CARBON AND ITS COMPOUNDS

Notes for Reading

Q. Write some rules for naming a compound/IUPAC rule.

Ans: - Rule 1: Locate the longest carbon chain in the compound.

Rule 2: Give a name to the longest chain.

Rule 3: Find out what the ending should be, i.e., suffix.

See whether it is a triple/double bond or single bond.

Rule 4: Name the side group.

Rule 5: Put the side groups in alphabetical order.

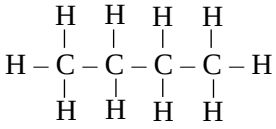
✓ The first ten members of Alkane (C_2H_{2n+2}) are:

C_1H_4	Methane
C_2H_6	Ethane
C_3H_8	Propane
C_4H_{10}	Butane
C_5H_{12}	Pentane
C_6H_{14}	Hexane
C_7H_{16}	Heptane
C_8H_{18}	Octane
C_9H_{20}	Nonane
$C_{10}H_{22}$	Decane

Isomers

- Isomers of C_4H_{10}:

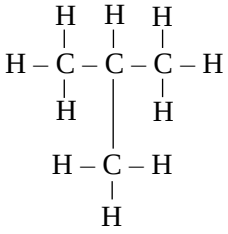
(i)



$CH_3CH_2CH_2CH_3$

Butane (n-butane)

(ii)



$CH_3CH_2CH_2CH_3$

2-Methyl propane

(Isobutane)

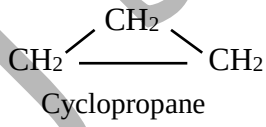
- Isomers of C_5H_{12}: (Do it yourself)
  - (i) Pentane
  - (ii) 2-Methyl butane
  - (iii) 2,2-Dimethly propane

- Isomers of C_6H_{14}: (Do it yourself)
  - (i) Hexane
  - (ii) 2-Methyl pentane
  - (iii) 3-Methyl pentane
  - (iv) 2,2-Dimethly butane
  - (v) 2,3-Dimethyl butane

- Isomers of C_7H_{16}: (Do it yourself)
  - (i) Heptane
  - (ii) 2-Methyl hexane
  - (iii) 3-Methyl hexane
  - (iv) 2,2-Methyl pentane
  - (v) 3,3-Dimethyl pentane
  - (vi) 2,3-Dimethyl pentane
  - (vii) 2,4-Dimethyl pentane
  - (viii) 2,2,3-Trimethyl butane

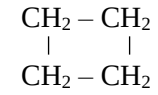
- Some members of Cycloalkanes:

1. C_3H_6



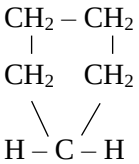
Cyclopropane

2. C_4H_8



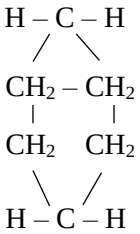
Cyclobutane

3. C_5H_{10}



Cyclopentane

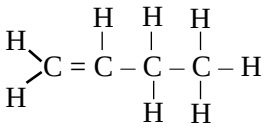
4. C_6H_{12}



Cyclohexane

- Isomers of C_4H_8: (check the number of bonds)

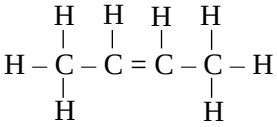
(i)



$CH_2=CHCH_2CH_3$

But-1-ene

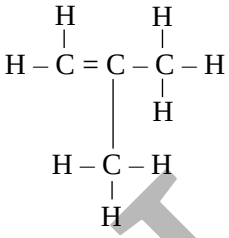
(ii)



$CH_3CH=CHCH_3$

But-2-ene

(iii)



$CH_2=CCH_3$ with CH_3

2-Methyl propene

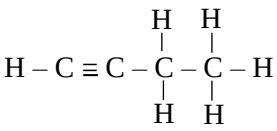
- ✓ In isomers of C_4H_8, But-1-ene and But-2-ene are positional isomers
- ✓ But-1-ene and 2-Methyl propene; But-2-ene and 2-Methyl propene are structural isomers

- Isomers of C_5H_{10}: (Do it yourself)

(i) Pent-1-ene (ii) Pent-2-ene
(iii) 2-Methyl but-1-ene (iv) 3-Methyl but-1-ene
(v) 2-Methyl but-2-ene

- Isomers of C_4H_6:

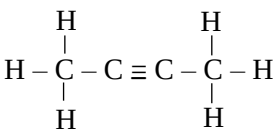
(i)



$CH\equiv CCH_2CH_3$

But-1-yne

(ii)



$CH_3C\equiv CCH3$

But-2-yne

- Isomers of C_5H_8: (Do it yourself)
  (i) Pent-1-yne (ii) Pent-2-yne
  (iii) 3-Methyl but-1-yne

- Benzene (C_6H_6): Arenes/Aromatic Hydrocarbons
  General Formula: C_nH_{2n}-6

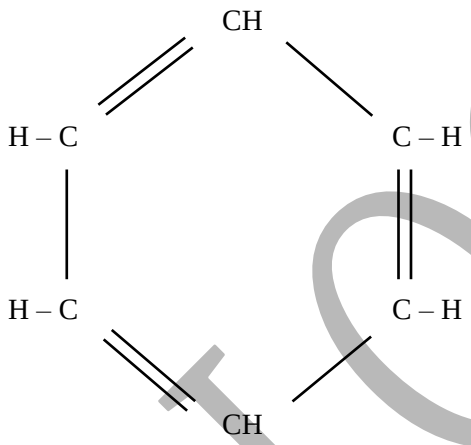


Fig: Benzene Ring

Q. Name the following hydrocarbons.

i. CH_2OH	
ii. CH_3CH_2OH	
iii. $CH_3CH_2CH_2OH$	
iv. $CH_3CH\text{-}OHCH_3$	
v. $CH_3CH_2CH_2OH$	
vi. $CH_3CH_2CH\text{-}OHCH_3$	
vii. $Cl\text{-}CH_2CH_2OH$	
viii. $CH_3CH\text{-}BrCH_2OH$	
ix. $(CH_3)_2CHCH2CH2OH$	
x. $(CH_3)_2C{=}CHCH_2OH$	
xi. CH_3CHO	
xii. CH_3CH_2CHO	
xiii. $CH_3CH\text{-}ClCHO$	
xiv. $CH_3CH_2CH_2CHO$	
xv. $CH_3CH_2CH(CH_3)CHO$	

xvi. CH_3COCH_3	
xvii. $CH_3COCH_2CH_3$	
xviii. $CH_3CH_2COCH_2CH_3$	
xix. $CH_3CH_2CH_2COCH_3$	
xx. HCOOH	
xxi. CH_3COOH	
xxii. CH_3CH_2COOH	
xxiii. $(CH_3)_2CHCH_2COOH$	
xxiv. $CH_3CH_2CH\text{-}BrCH_2Br$	
xxv. $CH_2{=}CHCH(CH_3)_2$	
xxvi. $Cl\text{-}CH_2CH_2CH_3$	
xxvii. $CH{\equiv}CCH_2C(CH_3)_3$	

Q. Draw the structure of:

(i) 3-Methyl butan-1-ol (ii) Butanone (iii) 2-Chloropropanol

(iv) Propanoic acid (v) Butanoic acid

(vi) 2-Bromo-1-chloro-2-methyl pentane

Q. Write equations to show what happens when acetic acid reacts with:

(i) Sodium (Na) (ii) Zinc (Zn)

(iii) Sodium hydroxide (NaOH) (iv) Sodium carbonate (Na_2CO_3)

(v) Sodium hydrogen carbonate ($NaHCO_3$)

Ans: - (i) $2CH_3COOH + 2Na \longrightarrow 2CH_3COONa + H_2$

Sodium acetate

(ii) $2CH_3COOH + Zn \longrightarrow (CH_2COO)_2Zn + H_2$

Zinc acetate

(iii) $CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$

Sodium acetate

(iv) $2CH_3COOH + NaCO_3 \longrightarrow 2CH_3COONa + H_2O + CO_2$

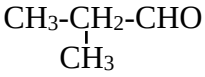
Sodium acetate

(v) $CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$

Sodium acetate

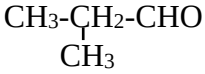
Notes for Revision

3 marks each:

Q. What are functional groups? Write the complete name of the IUPAC of an organic compound. Give the IUPAC name of an organic compound. Give the IUPAC name of the structure 

Ans: - The heteroatoms group attached to the hydrocarbon atom parts forming a stable molecule characterising specific properties irrespective of the nature and length of the carbon chain are called functional groups.

Complete name of an organic compound – Methane (CH_4)

IUPAC name of  is *2-Methylpropanal*.

Q. An unsaturated hydrocarbon A has the similar structure of cyclopropane. When the hydrocarbon A added to hydrogen molecule in the presence of Ni catalyst, it gives a compound B. Identify A and B. Write the reaction involved.

Ans: - Cyclopropane, C_3H_6

A is propene (CH_2=CH-CH_3)

B is propane (CH_3-CH_2-CH_3)

Reaction involved:

$$CH_2=CH-CH_3 + H_2 \longrightarrow CH_3-CH_2-CH_3 + H_2.$$

Q. Write the reaction for the conversion of the following molecules.

i) Ethanol into ethyl ethanoate

ii) Propanol into 1,2-Dibromopropane

iii) Ethanol into ethanoic acid

Ans: - The reactions are:

i) $CH_3CH_2OH + CH_3COOH \longrightarrow CH_3COOCH_3CH_2 + H_20$

(ethanol) (Acetic acid) (Ethyl ethanoate)

ii) $CH_3CH_2CH_2OH \xrightarrow[170°C]{H_2SO_4} CH_2=CH-CH_3 + H_2O$

(propanol) (propene)

$CH_2=CH-CH_3 + Br_2 \longrightarrow CH_2Br-CHBr-CH_3$

(1,2-Dibromopropane)

iii) $CH_3CH_2OH + [O] \xrightarrow{KMnO} CH_3CHO + H_2O$

$CH_3CHO + [O] \xrightarrow{KMnO} CH_3COOH$

5 marks each:

Q. A hydrocarbon represented by C_2H_6O is oxidised in the presence of potassium permanganate, has a component A. And further A is oxidised in presence of alkaline $KMnO_4$ to form another compound B, represented by $C_2H_4O_2$

i) Identify A and B

ii) Write the equations for the conversion of C_2H_6O into B

iii) What product will be obtained when sodium metal reacts with B?

Ans: - i) A is *ethanal* and B is *ethanoic acid*

ii) $CH_3CH_2OH + [O] \xrightarrow{KMnO} CH_3CHO + H_2O$

(ethanol) (ethanal)

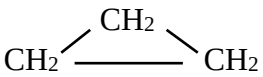
iii) When Na metal reacts with CH_3COOH, it produces Sodium acetate.

$2CH_3COOH + 2Na \longrightarrow 2CH_3COONa + H_2$

(Sodium acetate)

Q. Give the IUPAC names and write the possible structures of the molecules C_3H_6. Which one of them is not a homologous of the unsaturated hydrocarbon. What will happen when the unsaturated hydrocarbon is added to bromine water? Write the equations of the reaction.

Ans: - C_3H_6 represents both cycloalkane and alkane.

i) 

Cyclopropane

ii) $CH_2=CH-CH_3$

Propane

Saturated hydrocarbon is Cyclopropane.

Propene undergoes addition of Bromine water to form 1,2-Dibromopropane.

CH_2-$CHBr$-CH_3

Q. An alcohol is oxidised in presence of potassium dichromate (K_2CrO_7) to form a compound X which is further oxidised in presence of potassium dichromate to form another compound Y. The alcohol gives propane when heated with conc. H_2SO_4 at 70°C.

i) Name the alcohol and write its formula

ii) Identify X and Y

iii) The reaction for conversion of alcohol into Y

Ans: - i) The name of the alcohol is propanol. Formula: CH_3-CH_2-CH_2-OH

ii) X is propanal

Y is propanoic acid

iii) CH_3-CH_2-CH_2-OH + [O] $\xrightarrow{K_2CrO_7}$ CH_3-CH_2-CHO + H_2O

(propanal)

CH_3-CH_2-CHO + [O] $\xrightarrow{K_2CrO_7}$ CH_3-CH_2-COOH

(Propanoic acid)