CBSE NCERT Solutions for Class 11 chemistry Chapter 6

Exercises

Q.1. How do you account for the formation of ethane during chlorination of methane?

Solution: Chain initiation: The reaction starts with the homolytic cleavage of Cl–Cl bond and free radicals are formed.

$$\mathrm{Cl - Cl \xrightarrow{h\nu} \dot{C}l + \dot{C}l}$$

Propagation:
In the second step, chlorine-free radicals attack methane molecules and break down the C–H bond to the generation of methyl radical.

Termination:
Formation of ethane is a result of the termination of chain reactions taking place as a result of the consumption of reactants as:

$$\mathrm{\dot{C}l + \dot{C}l \longrightarrow Cl - Cl}$$

$$\mathrm{H_3\dot{C} + \dot{C}H_3 \longrightarrow \underset{(Ethane)}{H_3C - CH_3}}$$

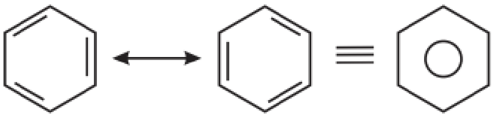
These methyl radicals react with other chlorine-free radicals to form methyl chloride along with the liberation of a chlorine-free radical.

$$\mathrm{\dot{C}H_3 + Cl - Cl \longrightarrow \underset{Methyl\ chloride}{CH_3 - Cl} + \dot{C}l}$$

Hence, methyl free radicals and chlorine-free radicals set up a chain reaction. While HCl and CH3Cl are the major products formed, other higher halogenated compounds are also formed as:
Hence, by this process, ethane is obtained as a by-product of chlorination of methane.

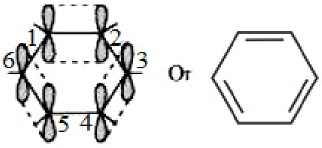
Q.2. Why is benzene extraordinarily stable though it contains three double bonds?

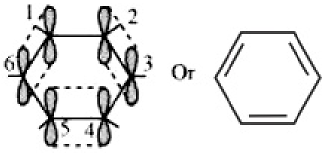
Solution: Benzene is a hybrid of resonating structures given as:



In benzene, all six C-atoms are sp2 hybridized. The two carbon atoms overlap with each other as formed sp2-sp2 hybrid orbitals in the hexagonal plane. The remaining sp2 hybrid orbital on each carbon atom overlaps with the *s*-orbital of hydrogen to form six sigma C–H bonds.

The remaining unhybridized p-orbital of carbon atoms has the possibility of forming three π bonds by the lateral overlap of C1-C2,C3-C4,C5-C6, or C2-C3,C4-C5,C6-C1





With six carbon nuclei, the six π-electrons are delocalized and can move freely. Due to presence of delocalized π-electrons benzene gets stabilized.

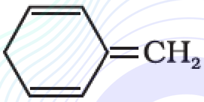
Q.3. What are the necessary conditions for any system to be aromatic?

Solution: Three necessary conditions for aromaticity :
(i) Compound should have a planar structure.

(ii) The π–electrons of the compound are completely delocalized in the ring.

(iii) The total number of π–electrons present in the ring should be equal to 4n+2, where n=0,1,2… etc. This is known as Huckel's rule.

Q.4. Explain why the following systems are not aromatic?



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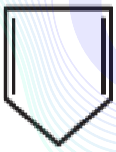

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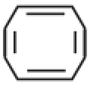

Solution: Three necessary conditions for aromaticity :
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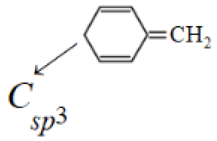
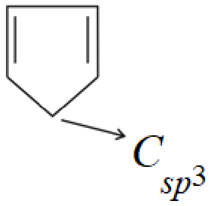


This compound is not a planar one, because it has Csp3 which is tetrahedral. So, it is a non-aromatic compound.

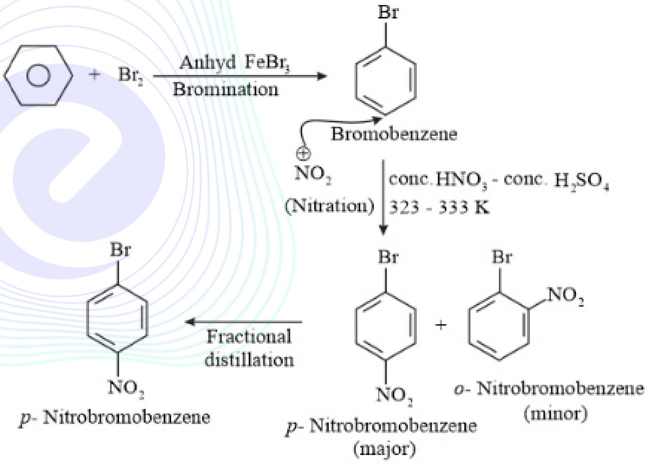


This compound is not planar, because it has Csp3 which is tetrahedral. So, it is non-aromatic compound.

This compound has a tab type shape. So, it is also non-planar hence, it is non-aromatic compound.

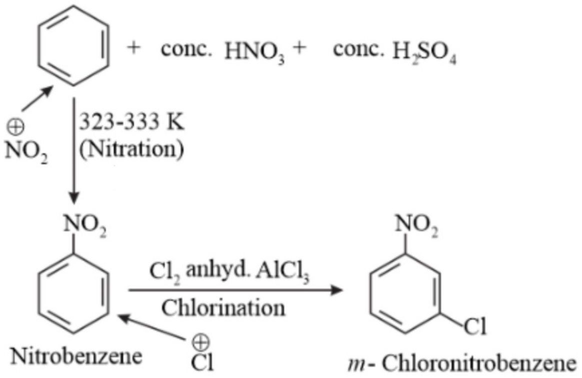
Q.5. How will you convert benzene into p-nitrobromobenzene.

Solution: Benzene can be converted into p-nitrobromobenzene as:
Benzene react with Br2 in the presence of Lewis acid FeBr3 and gives bromobenzene by electrophilic substitution reaction.
The -Br shows (-I and +M) effect. Due to the -I effect, it is ring deactivating group towards electrophile attack and due to +M effect it is ortho/para directing group. So, NO2+ attack at ortho/para position of bromobenzene.



Q.6. How will you convert benzene into m-nitrochlorobenzene.

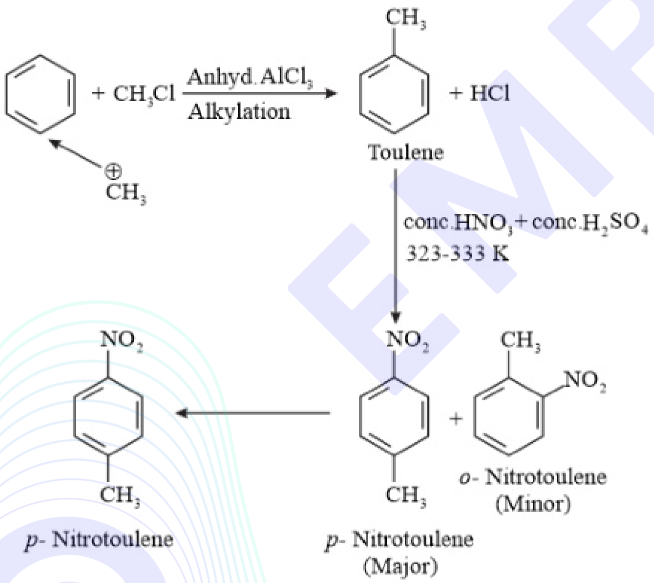
Solution: Benzene can be converted into m-nitrochlorobenzene as:



-NO2 group is -M group so it withdraws electrons by delocalization mechanism from rest of the molecule. So, it is ring deactivating and meta directing group. So, the electrophile Cl+ attacks at meta position.

Q.7. How will you convert benzene into p-nitrotoluene.

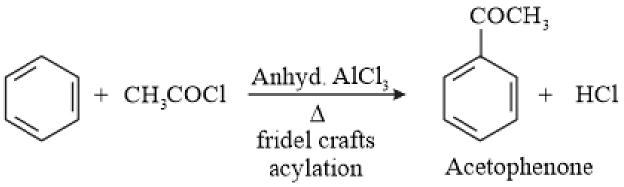
Solution: Benzene can be converted into p-nitrotoluene as:



-CH3 is ring activating and ortho/para directing group. So, electrophile NO2+ attack at ortho and para position. We can isolate the product by steam distillation.

Q.8. How will you convert benzene into acetophenone.

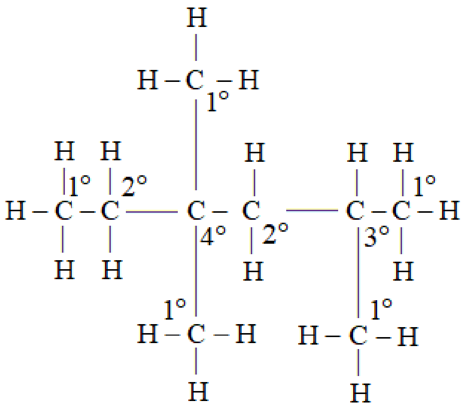
Solution: Benzene can be converted into acetophenone as:



CH3CO+ is an electrophile in Friedel Crafts acylation reaction.

Q.9. In the alkane H3C–CH2–CCH32–CH2–CHCH32, identify 1o,2o,3o carbon atoms and give the number of H atoms bonded to each one of these.

Solution:



1o carbon atoms are those which are bonded to only one carbon atom i.e., they have only one carbon atom as their neighbor. The given structure has five 1o carbon atoms and fifteen hydrogen atoms attached to it.

2o carbon atoms are those which are bonded to two carbon atoms i.e., they have two carbon atoms as their neighbors. The given structure has two 2o carbon atoms and four hydrogen atoms attached to it.
3o carbon atoms are those which are bonded to three carbon atoms i.e., they have three carbon atoms as their neighbors. The given structure has one 3o carbon atom and only one hydrogen atom is attached to it.

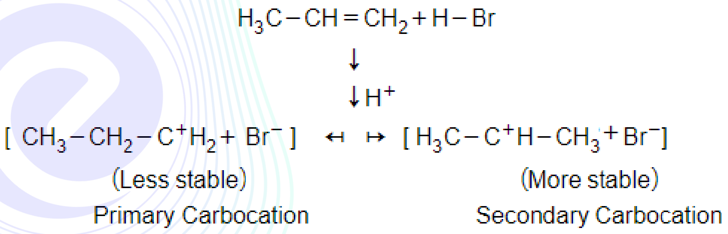
Q.10. What effect does branching of an alkane chain has on its boiling point?

Solution: Alkane has intermolecular Van der Waals forces. The stronger the force, the greater will be the boiling point of the alkane.
Van der Waals forces ∝ molecular weight.

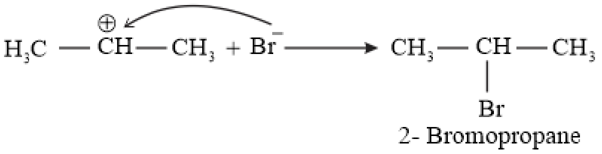
Compounds with same molecular mass can have straight or branched structure. As branching increases, the surface area of the molecule decreases which results in a small area of contact. As a result, the Van der Waals force also decreases which can be overcome at a relatively lower temperature. Hence, the boiling point of an alkane decreases with an increase in branching.
Boiling Point ∝1branching

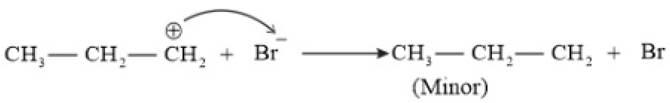
Q.11. Addition of HBr to propene yields 2-bromopropane, while in the presence of benzoyl peroxide, the same reaction yields 1-bromopropane. Explain and give mechanism.

Solution: Addition of HBr to propene is an example of electrophilic substitution reaction. Hydrogen bromide provides an electrophile, H+. This electrophile attacks the double bond to form 1o and 2o carbocations as shown:



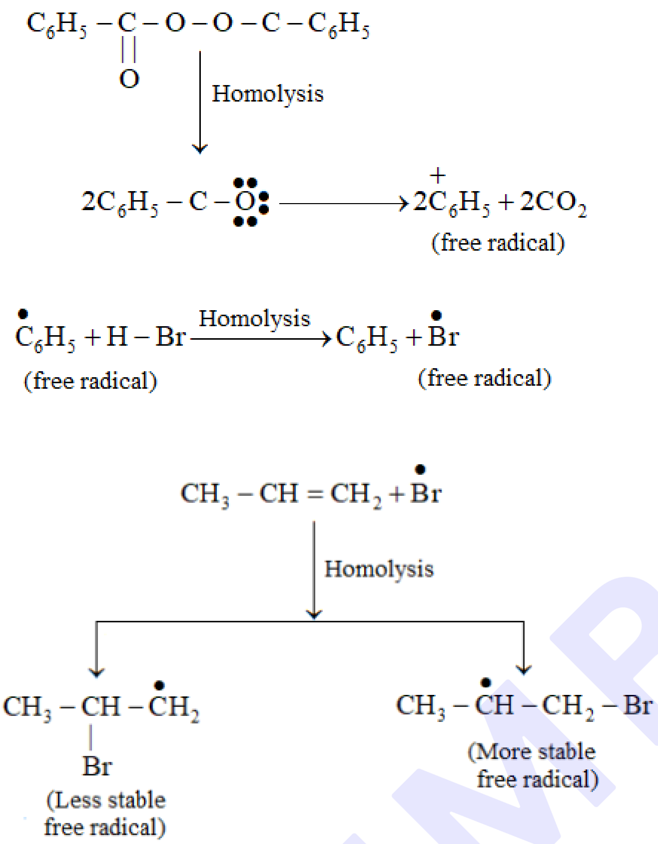
Secondary carbocations are more stable than primary carbocations. Hence, the former predominates since it will form at a faster rate. Thus, in the next step, Br– attacks the carbocation to form 2-bromopropane as the major product.





This reaction follows Markovnikov's rule where the negative part of the reagent addendum is attached to the carbon atom having a lesser number of hydrogen atoms.

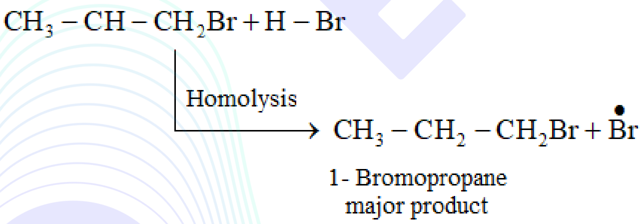
While in the presence of benzoyl peroxide, an addition reaction takes place which is according to the anti Markovnikov's rule. The reaction follows a free radical mechanism.



$$\dot{C}_6H_5 + H-Br \xrightarrow{\text{Homolysis}} C_6H_5 + \dot{Br}$$

$$CH_3-CH=CH_2+\dot{Br}$$

More stable free radical product will forms at a faster rate. Thus, 1–bromopropane is obtained as the major product.

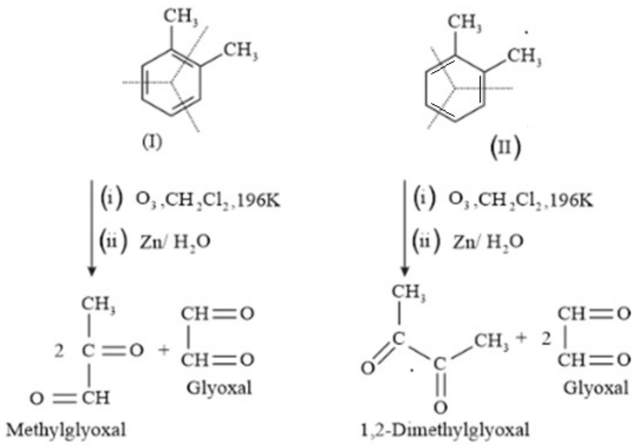


$$CH_3-CH-CH_2Br+H-Br \xrightarrow{\text{Homolysis}} CH_3-CH_2-CH_2Br+\dot{Br}$$

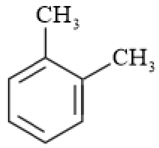
In the presence of peroxide, Br free radical acts as an electrophile. Hence, two different products, 2-bromopropane and 1-bromopropane are obtained on the addition of HBr to propene.

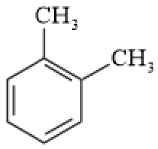
Q.12. Write down the products of ozonolysis of 1,2-dimethylbenzene (o-xylene). How does the result support Kekule structure for benzene?

Solution: 1,2-dimethylbenzene (o-xylene) can undergo ozonolysis in two ways as they have two resonance structures:



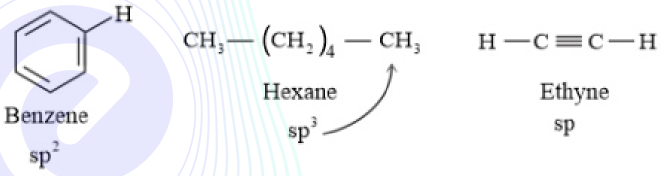
All three products, i.e., methyl glyoxal, 1, 2-demethylglyoxal, and glyoxal are obtained from two Kekule structures. Since all three products cannot be obtained from any one of the two structures, this proves that *o*-xylene is a resonance hybrid of two Kekule structures.



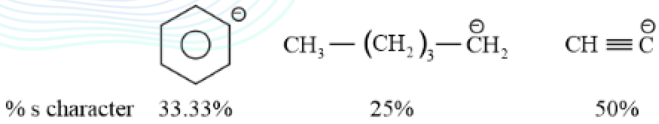


Q.13. Arrange benzene, n-hexane and ethyne in decreasing order of acidic behaviour. Also give reason for this behaviour.

Solution: Acidic strength $\propto$ stability of conjugate base (Anion).
Stability of conjugate base $\propto$1electron density.
Acidic character of a species is defined on the basis of ease with which it can lose its hydrogen atoms.
The hybridization state of carbon in the given compound is:



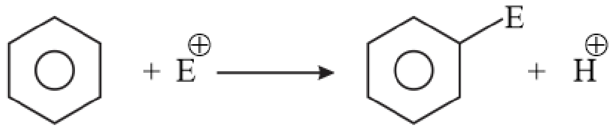
Conjugate base



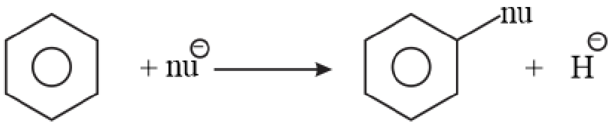
As the s-character increases, the electronegativity of carbon increases and the electrons of C–H bond pair lie closer to the carbon atom. As a result, partial positive charge of hydrogen atom increases and H+ ions are set free.
The s—character increases in the order:
sp3<sp2<sp
Hence, the decreasing order of acidic behaviour is Ethyne>Benzene>Hexane.

Q.14. Why does benzene undergo electrophilic substitution reactions easily and nucleophilic substitutions with difficulty?

Solution: Benzene is a planar molecule having delocalized electrons above and below the plane of ring. Hence, it is electron-rich. As a result, it is highly attractive to electron deficient species i.e., electrophiles and H+ is good leaving group. Therefore, it undergoes electrophilic substitution reactions very easily.

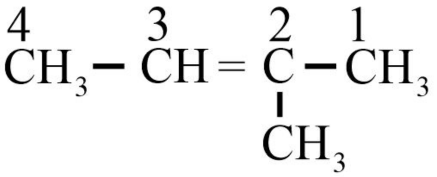


Nucleophiles are electron-rich. Hence, they are repelled by benzene. H-(hydride) is poor leaving group. Hence, benzene undergoes nucleophilic substitutions with difficulty.



Q.15. Write IUPAC name of the given compound:
CH3CH=CCH32

Solution:



$$\overset{4}{CH_3}-\overset{3}{CH}=\overset{2}{\underset{\displaystyle CH_3}{\underset{|}{C}}}-\overset{1}{CH_3}$$

The parent chain consists of four carbon atoms. So, the prefix 'but' is used.
One double bond is present at position 2.
One substituent i.e. methyl group is present at position 2.
Therefore, the IUPAC name of the given compound is 2-Methylbut-2-ene.

Q.16. Write IUPAC name of the given compound:

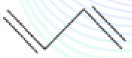
CH2=CH-C≡C-CH3

Solution:

$$\overset{1}{CH_2}=\overset{2}{CH}-\overset{3}{C}\equiv\overset{4}{C}-\overset{5}{CH_3}$$

Parent carbon chain has five carbon atoms and the word root will be 'pent'.
Primary suffix =(double bond) ene, yne(triple bond)
Secondary prefix + primary prefix +word root + Primary suffix+ secondary suffix
IUPAC name: Pent-1-en-3-yne.

Q.17. Write IUPAC name of the given compound:



Solution:

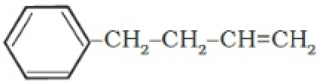
can be written as

$$H_2\overset{1}{C}=\overset{2}{CH}-\overset{3}{CH}=\overset{4}{CH_2}$$

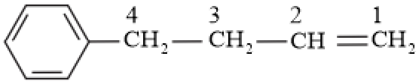
Parent carbon chain has 4 carbon atoms and the word root will be 'but'

Primary suffix =(double bond) 'ene'. Secondary suffix='di' Secondary prefix + primary prefix +word root + Primary suffix+ secondary suffix. IUPAC name:1,3-butadiene.

Q.18. Write IUPAC name of the given compound:



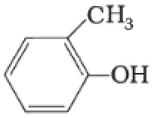
Solution:



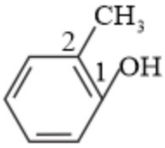
Parent carbon chain has four carbon atoms and the word root will be 'but'.

Primary prefix (substitute) = 4-Phenyl. Primary suffix = 'ene'. Secondary prefix + primary prefix +word root + Primary suffix+ secondary suffix.
IUPAC name: 4-Phenyl but-1-ene.

Q.19. Write IUPAC name of the given compound:



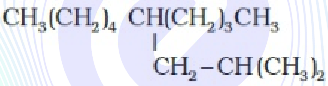
Solution:



Parent carbon chain=phenol.

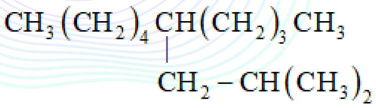
Primary prefix (substitute) = 2-methyl. Secondary prefix + primary prefix +word root + Primary suffix+ secondary suffix.
IUPAC name: 2-Methyl phenol.

Q.20. Write IUPAC name of the given compound:



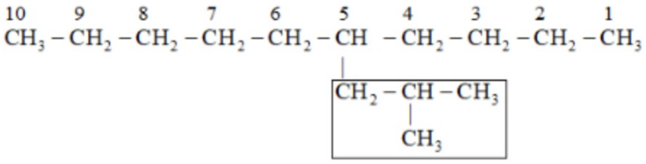
$$CH_3(CH_2)_4\underset{\displaystyle CH_2-CH(CH_3)_2}{\underset{|}{CH}}(CH_2)_3CH_3$$

Solution:



$$CH_3(CH_2)_4\underset{\displaystyle CH_2-CH(CH_3)_2}{\underset{|}{CH}}(CH_2)_3CH_3$$

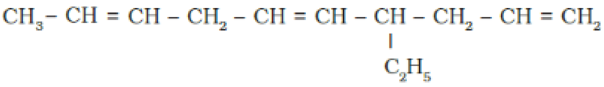
Can be written as:



$$\overset{10}{CH_3}-\overset{9}{CH_2}-\overset{8}{CH_2}-\overset{7}{CH_2}-\overset{6}{CH_2}-\overset{5}{\underset{\boxed{\begin{array}{l}CH_2-CH-CH_3\\ \qquad\;\;|\\ \qquad CH_3\end{array}}}{\underset{|}{CH}}}-\overset{4}{CH_2}-\overset{3}{CH_2}-\overset{2}{CH_2}-\overset{1}{CH_3}$$

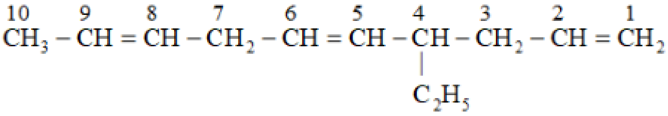
The correct IUPAC name of the compound is 5-(2-methylpropyl)-decane. The parent hydrocarbon contains 10 carbon atoms and is called decane. At fifth carbon atom, 2-methylpropyl group is present.

Q.21. Write IUPAC name of the given compound:



$$CH_3-CH=CH-CH_2-CH=CH-\underset{\underset{C_2H_5}{|}}{CH}-CH_2-CH=CH_2$$

Solution:

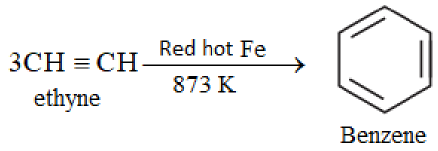


$$\overset{10}{CH_3}-\overset{9}{CH}=\overset{8}{CH}-\overset{7}{CH_2}-\overset{6}{CH}=\overset{5}{CH}-\underset{\underset{C_2H_5}{|}}{\overset{4}{CH}}-\overset{3}{CH_2}-\overset{2}{CH}=\overset{1}{CH_2}$$

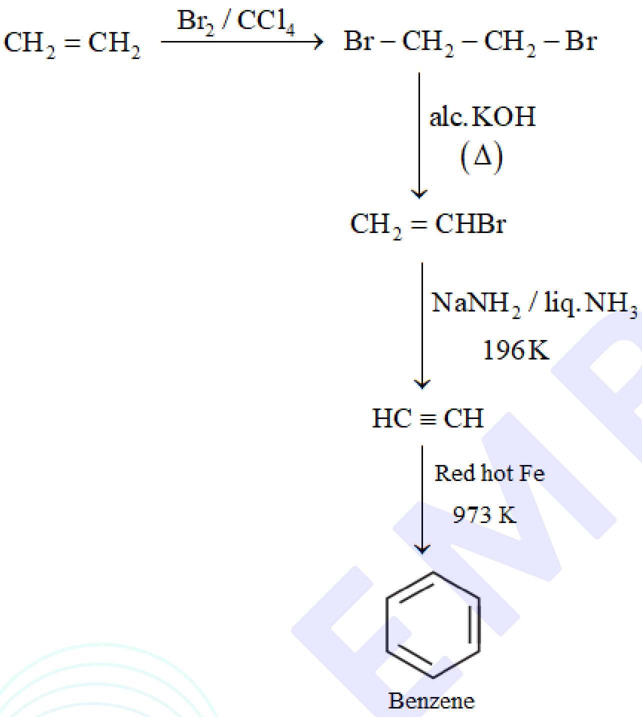
Parent carbon chain has 10 carbon atoms and the word root will be 'deca'.
Primary suffix = 'ene'.
Primary prefix (substitute) : 4- ethyl.
Secondary prefix + primary prefix +word root + Primary suffix+ secondary suffix.
IUPAC name: 4-ethyldeca-1, 5, 8-triene

Q.22. How would you convert the following compounds into benzene?
Ethyne, Ethene, Hexane

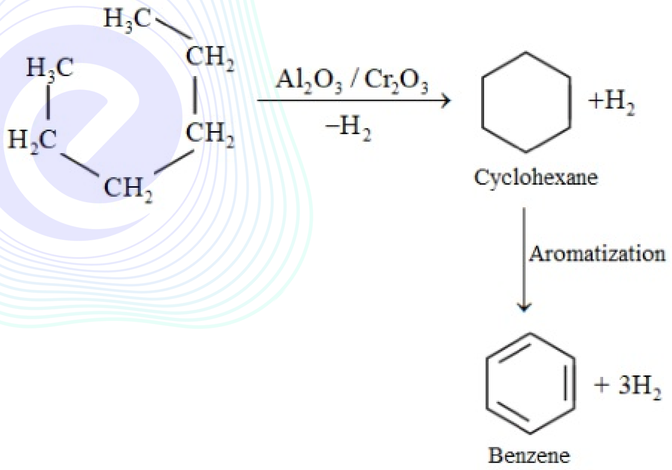
Solution: Benzene from ethyne: Ethyne should be heated at high temperature in the presence of iron to get benzene.



Benzene from Ethene: Ethene should be heated in the presence of bromine and carbon tetrachloride to give 1,2-dibromo-ethane which on treating with alcoholic potash gives dehydrohalogenated product, bromoethene. Bromoethene on reaction with sodamide and liquid ammonia gives ethyne. Ethyne should be heated at high temperature in the presence of iron to get benzene.



Hexane to benzene: hexane is passed over chromium oxide supported over alumina under high temperature and pressure. The reaction involves simultaneous cyclization and dehydrogenation which results into aromatisation.



Q.23. Write structures of all the alkenes which on hydrogenation give 2-methylbutane.

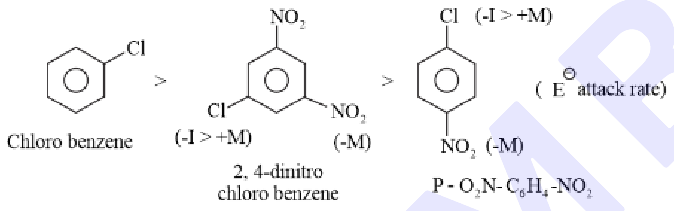
Solution: Structure of 2-methylbutane is given below:
H3C1 -HC2-H2C3-C4H3 | CH3
By the hydrogenation of alkene the skeleton will not change. On that basis, various alkenes that will give 2-methylbutane on hydrogenation are:
(a) 3-methyl butene
H3C4—CH3—C2H=C1H2 | CH3

(b) 2-methyl but-2-ene
CH3-C=CH-CH3 | CH3

(c) 2-methyl butene
C1H2=C2-C3H-C4H3 | CH3

Q.24. Arrange the following set of compounds in order of their decreasing relative reactivity with an electrophile, E+
a) Chlorobenzene, 2,4-dinitrochlorobenzene, p-nitrochlorobenzene.
b) Toluene, p-H3C–C6H4–NO2, p-O2N–C6H4–NO2.

Solution: Electrophiles are reagents that participate in a reaction by accepting an electron pair in order to make bond with nucleophiles.
The higher the electron density on a benzene ring, the more reactive is the compound towards an electrophile, E+ (Electrophilic reaction).
The presence of an electron withdrawing group deactivates the aromatic ring by decreasing the electron density at the ortho and para positions. Chlorine donates its lone pair of electrons to the aromatic ring and hence increase the electron density at ortho and para positions, whereas nitro group is an electron withdrawing deactivating group. Thus, the order of their decreasing relative reactivity with an electrophile is given below:

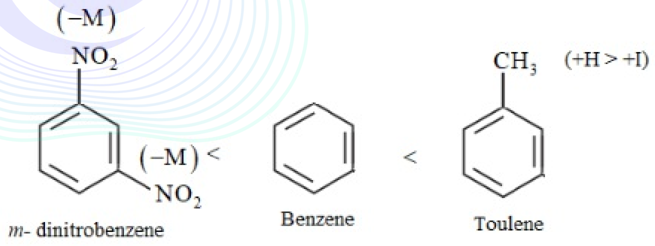


While -CH3 is an electron donating group, NO2– group is electron withdrawing. Hence, toluene will have the maximum electron density and is most easily attacked by E+. NO2– is an electron withdrawing group. Hence, when the number of NO2– substituent increases the reactivity towards electrophile decreases. Thus, the order of their decreasing relative reactivity with an electrophile is given below:
Toluene>p–CH3–C6H4–NO2>p–O2N–C6H4–NO2

Q.25. Out of benzene, m–dinitrobenzene and toluene which will undergo nitration most easily and why?

Solution: Rate of nitration depends on the presence of electron density on the compound to form nitrates. Nitration reactions are examples of electrophilic substitution reactions where an electron-rich species is attacked by a nitronium ion NO2+.

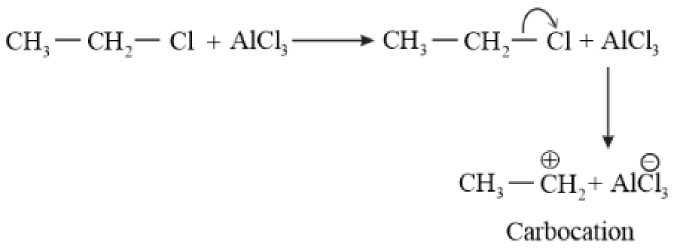
-CH3 is ring activating group and -NO2 is ring deactivating group.
Now, CH3 group is electron donating and NO2– is electron withdrawing. Therefore, toluene will have the maximum electron density among the three compounds followed by benzene.
On the other hand, m-dinitrobenzene will have the least electron density. Hence, it will undergo nitration with difficulty. Hence, the increasing order of nitration is as follows:



Rate of nitration by electrophilic substitution.

Q.26. Suggest the name of a Lewis acid other than anhydrous aluminium chloride which can be used during ethylation of benzene.

Solution: The ethylation reaction of benzene involves the substitution of an ethyl group (electrophile) on the benzene ring. Such a reaction is called a Friedel-Craft alkylation reaction. This reaction takes place in the presence of a Lewis acid.



Any Lewis acid like anhydrous FeCl3,SnCl2,BF3 etc. can be used during the ethylation of benzene.

Q.27. Why is Wurtz reaction not preferred for the preparation of alkanes containing an odd number of carbon atoms? Illustrate your answer by taking one example.

Solution: Wurtz reaction is limited for the synthesis of symmetrical alkanes (alkanes with an even number of carbon atoms). In the reaction, two similar alkyl halides are taken as reactants and an alkane containing double the number of carbon atoms are formed.

Example:
CH3-BrBromomethane+2NaSodium+Br-CH3Bromomethane →dry etherCH3-CH3Ethane+2NaBrSodium bromide

Wurtz reaction cannot be used for the preparation of unsymmetrical alkanes because if two dissimilar alkyl halides are taken as the reactants, then a mixture of alkanes is obtained as the products. Since the reaction involves free radical species, a side reaction also occurs to produce an alkene. For example, the reaction of bromomethane and iodoethane gives a mixture of alkanes.

Q.28. For the given compound, write structural formulas and IUPAC names for all possible isomers having the number of double or triple bond as indicated:
C4H8 (one double bond).

Solution: Structural isomers are molecules with the same molecular formula, but their atoms have different arrangements or bonds. The following structural isomers are possible for C4H8 with one double bond:

$$\overset{1}{H_2C}=\overset{2}{CH}-\overset{3}{CH_2}-\overset{4}{CH_3}$$

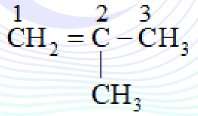
(1)

IUPAC name of the compound is bute-1-ene.

$$\overset{1}{CH_3}-\overset{2}{CH}=\overset{3}{CH}-\overset{4}{CH_3}$$

(II)

IUPAC name of the compound is but-2-ene.



$$\overset{1}{CH_2}=\overset{2}{\underset{\displaystyle CH_3}{\underset{|}{C}}}-\overset{3}{CH_3}$$

(III)

IUPAC name of the compound is 2-methylprop-1-ene.

Q.29. For the given compound, write structural formulas and IUPAC names for all possible isomers having the number of double or triple bond as indicated:

C5H8(one triple bond).

Solution: Structural isomers are molecules with the same molecular formula, but their atoms have different arrangements or bonds. The following structural isomers are possible for C5H8 with one triple bond:

$$H\overset{1}{C}\equiv\overset{2}{C}-\overset{3}{C}H_2-\overset{4}{C}H_2-\overset{5}{C}H_3$$

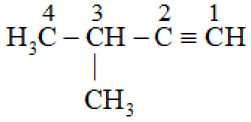
(I)

IUPAC name of the compound is pent-1-yne.

$$H_3\overset{1}{C}-\overset{2}{C}\equiv\overset{3}{C}-\overset{4}{C}H_2-\overset{5}{C}H_3$$

(III)

IUPAC name of the compound is pent-2-yne, and



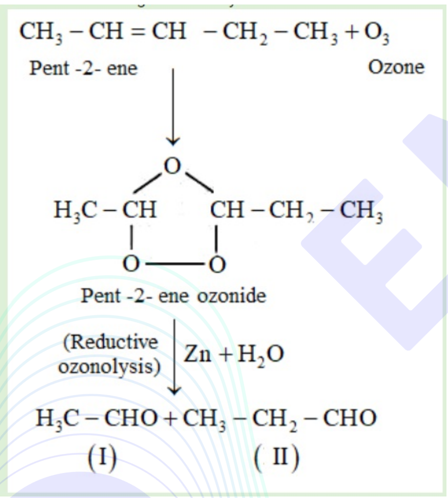
$$H_3\overset{4}{C}-\underset{\displaystyle CH_3}{\overset{3}{C}H}-\overset{2}{C}\equiv\overset{1}{C}H$$

(III)

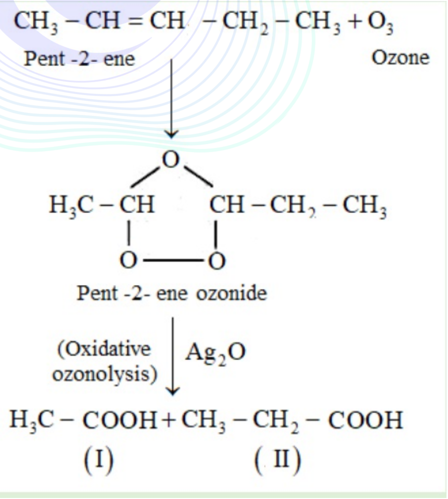
The IUPAC name of the compound is 3-methylbut-1-yne.

Q.30. Write IUPAC names of the products obtained by the ozonolysis of pent- 2-ene.

Solution: Pent-2-ene undergoes ozonolysis as:



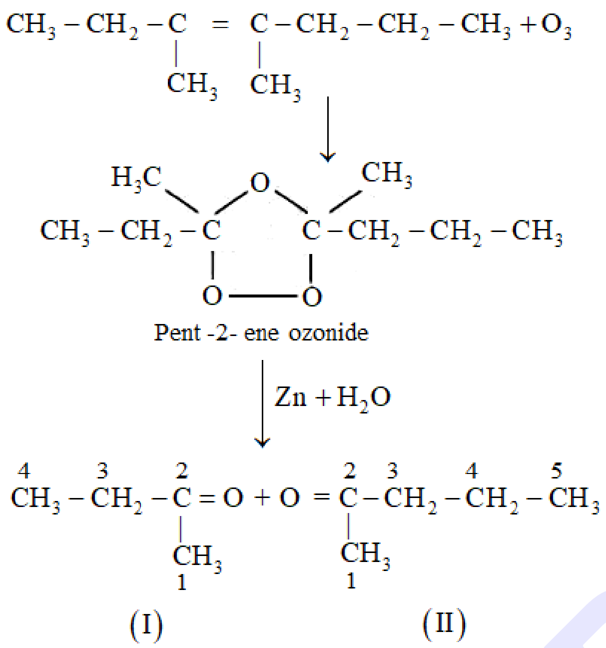
The IUPAC name of product (I) is ethanal and product (II) is propanal.



The IUPAC name of product (I) is ethanoic acid and Product (II) is propanoic acid.

Q.31. Write IUPAC names of the products obtained by the ozonolysis of 3,4-dimethylhept- 3-ene.

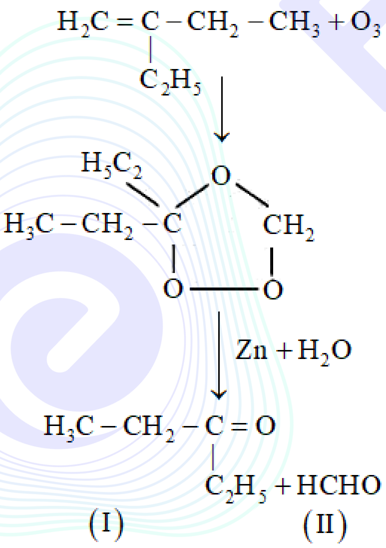
Solution: 3, 4-dimethylhept-3-ene undergoes ozonolysis as:



The IUPAC name of product (I) is butan-2-one and product (II) is pentan-2-one.

Q.32. Write IUPAC names of the products obtained by the ozonolysis of 2-ethylbut- 1-ene.

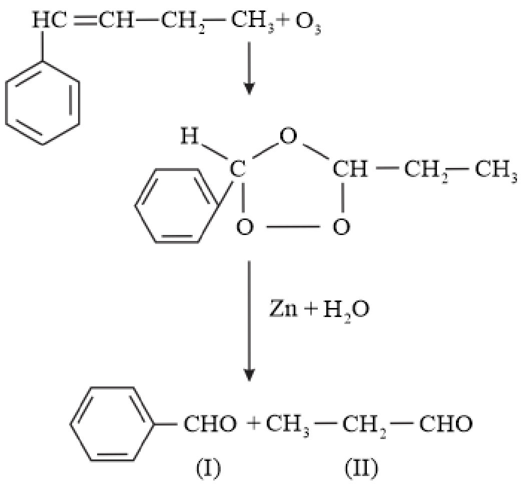
Solution: 2-ethylbut-1-ene undergoes ozonolysis as:



The IUPAC name of product (I) is pentan-3-one and product (II) is methanal.

Q.33. Write IUPAC names of the products obtained by the ozonolysis of 1-phenylbut- 1-ene.

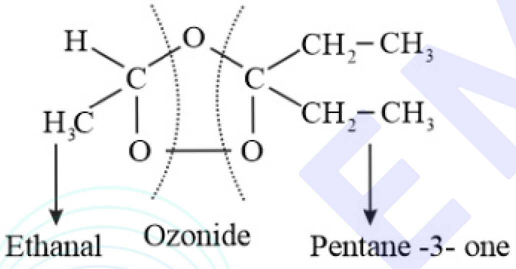
Solution: 1-phenylbut-1-ene undergoes ozonolysis as:



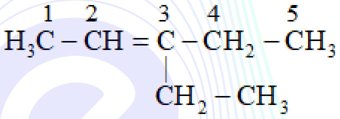
The IUPAC name of product (I) is benzaldehyde and product (II) is propanal.

Q.34. An alkene ‘A’ on ozonolysis gives a mixture of ethanal and pentan-3-one. Write structure and IUPAC name of ‘A’.

Solution: During reductive ozonolysis, an ozonide having a cyclic structure is formed as an intermediate which undergoes cleavage to give the final products. Ethanal and pentan-3-one are obtained from the intermediate ozonide. Hence, the expected structure of the ozonide is:



This ozonide is formed as an addition of ozone to ‘A’. The desired structure of ‘A’ can be obtained by the removal of ozone from the ozonide, and inserting double bond in its position. Hence, the structure of ‘ A' is:



$$\overset{1}{H_3C}-\overset{2}{CH}=\overset{3}{\underset{\begin{array}{l}|\\ CH_2-CH_3\end{array}}{C}}-\overset{4}{CH_2}-\overset{5}{CH_3}$$

The IUPAC name of ‘ A’ is 3-ethylpent-2-ene.

Q.35. An alkene ‘A’ contains three C–C, eight C–H σ bonds and one C–C π bond. ‘A’ on ozonolysis gives two moles of an aldehyde of molar mass 44 u. Write IUPAC name of ‘A'.

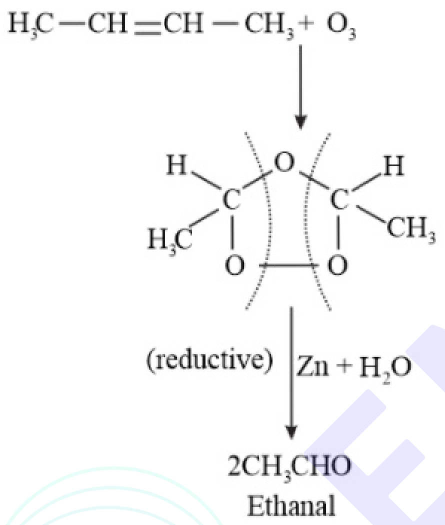
Solution: Given in question, ''A' on ozonolysis gives two moles of an aldehyde of molar mass 44 u. The formation of two moles of an aldehyde indicates the presence of identical structural units on both sides of the double bond containing carbon atoms. Hence, the structure of ' A' can be represented as:

XC=CX

There are eight C–H σ bonds. Hence, there are 8 hydrogen atoms in ' A'. Also, there are three C–C bonds. Hence, there are four carbon atoms present in the structure of ' A'. Combining the inferences, the structure of ' A' can be represented as:

' A' has 3 C–C bonds, 8 C–H σ bonds, and one C–C π bond.

Hence, the IUPAC name of compound ' A' is but-2-ene.



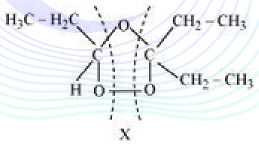
The final product is ethanal with molecular mass $=2\times12+4\times1+1\times16=44$ u.

Q.36. Propanal and pentan-3-one are the ozonolysis products of an alkene? What is the structural formula of the alkene?

Solution: As per the given information, propanal and pentan-3-one are the ozonolysis products of an alkene. Let the given alkene be 'A'. Writing the reverse of the ozonolysis reaction, we get:

CH3-CH2-CC2H5|=O and CH3-CH2-CHO

The products are obtained on the cleavage of ozonide ' X'. Hence, ' X' contains both products in the cyclic form. The possible structure of ozonide can be represented as:



Now, ' X' is an addition product of alkene ' A' with ozone. Therefore, the possible structure of alkene ' A' is: CH3-CH2-CC2H5|=CH-CH2-CH3. The IUPAC name of the compound is 3-ethyl-hex-3-ene.

Q.37. Write chemical equations for combustion reaction of the following hydrocarbons:
Butane, Pentene, Hexyne, Toluene.

Solution: Combustion of alkane is a chemical reaction with oxygen in which alkane is converted into carbon dioxide and water with the release of heat energy.

Combustion reaction of butane:

$$2C_4H_{10}(g)+13O_2(g)\rightarrow 8CO_2(g)+10H_2O(g)+\text{Heat}$$

Butane

Combustion of alkene is a chemical reaction with oxygen in which alkene is converted into carbon dioxide and water with the release of heat energy. Combustion reaction of pentene:

$$2C_5H_{10}(g)+15O_2(g)\rightarrow 10CO_2(g)+10H_2O(g)+\text{Heat}$$

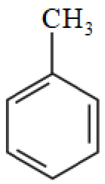
Pentene

Combustion of alkyne is a chemical reaction with oxygen in which alkyne is converted into carbon dioxide and water with the release of heat energy. Combustion reaction of hexyne:

$$2C_6H_{10}(g)+17O_2(g)\rightarrow 12CO_2(g)+10H_2O(g)+\text{Heat}$$

Hexyne

Combustion of aromatic compound is a chemical reaction with oxygen in which the compound is converted into carbon dioxide and water with the release of heat energy. Combustion reaction of toluene:

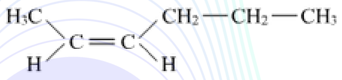


$$+9O_2(g)\rightarrow 7CO_2(g)+4H_2O(g)+\text{Heat}$$

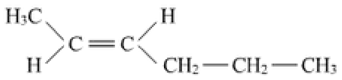
Toluene

Q.38. Draw the cis and trans structures of hex-2-ene. Which isomer will have higher b.p. and why?

Solution: Hex-2-ene is represented as:
H3C-HC=CH-CH2-CH2-CH3
Geometrical isomers of hex-2-ene are:



cis-isomer



trans-isomer

Cis isomer: Higher priority group present at same side. The dipole moment of cis-compound is a sum of the dipole moments of C–CH3 and C–CH2CH2CH3 bonds acting in the same direction.
Trans isomer: Higher priority group present at opposite side. The dipole moment of trans-compound is the resultant of the dipole moments of C–CH3 and C–CH2CH2CH3 bonds acting in opposite directions. Hence, cis-isomer is more polar than trans-isomer. The higher the polarity, the greater the intermolecular dipole-dipole interaction and the higher will be the boiling point. Hence, cis-isomer will have a higher boiling point than trans-isomer.