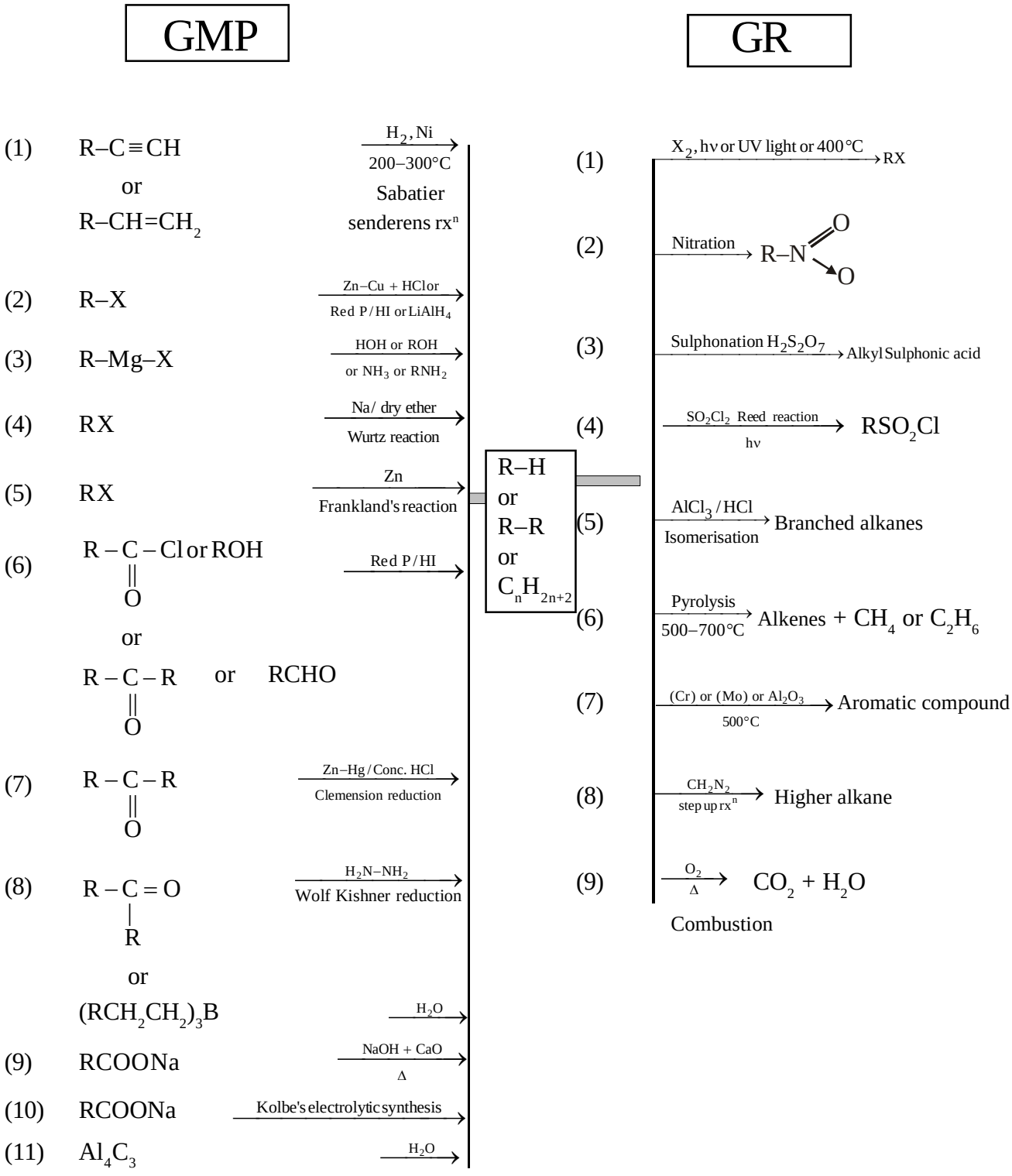
HYDROCARBON

REACTION CHART FOR ALKANES



III. PROPERTIES

(i). Physical Properties :

(1) C_1 to C_4 gases, Neopentane is also a gas but n-pentane and isopentane are low boiling point liquids. Next members C_5 to C_{17} are Colourless liquids and above C_{17} are Waxy solids.

(2) **Density** : Density of alkanes increases with increase in molecular weight and becomes constant at 0.8 g/mL. Thus all alkanes are lighter than water.

(3) **Solubility** : Alkanes being non polar and thus insoluble in water but soluble in non-polar solvents (C_6H_6, CCl_4 ,ether etc). The solubility of alkanes decreases with increase in molecular weight. Liquid alkanes are themselves good non-polar solvents.

(4) **Boiling point** : Boiling point increases with molecular weight (for n-alkanes).

Note : Van derwaal's forces of attraction increases with molecular weight as well as surface area of molecule.

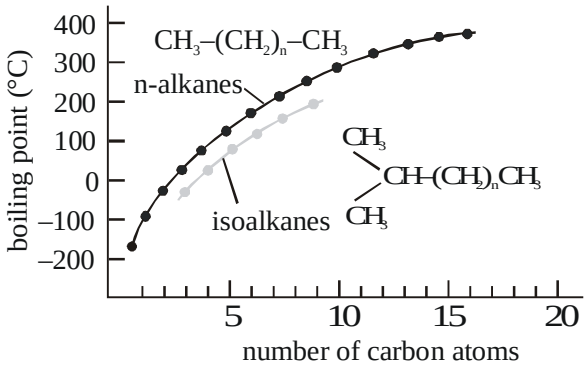
i.e. order of boiling point, Pentane < hexane < heptane

$$\text{Also boiling point} \quad \propto \frac{1}{\text{number of side chain}}$$

because the shape approaches to spherical which results in decrease in Vanderwaals forces (as surface area decreases)

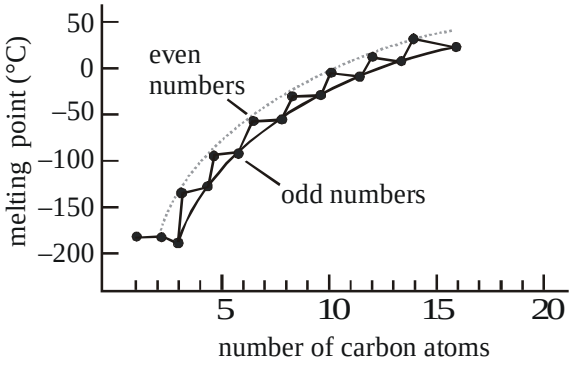
Thus boiling point n–Pentane > Isopentane > neopentane

Variation of Boiling point with number of carbon atoms takes place as following :



(6) **Melting Point :** Melting Point of alkanes do not show regular trend. Alkanes with even number of carbon atoms have higher melting point than alkanes with odd number of carbon atoms.

The abnormal trend in melting point is due to the fact that alkanes with odd number of carbon atoms have their end carbon atom on the same side and in alkane with even number of carbon atom have their end carbon atom on opposite side.



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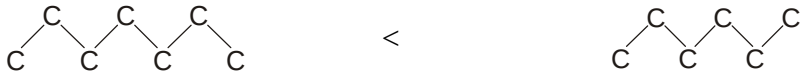
Thus alkanes with even carbon atoms are packed closely in crystal lattice to permit greater intermolecular attractions.



Odd number of carbon Even number of carbon

(B) Nitration (Vapour phase nitration) : Replacement of hydrogen atom of alkane by $-NO_2$ group is known as nitration. At ordinary temperature, alkanes do not react with HNO_3, but reacts with vapours of concentrated HNO_3 at 450° C. Since the reaction is carried out at high temp. the C—C bonds of alkanes break during the reaction and a mixture of nitroalkanes is formed.

$$R-H+HO-NO_2 \xrightarrow{400-500^0C} R-NO_2+H_2O$$

Mechanism : (Free Radical substitution)

Step – I $HO-NO_2 \xrightarrow{\Delta} \dot{O}H + \dot{N}O_2$

$R- H + \dot{O}H \longrightarrow \dot{R} + H_2O$

Step – II $\dot{R} + HO-NO_2 \longrightarrow \underset{\text{(Product)}}{R-NO_2} + \dot{O}H$

Step – III $\dot{R} + \dot{N}O_2 \longrightarrow R-NO_2$

$\dot{R} + \dot{O}H \longrightarrow R-OH$ (minor)

$\dot{O}H + \dot{N}O_2 \longrightarrow HONO_2$

Example : $CH_3—CH_3 + HNO_3 \xrightarrow{450^0C} CH_3CH_2NO_2 + CH_3NO_2 + H_2O$

(C) Sulphonation : Replacement of H atom of alkane by $-SO_3H$ is known sulphonation. Alkane react with fuming H_2SO_4 or oleum ($H_2S_2O_7$). The branched lower alkanes and higher alkanes react to give alkane sulphonic acid.

The reactivity order for sulphonation is $3^o H > 2^o H > 1^o H$

$R - H + HO- SO_3H \rightarrow R - SO_3H + H_2O$

Mechanism : (Free Radical substitution)

$HOSO_3H \xrightarrow{400^\circ C} HO^\bullet + \dot{S}O_3H$

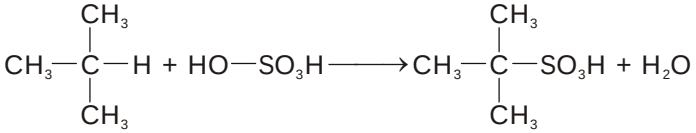
$R - H + {}^\bullet OH \rightarrow R^\bullet + H_2O$

$R^\bullet + {}^\bullet SO_3H \rightarrow R- SO_3H$

Lower members such as propane, butane, pentane etc. react with SO_3 in vapour phase to form sulphonic acids.

$C_3H_8 + SO_3 \longrightarrow C_3H_7 - SO_3H$

Example :



2–Methyl propane 2–methyl propane–2–sulphonic acid

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(2). Oxidation :

(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.

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

(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 :

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

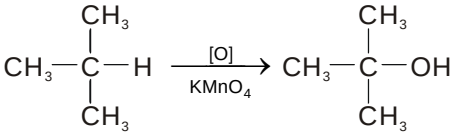
$$2CH_4 + O_2 \xrightarrow[\text{High P and T}]{\text{Red hot Cu or Fe tube}} 2CH_3OH$$

$$CH_4 + O_2 \xrightarrow[230^0\,C,100\,atm]{Mo_2O_3} HCHO + H_2O$$

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

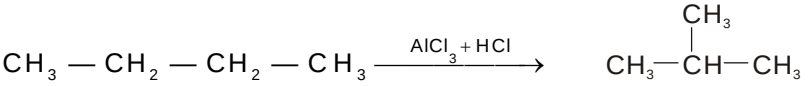
$$CH_3(CH_2)_nCH_3 \xrightarrow[\text{high Temp}]{(CH_3COO)_2\,Mn} CH_3(CH_2)_nCOOH$$

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

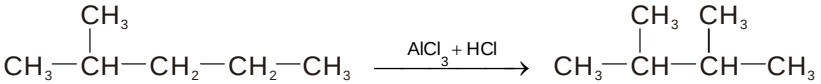


(3). Isomerization : Unbranched chain alkanes on heating with $AlCl_3$ + HCl / 200^0C are converted in to branched chain alkanes. Branched chain alkanes converted to more branched alkane. Isomerisation of alkanes is of great importance in petroleum industry to increase the octane number of petrol (gasoline).

Examples :



n-butane Isobutane



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(4). Pyrolysis or Cracking or thermal decomposition : When alkanes are heated to 500-700^{0}C they are decomposed in to lower hydrocarbon. This decomposition is called pyrolysis. The mechanism of pyrolysis occurs via free radicals. In petroleum industry it is also termed as cracking. Cracking is used for the manufacture of petrol, petrol gas/oil gas etc.

Example : $CH_4 \xrightarrow{1000^\circ C} C + H_2$

$$CH_3 - CH_3 \xrightarrow[\text{absence of air}]{500^\circ C} CH_2 = CH_2 + H_2$$

$$CH_3CH_2CH_3 \longrightarrow \begin{cases} CH_2{=}CH_2 + CH_4 \\ CH_3{-}CH{=}CH_2 + H_2 \end{cases}$$

n-Butane $\xrightarrow{\text{Cracking}}$ 1-Butene + 2–Butene + Ethane + Ethene + Propene + CH4 + H_2

(5). Hydroforming or dehydrogenation or cyclisation or catalytic reforming or aromatization:

Unbranched higher alkanes (from 6 to 10 carbon atoms) when heated in presence of oxides of Cr, Mo, V on Al_2O_3 support at 500^0 C aromatic hydrocarbons are formed.

$$\text{n – hexane} \xrightarrow[500^\circ C]{Cr_2O_3 / Al_2O_3} \bigcirc + \ 4H_2$$

$$CH_3(CH_2)_5 - CH_3 \xrightarrow[500^\circ C]{Cr_2O_3 / Al_2O_3} \bigcirc\!\!-CH_3 + \ 4H_2$$

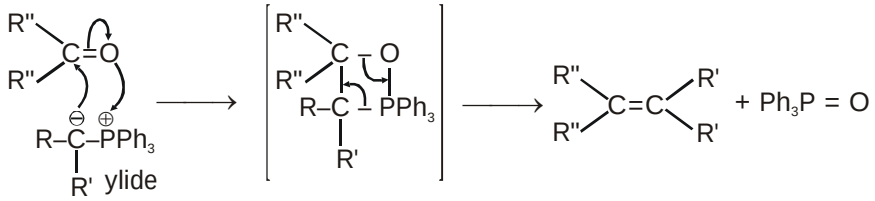
n-heptane Toluene

$$CH_3(CH_2)_6 - CH_3 \xrightarrow[500^\circ C]{Cr_2O_3 / Al_2O_3} \bigcirc\!\!\begin{matrix}-CH_3\\-CH_3\end{matrix}$$

n-octane o-xylene

It provides an excellent method of passing from aliphatic to aromatic series.

Wittig Reaction : Aldehydes and ketones are converted into alkenes by using a special class of compounds called **phosphorus ylides**, also called Wittig reagents. The triphenyl group of phosphorane has a strong tendency to pull oxygen atom of the aldehyde or ketone via a cyclic transition state forming an alkene.



(R, R', R" and R"' may be hydrogen or any alkyl group)

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

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

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

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

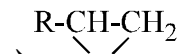
(2) $\xrightarrow{X_2} R–CHX–CH_2X$

(3) $\xrightarrow{HX} R–CHX–CH_3$

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

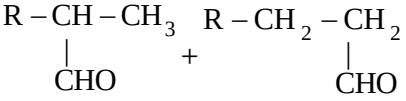
(5) $\xrightarrow{HOCl} R–CH(OH)–CH_2Cl$

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

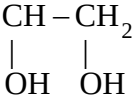
(7) $\xrightarrow[Ag\,300°C]{1/2\,O_2}$ 

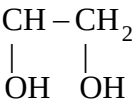
(8) $\xrightarrow{+CH_2N_2}$

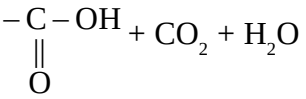
(9) $\xrightarrow{BH_3} (RCH_2CH_2)_3B$

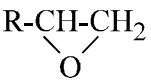
(10) $\xrightarrow[HCo(CO)_4]{CO+H_2}$ 

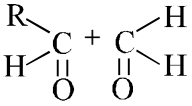
(11) $\xrightarrow[\Delta]{O_2} CO_2 + H_2O$

(12) $\xrightarrow{OsO_4}$ 

(13) $\xrightarrow[1\%\,alkaline\,KMnO_4]{Bayer\,reagent}$ 

(14) $\xrightarrow{strong\,oxidant}$ 

(15) $\xrightarrow[Pr\,iles–chalev's\,reaction]{Per\,acid}$ 

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

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

(21) $\xrightarrow[\Delta]{Alkane}$ Higher alkane

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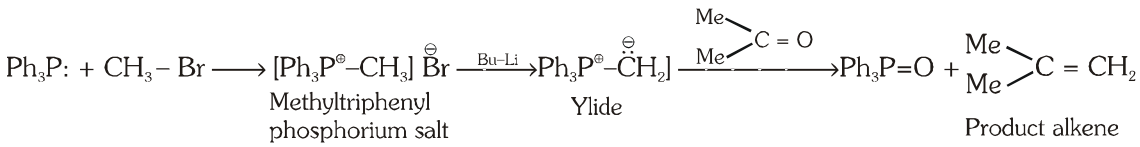
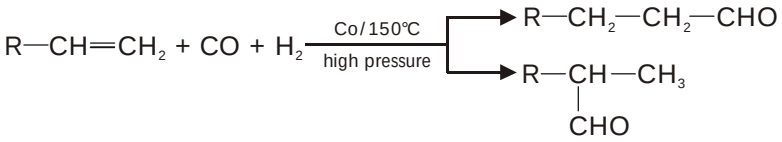
Example :

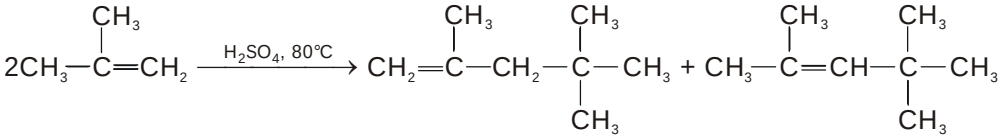


Hydroformylation or Oxo reaction : Alkenes react with Carbon monoxide and hydrogen at 100 – 150°C temperature and high pressure (200 atm) in the presence of Cobalt catalyst to produce an aldehyde. It does not follow markonikoff's rule.

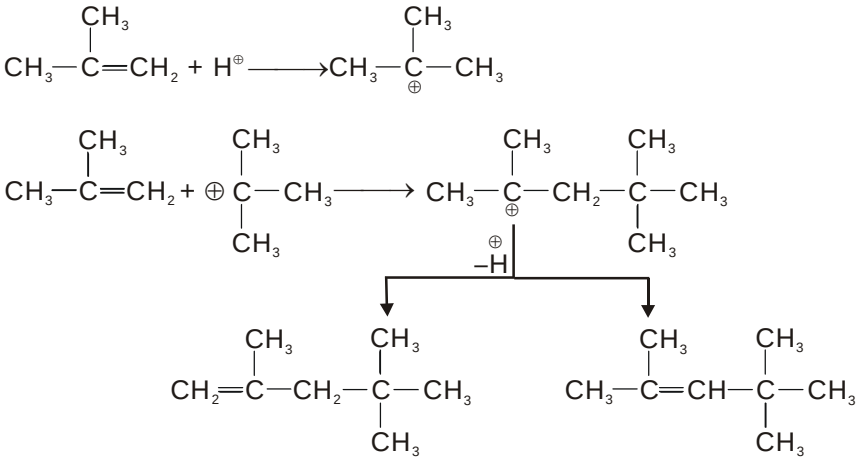
The net reaction is the addition of a H–atom to one of the Olefinic bond and a formyl (–CHO) group to the other.



Alkenylation (Addition of alkene) In presence of H_2SO_4 or H_3PO_4 at 80°C dimerisation of isobutylene take place gives two isomer of octene.



Mechanism :



Combustion : 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.

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(1) From Metal carbide [Laboratory method] : Acetylene is prepared in the laboratory by the action of water on calcium carbide.

$$CaC_2 + 2H_2O \longrightarrow CH{\equiv}CH + Ca(OH)_2$$

$$Ca^{+2} + \overset{\ominus}{C}{\equiv}\overset{\ominus}{C} + 2H^+ + 2OH^- \longrightarrow CH{\equiv}CH + Ca(OH)_2$$

$$Mg_2C_3 + 4H_2O \rightarrow 2Mg(OH)_2 + C_3H_4$$

(2) Presence of acidic hydrogen atom : The hydrogen atom attached to the triple bonded carbon can be easily removed by a strong base and hence acetylene and 1-alkynes are considered as weak acids.

Explanation : The amounts of s-character in various types of C—H bonds is as-

≡C—H	=C—H	—C—H
50%	33%	25%

Since s electrons are closer to the nucleus than the p electrons, the electrons present in a bond having more s-character will be more closer to nucleus. Due to high s-character of the C—H bond in alkyne (s = 50%) the electrons constituting this bond are more strongly held by the carbon nucleus, with the result the H present on carbon atom can be easily removed as proton. Thus terminal alkynes have acidic nature.

The acidic nature of the three types of –C–H bonds as

≡C—H	>	=C—H	>	—C—H
sp		sp^2		sp^3

Only terminal alkynes due to acidic characters gives substitution reaction $\equiv \overset{\delta^-}{C}—\overset{+\delta}{H}$. Which are explained below.

(iii) Substitution Reaction (Formation of metallic derivatives) : Acetylene is dibasic acid where as propyne is monobasic means acetylene can give two H^+ where as propyne can give one H^+.

(1) Formation of sodium acetylides : Acetylene and 1-alkynes react with sodamide to form acetylides

$$H—C{\equiv}C—H \xrightarrow{NaNH_2} \underset{\text{Mono sodium acetylide}}{NaC{\equiv}C—H} \xrightarrow{NaNH_2} \underset{\text{Disodium acetylide}}{NaC{\equiv}CNa}$$

Dry alkynides are generally unstable and explosive. These are easily converted in to original alkynes when heated with dilute acids.

$$NaC{\equiv}CNa + 2HNO_3 \longrightarrow HC{\equiv}CH + 2NaNO_3$$

This reaction can be used for the purification, seperation and identification of 1-alkynes.

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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) $Mg_2C_3 \xrightarrow{HOH} CH_3–C\equiv CH + Mg(OH)_2$

C_2H_2

GR

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

(2) $\xrightarrow{X_2} C_2H_2X_4$

(3) $\xrightarrow[Peroxide]{HBr} CH_3BrCH_2Br$

(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) $\xrightarrow{Conc.H_2SO_4} CH_3CH(HSO_4)_2$

(10) $\xrightarrow[HgSO_4]{C_2H_5OH/H_2O} CH_3CHO$

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

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

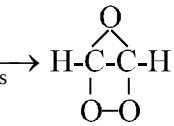
(13) $\xrightarrow{NaNH_2} NaC\equiv CNa$

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

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

(16) $\xrightarrow{Combustion\ O_2} CO_2 + H_2O$

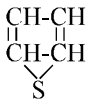
(17) $\xrightarrow{Bayer\ Reagent} \begin{matrix}CHO\\ |\\ CHO\end{matrix} \longrightarrow HCOOH$

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

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

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

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

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

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

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(2) Formation of silver & copper acetylides : Copper and silver acetylides are obtained by passing 1-alkynes in the ammonical solution of silver nitrate (Tollen's reagent) and cuprous chloride respectivley.

$$R—C\equiv C—H + AgNO_3 + NH_4OH \longrightarrow \underset{\text{White ppt.}}{R—C\equiv CAg} + NH_4NO_3 + H_2O$$

(Tollen's reagent)

$$R—C\equiv C—H + Cu_2Cl_2 + NH_4OH \longrightarrow \underset{\text{copper acetylide [Red ppt.]}}{R—C\equiv CCu} + NH_4Cl + H_2O$$

(ammonical cuprous-chloride)

These reactions are used for detecting the presence of acetylenic (acidic) hydrogen.These are test for distinguish alkenes and alkynes or 1-alkynes and 2-alkynes.

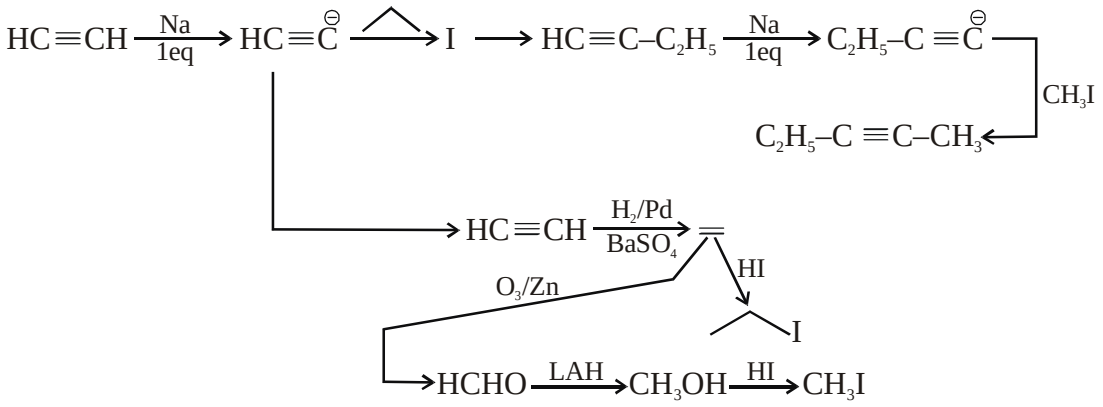
(i) $HC\equiv CH \longrightarrow RC\equiv CH$

$$HC\equiv CH \xrightarrow[1eq]{Na} HC\equiv C^{\ominus}Na^{\oplus} \xrightarrow{R–I} HC\equiv CR$$

(ii) $HC\equiv CH \longrightarrow RC\equiv C–R'$

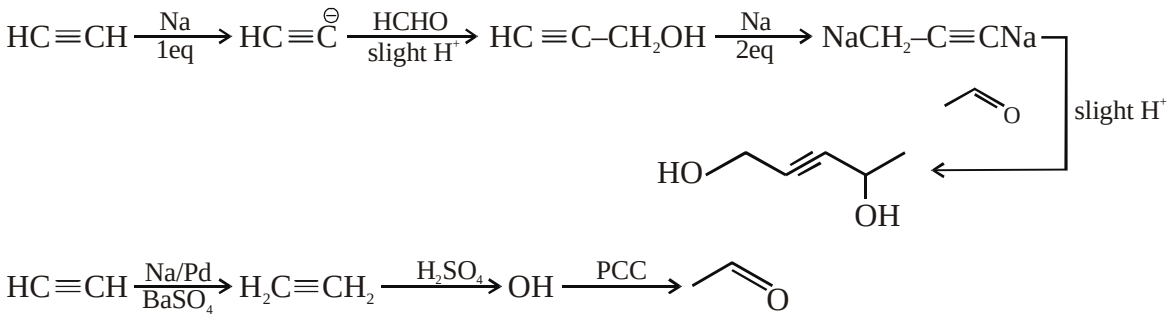
$$HC\equiv CH \xrightarrow[1eq]{Na} HC\equiv C^{\ominus}Na^{\oplus} \xrightarrow{R–I} HC\equiv CR \xrightarrow[1eq]{Na} RC\equiv C^{\ominus} \xrightarrow{R'–I} RC\equiv CR'$$

(iii) $CH\equiv CH \longrightarrow CH_3–C\equiv C–CH_2CH_3$



Convert following compounds :

(1) $HC\equiv CH \longrightarrow OH–CH_2–C\equiv C–\underset{\displaystyle OH}{\underset{|}{CH}}–CH_3$



$$HC\equiv CH \xrightarrow[BaSO_4]{Na/Pd} H_2C\equiv CH_2 \xrightarrow{H_2SO_4} OH \xrightarrow{PCC} \text{O}$$

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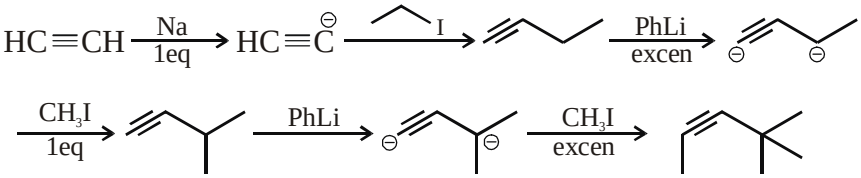
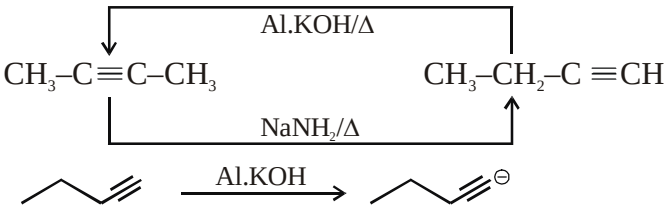
(2) $HC\equiv CH \longrightarrow CH_3-C\equiv C-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_3$





(1) Combustion :

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

$$2HC\equiv CH + 5O_2 \longrightarrow 4CO_2 + 2H_2O + 312\ \text{K.cal}$$

The combustion of acetylene is used for welding and cutting of metals in which oxy-acetylene flame having high temp (3000^0C) is produced.

(VII) Polymerisation :

(1) Linear polymerisation :

Dimerisation : When two molecules of acetylene passed through a solution of Cu_2Cl_2 and NH_4Cl a vinyl acetylene is obtained.

$$2HC\equiv C-H \xrightarrow[NH_4Cl]{Cu_2Cl_2} CH_2=CH-C\equiv C-H$$

mono vinyl acetylene

When vinyl acetylene react with HCl then chloroprene is obtained.

$$CH_2=CH-C\equiv C-H \xrightarrow{HCl} CH_2=CH-\underset{\displaystyle Cl}{\overset{|}{C}}=CH_2 \xrightarrow{\text{Polymerisation}} \textbf{Neoprene (Synthetic rubber)}$$

2- chloro-1,3-butadiene

[chloroprene]

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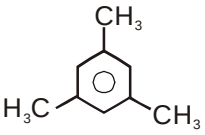
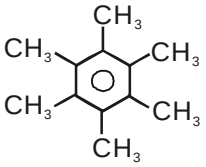
(2) Cyclic polymerisation : When alkyne is passed through red hot metallic tube, cyclic polymerisation takes place with the formation of aromatic compound

$3CH{\equiv}CH \xrightarrow[\text{iron tube}]{\text{Red hot}}$

Benzene

$3\ CH_3{-}C{\equiv}CH \xrightarrow[\text{iron tube}]{\text{Red hot}}$ 

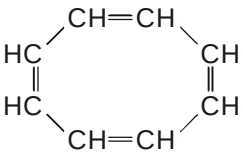
Mesitylene

$3\ CH_3{-}C{\equiv}C{-}CH_3 \xrightarrow[\text{iron tube}]{\text{Red hot}}$ 

Hexa methyl benzene

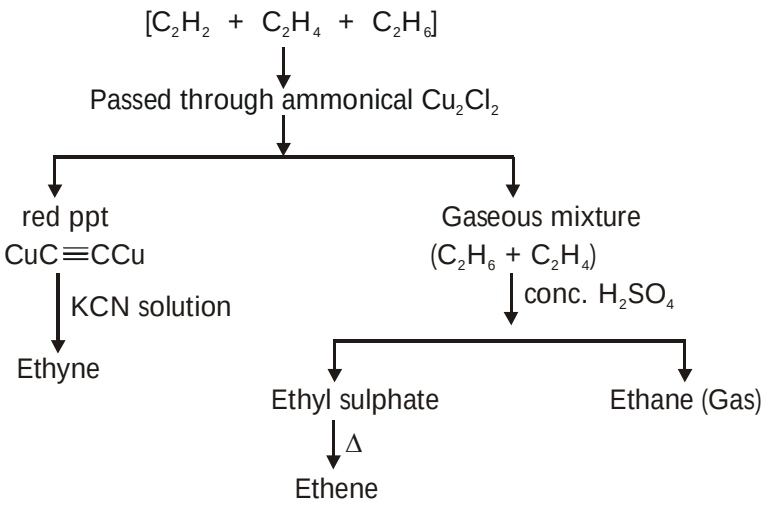
$3\ HC{\equiv}CH \xrightarrow[(C_6H_5)_3P]{Ni(CO)_4}$ benzene (90% yield)

(triphenyl–1–phosphene)

$4CH{\equiv}CH \xrightarrow{Ni(CN)_2}$ 

1,3,5,7–cyclooctatetraene

SEPERATION OF ETHANE, ETHENE AND ETHYNE :



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HYDROCARBON

REACTION CHART FOR ALKANES

GMP

(1) $R-C\equiv CH$ or $R-CH=CH_2$ $\xrightarrow[200-300°C]{H_2, Ni}$ 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) $R-\underset{\underset{O}{\|}}{C}-Cl$ 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) $\xrightarrow{X_2, h\nu \text{ or UV light or } 400°C}$ RX

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

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

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

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

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

Combustion

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

REACTION CHART FOR ALKENES

GMP

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

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

(3) $R–CH_2–CHX_2 \xrightarrow[\text{for higher alkene}\ -X_2]{Zn\ dust/\Delta}$

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

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

(6) $\begin{matrix}RCH-COOK\\|\\RCH-COOK\end{matrix} \xrightarrow{Kolbe's\ electrolytic\ synthesis}$

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

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

(9) $R–H \xrightarrow{Pyrolysis}$

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

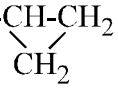
(2) $\xrightarrow{X_2} R–CHX–CH_2X$

(3) $\xrightarrow{HX} R–CHX–CH_3$

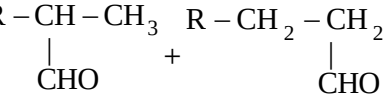
(4) $\xrightarrow{HBr,\ Peroxide} R–CH_2–CH_2Br$

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

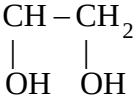
(6) $\xrightarrow[+H_2O]{dil.H_2SO_4} R–CH_2(OH)–CH_3$

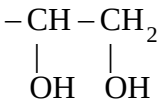
(7) $\xrightarrow{+CH_2N_2}$ 

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

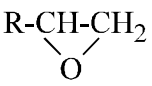
(9) $\xrightarrow[HCo(CO)_4]{CO+H_2}$ 

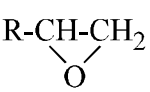
(10) $\xrightarrow[\Delta]{O_2} CO_2 + H_2O$

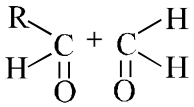
(11) $\xrightarrow[(ii)\ NaHSO_3/H_2O]{(i)\ OsO_4}$ 

(12) $\xrightarrow[1\%\ alkaline\ KMnO_4]{Baeyer's\ reagent}$ 

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

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

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

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

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

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

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

C_2H_2

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

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

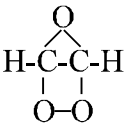
(12) $\xrightarrow{NaNH_2} NaC\equiv CNa$

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

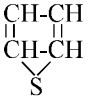
(16) $\xrightarrow{Baeyer's\ Reagent} \begin{matrix}CHO\\ |\\ CHO\end{matrix} \longrightarrow HCOOH$

(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

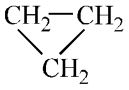
(B) Decreases progressively as the reaction proceeds

(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?

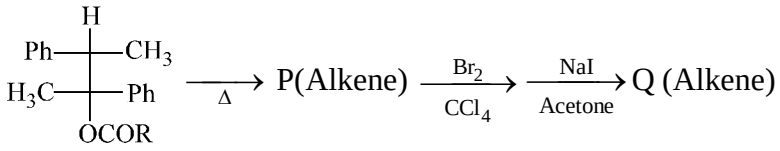
(A) 3 (B) 4 (C) 5 (D) 6

HC0003

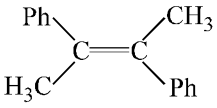
4. How many dibromo derivatives are formed when bromine is added to 3-Methyl Cyclohexene in 1,2-dichloroethane.

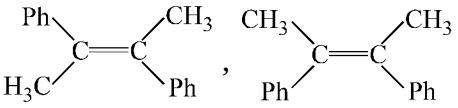
(A) 2 (B) 3 (C) 4 (D) 6

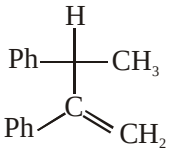
HC0004

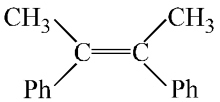
5. 

Alkene (P) & (Q) respectively are

(A) Both 

(B) 

(C) Both 

(D) Both 

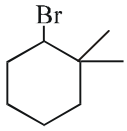
HC0005

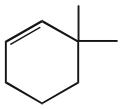
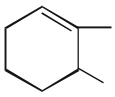
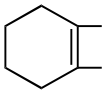
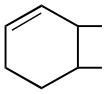
6. Anti–Markownikoff's addition of HBr is not observed in –

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

HC0006

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

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 –

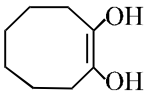
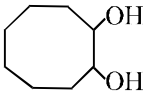
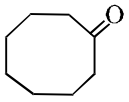
cis

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

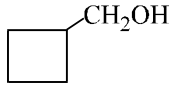
(C) Cold alkaline $KMnO_4$ (D) all of the above

HC0010

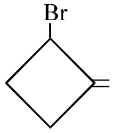
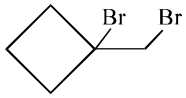
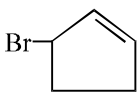
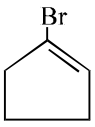
11. The reaction of cyclooctyne with $HgSO_4$ in the presence of a H_2SO_4 gives

(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

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

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 –

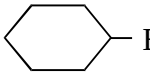
(A) CH_3CH_2CHO, $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$

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

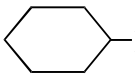
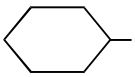
(C) CH_3CH_2CHO (both)

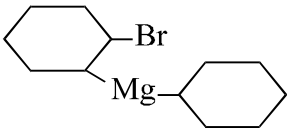
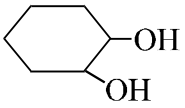
(D) $CH_3-\underset{\underset{O}{\|}}{C}-CH_3$ (both)

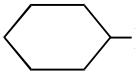
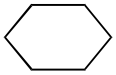
HC0014

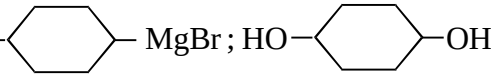
15.  $\xrightarrow{Mg/dry\ ether}$ (X) $\xrightarrow[O]{CH_3-C-NH_2}$ (Y)

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

(A)  ; 

(B)  ; 

(C)  ; 

(D) 

HC0015

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

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) $CH_2=CHCH_2\underset{\underset{Br}{|}}{C}=CH_2$

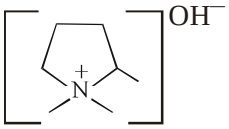
HC0018

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

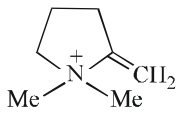
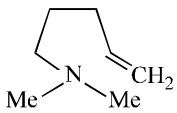
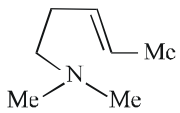
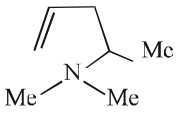
(A) $CH_3.CHCl.CH_2.CH_3 + KOH \xrightarrow{EtOH}$ (B) $CH_3.\underset{\underset{\overset{+}{N}Me_3}{|}}{CH}.CH_2.CH_3 + NaOEt \xrightarrow[\Delta]{EtOH}$

(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

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

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) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}=CH_2 \xrightarrow[(ii)\,H_2O_2/\overset{\oplus}{O}H]{(i)\,BH_3/THF}$	(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) $CH_3-CH_2-\underset{\displaystyle |}{\overset{\displaystyle Cl}{CH}}-CH_3 \xrightarrow{CH_3ONa/\Delta}$	(R) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}-CH_2OH$
(D) $CH_3-CH_2-\underset{\displaystyle |}{\overset{\displaystyle Cl}{CH}}-CH_3 \xrightarrow[\Delta]{(CH_3)_3CONa}$	(S) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{\overset{\displaystyle OH}{\overset{\displaystyle |}{C}}}}-CH_3$

HC0025

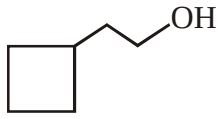
node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

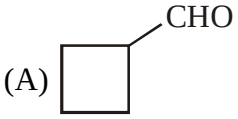
EXERCISE # S-1

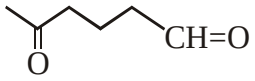
1. When n-butane is heated in the presence of $AlCl_3$/HCl it will be converted into –

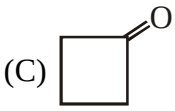
(A) Ethane (B) Propane (C) Butene (D) Isobutane

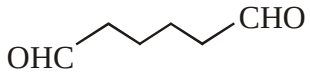
HC0026

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

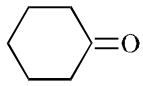
(A)  + HCHO

(B) 

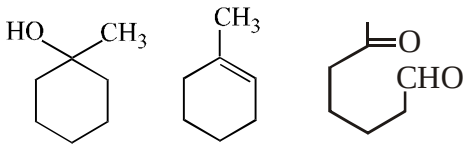
(C)  + CH_3CHO

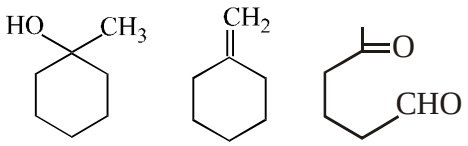
(D) 

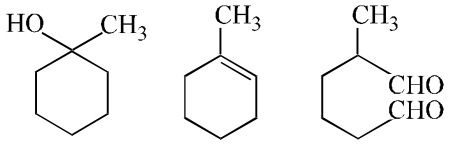
HC0027

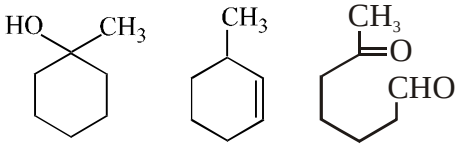
3.  + $CH_3MgBr \xrightarrow{H_3O^+}$ A $\xrightarrow[\Delta]{Con.\ H_2SO_4}$ B $\xrightarrow[(ii)\ Zn,H_2O]{(i)\ O_3}$ C ; A, B and C are –

A B C

(A) 

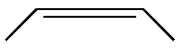
(B) 

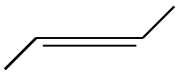
(C) 

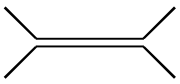
(D) 

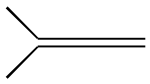
HC0028

4. Which has least heat of hydrogenation –

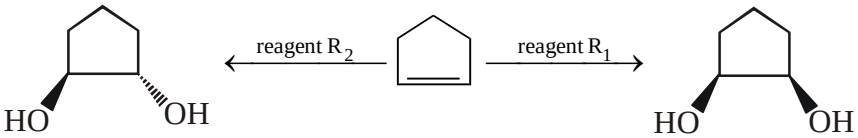
(A) 

(B) 

(C) 

(D) 

HC0029

5. (±) 

R_1 and R_2 respectively are –

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

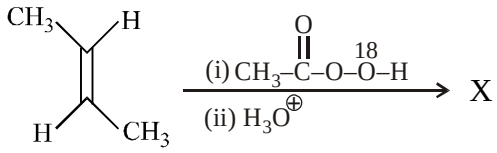
(B) Cold alkaline $KMnO_4$, HCO_3H / H_3O^+

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

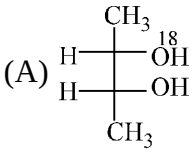
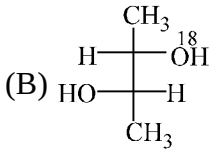
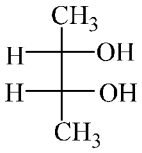
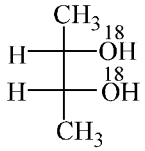
(D) $C_6H_5CO_3H$, HCO_3H / H_3O^+

HC0030

node06\B0BO-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

6. 

The probable structure of 'X' is

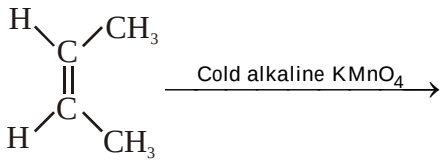
(A) 
(B) 
(C) 
(D) 

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≡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

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

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) $Cu–C\equiv C–Cu$ (B) $H_2C=CH–C\equiv CH$

(C) $HC\equiv C–Cu$ (D) $Cu–C\equiv C–NH_4$

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

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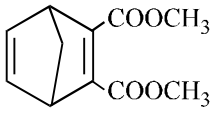
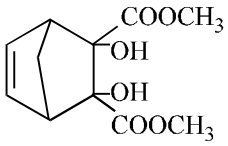
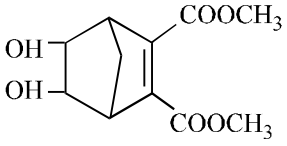
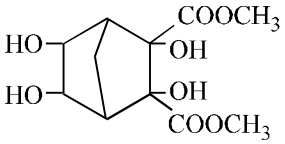
20.  $\xrightarrow[H_2O/\text{Acetone}]{O_sO_4\ (1eq)}$ X.

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

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

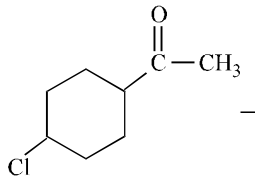
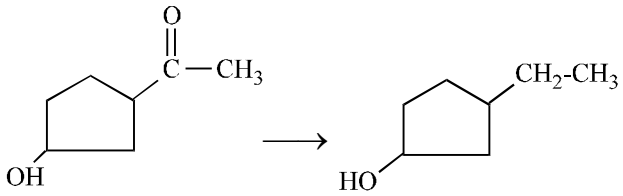
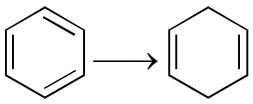
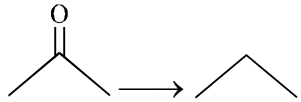
25. Which reagent is the most useful for distinguishing compound I from the rest of the compounds

$CH_3CH_2C{\equiv}CH$ (I) $CH_3C{\equiv}CCH_3$ (II) $CH_3CH_2CH_2CH_3$ (III) $CH_3CH{=}CH_2$ (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) $RCOONa \xrightarrow{\text{electrolysis}} R{-}R$	(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

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

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]**

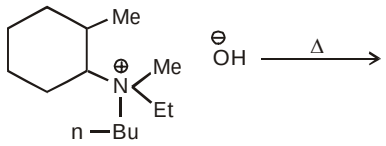
(1) secondary or tertiary alcohol

(2) primary alcohol

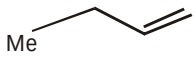
(3) mixture of secondary and tertiary alcohols

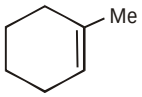
(4) mixture of primary and secondary alcohols

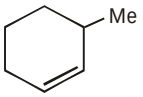
HC0057

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

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

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

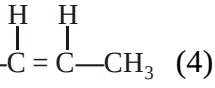
10. The hydrocarbon which can react with sodium in liquid ammonia is **[AIEEE-2008]**

(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

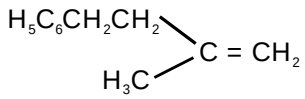
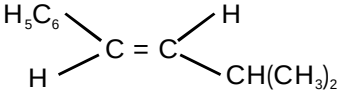
11. The treatment of CH_3MgX with $CH_3C\equiv C–H$ produces **[AIEEE-2008]**

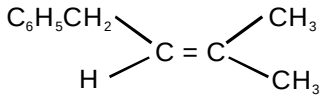
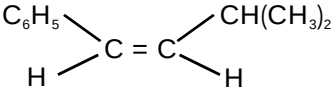
(1) $CH_3–CH=CH_2$ (2) $CH_3C\equiv C–CH_3$ (3)  (4) CH_4

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

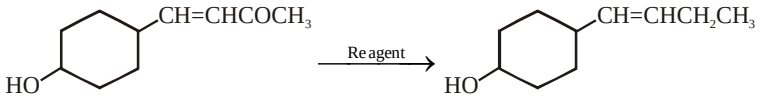
HC0068

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 :

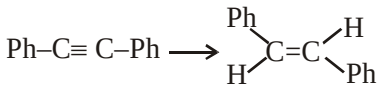
(JEE MAIN ONLINE 2014)

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

HC0075

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

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

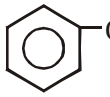


is :

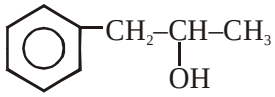
(1) H_2/Lindlar Cat. (2) Cat. Hydrogenation

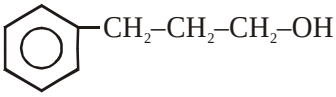
(3) $LiAlH_4$ (4) Li/NH_3

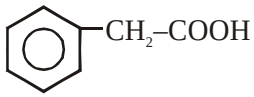
HC0076

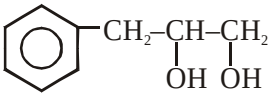
24.  on mercuration- demercuration produces the major product :-

(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)**

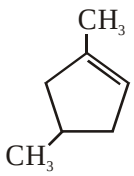
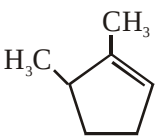
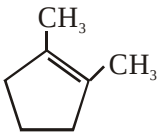
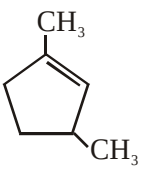
(2) One of the steps is endothermic in HCl and HI

(3) HCl is oxidizing and the HI is reducing

(4) Both HCl and HI are strong acids

HC0079

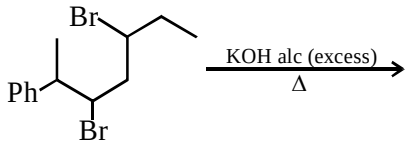
27. Which compound would give 5-keto-2-methyl hexanal upon ozonlysis? **(Jee Main offline 2015)**

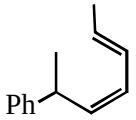
(1)  (2)  (3)  (4) 

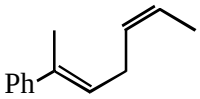
HC0080

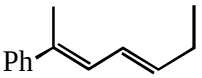
node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

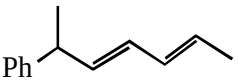
28. The major product of the following reaction is **(Jee Main (Jan) 2019)**



(1) 

(2) 

(3) 

(4) 

HC0081

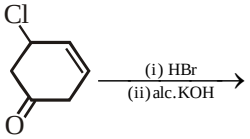
29. Which hydrogen in compound (E) is easily replaceable during bromination reaction in presence of light : **(Jee Main (Jan) 2019)**

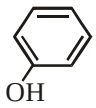
$\underset{\delta}{CH_3}-\underset{\gamma}{CH_2}-\underset{\beta}{CH}=\underset{\alpha}{CH_2}$

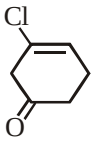
(1) β – hydrogen (2) γ – hydrogen (3) δ – hydrogen (4) α – hydrogen

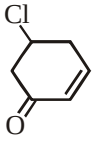
HC0082

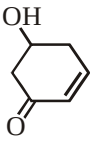
30. The major poduct of the following reaction is: **(Jee Main (Jan) 2019)**



(1) 

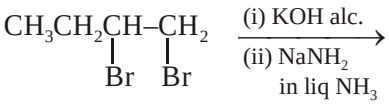
(2) 

(3) 

(4) 

HC0083

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



(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

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

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

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

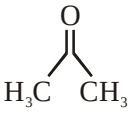
(1) $CH_3CD(Cl)CHD(I)$ (2) $CH_3CD_2CH(Cl)(I)$

(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) $CH_3-\underset{Cl}{\underset{|}{CH}}-\underset{OH}{\underset{|}{CH_2}}$ (2) $H_3C-\underset{OH}{\underset{|}{CH}}-\underset{Cl}{\underset{|}{CH_2}}$ (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

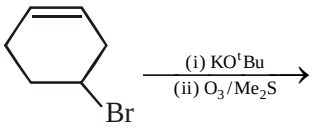
(2) $CH_3-\underset{OH}{\underset{|}{CH}}-\underset{OH}{\underset{|}{CH}}-CH_3$

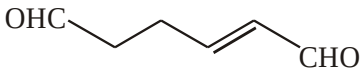
(3) 2 molecules of CH_3COOH

(4) 2 molecules of CH_3CHO

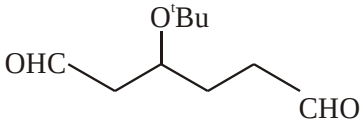
HC0088

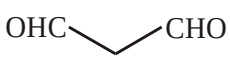
36. The major product(s) obtained in the following reaction is/are : **(Jee Main (April) 2019)**



(1) 

(2)

(3) 

(4) 

HC0089

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

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

$$CH_3-\underset{\underset{CH(CH_3)_2}{|}}{C}=CH-CH_2CH_3 \xrightarrow[(ii)\ H_2O_2,OH^{\ominus}]{(i)B_2H_6} [A] \xrightarrow[\Delta]{\text{dil. } H_2SO_4} [B]$$

(1) $CH_3-\underset{\underset{C}{\|}}{C}-CH_2CH_2CH_3$ (with H_3C and CH_3 on C)

(2) $CH_2=\underset{\underset{CH(CH_3)_2}{|}}{C}-CH_2CH_2CH_3$

(3) $CH_3-\underset{\underset{CH(CH_3)_2}{|}}{CH}-CH=CH-CH_3$

(4) $CH_3-\underset{\underset{CH(CH_3)_2}{|}}{C}=CH-CH_2CH_3$

HC0090

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

$$CH_3-\underset{\underset{CH_3}{|}}{CH}-C\equiv CH \xrightarrow[H_2O]{HgSO_4,H_2SO_4} X \xrightarrow[(ii)\text{Conc. } H_2SO_4/\Delta]{(i)C_2H_5MgBr,H_2O} Y$$

(1) $H_3C-\underset{\underset{C_2H_5}{|}}{\overset{\overset{CH_2}{\|}}{C}}-CH-CH_3$

(2) $CH_3-\underset{\underset{CH_3}{|}}{CH}-\underset{\underset{CH_3}{|}}{C}=CH-CH_3$

(3) $CH_3-\underset{\underset{CH_2CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}=CH-CH_3$

(4) $CH_3-\underset{\underset{CH_2CH_3}{|}}{\overset{\overset{CH_3}{|}}{CH}}-C=CH_2$

HC0091

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

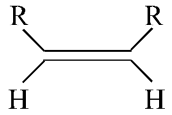
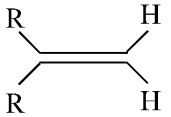
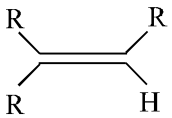
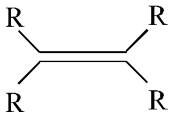
EXERCISE # (JEE ADVANCE)

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

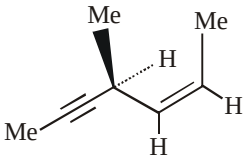
HC0094

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]**

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

Identify the structure of the major product 'X'

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

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

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

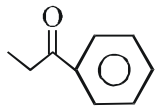
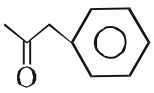
8. Identify a reagent from the following list which can easily distinguish between 1–butyne and 2-butyne- **[IIT '2002]**

(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

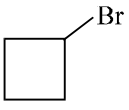
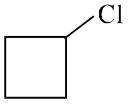
13. When Phenyl Magnesium Bromide reacts with tert. butanol, which of the following is formed?

(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

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

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

Identify the adduct.

(A) $CH_3-\underset{\underset{Cl}{|}}{CH}-\underset{\underset{NO}{|}}{CH_2}$ (B) $CH_3-\underset{\underset{NO}{|}}{CH}-\underset{\underset{Cl}{|}}{CH_2}$

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

HC0106

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

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

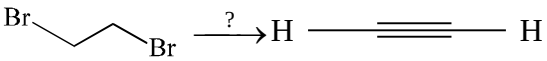
HC0107

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 $CH_3CH_2C \equiv CH$

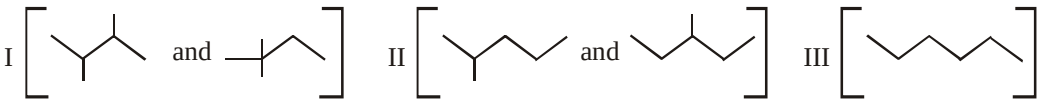
(B) $BrCH_2CH_2CH_3$ and $CH_3CH_2CH_2C \equiv CH$

(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

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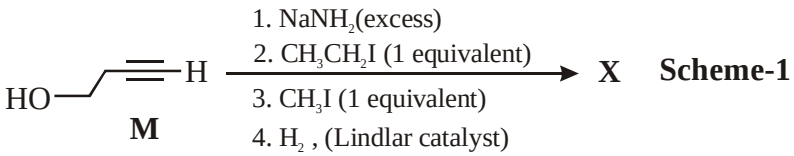
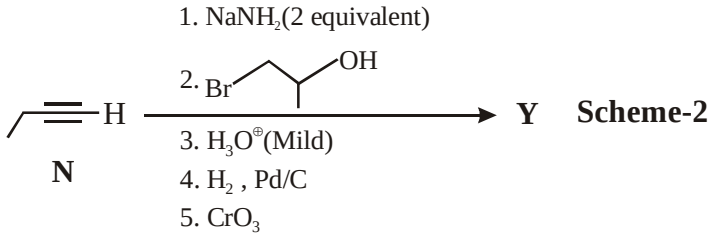
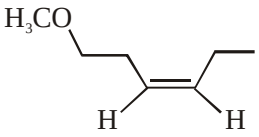
Paragraph For Question 21 and 22

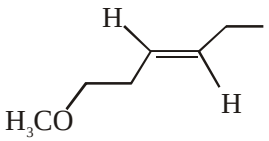
Schemes 1 and 2 describe sequential transformation of alkynes M and N. Consider only the major products formed in each step for both the schemes. **[IIT-2014]**

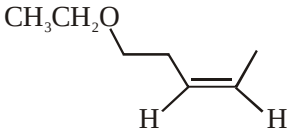


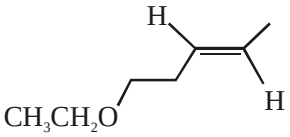


21. The product X is -

(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

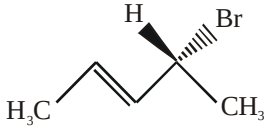
(B) It gives a positive Tollens test and is a geometrical isomer of X

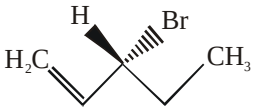
(C) It gives a positive Iodoform test and is a functional isomer of X

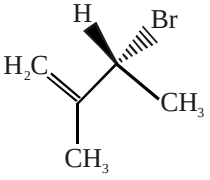
(D) It gives a positive Iodoform test and is a geometrical isomer of X

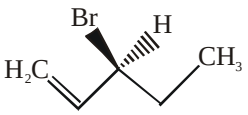
HC0113

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

(A) 

(B) 

(C) 

(D) 

HC0114

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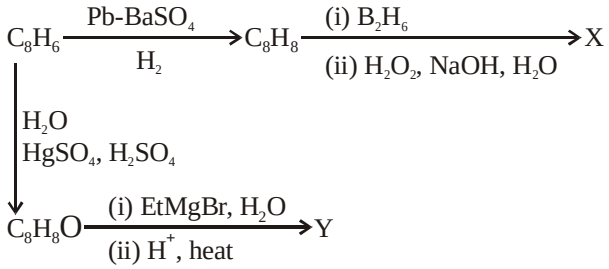
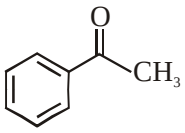
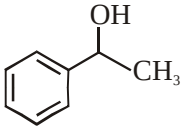
Paragraph For Questions 24 and 25

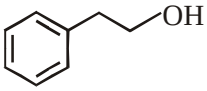
In the following reaction **[IIT-2015]**

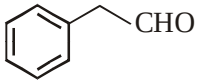


24. Compound X is :

(A) 

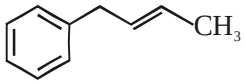
(B) 

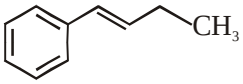
(C) 

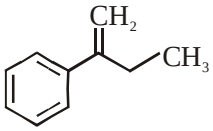
(D) 

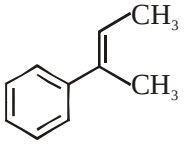
HC0115

25. The major compound Y is :

(A) 

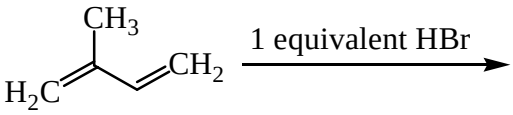
(B) 

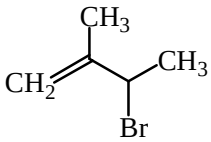
(C) 

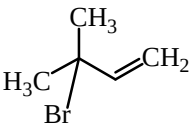
(D) 

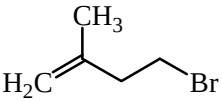
HC0116

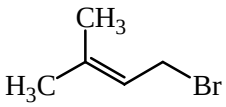
26. In the following reaction, the major product is - **[IIT-2015]**



(A) 

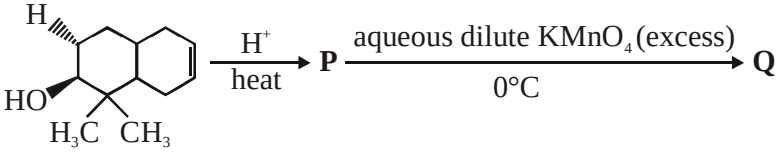
(B) 

(C) 

(D) 

HC0117

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



HC0118

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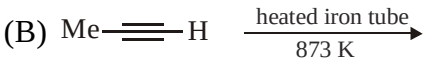
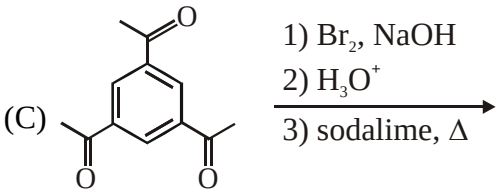
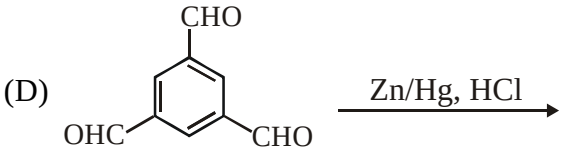
28. The reaction(s) leading to the formation of 1,3,5-trimethylbenzene is (are) **[IIT-2018]**

(A)

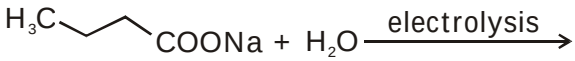
(B) 

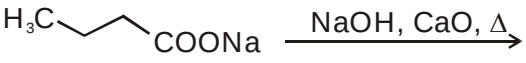
(C) 

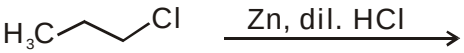
(D) 

HC0119

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

(A) 

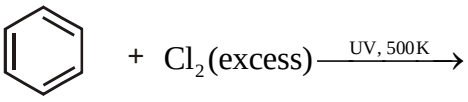
(B) 

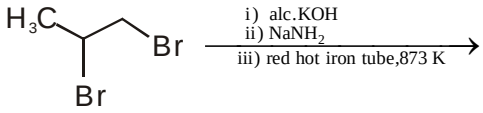
(C) 

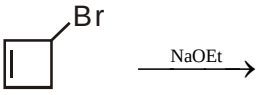
(D)

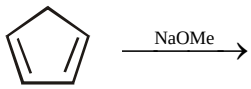
HC0120

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

(A) 

(B) 

(C) 

(D) 

[IIT-2019]

HC0121

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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**

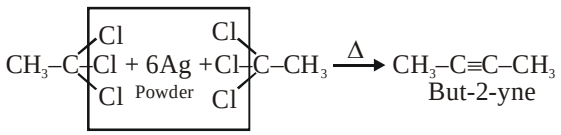
EXERCISE # S-1

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)						

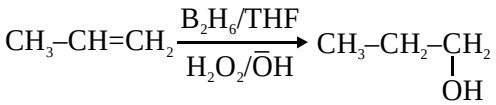
18. (1)



19. (3)

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

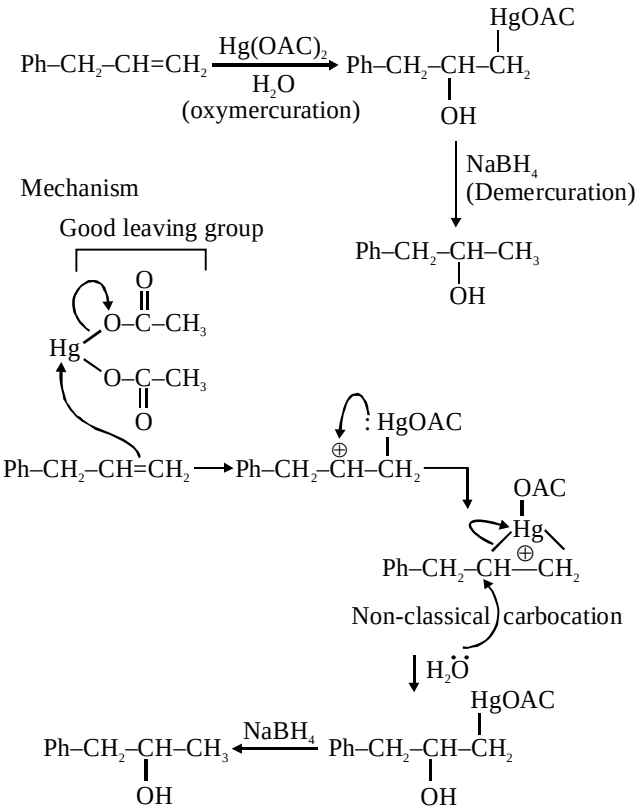
20. (1)



21. (2)

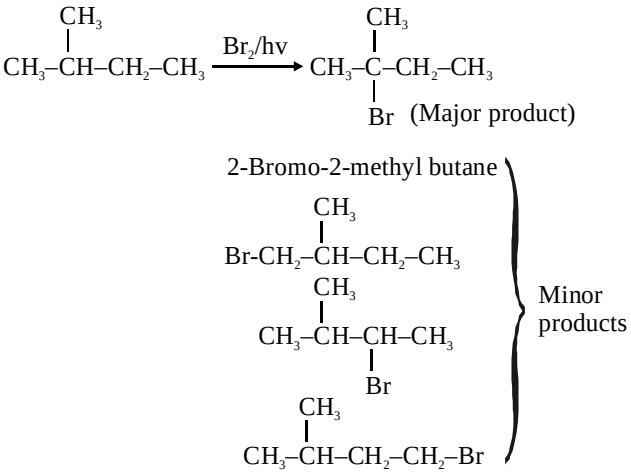
22. (2) **23.** (4)

24. (1)



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

25. (1)



relectivity ratio for bromination is

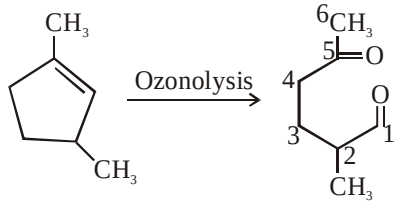
1° : 2° : 3° : : 1 : 82 : 1600

Hence 3° product will be major product.

26. (2)

node06\B0B0-BA\Kota\JEE(Advanced)\Leader\Che\Sheet\Hydrocarbon\ENG\02_HYDROCARBON (ENG).p65

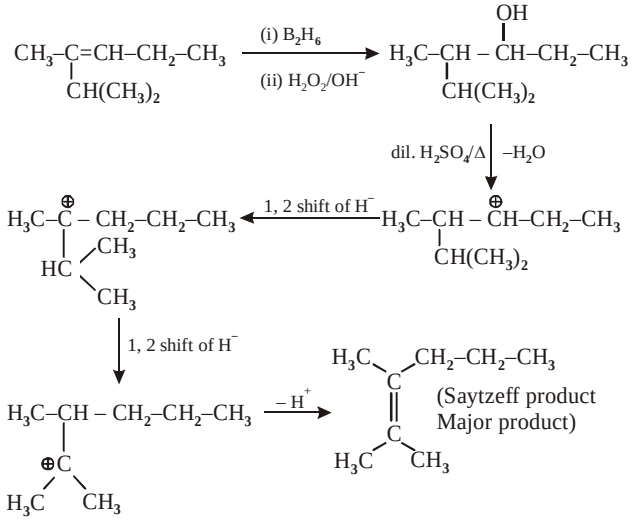
27. (4)



5-Keto-2-Methylhexanal

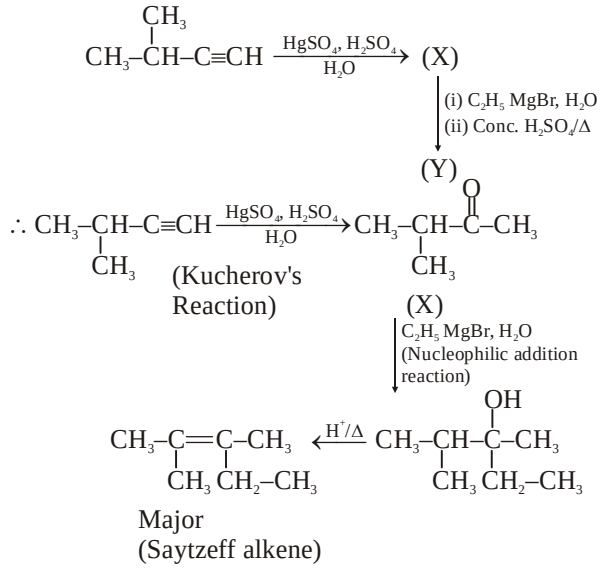
28. Ans. (3) **29. Ans. (2)** **30. Ans. (1)** **31. Ans. (1)**
32. Ans. (1) **33. Ans. (4)** **34. Ans.(2)** **35. Ans. (3)**
36. Ans. (2)
37. Ans. (1)

Sol.



38. Ans. (3)

Sol.



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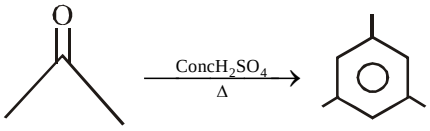
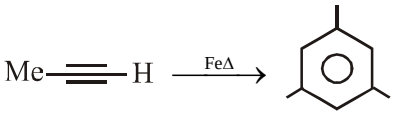
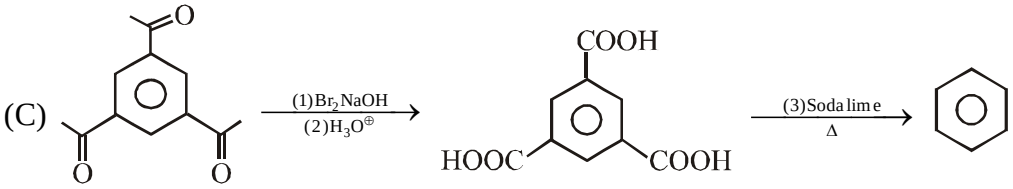
EXERCISE # (JEE ADVANCE)

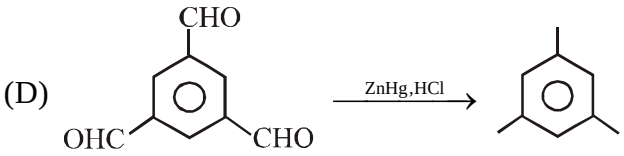
1.	(D)	2.	(A)	3.	(C)	4.	(B)	5.	(B)
6.	(B)	7.	(A)	8.	(D)	9.	(A)	10.	(B)
11.	(B)	12.	(A)	13.	(B)	14.	(D)	15.	(A)
16.	(A)	17.	(C)	18.	(B)	19.	(D)	20	(B)
21.	(A)	22.	(C)	23.	(B,D)	24.	(C)	25.	(D)
26.	(D)	27.	(4)						

28 (A,B,D)

Sol. (A) 

(B) 

(C) 

(D) 

29. Ans. (B,C) **30. Ans. (B,D)**

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