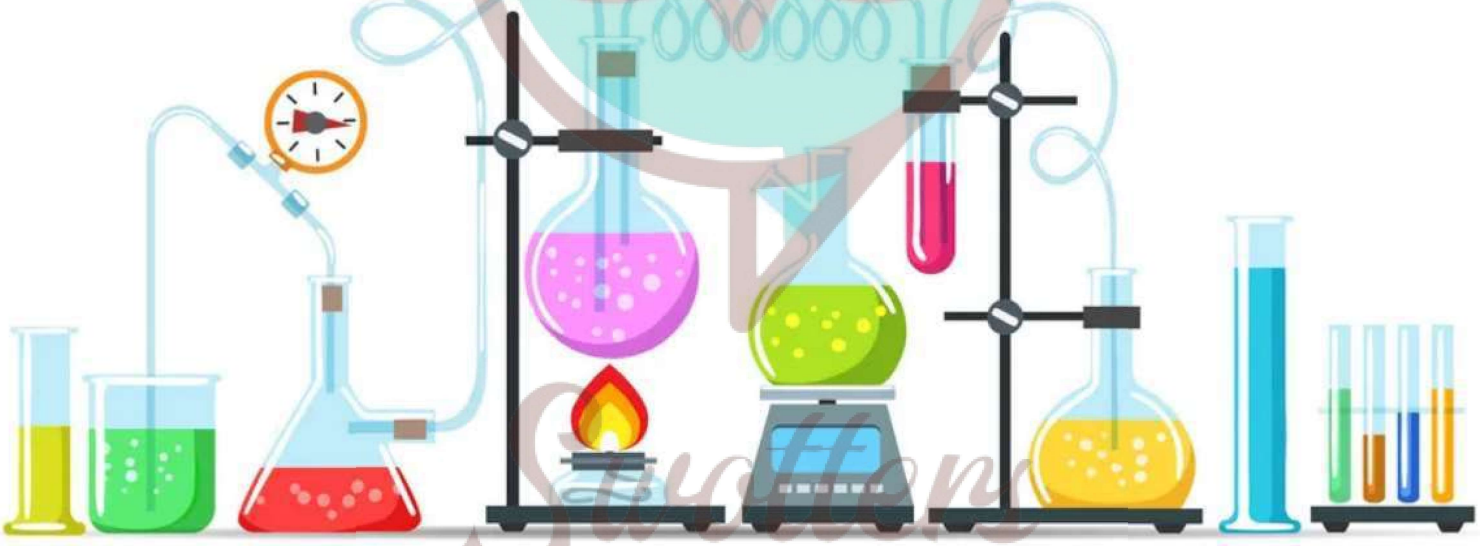
CHEMISTRY



Important Questions

Multiple Choice questions-

Question 1. Which of the following compounds will exhibit geometrical isomerism?

(a) 1 – Phenyl – 2 – butene

(b) 3 – Phenyl – 1 – butene

(c) 2 – Phenyl – 1 butene

(d) 1, 1 – Diphenyl – propene.

Question 2. Hydrocarbon containing following bond is most reactive

(a) C ≡ C

(b) C = C

(c) C – C

(d) All of these

Question 3. A gas decolourised by KMno4 solution but gives no precipitate with ammoniacal cuprous chloride is

(a) Ethene

(b) Propane

(c) Propene

(d) Methane

Question 4. A dibromo derivative of an alkane reacts with sodium metal to form an alicyclic hydrocarbon. The derivative is _____

(a) 1, 4-dibromobutane

(b) 1, 2-dibromoethane

(c) Carbon

(d) None of the above

Question 5. Reaction of HBr with propene in the presence of peroxide gives:

(a) 3 – Bromo propane

(b) Allyl bromide

(c) n – Propyl bromide

(d) Isoproyl bromide

Question 6. Which branched chain isomer of the hydrocarbon with molecular mass 72u gives

only one isomer of mono substituted alkyl halide?

(a) Neopentane

(b) Carbon

(c) Isohexane

(d) Neohexane

Question 7. Aromatic compounds burn with a sooty flame because?

(a) They have a ring structure of carbon atoms

(b) They have a relatively high percentage of hydrogen

(c) They have a relatively high percentage of carbon

(d) They resist reaction with oxygen of air

Question 8. The lowest alkene, that is capable of exhibiting geometrical isomerism is

(a) Ethene

(b) But – 1- ene

(c) But – 2 – ene

(d) Propene

Question 9. Which one of these is NOT TRUE for benzene?

(a) Heat of hydrogenation of benzene is less than the theoretical value

(b) There are three carbon-carbon single bonds and three carbon-carbon double bonds

(c) It forms only one type of monosubstituted product

(d) The bond angle between carbon-carbon bonds is 120o

Question 10. Ethyl benzene cannot be prepared by _____.

(a) Wurtz Reaction

(b) Wurtz Fittig reaction

(c) Clemmensen Reduction

(d) Carbon

Question 11. Propyne on polymerization yields

(a) Mesitylene

(b) Benzene

(c) Ethyl benzene

(d) Propyl benzene.

Question 12. A gas decolourised by KMno4 solution but gives no precipitate with ammoniacal

cuprous chloride is

(a) Ethene

(b) Propane

(c) Propene

(d) Methane

Question 13. Among the following compounds the one that is most reactive towards electrophilic nitration is

(a) Toluene

(b) Benzene

(c) Benzoic Acid

(d) Nitrobenzene

Question 14. HBr reacts with $CH_2 = CH - OCH_3$ under anhydrous conditions at room temperature to give

(a) CH_3CHO and CH_3Br

(b) $BrCH_2CHO$ and CH_3OH

(c) $BrCH_2 - CH_2 - OCH_3$

(d) $H_3C - CHBr - OCH_3$

Question 15. The angle strain in cyclobutane is

(a) 24°44

(b) 29°16

(c) 19°22

(d) 9°44

Very Short:

1. Give different isomers of C4H10 with their I.U.P.A.C. names.
2. Give the I.U.P.A.C. name of the lowest molecular weight alkane that contains a quaternary carbon.
3. Which of the following has the highest boiling point?
   (i) 2-methylpentane
   (ii) 2, 3 – dimethylbutane
   (iii) 2, 2-dimethylbutane.
4. Give the structure of the alkene (C_4H_8) which adds on HBr in the presence and in the

absence of peroxide to give the same product C_4H_9Br.

5. How will you separate propene from propyne?
6. Name two reagents that can be used to distinguish \ between ethene and ethyne.
7. How will you detect the presence of unsaturation in an organic compound?
8. Arrange the following In order of increasing volatility: gasoline, kerosene, and diesel.
9. Arrange the following: HCl, HBr, HI, HF in order of decreasing reactivity towards alkenes.
10. Out of ethylene and acetylene which is more acidic and why?

Short Questions:

1. What are the various products expected when propane reacts with fuming nitric acid?
2. What is aromatization? How will you convert ^hexane into benzene?
3. Give the different conformations of ethane with their

   (i) Sawhorse representation and

   (ii) Newmann Projection formulae.
4. What are the relative stabilities of different conformations of ethane? Is it possible to isolate these at room temperature?
5. What is Saytzeff Rule? What are the expected products when 2-Bromobutane is dehydrohalogenation with ale. KOH?
6. Define Markownikov rule. Explain it with an example.

Long Questions:

1. Alkynes are less reactive than alkenes towards addition reaction even though they contain 2-7t bond. Give reason.
2. Why do addition reactions occur more readily with alkenes & alkynes than with aromatic hydrocarbons?
3. A Hydrocarbon A,ss adds one mole of hydrogen in presence of platinum catalyst from n-Hexane. When A is oxidized vigorously with KMnO4, a single carboxylic acid, containing three carbon atoms is isolated. Give the structure of A & explain.
4. How would you carry out the following conversion?
5. How would you convert the following compounds to benzene?

   (i) Acetylene

   (ii) Benzoic acid

   (iii) Hexane

(iv) Benzene diazonium chloride

Assertion Reason Questions:

1. In the following questions, a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

   Assertion (A) : Toluene on Friedel Crafts methylation gives o– and p–xylene.

   Reason (R) : CH3-group bonded to benzene ring increases electron density at o– and p– position.

   (i) Both A and R are correct and R is the correct explanation of A.

   (ii) Both A and R are correct but R is not the correct explanation of A.

   (iii) Both A and R are not correct.

   (iv) A is not correct but R is correct.

2. In the following questions, a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

   Assertion (A) : Nitration of benzene with nitric acid requires the use of concentrated sulphuric acid.

   Reason (R) : The mixture of concentrated sulphuric acid and concentrated nitric acid produces the electrophile, NO2

   (i) Both A and R are correct and R is the correct explanation of A.

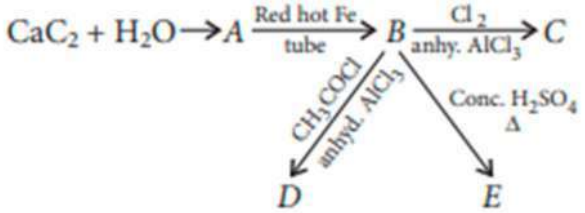
   (ii) Both A and R are correct but R is not the correct explanation of A.

   (iii) Both A and R are not correct.

   (iv) A is not correct but R is correct.

Case Study Based Question:

1. Compound (A) is an important industrial feed stocks, but it's largest use as the fuel for the oxyacetylene torch. It is a colourless, foul smelling gas that burns in air with a yellow, sooty flame.



(1) Identify the product A.

(a) Ethane

(b) Ethyne

(c) Ethene

(d) Methane

(2) The compound (B) formed is:

(a) Cyclohexane

(b) Benzene

(c) Hexane

(d) Cyclopentane.

(3) The product E is:

(a) Nitrobenzene

(b) Benzene sulphonic acid

(c) Both (a) and b

(d) None of these.

(4) Identify the product 'D'.

(a) Chlorobenzene

(b) Bromobenzene

(c) Toluene

(d) Acetophenone

Answer Key:

MCQ

1. (a) 1 – Phenyl – 2 – butene
2. (a) C = C
3. (a) Ethene
4. (a) 1, 4-dibromobutane
5. (c) n – Propyl bromide
6. (a) Neopentane

7. (c) They have a relatively high percentage of carbon

8. (c) But – 2 – ene

9. (b) There are three carbon-carbon single bonds and three carbon-carbon double bonds

10.(a) Wurtz Reaction

11.(a) Mesitylene

12.(a) Ethene

13.(a) Toluene

14.(d) $H_3C – CHBr – OCH_3$

15.(d) 9°44

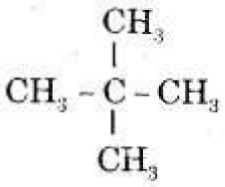
Very Short Answer:

1.

$$\underset{\text{Butane}}{CH_3 - CH_2 - CH_2 - CH_3} \text{ and } \underset{\substack{| \\ CH_3}}{CH_3 - CH - CH_3}$$

2 – Methylpropane

2.



It is and its I.U.P.A.C. name is 2, 2-Dimethylpropane.

3. (i) 2—methyl pentane has the largest surface area and hence has the highest boiling point.

4. 2-Butene with structure $CH_3 – CH = CH — CH_3$ being symmetrical gives the same product, i.e., 2-bromobutane CH_3 CH (Br) CH_2CH_3.

5. Bypassing the mixture through ammoniacal $AgNO_3$ solution when propyne reacts while propene passes over.

6. Tollen's reagent | Ammoniacal $AgNO_3$ | and amm. CuCl solution.

7. Either by Baeyer's reagent

$$\underset{\text{Solution}}{\overset{1\%}{|\text{Alkaline KMnO4}|}}$$

or by Br, in CC14.

8. Diesel, kerosene, gasoline.

9. HF, HCl, HBr, HI..

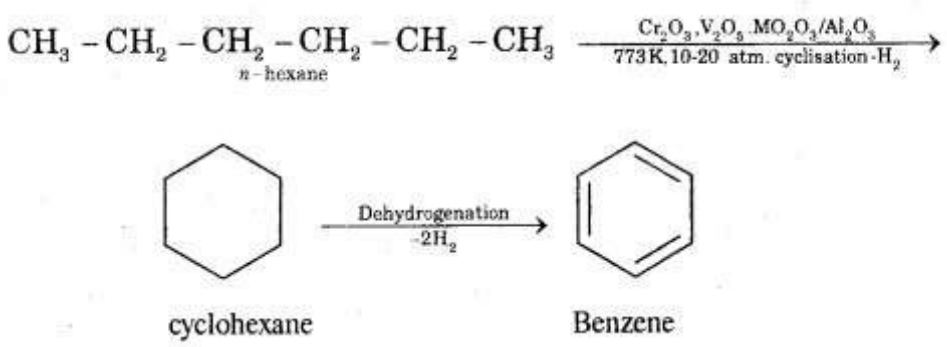
10. Acetylene. Ethylene and acetylene have sp2, sp hybridized C atoms respectively. Due to the 50% S character of the C – H bond of acetylene rather than the 33% S-Character of the C – H bond in ethene, acetylene is more acidic.

Short Answer:

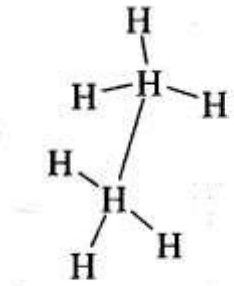
Ans: 1

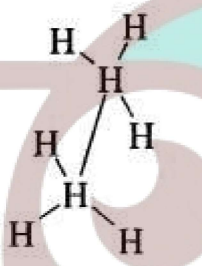
$$\underset{\text{Propane}}{CH_3-CH_2-CH_3} \xrightarrow{\text{Fuming } HNO_3} \begin{cases} CH_3-CH_2-CH_2-NO_2\ (25\%) \\ \qquad\qquad [1\text{-Nitropropane}] \\ CH_3-\underset{\displaystyle NO_2}{\underset{|}{CH}}-CH_3 \quad [2\text{-Nitropropane}\ (40\%)] \\ CH_3CH_2NO_2 \qquad [\text{Nitroethane}\ (10\%)] \\ CH_3-NO_2 \qquad [\text{Nitromethane}\ 25\%] \end{cases}$$

Ans: 2. Aromatization. It is the process that involves cyclization, isomerization, and dehydrogenation with the application of heat and catalyst to convert alkanes containing six or more carbon atoms into aromatic hydrocarbons.



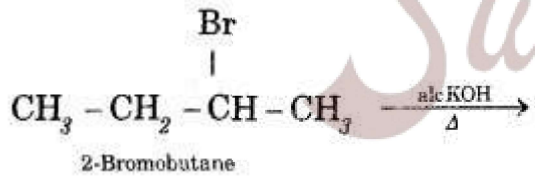
Ans: 3. Sawhorse representation Newmann projection models

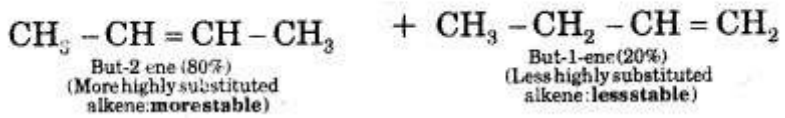




Ans: 4. The staggering form of ethane is more stable than the eclipsed form because the force of repulsion between hydrogen atoms on adjacent C atoms is minimum. The energy difference between the staggered form and eclipsed form of ethane is just 12.55 kJ mol^{-1}. Therefore, it is not possible to separate these two forms of ethane at room temperature.

Ans: 5. The staggering form of ethane is more stable than the eclipsed form because the force of repulsion between hydrogen atoms on adjacent C atoms is minimum. The energy difference between the staggered form and eclipsed form of ethane is just 12.55 kJ mol^{-1}. Therefore, it is not possible to separate these two forms of ethane at room temperature.





Ans: 6. Markownikov rule states. The negative part of the addendum adding to an unsymmetric alkene goes to that C atom of the double bond which is attached to a lesser number of C atoms.

$$CH_3 - \underset{\text{Propene (unsym. alkene)}}{CH = CH_2} + HBr \longrightarrow$$

$$CH_3 - \underset{\underset{Br}{|}}{CH} - CH_3 + CH_3 - CH_2 - CH_2Br$$

2-Bromopropane (chief product) — 1-bromopropane (minor product)

Long Answer:

Ans: 1. This is due to

1. greater electronegativity of sp-hybridized carbon of alkynes than sp^2 hybridized carbon atoms of alkenes which holds the π-electrons of alkynes more tightly and

2. greater delocalization of π-electrons in alkynes (because of the cylindrical nature of their n electron cloud) than in alkenes. As a result, n electrons of alkynes are less easily available for addition reactions than those of alkenes.

Consequently, alkynes are less reactive than alkenes towards addition reactions.

Ans: 2. The energy gained by forming two sigma bonds (of four sigma bonds) more than compensates for the loss of one or two n bonds when addition occurs to an alkene or alkyne. However, in aromatic hydrocarbons, the aromatic ring is specially stabilized by the delocalization of n electrons about the ring.

It, therefore, requires substantial activation energy to cause the loss of its aromatic character. The most usual reaction in arenes is thus substitution rather than addition, since substitution does not result in loss of aromatic character.

Ans: 3.

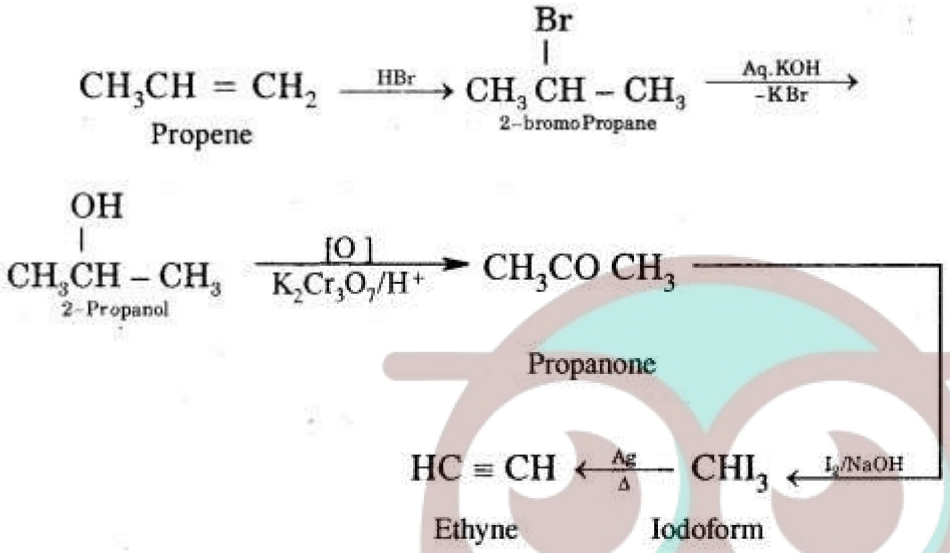
1. Since hydrocarbon A adds one molecule of H_2 in presence of platinum to form n-hexane. A must be a hexene.

2. Since A on vigorous oxidation with $KMnO_4$ gives a single carboxylic acid containing three carbon atoms, therefore, A must be asymmetrical hexene i.e. hex-3-ene.

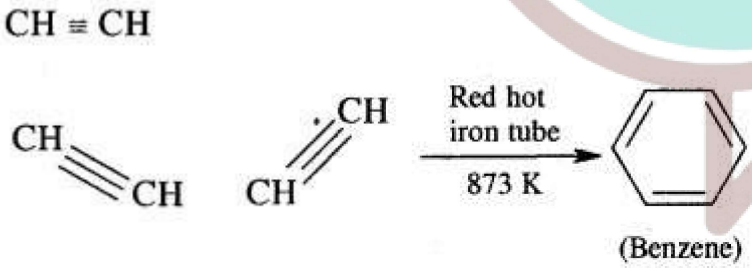
$$\underset{\text{(A)}}{CH_3CH_2\,CH = CH\,CH_2\,CH_3} \xrightarrow[KMnO_4]{O} \underset{\text{propanoic acid}}{2CH_3CH_2\,COOH}$$

Thus, the given hydrocarbon A is hex-3-ene.

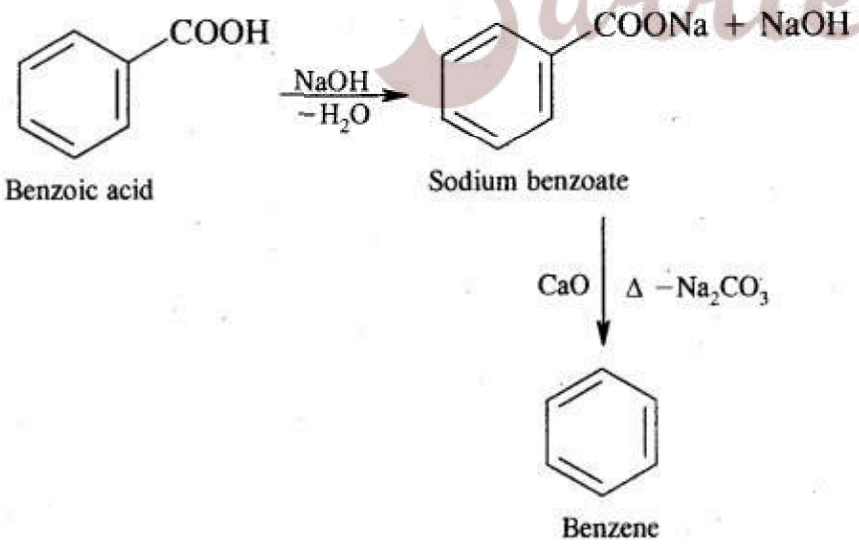
Ans: 4. Propene to Ethyne



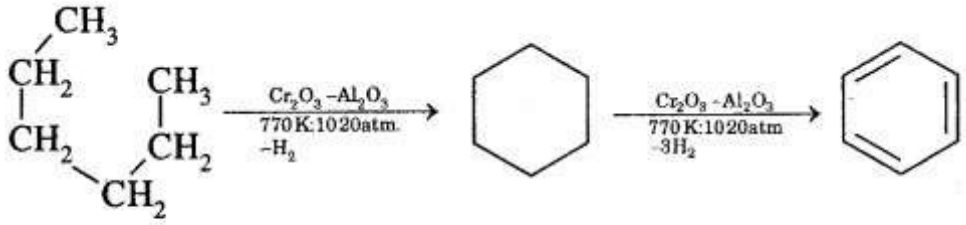
Ans: 5. (i) Acetylene into benzene. Ethyne (Acetylene) in passing through a red hot iron tube at 873 K undergoes cyclic polymerization as shown below.



(ii) Benzoic acid into benzene



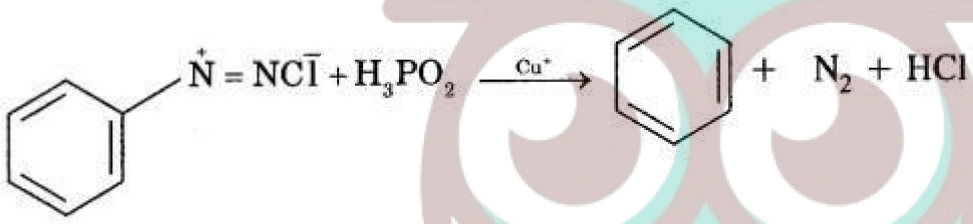
(iii) Hexane into benzene



Hexane Cyclohexane

Benzene

(iv) Benzene diazonium chloride into benzene



Benzene diazonium chloride Benzene

Assertion Reason Answer:

1. (i) Both A and R are correct and R is the correct explanation of A.
2. (i) Both A and R are correct and R is the correct explanation of A.

Case Study Answer:

1. **Answer:**

(1) (b) Ethyne

(2) (c) Hexane

(3) (b) Benzene sulphonic acid

(4) (d) Acetophenone