GOVERNMENT OF KARNATAKA

DEPARTMENT OF SCHOOL EDUCATION (PRE-UNIVERSITY)

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CHAPTERWISE MULTIPLE CHOICE QUESTIONS FOR COMPETATIVE EXAM

SUBJECT: I PUC CHEMISTRY

NAME OF THE CHAPTER: UNIT: 09-HYDROCARBONS

1. Introduction & Classification

Hydrocarbons are organic compounds composed exclusively of carbon and hydrogen atoms. They serve as primary sources of energy (LPG, CNG, LNG, petrol) and act as feedstocks for the synthesis of polymers, drugs, and dyes.

Based on structure, hydrocarbons are broadly classified into two categories:

- Acyclic or Open-Chain Hydrocarbons: Divided into saturated (alkanes) containing only single bonds, and unsaturated (alkenes and alkynes) containing double or triple bonds.
- Cyclic or Closed-Chain Hydrocarbons: Subdivided into alicyclic (cycloalkanes) and aromatic hydrocarbons (arenes).

2. Alkanes (Saturated Hydrocarbons)

Alkanes are saturated open-chain hydrocarbons containing carbon-carbon single bonds. They are also called paraffins (Latin: *parum* = little, *affinis* = affinity) due to their relatively inert chemical behavior under normal conditions.

The general formula for alkanes is C_nH_{2n+2}. All carbon atoms are sp^3 hybridized with a tetrahedral geometry and a bond angle of 109.5°.

A. Nomenclature & Isomerism

Alkanes exhibit structural isomerism, specifically chain isomerism, starting from butane (C_4H_{10}). For example, butane has 2 isomers (n-butane and isobutane), while pentane (C_5H_{12}) has 3 isomers (n-pentane, isopentane, and neopentane).

B. Methods of Preparation

1. From Unsaturated Hydrocarbons (Catalytic Hydrogenation):

$$R-CH=CH_2+H_2 \xrightarrow{Ni/Pt/Pd} R-CH_2-CH_3$$

$$CH_2=CH_2+H_2 \xrightarrow{Ni} CH_3-CH_3$$

2. From Alkyl Halides:
   - Reduction: $R-X+H_2 \xrightarrow{Zn/H^+} R-H+HX$
   - Wurtz Reaction: Used to prepare symmetrical alkanes with an even number of carbon atoms.

$$2R-X+2Na \xrightarrow{Dry\ ether} R-R+2NaX$$

3. From Carboxylic Acids:
   - Decarboxylation (Sada-lime method): Heating sodium salt of carboxylic acid with soda-lime (***NaOH + CaO*** in 3:1 ratio) yields an alkane containing one carbon less than the parent acid.

$$R-COONa+NaOH \xrightarrow[\Delta]{CaO} R-H+Na_2CO_3$$

- Kolbe's Electrolytic Method: Electrolysis of an aqueous solution of sodium or potassium salt of a carboxylic acid gives an alkane with an even number of carbon atoms at the anode.

$$2R-COONa+2H_2O \xrightarrow{\text{Electrolysis}} R-R+2CO_2+H_2+2NaOH$$

C. Physical & Chemical Properties

Physical Properties: Non-polar in nature. Boiling point increases with molecular mass due to increasing van der Waals forces. Branching decreases boiling point because it reduces the surface area.

Chemical Properties:

- Halogenation (Free Radical Substitution): Reactivity order: $F_2 > Cl_2 > Br_2 > I_2$.

$$CH_4+Cl_2 \xrightarrow{h\nu} CH_3-Cl+HCl \xrightarrow{h\nu} CH_2Cl_2 \xrightarrow{h\nu} CHCl_3 \xrightarrow{h\nu} CCl_4$$

- Combustion: Complete oxidation yields carbon dioxide and water with the release of large amounts of heat.

$$C_nH_{2n+2}+\left(\frac{3n+1}{2}\right)O_2 \rightarrow nCO_2+(n+1)H_2O+\Delta H$$

- Controlled Oxidation:

$$2CH_4+O_2 \xrightarrow{Cu\,/\,523\,K\,/\,100\,atm} 2CH_3OH$$

$$CH_4+O_2 \xrightarrow{Mo_2O_3,\Delta} HCHO+H_2O$$

$$2CH_3CH_3+3O_2 \xrightarrow[\Delta]{(CH3\,COO)Mn} 2CH_3COOH$$

- Isomerization: Heating n-alkanes in the presence of anhydrous $AlCl_3$ and HCl gas yields branched chain isomers.
- Aromatization: n-Alkanes having 6 to 10 carbon atoms convert into benzene or its homologues when heated to 773K and 10-20 atm over oxides of Cr, V, or Mo.

$$C_6H_{14} \xrightarrow[773\,K,10-20\,atm]{Cr_2O_3/V_2O_5/Mo_2O_3} C_6H_6$$

- Pyrolysis (Cracking): Decomposition of higher alkanes into lower alkanes/alkenes by heat.

$$C_6H_{14} \xrightarrow{773\,K} \begin{cases} C_6H_{12}+H_2 & \text{(Hexene + Hydrogen)} \\ C_4H_8+C_2H_6 & \text{(butene + Ethane)} \\ C_3H_6+C_2H_4+CH_4 & \text{(Propene + Ethene + Methane)} \end{cases}$$

D. Conformations of Ethane

Conformations are different spatial arrangements of atoms that can be interconverted by rotation around a C-C single bond. Ethane exhibits infinite conformations, primarily studied as two extreme limits:

- Eclipsed Conformation: Hydrogen atoms attached to both carbon atoms are directly in front of each other. Maximum steric hindrance and torsional strain make it less stable.
- Staggered Conformation: Hydrogen atoms are as far apart as possible (dihedral angle = 60°). Minimum strain makes it highly stable.

The energy difference between these two conformations is only 12.5 kJ/mol, which is easily overcome at room temperature.

3. Alkenes (Unsaturated Hydrocarbons)

Alkenes are unsaturated hydrocarbons containing at least one carbon-carbon double bond. They are also

known as olefins (oil-forming) because lower members form oily liquids upon reacting with chlorine. General formula: C_nH_{2n}. Double-bonded carbons are sp^2 hybridized with a planar trigonal geometry (bond angle ~120°). The double bond consists of one strong sigma (σ) bond and one weak pi (π) bond.

A. Isomerism in Alkenes

Alkenes exhibit both structural isomerism (chain and position) and stereoisomerism (Geometrical Isomerism due to restricted rotation about the C=C double bond):

- Cis-isomer: Identical groups are located on the same side of the double bond. It possesses higher dipole moment and boiling point.
- Trans-isomer: Identical groups are located on opposite sides of the double bond. It is more stable due to lower steric repulsion, and has a higher melting point due to symmetry.

B. Methods of Preparation

1. From Alkynes: Controlled partial reduction.
   - Cis-alkene: Reduction with hydrogen in the presence of palladized charcoal partially deactivated with sulfur or quinoline (Lindlar's Catalyst).
   - Trans-alkene: Reduction with sodium in liquid ammonia (Birch Reduction).
2. From Alkyl Halides (Dehydrohalogenation / β-Elimination): Heating with alcoholic KOH.

   $$R\text{-}CH_2\text{-}CH_2\text{-}X \xrightarrow[\Delta]{\text{alc. KOH}} R\text{-}CH{=}CH_2$$

   Ease of dehydrohalogenation follows the order: 3° > 2° > 1° alkyl halides. *Saytzeff's Rule* applies: the highly substituted alkene is preferred.
3. From Vicinal Dihalides (Dehalogenation): Reacting with zinc dust.

   $$R\text{-}CHX\text{-}CHX\text{-}R + Zn \longrightarrow R\text{-}CH{=}CH\text{-}R + ZnX_2$$

4. From Alcohols (Acidic Dehydration): Heating with concentrated H_2SO_4.

   $$R\text{-}CH_2\text{-}CH_2\text{-}OH \xrightarrow{\text{Conc. } H_2SO_4,\,443\text{ K}} R\text{-}CH{=}CH_2 + H_2O$$

C. Chemical Properties

Alkenes readily undergo Electrophilic Addition Reactions due to the presence of easily accessible π electrons.

- Addition of Hydrogen Halides (HX):
  - Markovnikov's Rule: The negative addendum adds to the carbon containing fewer hydrogen atoms.

    $$CH_3\text{-}CH{=}CH_2 + HBr \rightarrow CH_3\text{-}CH(Br)\text{-}CH_3$$

  - Anti-Markovnikov's Effect (Peroxide / Kharasch Effect): In the presence of organic peroxides, addition of HBr (only) to unsymmetrical alkenes goes opposite to Markovnikov's rule.

    $$CH_3\text{-}CH{=}CH_2 + HBr \xrightarrow{\text{Peroxide}} CH_3\text{-}CH_2\text{-}CH_2Br$$

- Addition of Water (Hydration): Forms alcohols in accordance with Markovnikov's rule in the presence of an acid catalyst.
- Addition of Halogens: Addition of Br_2 in CCl_4 results in decoloring of the reddish-orange bromine solution. This serves as an analytical test for unsaturation.
- Ozonolysis: Action of ozone followed by reduction with Zn/H_2O splits the double bond to yield aldehydes and/or ketones. Highly useful in locating the position of double bonds.

- Oxidation (Baeyer's Test): Reaction with cold, dilute, alkaline $KMnO_4$ (Baeyer's Reagent) decolors the purple reagent and yields vicinal glycols.

$$R\text{-}CH{=}CH\text{-}R + O_3 \rightarrow (\text{Ozonide Intermediate}) \xrightarrow{Zn/H_2O} 2R\text{-}CHO + ZnO$$

4. Alkynes (Unsaturated Hydrocarbons)

Alkynes are unsaturated open-chain hydrocarbons containing at least one carbon-carbon triple bond. Their general formula is C_nH_{2n-2}. Triple-bonded carbon atoms are ***sp*** hybridized with a linear shape and a bond angle of 180°. The triple bond contains one sigma (σ) and two pi (π) bonds.

A. Methods of Preparation

1. From Calcium Carbide: Industrial synthesis method.

$$CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$$

2. From Vicinal Dihalides: Double dehydrohalogenation using alcoholic KOH followed by strong base sodamide ($NaNH_2$).

$$R\text{-}CHX\text{-}CH_2X \xrightarrow{\text{alc. KOH}} R\text{-}CX{=}CH_2 \xrightarrow{NaNH_2} R\text{-}C{\equiv}CH$$

B. Chemical Properties

- Acidic Character of Terminal Alkynes: Hydrogen atoms attached to ***sp*** hybridized carbons are acidic due to high s-character (50%), which makes the carbon highly electronegative. They react with sodium metal or sodamide to liberate hydrogen gas.

$$HC{\equiv}CH + Na \rightarrow HC{\equiv}C^-Na^+ + \frac{1}{2}H_2$$

- Electrophilic Addition Reactions: Alkynes add hydrogen, halogens, and hydrogen halides in two successive steps to form alkenes, and then corresponding saturated derivatives.
- Addition of Water (Hydration): Occurs in the presence of Hg^{2+} / H^+ at 333K. Yields carbonyl compounds via tautomerism.

$$HC{\equiv}CH + H_2O \xrightarrow{HgSO_4/H_2SO_4} [CH_2{=}CH\text{-}OH] \xrightarrow{\text{Tautomerism}} CH_3CHO$$

- Cyclic polymerisation: Ethyne undergoes cyclic polymerization when passed through a red-hot iron tube at 873K to form benzene.

$$3C_2H_2 \xrightarrow{\text{Red hot Fe tube, 873 K}} C_6H_6$$

5. Aromatic Hydrocarbons (Arenes)

Aromatic hydrocarbons are cyclic, planar unsaturated systems exhibiting distinct stability due to delocalized π electron clouds. Benzene (C_6H_6) is the simplest parent aromatic hydrocarbon.

A. Nomenclature, Structure & Stability

B. Benzene exhibits a planar regular hexagonal ring where all carbon atoms are sp^2 hybridized. Resonance structures proposed by Kekulé contribute to its resonance hybrid. All C-C bond lengths are identical (139 pm), intermediate between a single (154 pm) and double (134 pm) bond.

C. Hückel's Rule of Aromaticity

For a compound to be classified as aromatic, it must satisfy the following critical structural conditions:

1. The molecule must be cyclic.
2. The molecule must be planar (all ring atoms must be sp^2 or ***sp*** hybridized).

3. There must be complete cyclic delocalization of π electrons in the ring.

4. It must contain $(4n + 2)\pi$ electrons, where $n = 0, 1, 2, 3...$ (an integer).

Systems containing $4n\pi$ electrons are anti-aromatic, while non-planar non-conjugating systems are non-aromatic.

D. Methods of Preparation of Benzene

1. Cyclic Polymerization of Ethyne: $3C_2H_2 \xrightarrow{\text{Red hot Fe tube, 873 K}} C_6H_6$

2. Decarboxylation of Sodium Benzoate: Heating with soda-lime.

$$C_6H_5COONa + NaOH \xrightarrow{CaO,\Delta} C_6H_6 + Na_2CO_3$$

3. Reduction of Phenol: Distillation with zinc dust.

$$C_6H_5OH + Zn \xrightarrow{\Delta} C_6H_6 + ZnO$$

E. Chemical Properties & Electrophilic Substitution (SE) Mechanisms

Due to the preservation of aromatic resonance stability, benzene undergoes Electrophilic Aromatic Substitution (S_EAr) rather than regular addition reactions.

Reaction	Reagents Used	Electrophile	Principal Product
Halogenation	Cl_2 + Anhydrous $FeCl_3$	Chloronium ion (Cl^+)	Chlorobenzene (C_6H_5Cl)
Nitration	Conc. HNO_3 + Conc.H_2SO_4	Nitronium ion (NO_2^+)	Nitrobenzene ($C_6H_5NO_2$)
Sulfonation	Fuming H_2SO_4 (Oleum)	Sulfur trioxide (SO_3)	Benzenesulfonic acid ($C_6H_5SO_3H$)
Friedel-Crafts Alkylation	R-Cl + Anhydrous $AlCl_3$	Alkyl carbocation (R^+)	Alkylbenzene (C_6H_5R)
Friedel-Crafts Acylation	RCOCl + Anhydrous $AlCl_3$	Acylium ion (RCO^+)	Acylbenzene (C_6H_5COR)

General Mechanism of Electrophilic Aromatic Substitution

1. Generation of the Electrophile: Interaction of the reagent with a Lewis acid catalyst generates a strong electrophile (E^+).
2. Formation of Arenium Ion (Sigma Complex): The electrophile attacks the aromatic ring, creating a resonance-stabilized carbocation intermediate (arenium ion), which temporarily loses its aromaticity.
3. Removal of Proton: A weak base abstracts a proton (H^+) from the sp^3 hybridized carbon of the sigma complex, restoring the aromatic stability of the ring system.

Directive Influence of Functional Groups

When mono-substituted benzene undergoes further electrophilic substitution, the existing substituent determines the incoming group's orientation:

• Ortho and Para Directing Groups (Activating Groups): Groups that increase electron density on ortho and

para positions via inductive or resonance (+R) effects. Examples: ***-OH, -NH_2, -OCH_3, -CH_3***. (Halogens are deactivating but ortho/para directing due to competing -I and +R effects).

- Meta Directing Groups (Deactivating Groups): Groups that withdraw electron density from the aromatic ring, specifically leaving the meta position relatively more electron-rich than ortho/para via resonance (-R) effects. Examples: ***-NO_2, -CN, -CHO, -COOH, -SO_3H***.

6. Carcinogenicity & Toxicity

Benzene and polynuclear aromatic hydrocarbons containing more than two fused benzene rings (e.g., 3,4-benzopyrene, 1,2-benzanthracene) are formed during the incomplete combustion of organic substances like tobacco, coal, and petroleum. They enter the human body and undergo biochemical oxidation to form reactive epoxides, which bind covalently to DNA, causing genetic mutations and triggering carcinogenic (cancer-inducing) activity.

IUPAC Nomenclature & Isomerism

1. What is the correct IUPAC name for $(CH_3)_2CH-CH_2-CH(CH_3)_2$?

   (a) 2,4-Dimethylpentane (b) 2,2-Dimethylpentane

   (c) 1,1,3,3-Tetramethylpropane (d) 2,3-Dimethylpentane

2. How many structural isomers are possible for the molecular formula C_5H_{12}?

   (a) 3 (b) 4

   (c) 5 (d) 6

3. Which of the following compounds exhibits geometrical (cis-trans) isomerism?

   (a) Propene (b) 1-Butene

   (c) 2-Butene (d) 2-Methylpropene

4. The IUPAC name of HC≡C-CH=CH-CH_3 is:

   (a) Pent-3-en-1-yne (b) Pent-1-yn-3-ene

   (c) Pent-2-en-4-yne (d) Pent-4-yn-2-ene

5. What is the hybridization state of each carbon in $CH_2=C=CH_2$ (allene) respectively?

   (a) sp^2, sp, sp^2 (b) sp^2, sp^2, sp^2

   (c) sp^3, sp, sp^3 (d) sp, sp^2, sp

6. The IUPAC name of $C_6H_5-CH_2-CH_2-CH_3$ is:

   (a) 1-Phenylpropane (b) 3-Phenylpropane

   (c) Propylbenzene (d) Both A and C are accepted

7. Which type of isomerism is shown by Pentan-2-one and Pentan-3-one?

   (a) Chain isomerism (b) Position isomerism

   (c) Functional isomerism (d) Tautomerism

8. Dihedral angle in the staggered conformation of ethane is:

   (a) 0° (b) 60°

   (c) 120° (d) 180°

9. Statement I: Staggered conformation of ethane is more stable than the eclipsed conformation.
Statement II: The torsional strain in staggered conformation is more.
Read the above statements and choose the correct answer from the options given below. **[KCET 2026]**

(a) Both Statement I and Statement II are true.
(b) Both Statement I and Statement II are false.
(c) Statement I is true, but Statement II is false.
(d) Statement I is false, but Statement II is true.

Alkanes — Preparation, Physical & Chemical Properties

10. Sodium salt of which carboxylic acid on Kolbe's electrolysis yields ethane?

(a) Sodium formate
(b) Sodium acetate
(c) Sodium propionate
(d) Sodium butyrate

11. In the preparation of alkanes from alkyl halides using Wurtz reaction, the metal used is:

(a) Magnesium in dry ether
(b) Sodium in dry ether
(c) Zinc in dilute HCl
(d) Copper powder

12. Decarboxylation of sodium benzoate with soda lime gives:

(a) Methane
(b) Ethane
(c) Benzene
(d) Toluene

13. The chlorination of methane in presence of sunlight follows which mechanism?

(a) Electrophilic substitution
(b) Free radical substitution
(c) Nucleophilic substitution
(d) Electrophilic addition

14. Boiling point of alkanes increases with:

(a) Increase in branching
(b) Increase in molecular mass
(c) Decrease in surface area
(d) Decrease in van der Waals forces

15. When methane reacts with steam at 1273 K in the presence of Nickel catalyst, it produces:

(a) $CO + H_2$
(b) $CO_2 + H_2O$
(c) CH_3OH
(d) HCHO

16. Controlled oxidation of methane with molybdenum trioxide (Mo_2O_3) catalyst gives:

(a) Methanol
(b) Methanal (Formaldehyde)
(c) Methanoic acid
(d) Carbon monoxide

17. Alkane which cannot be synthesized by Wurtz reaction:

(a) Ethane
(b) Methane
(c) n-Butane
(d) n-Hexane

18. Conformers of a compound differ in:

(a) Molecular formula
(b) Structural formula
(c) Dihedral angle and potential energy
(d) Position of functional group

19. Alkanes are paraffinic in nature because:

(a) They are highly reactive
(b) They are insoluble in water
(c) They have little affinity towards reagents
(d) They contain double bonds

20. Which of the following has the highest boiling point?

(a) 2,2-Dimethylpropane (b) 2-Methylbutane

(c) n-Pentane (d) Isobutane

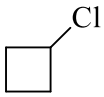
21. Pyrolysis or cracking of alkanes involves:

(a) Breakdown of higher alkanes into smaller hydrocarbons by heat

(b) Addition of hydrogen across double bonds

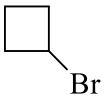
(c) Oxidation to carboxylic acids (d) Isomerization to branched alkanes

22. The major product formed when 1-bromo-3-chlorocyclobutane reacts with metallic sodium in dry ether is: **[KCET 2025]**

(a) 

(b) 

(c) 

(d) 

23. Sodium ethanoate on heating with soda lime gives 'X'. Electrolysis of aqueous solution of sodium ethanoate gives 'Y'. 'X' and 'Y' respectively are: **[KCET 2024]**

(a) Methane and Ethane (b) Methane and Methane

(c) Ethane and Methane (d) Ethane and Ethane

24. 2-Methyl propane can be prepared by Wurtz reaction. The haloalkanes taken along with metallic sodium and dry ether are: **[KCET 2024]**

(a) Chloromethane and 2-chloropropane (b) Chloroethane and chloromethane

(c) Chloroethane and 1-chloropropane (d) Chloromethane and 1-chloropropane

25. The alkyl halides required to prepare 2,3-dimethylbutane by Wurtz reaction are: **[KCET 2018]**

(a) 2-chloropropane only (b) Chloromethane and 1-chloropropane

(c) Chloroethane and 2-chloropropane (d) Chloromethane and 2-chlorobutane

26. n-Propyl chloride reacts with sodium metal in dry ether to give: **[KCET 2018]**

(a) $CH_3–CH_2–CH_2–CH_2–CH_2–CH_3$ (b) $CH_3–CH_2–CH_3$

(c) $CH_3–CH_2–CH_2–CH_3$ (d) $CH_3–CH_2–CH_2–CH_2–CH_2–CH_2–CH_3$

27. For the preparation of alkanes, aqueous solution of sodium or potassium salt of carboxylic acid is subjected to: **[KCET 2017]**

(a) Hydrolysis (b) Oxidation

(c) Hydrogenation (d) Electrolysis

Alkenes — Preparation, Addition Reactions & Mechanisms

28. Propene reacts with HBr in the presence of peroxide to give:

(a) 1-Bromopropane (b) 2-Bromopropane

(c) 1,2-Dibromopropane (d) 2,2-Dibromopropane

29. Ozonolysis of 2-methylbut-2-ene followed by reduction with Zn/H_2O yields:

(a) Propanone and Ethanal
(b) Propanal and Ethanal
(c) Propanone and Methanal
(d) Ethanal and Ethanal

30. When propene is treated with HCl in the presence of benzoyl peroxide, the major product is:

(a) 1-Chloropropane
(b) 2-Chloropropane
(c) 1,2-Dichloropropane
(d) Propyl peroxide

31. Dehydration of ethanol with concentrated H_2SO_4 at 443 K gives:

(a) Diethyl ether
(b) Ethene
(c) Ethane
(d) Ethyne

32. Cold alkaline $KMnO_4$ solution is known as:

(a) Tollens' Reagent
(b) Baeyer's Reagent
(c) Fehling's Reagent
(d) Grignard Reagent

33. Vicinal dihalides on heating with zinc dust in ethanol undergo dehalogenation to form:

(a) Alkanes
(b) Alkenes
(c) Alkynes
(d) Cycloalkanes

34. The geometry of double bonded carbon atoms in alkenes is:

(a) Linear
(b) Trigonal planar
(c) Tetrahedral
(d) Pyramidal

35. In Markovnikov's rule, the electrophile adds to which carbon of the double bond?

(a) Carbon with more hydrogens
(b) Carbon with fewer hydrogens
(c) Any carbon equally
(d) Terminal carbon only

36. In the given sequence of reactions, identify 'P', 'Q', 'R' and 'S' respectively: **[KCET 2024]**

$$CH_2=CH_2 \xrightarrow{P} CH_2Br-CH_2Br \xrightarrow{Q} CH_2=CH-Br \xrightarrow{R} CH\equiv CH \xrightarrow{S} C_6H_6$$

(a) Br_2, Alc. KOH, NaOH, Al_2O_3
(b) HBr, Alc. KOH, CaC_2, $KMnO_4$
(c) HBr, Alc. KOH, $NaNH_2$, Red hot iron tube
(d) Br_2, Alc. KOH, $NaNH_2$, Red hot iron tube

37. Identify A and B in the reaction:

$$\text{Propene} \xrightarrow{\text{HBr, Benzoyl peroxide}} A\ (\text{Major product}) \xrightarrow{HI} B\ (\text{Major product})$$ **[KCET 2022]**

(a) A = CH_3–CH(Br)–CH_3, B = CH_3–CH_2–CH_2I
(b) A = CH_3–CH_2–CH_2Br, B = CH_3–CH(I)–CH_3
(c) A = CH_3–CH_2–CH_2Br, B = CH_3–CH_2–CH_2I
(d) A= CH_3–CH(Br)–CH_3, B = CH_3–CH(I)–CH_3

38. When the vapours of tertiary butyl alcohol are passed through heated copper at 573 K, the product formed is: **[KCET 2018]**

(a) But-2-ene
(b) 2-Butanone
(c) 2-Methylpropene
(d) Butanal

Alkynes — Acidity, Preparation & Polymerization

39. When ethyne is passed through a red-hot iron tube at 873 K, it undergoes cyclic polymerization to form:

(a) Cyclohexane (b) Benzene

(c) Cyclooctatetraene (d) Toluene

40. Acidic hydration of ethyne in the presence of $HgSO_4$ /dil. H_2SO_4 at 333 K yields:

(a) Ethanol (b) Ethanal

(c) Propanone (d) Methanal

41. The hybridization of carbon atoms in ethyne (acetylene) is:

(a) sp^3 (b) sp^2

(c) sp (d) dsp^2

42. Compare the acidic strength of: Ethane (I), Ethene (II), Ethyne (III).

(a) I > II > III (b) III > II > I

(c) II > III > I (d) III > I > II

43. Calcium carbide on reaction with water liberates:

(a) Methane (b) Ethane

(c) Ethene (d) Ethyne

44. When 1,1-dibromopropane is treated with excess alcoholic KOH followed by $NaNH_2$, product obtained is:

(a) Propene (b) Propyne

(c) Propane (d) 1-Bromopropene

45. Propyne reacts with 2 moles of HBr to give:

(a) 1,2-Dibromopropane (b) 2,2-Dibromopropane

(c) 1,1-Dibromopropane (d) 1,3-Dibromopropane

46. The linear molecule among the following is:

(a) Ethene (b) Ethane

(c) Ethyne (d) Benzene

47. But-1-yne on reaction with dil. H_2SO_4 in presence of Hg^{2+} ions at 333 K gives: **[KCET 2024]**

(a) Butan-2-one (b) Butanal

(c) Butan-1-ol (d) Butan-2-ol

48. 2-Butyne is reduced to trans-but-2-ene using: **[KCET 2019]**

(a) H_2 / Pd–C (b) Zn in dil. HCl

(c) H_2 / Ni (d) Na in liq. NH_3

49. The reagent 'X' used for the following reaction is:

$$R-C\equiv C-R' + H_2 \xrightarrow{X} \text{cis}-\text{alkene}$$ **[KCET 2018]**

(a) Ni (b) Pd/C (Lindlar's catalyst)

(c) $LiAlH_4$ (d) Na / liquid NH_3

Aromatic Hydrocarbons & Electrophilic Substitution

50. Which of the following is NOT an aromatic compound according to Hückel's rule?

(a) Benzene (b) Naphthalene

(c) Cyclooctatetraene (d) Anthracene

51. In Friedel-Crafts alkylation of benzene with CH_3Cl, the electrophile species is:

(a) Cl^+ (b) CH_3^+

(c) $AlCl_4^-$ (d) $CH_3-Cl...AlCl_3$ complex

52. Nitration of benzene is carried out using conc. HNO_3 and conc. H_2SO_4. The electrophile generated is:

(a) NO_2^+ (b) NO_2^-

(c) NO_3^- (d) HNO_2

53. Benzene reacts with CH_3COCl in presence of anhydrous $AlCl_3$ to form acetophenone. This reaction is:

(a) Friedel-Crafts Alkylation (b) Friedel-Crafts Acylation

(c) Wurtz-Fittig Reaction (d) Kolbe's Reaction

54. Which group acts as ortho- and para-directing but deactivating towards electrophilic aromatic substitution?

(a) -OH (b) $-CH_3$

(c) -Cl (Halogens) (d) $-NO_2$

55. According to Hückel's rule, a cyclic planar conjugated polyene is aromatic if it contains:

(a) $4n$ π electrons (b) $(4n + 2)$ π electrons

(c) $(2n + 2)$ π electrons (d) $(4n - 2)$ π electrons

56. Benzene reacts with chlorine in the presence of UV light (sunlight) to form:

(a) Chlorobenzene (b) Hexachlorobenzene

(c) Benzene hexachloride (BHC/Gammexane) (d) 1,2-Dichlorobenzene

57. Which of the following is a potent carcinogen and mutagen formed during incomplete combustion of tobacco?

(a) 3,4-Benzpyrene (b) Methane

(c) Ethane (d) Toluene

58. Identify 'X' in the following reaction: $\text{Benzene} + 6\,Cl_2 \xrightarrow[\text{dark, cold}]{\text{Anhyd. } AlCl_3} X + 6\,HCl$ **[KCET 2020]**

(a) Hexachlorobenzene (b) Benzene hexachloride

(c) Chlorobenzene (d) 1,4-Dichlorobenzene

59. The number of π-bonds and σ-bonds present in naphthalene are respectively: **[KCET 2019]**

(a) 5, 11 (b) 5, 20

(c) 6, 19 (d) 5, 19

Answer Key:

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
a	**a**	**c**	**a**	**a**	**c**	**b**	**b**	**c**	**b**
11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
b	**c**	**b**	**b**	**a**	**b**	**b**	**c**	**c**	**c**
21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
a	**c**	**a**	**a**	**a**	**a**	**d**	**a**	**a**	**b**
31.	32.	33.	34.	35.	36.	37.	38.	39.	40.
b	**b**	**b**	**b**	**a**	**d**	**c**	**c**	**b**	**b**
41.	42.	43.	44.	45.	46.	47.	48.	49.	50.
c	**b**	**d**	**b**	**b**	**c**	**a**	**d**	**b**	**c**
51.	52.	53.	54.	55.	56.	57.	58.	59.	
b	**a**	**b**	**c**	**b**	**c**	**a**	**b**	**d**	

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