adding a bromoalkane into a mixture of sodium amide and an alkyne. The bromoalkane and alkyne respectively are **[IIT-2010]**

(A) $BrCH_2CH_2CH_2CH_2CH_3$ and $CH_3CH_2C \equiv CH$

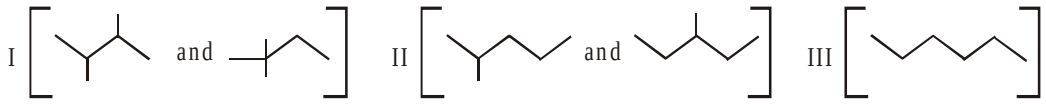
(B) $BrCH_2CH_2CH_3$ and $CH_3CH_2CH_2C \equiv CH$

(C) $BrCH_2CH_2CH_2CH_2CH_3$ and $CH_3C \equiv CH$

(D) $BrCH_2CH_2CH_2CH_3$ and $CH_3CH_2C \equiv CH$

HC0110

20. Isomers of hexane, based on their branching, can be divided into three distinct classes as shown in the figure. **[IIT-2014]**



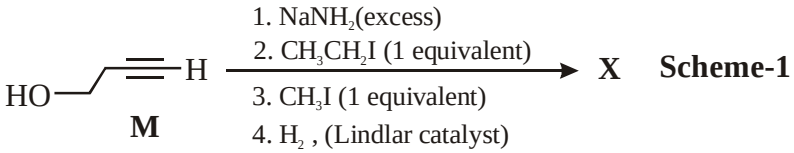
The correct order of their boiling point is

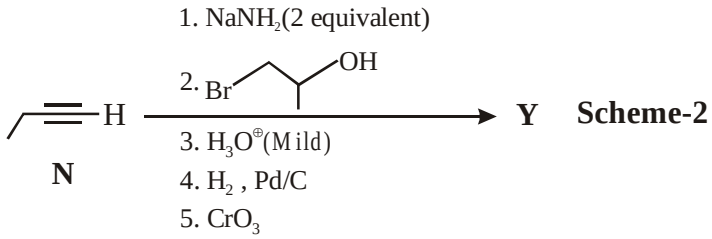
(A) I > II > III (B) III > II > I (C) II > III > I (D) III > I > II

HC0111

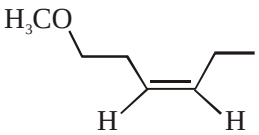
Paragraph For Question 21 and 22

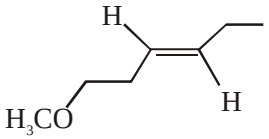
Schemes 1 and 2 describe sequential transformation of alkynes M and N. Consider only the major products formed in each step for both the schemes. **[IIT-2014]**

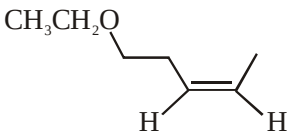


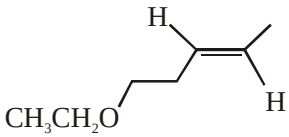


21. The product X is -

(A) 

(B) 

(C) 

(D) 

HC0112

22. The correct statement with respect to prodcut Y is -

(A) It gives a positive Tollens test and is a functional isomer of X

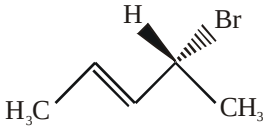
(B) It gives a positive Tollens test and is a geometrical isomer of X

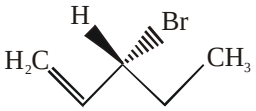
(C) It gives a positive Iodoform test and is a functional isomer of X

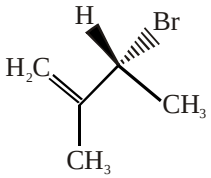
(D) It gives a positive Iodoform test and is a geometrical isomer of X

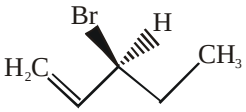
HC0113

23. Compound(s) that on hydrogenation produce(s) optically inactive compound(s) is (are) **[IIT-2015]**

(A) 

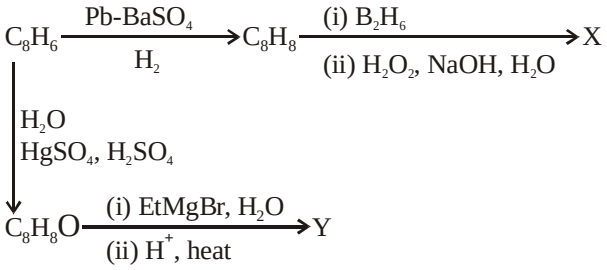
(B) 

(C) 

(D) 

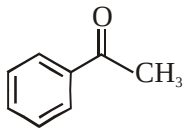
Paragraph For Questions 24 and 25

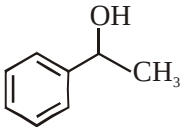
In the following reaction **[IIT-2015]**

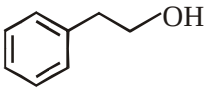


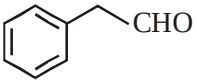
HC0114

24. Compound X is :

(A) 

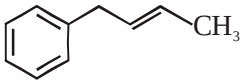
(B) 

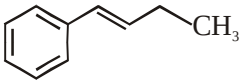
(C) 

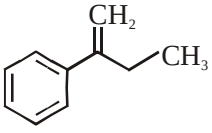
(D) 

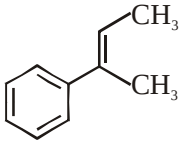
HC0115

25. The major compound Y is :

(A) 

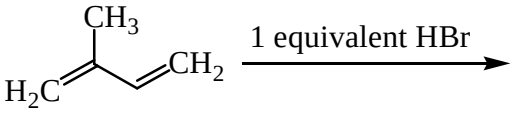
(B) 

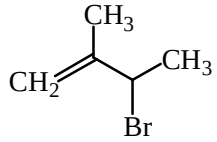
(C) 

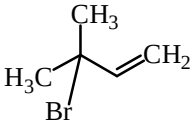
(D) 

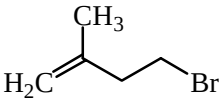
HC0116

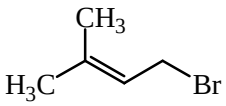
26. In the following reaction, the major product is - **[IIT-2015]**



(A) 

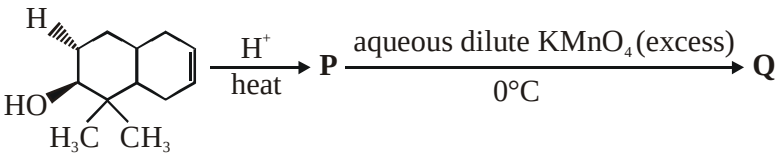
(B) 

(C) 

(D) 

HC0117

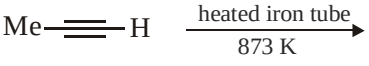
27. The number of hydroxyl group(s) in **Q** is **[IIT-2015]**

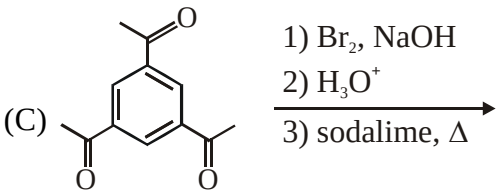


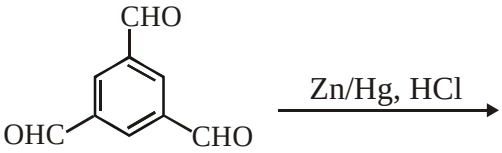
HC0118

28. The reaction(s) leading to the formation of 1,3,5-trimethylbenzene is (are) **[IIT-2018]**

(A) 

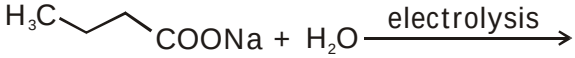
(B) 

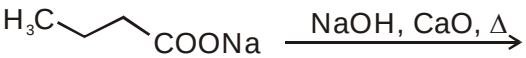
(C) 

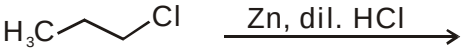
(D) 

HC0119

29. Which of the following reactions produce(s) propane as a major product? **[IIT-2019]**

(A) 

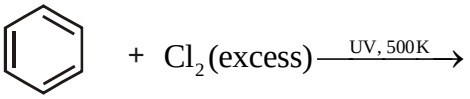
(B) 

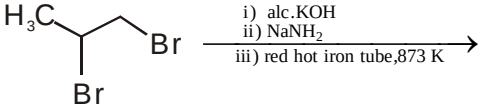
(C) 

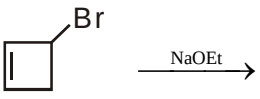
(D) 

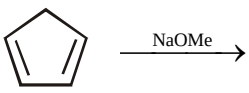
HC0120

30. Choose the correct option(s) that give(s) an aromatic compound as the major product.

(A) 

(B) 

(C) 

(D) 

[IIT-2019]

HC0121

ANSWER-KEY

EXERCISE # O-1

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

EXERCISE # O-2

1.	**(B)**	**2.**	**(A,B,C,D)**	**3.**	**(A,B)**	**4.**	**(B,C)**
5.	**(B,C,D)**	**6.**	**(A,C)**	**7.**	**(A,B,D)**	**8.**	**(A,C)**
9.	**(A)→P ; (B)→R ; (C)→S ; (D)→Q**			**10.**	**(A)→R ; (B)→S ; (C)→Q ; (D)→P**		

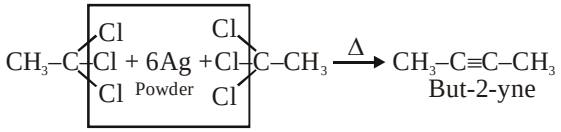
EXERCISE # S-1

1.	**(D)**	**2.**	**(B)**	**3.**	**(A)**	**4.**	**(C)**
5.	**(B)**	**6.**	**(A)**	**7.**	**(B)**	**8**	**(A)**
9	**(B)**	**10**	**(A)**	**11**	**(C)**	**12**	**(A)**
13	**(C)**	**14**	**(A)**	**15**	**(B)**	**16**	**(B)**
17.	**(D)**	**18.**	**(B)**	**19.**	**(C)**	**20.**	**(B)**
21.	**(A,B,C,D)**	**22.**	**(A,B)**	**23.**	**(A,B,C)**	**24.**	**(A,B,C,D)**
25.	**(D)**	**26.**	**(A)→S ; (B)→R ; (C)→P ; (D)→R,S**				
27.	**(A)→Q ; (B)→R ; (C)→S ; (D)→P**			**28.**	**(A)→Q ; (B)→P ; (C)→S ; (D)→R**		

EXERCISE # J-MAINS

1.	**(1)**	**2.**	**(4)**	**3.**	**(1)**	**4.**	**(1)**	**5.**	**(2)**
6.	**(4)**	**7.**	**(2)**	**8.**	**(1)**	**9.**	**(4)**	**10.**	**(2)**
11.	**(4)**	**12.**	**(2)**	**13.**	**(4)**	**14.**	**(4)**	**15.**	**(4)**
16.	**(3)**	**17.**	**(2)**						

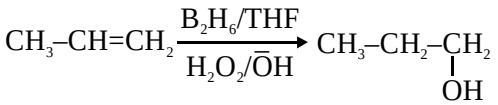
18. **(1)**



19. **(3)**

$Ca^{+2}[C\equiv C]^{-2}$

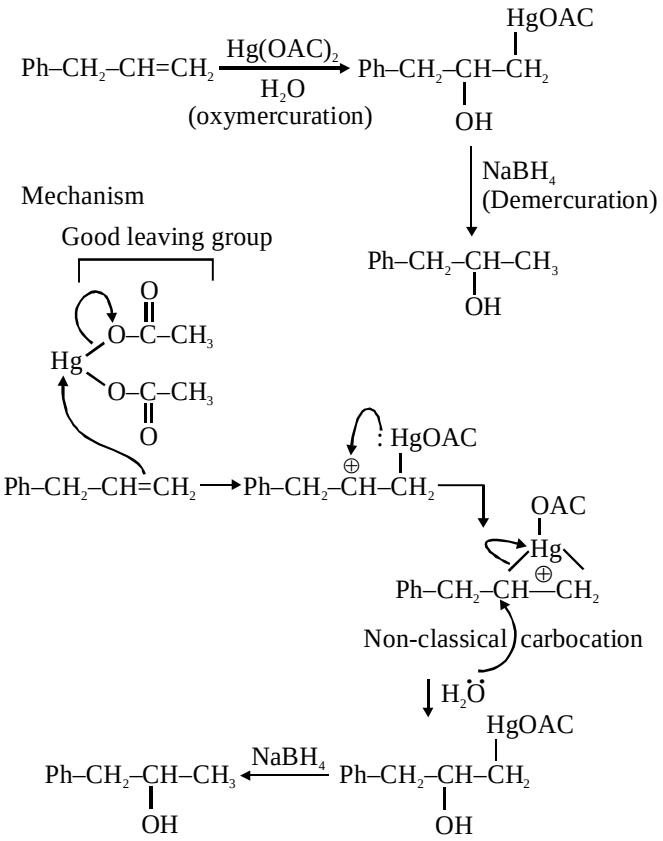
20. **(1)**



21. **(2)**

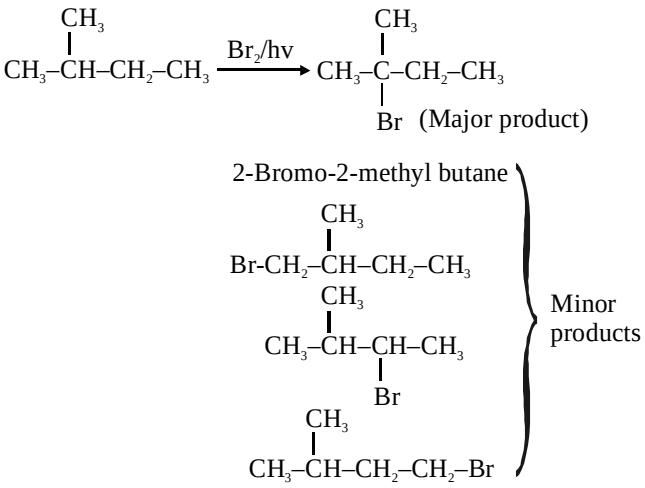
22. (2) **23. (4)**

24. (1)



Rearrangement of carbocation formed is not possible due to formatiion of cyclic non-classical carbocation.

25. (1)



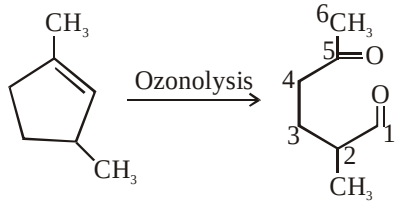
Relectivity ratio for bromination is

1° : 2° : 3° : : 1 : 82 : 1600

Hence 3° product will be major product.

26. (2)

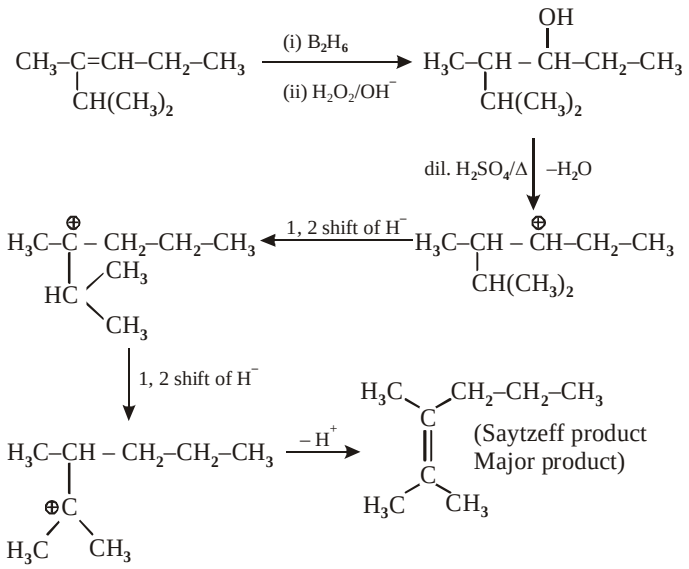
27. (4)



5-Keto-2-Methylhexanal

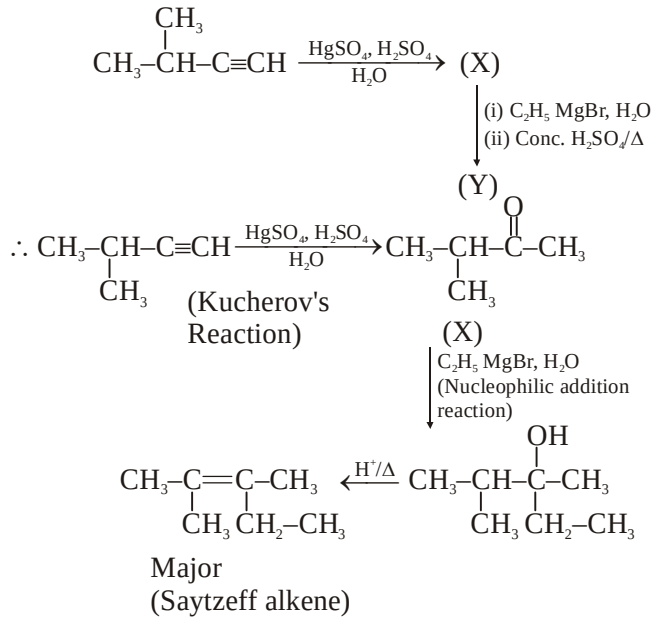
28. Ans. (3) **29. Ans. (2)** **30. Ans. (1)** **31. Ans. (1)**
32. Ans. (1) **33. Ans. (4)** **34. Ans.(2)** **35. Ans. (3)**
36. Ans. (2)
37. Ans. (1)

Sol.



38. Ans. (3)

Sol.

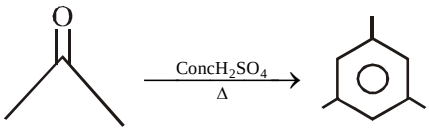


EXERCISE # JEE ADVANCE

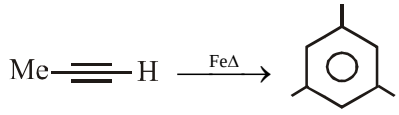
1.	**(D)**	**2.**	**(A)**	**3.**	**(C)**	**4.**	**(B)**	**5.**	**(B)**
6.	**(B)**	**7.**	**(A)**	**8.**	**(D)**	**9.**	**(A)**	**10.**	**(B)**
11.	**(B)**	**12.**	**(A)**	**13.**	**(B)**	**14.**	**(D)**	**15.**	**(A)**
16.	**(A)**	**17.**	**(C)**	**18.**	**(B)**	**19.**	**(D)**	**20**	**(B)**
21.	**(A)**	**22.**	**(C)**	**23.**	**(B,D)**	**24.**	**(C)**	**25.**	**(D)**
26.	**(D)**	**27.**	**(4)**						

28. (A,B,D)

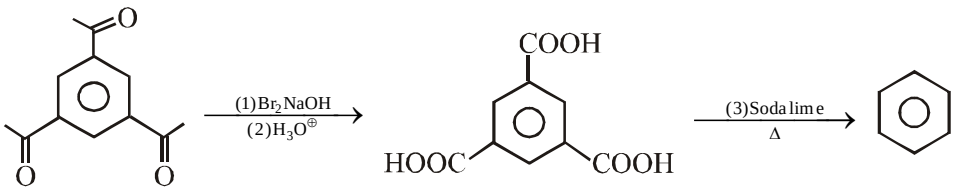
Sol. (A)



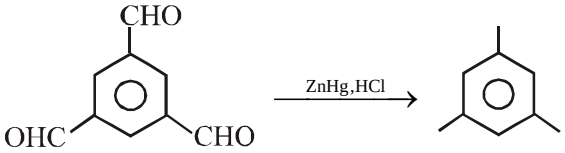
(B)



(C)



(D)



29. Ans. (B,C)

30. Ans. (B,D)