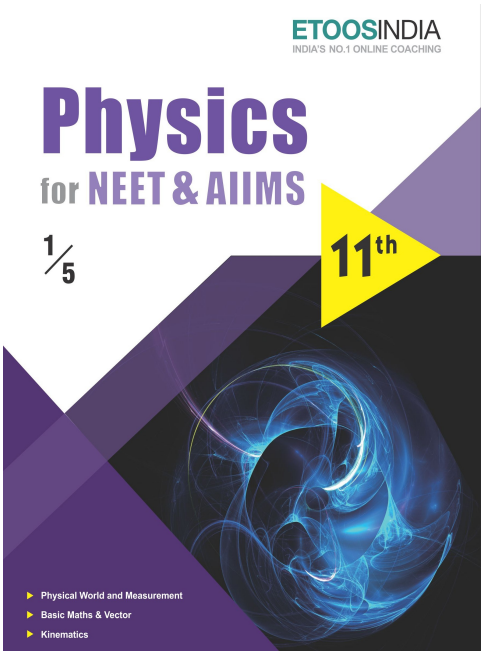
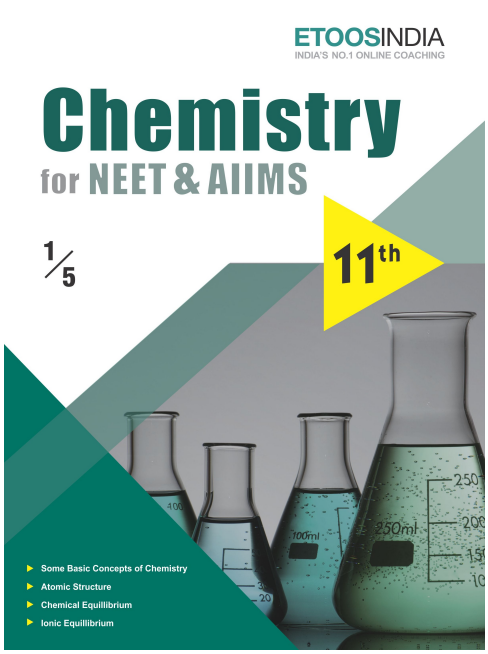
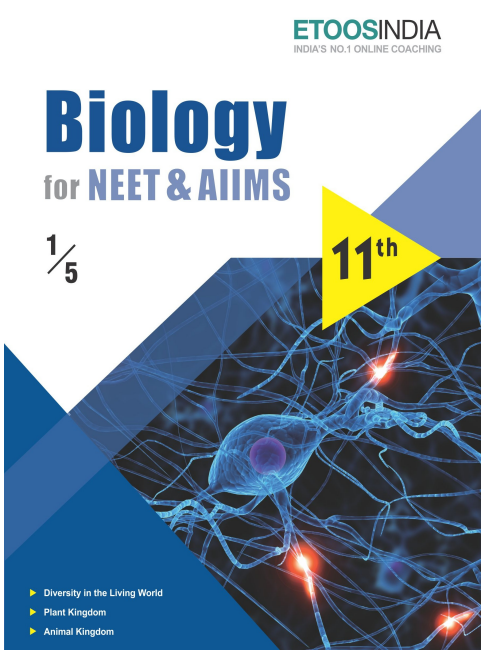
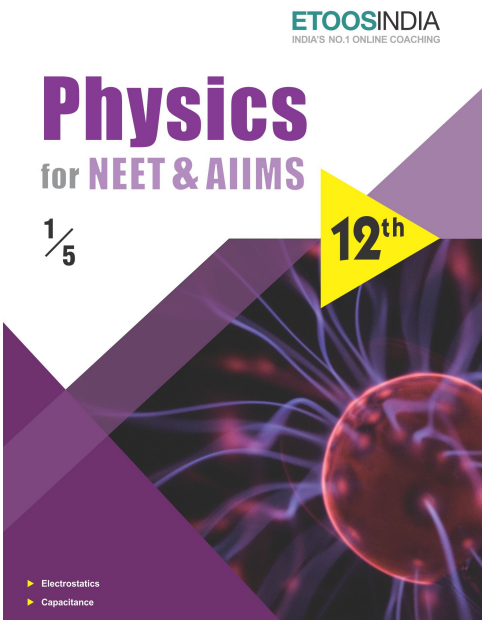
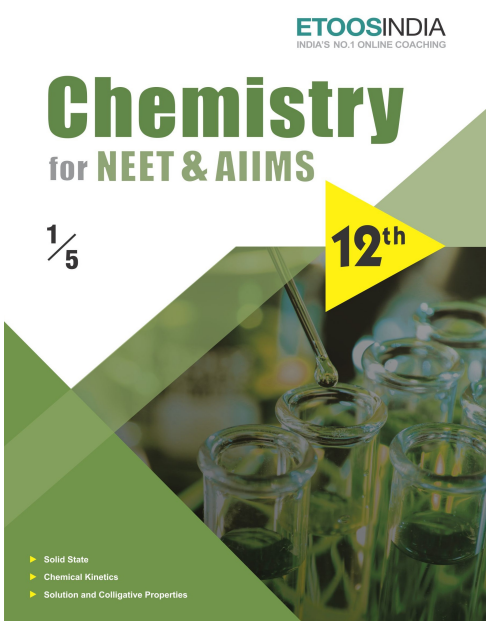
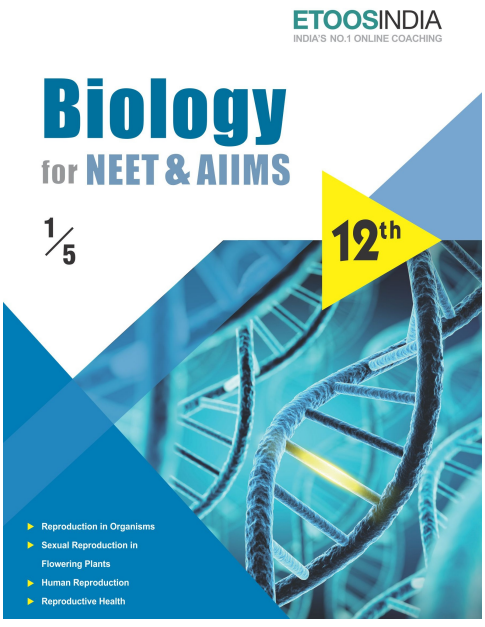












CHAPTER 16

HYDROCARBONS

In organic chemistry, we have learnt to derive from compounds containing only carbon and hydrogen, i.e. from the hydrocarbons, all other types of combinations such as alcohols, aldehydes, ketones, acids, etc.

"OTTO WALLACH"

INTRODUCTION

The term hydrocarbon is self-explanatory which means compounds of carbon and hydrogen only. Hydrocarbons play a key role in our daily life. We must be familiar with the terms LPG and CNG used as fuels. LPG is the abbreviated form of liquified petroleum gas whereas CNG stands for compressed natural gas. Another term LNG (liquified natural gas) is also in news these days. This is also a fuel and is obtained by liquifaction of natural gas. Petrol, diesel and kerosene oil are obtained by the fractional distillation of petroleum found under the earth's crust. Coal gas is obtained by the destructive distillation of coal, Natural gas is found in upper strata during drilling of oil wells. The gas after compression is known as compressed natural gas. LPG is used as a domestic fuel with the least pollution. Kerosence oil is also used as a domestiofuel but it causes some pollution. Automobiles need fuels like petrol, diesel and CNG. petrol and CNG operated automobiles cause less pollution. All these fuels contain mixture of hydrocarbons, which are sources of energy. Hydrocarbons are also used for the manufacture of polymers like polythene, polypropene, polystyrene etc. Higher hydrocarbons are used as solvents for paints. They are also used as the starting materials for manufacture of many dyes and drugs. Thus , we can well understand the importance of hydrocarbons in our daily life. In this unit, we will learn more about hydrocarbons.

$CH_3^{\bullet} + Cl_2 \longrightarrow CH_3Cl + Cl^{\bullet}$

(iii) Chain terminating (third) step

$CH_3^{\bullet} + {}^{\bullet}Cl \longrightarrow H_3Cl$

$CH_3^{\bullet} + {}^{\bullet}CH_3 \longrightarrow CH_3 - CH_3$

$Cl^{\bullet} + Cl^{\bullet} \longrightarrow Cl_2$

Ex. $CH_4 + Cl_2 \xrightarrow{hv} CH_3Cl + HCl$
Methane (excess) Methyl chloride

When chlorine is in excess, carbon tetrachloride will be the major product.

Ex. $CH_4 + Cl_2 \xrightarrow{hv} CCl_4$
Methane (excess) (Main)

Bromination : Bromination of alkanes is similar to chlorination but not so vigrous.

Iodination : Iodination of alkanes is slow and reversible.

$CH_4 + I_2 \overset{\Delta}{\rightleftharpoons} CH_3 - I + HI$

$5HI + HIO_3 \longrightarrow 3I_2 + 3H_2O$

Iodisation is very slow because energy of activation of the reaction is very large.

ETOOS KEY POINTS

Halogenation is inhibited in presence of oxygen because oxygen reacts with alkyl free radicals to form less reactive peroxy alkyl radical R–O–O° which can not propagate the chain.

Ex. What is the percentage of products obtained from monobromination of isobutane?

Sol. $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_3 + Br_2 \longrightarrow \underset{\text{(I)}}{CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{Br}{|}}{C}}-CH_3} + \underset{\text{(II)}}{CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-Br}$

$$\frac{\text{Product (I)}}{\text{Product (II)}} = \frac{\text{No. of primary H}}{\text{No. of tertiary H}} \times \frac{\text{reactivity of primary H}}{\text{reactivity of tertiary H}} = \frac{9}{1} \times \frac{1}{1600} = \frac{9}{1600}$$

$$\% \text{ of product (I)} = \frac{9}{1600+9} \times 100 = 0.56\%$$

$$\% \text{ of product (II)} = \frac{1600}{1600+9} \times 100 = 99.44\%$$

(b) Nitration : When a mixture of vapour of alkane nitric acid is heated at high temperature (400°C – 450°C) a mixture of all possible nitroalkanes is obtained (The reaction involves both C–C and C–H bond cleavage).

$R-\boxed{H+HO}-NO_2 \xrightarrow{\text{high temp.}} R-NO_2 + H_2O$

Etoos Tips & Formulas

REACTION CHART FOR ALKANES

GMP

(1) $R-C\equiv CH$ $\xrightarrow[200\text{-}300^\circ C]{H_2, Ni}$

or

$R-CH=CH_2$ Sabatier senderens reaction

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

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

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

(5) RX $\xrightarrow[\text{(Corey-House reaction)}]{R_2CuLi}$

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

(7) $R-OH$, $R-CHO$ $\xrightarrow{RedP/HI}$

$R-\underset{\underset{O}{\|}}{C}-R$, $RCOCl$, $RCOOH$

(8) $R-\underset{\underset{O}{\|}}{C}-R$ $\xrightarrow[\text{Clemensor's reduction}]{Zn\text{-}Hg/Conc.\ HCl}$

(9) $R-\underset{\underset{O}{\|}}{C}-R$ $\xrightarrow[\text{Wolf/Kishner reduction}]{H_2N\text{-}NH_2}$

or

$(RCH_2CH_2)_3B$ $\xrightarrow{-H_2O}$

(10) $RCOONa$ $\xrightarrow{NaOH+Cao}$

(11) $RCOONa$ $\xrightarrow{\text{Kolbe's Selectrolytic synthesis}}$

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

GR

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

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

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

(4) $SO_2 + Cl_2 \xrightarrow[hv]{\text{Reed reaction}} RSO_2Cl$

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

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

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

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

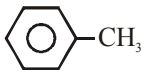
(9) $\xrightarrow{O_2}$ $CO_2 + H_2O$

Combustion

SOLVED EXAMPLE

Ex.1 n-Heptane when heated to a temperature of about 800 K under high pressure in the presence of Cr_2O_3/Al_2O_3 catalyst gives

(A) 1-heptene **(B)** 2-Methylhexane **(C)** Toluene **(D)** Xylene

Sol. **(C)** $CH_3-(CH_2)_5-CH_3 \xrightarrow{-4H_2}$  $-CH_3$

Toluene

Ex.2 The reaction conditions leading to the best yield of C_2H_5Cl are –

(A) C_2H_5 (excess) + $Cl_2 \xrightarrow{\text{UV light}}$ **(B)** $C_2H_6 + Cl_2 \xrightarrow[\text{room temperature}]{\text{Dark}}$

(C) $C_2H_6 + Cl_2$ (excess) $\xrightarrow{\text{UV light}}$ **(D)** $C_2H_6 + Cl_2 \xrightarrow{\text{UV light}}$

Sol. **(D)** C_2H_6 should be used in excess, otherwise polychlorination will take place

Ex.3 In iso-pentane, the H atom that can be most easily substituted is on –

$$\overset{1}{C}H_3-\overset{2}{C}H(CH_3)-\overset{3}{C}H_2-\overset{4}{C}H_3$$

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

Sol. **(B)** Ease of substitutation of various types of H atom is 3° > 2° > 1°.

Ex.4 8 c.c. of gaseous hydrocarbon requires 40 c.c. of O2 for complete combustion. Identify hydrocarbon.

Sol. Volume of hydrocarbon = 8 c.c. ; Volume of O_2 = 40 c.c.

Formula No.1, $\frac{8}{40} = \frac{2}{3n+1}$ (For alkane)

$\frac{1}{5} = \frac{2}{3n+1}$ or $3n + 1 = 10$ or $3n = 10 - 1 = 9$, $n = 2$

The value of n comes in whole number from 1st formula it means hydrocarbon is Alkane and it is of 3C atom.

$\therefore$ Hydrocarbon is C_3H_8 (Propane)

Ex.5 10 mL of a mixture of CH_4 and C_3H_8 requires 41 mL of oxygen for complete combustion. What is the volume of CH_4 and C_3H_8 in the mixture.

Sol. Suppose the volume of CH_4 in $(CH_4 + C_3H_8)$ mix = x c.c.

= Volume of C_3H_8 will be = 10 – x c.c.

For CH_4 $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

$\because$ 1 vol. of CH_4 requires 2 vol. of O_2 for complete combustion

$\therefore$ x c.c. of CH_4, 2x c.c. of O_2

For C_3H_8 $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

$\because$ 1 volume of C_3H_8 requires 5 ml of O_2 for complete combustion

$\therefore$ (10 – x) c.c. of C_3H_8 requires 5(10 – x) c.c. of O_2

Total Volume of O_2 = 2 x + 5 (10 – x) it is equivalent to 41

(according to question)

$\because$ $2x + (10 - x) = 41$

$\therefore$ x = 3 c.c.

Volume of CH_4 is 3 c.c. and volume of C_3H_8 is 7 c.c.

Exercise # 1 SINGLE OBJECTIVE NEET LEVEL

1. Which of the following will have least hindered rotation about carbon-carbon bond?
(A) Ethane (B) Ethylene
(C) Acetylene (D) Hexachloroethane

2. Alkanes are readily attacked by –
(A) Electrophiles (B) Nucleophiles
(C) Free radicals (D) bases

3. Isopropyl bromide undergoes Wurtz reaction to form –
(A) Hexane
(B) 2, 3-Dimethyl butane
(C) Propane
(D) Neohexane

4. Alkanes can be prepared from Grignard reagents by reacting with –
(A) Alcohols (B) Primary amines
(C) Alkynes (D) All of them

5. Which reducing agent is used in Clemmensen reduction –
(A) Zn/ HCl (B) $LiAlH_4$
(C) Zn-Hg/HCl (D) Na/C_2H_5OH

6. Isomerisation in alkane may be brought about by using
(A) Al_2O_3 (B) Fe_2O_3
(C) $AlCl_3$ and HCl (D) concentrated H_2SO_4

7. Formatio of alkane by the action of Zn on alkyl halide is called –
(A) Frankland reaction (B) Wurtz reaction
(C) Cannizzaro's reaction (D) Kolbe's reaction

8. The hydrocarbon which is a liquid at room temperature is –
(A) butane (B) propane
(C) decane (D) neopentane

9. The most important method of preparation of hydrocarbons of lower carbon number is –
(A) Pyrolysis of higher carbon number hydrocarbons
(B) Electrolysis of salts of fatty acids
(C) Sabatier Senderen's reaction
(D) Direct synthesis

10. Which of the following will not produce ethane
(A) Reduction of CH_3COOH with HI/P_4
(B) Reduction of CH_3COCH_3 with HI/P_4
(C) Decarboxylation of sodium propionate with soda lime
(D) Hydrogenation of ethene in the presence of Ni.

11. The thermal decomposition of alkanes in the absence of air is known as –
(A) oxidation (B) Combustion
(C) Hydrogenation (D) pyrolysis

12. Methane can be prepared by :
(A) Wurtz reactions
(B) hydrogenation
(C) decarboxylation
(D) dehydrohalogenation

13. Whihc of the following alkyl halides is not suitable for Corey-House synthesis of alkanes –
(A) CH_3I (B) C_2H_5Br
(C) $CH_3CH_2CH_2CH_2I$ (D) $(CH_3)_3CBr$

14. An alknae is most likely to react with –
(A) A free radical (B) An alkali
(C) An electrophilic (D) A nucleophile

15. The most volatile alkane is :
(A) n-pentane (B) isopentane
(C) neopentane (D) n-hexane

16. Which of the following reactions does not involved a C–C bond formation?
(A) Hydrolysis of a Grignard reagent
(B) Combination of two alkyl free radicals
(C) Corey-House synthesis of alkanes
(D) $RNa + R-Br \rightarrow R-R + NaBr$

17. Wurtz reaction on a mixture of ethyl halide and isobutyl halide gives –
(A) Butane and isobutane
(B) Butane and 2, 5-dimethylhexane
(C) Butane,2,5-dimethylhexane and isohexane
(D) Butane and isohexane

18. Which reducing agent is used in Clemmensen reduction ?
(A) Zn/HCl (B) $LiAlH_4$
(C) Zn-Hg/HCl (D) Na/C_2H_5OH

Exercise # 2 SINGLE OBJECTIVE AIIMS LEVEL

1. Alcohols undergo dehydration in the following sequence –
(A) 1° > 2° > 3° (B) 3° > 2° > 1°
(C) 1° > 3° > 2° (D) 3° > 1° > 2°

2. The reaction : $CH_2 = CHCH_3 + HBr \longrightarrow CH_3CHBrCH_3$ is –
(A) Nucleophilic additon
(B) Electrophilic additon
(C) Electrophilic substitution
(D) Free radical addition

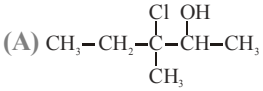
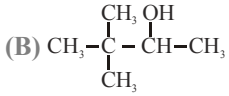
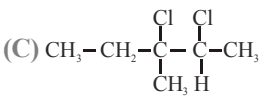
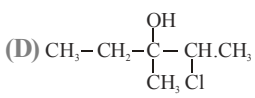
3. The ozonolysis of an olefin gives only propanone. The olefin is :
(A) propene
(B) but-1-ene
(C) but-2-ene
(D) 2,3-dimethylbut-2-ene

4. Aqueous sulphuric acid reacts with 2-methyl-1-butene to give predominantly –
(A) Isobutyl hydrogen sulphate
(B) 2-methyl-2-butanol
(C) 2-methyl-1-butanol
(D) Secondary butyl hydrogen sulphate

5. Olefines can be converted to paraffins by –
(A) Halogenation (B) Hydrolysis
(C) Hydration (D) Hydrogenation

6. Anti-Markownikoff addition of HBr is not observed in
(A) propene (B) butene
(C) 2-butene (D) 2-pentene

7. The addition of HCl in the presence of peroxide does not follow anti-Markownikoffs rule because
(A) HCl bond is too strong to be broken homolytically
(B) Cl atom is not reactive enough to add on to a double bond
(C) Cl combines with H to give back HCl
(D) HC is a reducing agent

8. 3-Methyl-2-penten on reaction with HOCl gives –
(A) 
(B) 
(C) 
(D) 

9. The addition of Br_2 to trans-2-butene produces
(A) (+) 2, 3-dibromobutane
(B) (–) 2,3-dibromobutane
(C) rac-2,3-dibromobutane
(D) meso-2,3-dibromobutane

10. $CH_2 = CH_2 \xrightarrow{Cl_2} A \xrightarrow{AgOH} ?$ the product is a –
(A) Glycol (B) Dial
(C) Dioic acid (D) None of these

11. The olefin which on ozonolysis gives CH_3CH_2CHO and CH_3CHO is –
(A) 1-butene (B) 2-butene
(C) 1-pentene (D) 2-pentene

12. Alkene $\xrightarrow{B_2H_5}$ $\xrightarrow{H_2O_2/OH^-}$ 2° alcohol. The alkene would be –
(A) $CH_3 - CH = CH_2$
(B) $CH_3CH_2 - CH = CH_2$
(C) $(CH_3)_2C = CH_2$
(D) $CH_3 - CH = CH - CH_3$

13. Ethylene reacts with alkaline $KMnO_4$ to form –
(A) Oxalic acid (B) HCHO
(C) Ethyl alcohol (D) Glycol

14. Which order is correct for bond length –
(A) $\equiv C - H > - C - H > = C - H$
(B) $- C - H < \equiv C - H < = C - H$
(C) $\equiv C - H < = C - H < - C - H$
(D) None of these

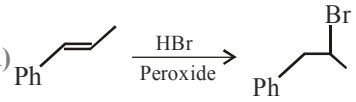
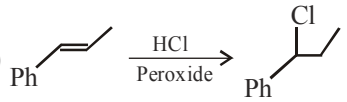
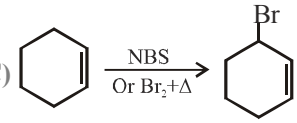
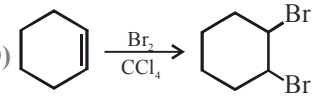
15. Which one of these will react with sodium metal –
(A) Ethyne (B) Ethene
(C) Ethane (D) Ether

16. Ethyne adds on HCl to first give a –
(A) Carbanion (B) A free radical
(C) A vinylic cation (D) A biradical

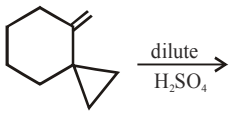
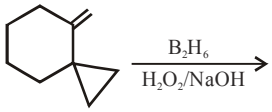
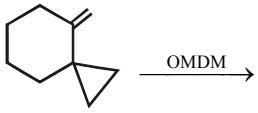
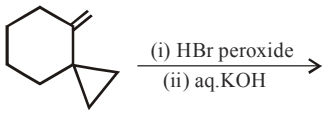
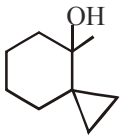
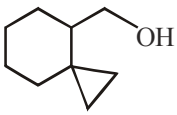
17. The relative acidity of ethyne, ethene and ethane follows the order –
(A) Ethane > Ethyne < Ethene
(B) Ethyne > Ethene > Ethane
(C) Ethyne < Ethene < Ethane
(D) Ethene < Ethane < Ethyne

Exercise # 3 PART - 1 MATRIX MATCH COLUMN

1.

Column I (Reactions) (Reactant) (Major Product)	Column - II (Intermediate involve)
(A) 	(p) Free Radical
(B) 	(q) Carbanion
(C) 	(r) Carbocation
(D) 	(s) Two isomers are formed

2. Match the column :

Column I	Column - II
(A) 	(p) Over all reaction involves Markowinkof's addition of water molecule on alkene.
(B) 	(q) Over all reaction involves Anti-Markownikof's addition of water molecule on alkene.
(C) 	(r) Reaction involves carbocation rearrangement.
(D) 	(s)  is major product
	(t)  is major product

Exercise # 4 PART - 1 PREVIOUS YEAR (NEET/AIPMT)

1. In Friedel-Craft's synthesis of toluene, the reactants in addition to anhydrous $AlCl_3$ are- [CBSE AIPMT- 2000]

(A) $C_6H_5Cl + CH_4$ (B) $C_6H_5Cl + CH_3Cl$
(C) $C_6H_6 + CH_4$ (D) $C_6H_6 + CH_3Cl$

2. Among the following alkenes

1- butene cis-2-butene trans-2butene
I II III

the decreasing order of stability is [CBSE AIPMT-2000]

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

3. Which alkene on ozonolysis gives

CH_3CH_2CHO and $CH_3\overset{}{\underset{}{C}}(=O)CH_3$ [CBSE AIPMT- 2001]

(A) $CH_3CH_2CH = C(CH_3)_2$
(B) $CH_3CH_2CH = CHCH_2CH_3$
(C) $CH_3CH_2CH = CHCH_3$
(D) $CH_3 - C(CH_3) = CHCH_3$

4. The compound, $CH_3 - \overset{CH_3}{\overset{|}{C}} = CH - CH_3$ on reaction with $NaIO_4$ in the presence of $KMnO_4$ gives [CBSE AIPMT - 2003]

(A) $CH_3COCH_3 + CH_3CHO$
(B) $CH_3CHO + CO_2$
(C) CH_3COCH_3
(D) $CH_3COCH_3 + CH_3COOH$

5. Reaction of HBr with propene in the presence of peroxide gives [CBSE AIPMT - 2004]

(A) iso-propyl bromide (B) 3-bromo propane
(C) allyl bromide (D) n-propyl bromide

6. Using anhy. $AlCl_3$ as catalyst, which one of the folowing reactions produce ethylbenzene (PhEt)? [CBSE AIPMT-2004]

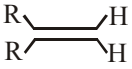
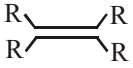
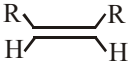
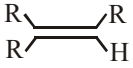
(A) $H_3C - CH_2OH + C_6H_6$
(B) $CH_3 - CH = CH_2 + C_6H_6$
(C) $H_2C = CH_2 = C_6H_6$
(D) $H_3C - CH_3 + C_6H_6$

7. Products of the following reaction- [CBSE AIPMT - 2005]

$CH_3C{\equiv}C.CH_2CH_3 \xrightarrow[(ii)\ hydrolysis]{(i)\ O_3}$ ..... are

(A) $CH_3CHO + CH_3CH_2CHO$
(B) $CH_3COOH + CH_3COCH_3$
(C) $CH_3COOH + HOOC.CH_2CH_3$
(D) $CH_3COOH + CO_2$

8. Which one of the following alkenes will react faster with H_2 under catalytic hydrogenation conditions? [CBSE AIPMT - 2005]

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

9. Predict the product C obtained in the following reaction of butyne - 1. [CBSE AIPMT - 2007]

$CH_3CH_2 - C \equiv CH + HCl \longrightarrow B \xrightarrow{HI} C$

(A) $CH_3 - \underset{Cl}{\underset{|}{CH}} - CH_2CH_2I$
(B) $CH_3 - CH_2 - CH_2 - \underset{Cl}{\underset{|}{\overset{I}{\overset{|}{C}}}} - H$
(C) $CH_3 - CH_2 - \underset{I}{\underset{|}{CH}} - CH2Cl$
(D) $CH_3CH_2 - \underset{Cl}{\underset{|}{\overset{I}{\overset{|}{C}}}} - CH_3$

10. Which of the following compounds with molecular formula, C_5H_{10} yields acetone on ozonolysis ? [CBSE AIPMT - 2007]

(A) 2- methyl-2buten (B) 3-methyl-1-butene
(C) Cyclopentane (D) 2-methyl-1-butene

11. $H_3C - \underset{CH_3}{\underset{|}{CH}} - CH = CH_2 + HBr \rightarrow A$

A (predominantly) is - [CBSE AIPMT - 2008]

(A) $CH_3 - \underset{CH_3}{\underset{|}{CH}} - CH_2 - CH_2Br$
(B) $CH_3 - \underset{CH_3}{\underset{|}{\overset{Br}{\overset{|}{C}}}} - CH_2CH_3$
(C) $CH_3 - \underset{Br}{\underset{|}{CH}} - \underset{CH_3}{\underset{|}{CH}} - CH_3$
(D) $CH_3 - \underset{CH_3}{\underset{|}{CH}} - \underset{Br}{\underset{|}{CH}} - CH_3$

MOCK TEST

1. $CH_3C \equiv CCH_3 \xrightarrow[(ii)H_2O/Zn]{(i)\ X} CH_3 - \underset{O}{\overset{|}{C}} - \underset{O}{\overset{|}{C}} - CH_3$

X in the above reaction is

(A) HNO_3 **(B)** O_2 **(C)** O_3 **(D)** $KMnO_4$

2. Which of the following is Friedel-Craft's reaction

(A) $C_6H_6 + FeCl_3 + Cl_2 \rightarrow C_6H_5Cl$

(B) $C_6H_5CHO + CH_3CHO + KOH \rightarrow C_6H_5CH = CH - CHO$

(C) $C_6H_6 + CH_3COCl + AlCl_3 \rightarrow C_6H_5 - \overset{O}{\overset{\|}{C}} - CH_3$

(D) $C_6H_5OH + CHCl_3 + KOH \longrightarrow$ Salicylaldehyde

3. Condition for maximum yield of C_2H_5Cl is

(A) C_2H_6 (excess) $+Cl_2 \xrightarrow{\text{UV Light}}$ **(B)** $C_2H_6 + Cl_2 \xrightarrow[\text{Room temp.}]{\text{Dark}}$

(C) $C_2H_6 + Cl_2$ (excess) $\xrightarrow{\text{UV Light}}$ **(D)** $C_2H_6 + Cl_2 \xrightarrow{\text{UV Light}}$

4. When ethyl alcohol is heated with red phosphorus and HI, then which of the following is formed

(A) C_2H_6 **(B)** CH_4 **(C)** C_3H_8 **(D)** C_2H_4

5. In the Fischer-Tropsch synthesis of petrol..... and ..... are used as the raw materials

(A) H_2; CO **(B)** CH_4 ; H_2 **(C)** CH_4; CH_3OH **(D)** CH_3OH; CO

6. Which one of the following reactions is most suitable for the preparation of n-propyl benzene

(A) Friedel-Craft's reaction **(B)** Wurtz reaction **(C)** Wurtz-Fittig reaction **(D)** Grignard reaction

7. Propane cannot be prepared from which reaction

(A) $CH_3 - CH = CH_2 \xrightarrow[OH^-]{B_2H_6}$ **(B)** $CH_3CH_2CH_2I \xrightarrow[P]{HI}$

(C) $CH_3CH_2CH_2Cl \xrightarrow{Na}$ **(D)** None of these

8. The reaction

$CH_3CH = CH_2 \xrightarrow[H^+]{(CO+H_2)} CH_3 - \underset{COOH}{\overset{|}{CH}} - CH_3$ is known as

(A) Wurtz reaction **(B)** Koch reaction **(C)** Clemmensen reduction **(D)** Kolbe's reaction

9. The compound $CH_3 - \overset{CH_3}{\overset{|}{C}} = CH - CH_3$ on reaction with $NaIO_4$ in the presence of $KMnO_4$ gives

(A) $CH_3CHO + CO_2$ **(B)** CH_3COCH_3

(C) $CH_3COCH_3 + CH_3COOH$ **(D)** $CH_3COCH_3 + CH_3CHO$

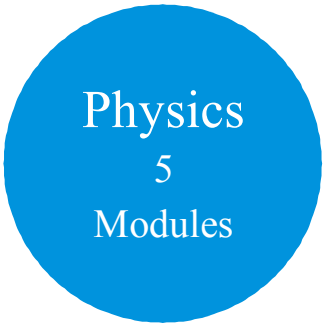
10. In the reaction :

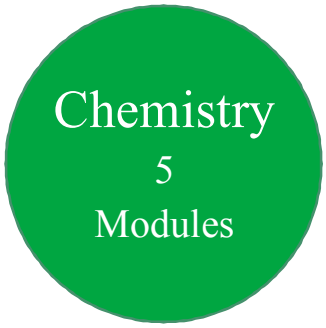
$HC \equiv CH + 2AgNO_3 \xrightarrow{NH_4OH} X + 2NH_4NO_3 + 2H_2O$

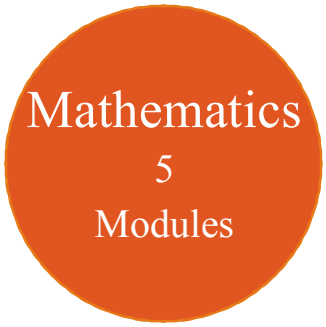
'X' is

(A) Ag_2C **(B)** Ag_2C_2 **(C)** AgC **(D)** AgOH

11th Class Modules Chapter Details

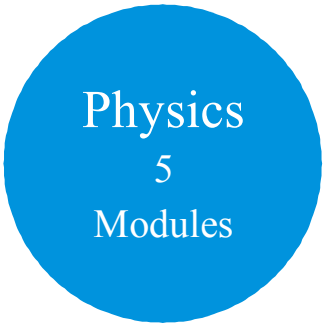


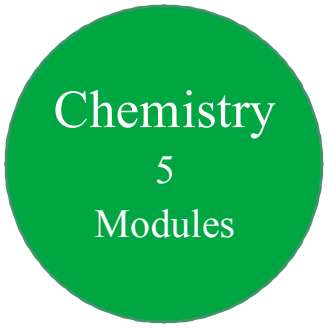


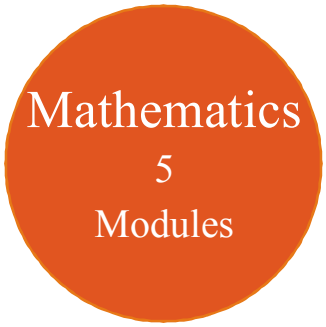


PHYSICS	CHEMISTRY	BIOLOGY
Module-1 1. Physical World & Measurements 2. Basic Maths & Vector 3. Kinematics **Module-2** 1. Law of Motion & Friction 2. Work, Energy & Power **Module-3** 1. Motion of system of particles & Rigid Body 2. Gravitation **Module-4** 1. Mechanical Properties of Matter 2. Thermal Properties of Matter **Module-5** 1. Oscillations 2. Waves	**Module-1(PC)** 1. Some Basic Conceps of Chemistry 2. Atomic Structure 3. Chemical Equilibrium 4. Ionic Equilibrium **Module-2(PC)** 1. Thermodynamics & Thermochemistry 2. Redox Reaction 3. States Of Matter (Gaseous & Liquid) **Module-3(IC)** 1. Periodic Table 2. Chemical Bonding 3. Hydrogen & Its Compounds 4. S-Block **Module-4(OC)** 1. Nomenclature of Organic Compounds 2. Isomerism 3. General Organic Chemistry **Module-5(OC)** 1. Reaction Mechanism 2. Hydrocarbon 3. Aromatic Hydrocarbon 4. Environmental Chemistry & Analysis Of Organic Compounds	**Module-1** 1. Diversity in the Living World 2. Plant Kingdom 3. Animal Kingdom **Module-2** 1. Morphology in Flowering Plants 2. Anatomy of Flowering Plants 3. Structural Organization in Animals **Module-3** 1. Cell: The Unit of Life 2. Biomolecules 3. Cell Cycle & Cell Division 4. Transport in Plants 5. Mineral Nutrition **Module-4** 1. Photosynthesis in Higher Plants 2. Respiration in Plants 3. Plant Growth and Development 4. Digestion & Absorption 5. Breathing & Exchange of Gases **Module-5** 1. Body Fluids & Its Circulation 2. Excretory Products & Their Elimination 3. Locomotion & Its Movement 4. Neural Control & Coordination 5. Chemical Coordination and Integration

12th Class Modules Chapter Details







PHYSICS

Module-1

1. Electrostatics
2. Capacitance

Module-2

1. Current Electricity
2. Magnetic Effect of Current and Magnetism

Module-3

1. Electromagnetic Induction
2. Alternating Current

Module-4

1. Geometrical Optics
2. Wave Optics

Module-5

1. Modern Physics
2. Nuclear Physics
3. Solids & Semiconductor Devices
4. Electromagnetic Waves

CHEMISTRY

Module-1(PC)

1. Solid State
2. Chemical Kinetics
3. Solutions and Colligative Properties

Module-2(PC)

1. Electrochemistry
2. Surface Chemistry

Module-3(IC)

1. P-Block Elements
2. Transition Elements (d & f block)
3. Co-ordination Compound
4. Metallurgy

Module-4(OC)

1. HaloAlkanes & HaloArenes
2. Alcohol, Phenol & Ether
3. Aldehyde, Ketone & Carboxylic Acid

Module-5(OC)

1. Nitrogen & Its Derivatives
2. Biomolecules & Polymers
3. Chemistry in Everyday Life

BIOLOGY

Module-1

1. Reproduction in Organisms
2. Sexual Reproduction in Flowering Plants
3. Human Reproduction
4. Reproductive Health

Module-2

1. Principles of Inheritance and Variation
2. Molecular Basis of Inheritance
3. Evolution

Module-3

1. Human Health and Disease
2. Strategies for Enhancement in Food Production
3. Microbes in Human Welfare

Module-4

1. Biotechnology: Principles and Processes
2. Biotechnology and Its Applications
3. Organisms and Populations

Module-5

1. Ecosystem
2. Biodiversity and Conservation
3. Environmental Issues