14. ALKYNES

SOLUTIONS

TEACHING TASK

JEE MAINS LEVEL QUESTIONS

1. Which of the following method is not used in the preparation of Acetylene
   A) Dehydrohalogenation B) Dehalogenation
   C) Hydrolysis D) dehydrogenation

Answer:D

Solution:Dehydrogenation refers to the removal of hydrogen atoms, and while it's a common reaction in organic chemistry, it's not the primary method for producing acetylene. Dehydrohalogenation and dehalogenation, on the other hand, are commonly used. Hydrolysis can also be used in certain circumstances.

2. Action of zinc on tetrabromoethane gives **(FA & SA- 2 Marks)**
   A) CH_3 - OH B) CH ≡ CH C) CH_3 - CH_3 D) CH_2 = CH_2

Answer:B

Solution:Tetrabromoethane = CBr_2–CBr_2 (1,1,2,2-tetrabromoethane)
Zn removes Br_2 molecules → (acetylene).

3. What is the product formed when acetylene reacts with hypochlorous acid
   A) CH_3COCl B) $ClCH_2CHO$ C) Cl_2CHCHO D) $ClCH_2COOH$

Answer:B

Solution:When acetylene (C_2H_2) reacts with hypochlorous acid (HOCl), one chlorine** and one hydroxyl group add across the triple bond, forming chloroacetaldehyde ($ClCH_2CHO$).

$$HC \equiv CH + HOCl \rightarrow ClCH_2CHO$$

4. What is the product when acetylene reacts with HCN
   (FA & SA- 3 Marks/4 Marks)
   A) CH_3COCl B) $CH_2 = CH - CN$ C) Cl_2CHCHO D) $ClCH_2COOH$

Answer:B

Solution: $HC \equiv CH + HCN \rightarrow CH_2 = CH - CN$

5. The intermediate compound formed when acetylene is hydrated in presence of dil. H_2SO_4 and $HgSO_4$ is
   A) Acetaldehyde B) Ethenol
   C) Vinyl chloride D) Ethenal

Answer:B

Solution: $CH \equiv CH \xrightarrow[HgSO_4]{H_2SO_4, H_2O} CH_2 = CHOH \rightarrow CH_3CHO$

The hydration first gives vinyl alcohol (ethenol) as an intermediate, which tautomerises to acetaldehyde (ethanal)

6. The acidic nature of hydrogens in acetylene cannot be explained by the reaction with

A) Sodium metal B) Ammonical cuprous chloride solution

C) Ammonical silver nitrate solution D) HCN

Answer:D

Solution:Acidic H in acetylene reacts with:

Na metal $\rightarrow$ sodium acetylide

Ammoniacal Cu_2Cl_2 $\rightarrow$ red Cu_2C_2 precipitate

Ammoniacal $AgNO_3$ $\rightarrow$ white Ag_2C_2 precipitate

HCN $\rightarrow$ no reaction of acidic H with HCN; HCN is acidic itself, so no acid–base reaction

7. Westron is the solvent obtained by the reaction of chlorine with

A) Ethylene B) Ethyne

C) Ethane D) Methane

Answer:B

Solution:Westron is a trade name for tetrachloroethane used as a solvent.

It is produced by chlorination of acetylene (ethyne):

$HC \equiv CH + 2Cl_2 \rightarrow CHCl_2 - CHCl_2$

8. The number of acidic hydrogen atoms in 1- butyne and 2- butyne respectively are

A) 1,0 B) 0,1 C) 1,1 D) 1,2

Answer:A

Solution:An acidic hydrogen is a hydrogen atom in a molecule that can be easily removed (released) as H^+ ion (proton) when it reacts with a base or metal like sodium

1-Butyne: $CH \equiv C–CH_2–CH_3$

The hydrogen attached to the terminal carbon of the triple bond (sp-hybridized) is acidic.

Only one hydrogen is attached to that terminal sp-carbon.

Acidic Hydrogens =1

2-Butyne: $CH_3–C \equiv C–CH_3$

In 2-butyne, both triple-bonded carbons are attached to alkyl groups (CH_3).

No hydrogen is directly attached to the sp-hybridized carbons.

Therefore, no terminal hydrogen $\rightarrow$ no acidic hydrogen.

Acidic Hydrogens = 0

9. Acetylene does not show which of the following reactions ?

A) Condensation B) Polymerization

C) Addition reactions D) Combustion reaction

Answer:A

Solution:Acetylene undergoes addition, polymerization, and combustion reactions — but not condensation.

10. The final product formed when ethyne and acetic acid react is
    A) Vinyl acetate B) Ethyl acetate
    C) Acetylene acetic acid D) Ethylidene acetate

Answer:A

Solution: $CH \equiv CH + CH_3COOH \xrightarrow{Hg^{2+}} CH_2 = CHOCOCH$

Ethyne (acetylene) reacts with acetic acid in the presence of Hg^{2+} catalyst to form vinyl acetate

11. When alkyl substituted acetylene udergoes addtion with hydrogen in presence of Lindlar's cataylst, the alkene formed is
    A) A mixture of cis and trans
    B) Trans product only
    C) cis product only
    D) In presence of Lindlar's catalyst, addition does not take place

Answer:C

Solutions:Lindlar's catalyst is a poisoned palladium catalyst (palladium deposited on calcium carbonate or barium sulfate and treated with lead salts/quinoline).
This catalyst is specifically designed to perform the partial hydrogenation of alkynes to alkenes and stop the reaction at the alkene stage.
The reaction occurs via a syn addition mechanism, where both hydrogen atoms add to the same face (side) of the triple bond.
Syn addition of hydrogen to an alkyne results exclusively in the formation of a cis (or Z) alkene product.

12. The compounds used in plastic industry and polymer industry respectively are
    A) Vinyl acetate & Vinylcyanide B) Vinyl cyanide & Vinyl acetate
    C) Acrylonitrile & Ethylidene D) Ethylidene cyanide & Vinyl cyanide

Answer:B

Solution:Vinyl cyanide (also known as acrylonitrile) is a vital monomer used in the plastic industry for the manufacture of important plastics such as polyacrylonitrile (PAN) and ABS plastic.
Vinyl acetate is an important precursor used in the polymer industry for making a wide range of polymers and copolymers, including polyvinyl acetate (PVAc), ethylene-vinyl acetate (EVA) copolymers, and polyvinyl alcohol (PVOH). These polymers are used in adhesives, paints, and other applications within the broader polymer industry.

13. The monosodium salt of acetylene on treating with methyl chloride forms

(FA & SA- 5 Marks/8 Marks)

A) $CH \equiv C.COOH$ B) $CH \equiv C - CH_3$ C) $CH_3C \equiv CCH_3$ D) $CH \equiv C.CH_2CH_3$

Answer:B

Solution: $HC \equiv CH \xrightarrow{Na} HC \equiv C^{-}Na^{+} + CH_3 - Cl \rightarrow HC \equiv C - CH_3 + NaCl$

14. The number of π bonds in westron
A) 0 B) 1 C) 2 D) 3

Answer:A

Solution:Westron is the common name for 1,1,2,2-tetrachloroethane (chemical formula: $CHCl_2CHCl_2$).The structure of 1,1,2,2-tetrachloroethane consists of a single bond between the two carbon atoms, and each carbon atom is bonded to two chlorine atoms and one hydrogen atom by single bonds.The molecule only contains single (sigma) bonds.
There are no double or triple bonds present in the structure.
Therefore, the total number of pi bonds in westron is 0.

$$H - C \equiv C - H \xrightarrow[CCl_4]{Cl_2} H - \underset{\displaystyle Cl}{\overset{\displaystyle Cl}{\underset{|}{\overset{|}{C}}}} - \underset{\displaystyle Cl}{\overset{\displaystyle Cl}{\underset{|}{\overset{|}{C}}}} - H$$

15. 'x' on ozonolysis gives a dial while 'y' reacts with Baeyer's reagent to give a diol. Then 'x' and 'y' respectively are
A) C_2H_2 & C_6H_6 B) C_2H_4 & C_2H_2
C) C_2H_2 & C_2H_4 D) C_2H_4 & C_6H_6

Answer:B

Solution:x = C_2H_2 (acetylene): ozonolysis of acetylene gives glyoxal (OHC–CHO), a dialdehyde.
y = C_2H_4 (ethene): Baeyer's reagent (cold $KMnO_4$) converts ethene to ethylene glycol (a diol)

16. In the following sequence of reactions the product (D) is

$$CH \equiv CH \xrightarrow{HBr} A \xrightarrow{HBr} B \xrightarrow{alcKOH} C \xrightarrow{NaNH_2} D.\ D\ is$$

A) Ethanol B) Ethyne C) Ethanal D) Ethene

Answer:B

Solution:

$$CH \equiv CH \xrightarrow{HBr} CH_2 = CH - Br \xrightarrow{HBr} CH_3 - \underset{\displaystyle Br}{\overset{\displaystyle H - Br}{\underset{|}{\overset{|}{C}}}} \xrightarrow{alcKOH} CH_2 = CH - Br \xrightarrow{NaNH_2} CH \equiv CH$$

17. 1-Butyne reacts with cold alkaline $KMnO_4$ to produce

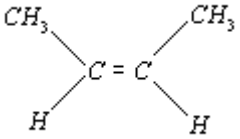
A) CH_3CH_2COOH B) $CH_3CH_2CH_2COOH$

C) $CH_3CH_2COOH + CO_2$ D) $CH_3CH_2COOH + HCOOH$

Answer:C

Solution:Cold alkaline $KMnO_4$ does syn dihydroxylation of double bonds, but 1-butyne is an alkyne.
Alkynes with cold, dilute $KMnO_4$ can give a-diketones, but terminal alkynes get oxidized to carboxylic acids + CO_2.
1-Butyne: $CH\equiv C–CH_2–CH_3 \rightarrow$ terminal alkyne oxidation:
$CH\equiv C–CH_2–CH_3 \rightarrow CO_2 + CH_3–CH_2–COOH$ (propanoic acid).

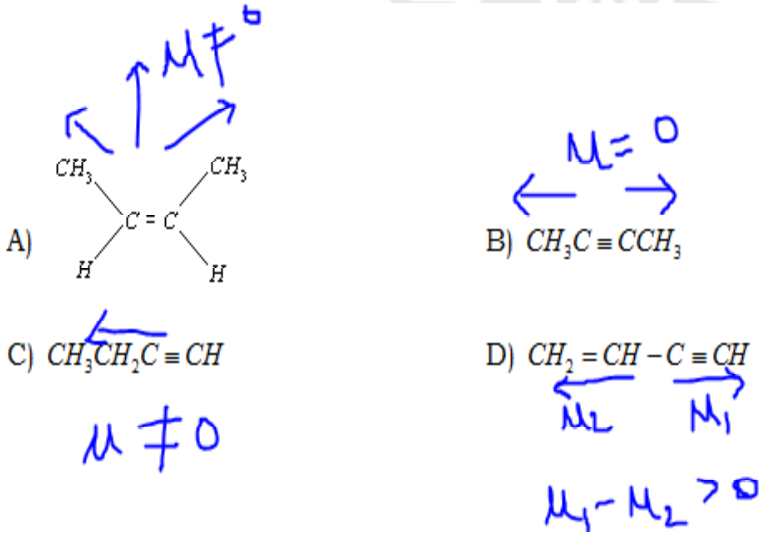
18. Which of the following compound has the lowest dipole moment

A)  B) $CH_3C \equiv CCH_3$

C) $CH_3CH_2C \equiv CH$ D) $CH_2 = CH - C \equiv CH$

Answer:B

Solution:



19. $CH \equiv CH \xrightarrow{NaNH_2} A \xrightarrow{CH_3Br} B$. B is

A) $CH_2 = CH - CH = CH_2$ B) $HC \equiv C - CH_3$

C) $CH_2 = CH - CH_3$ D) $CH_3 - CH_2 - CH_3$

Answer:B

Solution:

$$CH \equiv CH \xrightarrow[Base]{NaNH_2} CH \equiv C^- Na^+ \xrightarrow[-NaBr]{CH_3BR} CH \equiv C - CH_3$$

20. Hydration of ethyne to ethanal takes place through the formation of

A) $CH_3CH(OH)_2$ B) $CH_2=CHOH$ C) $CH_2=CHO^-$ D) $CH\equiv C^-$

Answer:B

Solution:Mechanism:

C_2H_2 + H_2O (H^+, Hg^{2+}) $\rightarrow$ vinyl alcohol (CH_2=CH–OH) (enol) $\rightarrow$tautomerizes to CH_3–CHO.

Intermediate = CH_2=CH–OH.

21. A compound on dehydrohalogenation with alcoholic KOH gives alkyne but on dehalogenation with zinc dust gives alkene. The compound is

A) C_2H_5Br B) CH_3 CH Br_2

C) CH_2Br -CH_2Br D) CH Br_2 - $CHBr_2$

Answer:C

Solution:Alcoholic KOH (strong base) does two eliminations on a vicinal dibromide to give an alkyne (e.g. acetylene from 1,2-dibromoethane). Zinc dust (reductive dehalogenation) converts vicinal dihalides to the alkene (ethene)

22. $CaC_2 \xrightarrow{Hydrolysis} A \xrightarrow{HgSO_4+dil.H_2SO_4} B$. B is

A) Acetylene B) Acetaldehyde

C) Acetone D) Acetic acid

Answer:B

Solution: $CaC_2 \xrightarrow{2H_2O} Ca(OH)_2 + C_2H_2(A)$

$C_2\ H_2 + H_2\ O\ (HgSO_4,\ dil\ H_2\ SO_4) \rightarrow CH_3\ CHO\ (B)$

23. $CaC_2 + H_2O \rightarrow A + B \xrightarrow{1mole\,Na}$

$C \xrightarrow{C_2H_5I} D$. D is

A) 1-butene B) Propene

C) 1-pentene D) 1 - Butyne

Answer:D

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

$A = C_2H_2$.

$B = Ca(OH)_2$.

$A + 1$ mole Na.

$C_2H_2 + Na \longrightarrow Na^+C_2H^- + \frac{1}{2}H_2$

$C = NaC\equiv CH$ (Monosodium acetylide)

Solutio:

$C + C_2H_5I \rightarrow D$.

$NaC\equiv CH + C_2H_5I \longrightarrow CH\equiv C-C_2H_5 + NaI$.

$D = CH\equiv C-C_2H_5$

24. $\underset{\underset{Cl}{|}}{CH_2}-\underset{\underset{Cl}{|}}{CH_2} \xrightarrow{Alc.\,KOH} A \quad A \xrightarrow{One\ mole\ HCl} B'B'\ is$

A) Ethyl chloride B) 1,2 dichloro ethene
C) Vinyl chloride D) Ethylidine chloride

Answer:C

$Cl-CH_2-CH_2-Cl \xrightarrow{Alc.KOH} CH\equiv CH + 2HCl$.
$\downarrow$
A.

Solution: $CH\equiv CH + HCl \longrightarrow \underbrace{CH_2=CHCl}$.
B → Vinyl chloride.

25. $CH \equiv CH \xrightarrow{HCl} A \xrightarrow{Polymersiation} B$ The polymer 'B' is

A) orlon B) PVC C) nylon D) teflon

Answer:B

$H-C\equiv C-H \xrightarrow{H^+Cl^-} \underbrace{H_2C=CH-Cl}$
Vinyl chloride → A

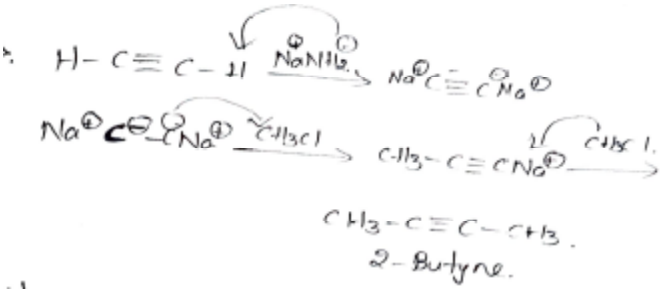
Solution: Vinyl chloride $\xrightarrow{Polymerisation}$ $\underbrace{\text{Poly vinyl chloride}}$
PVC.

26. $H-C\equiv C-H + NaNH_2 \rightarrow A \xrightarrow[CH_3Cl]{2\,mole} B$ then `B` is

A) 1-Butyne B) 2-Butyne C) 2-Pentyne D) Propyne

Answer:B

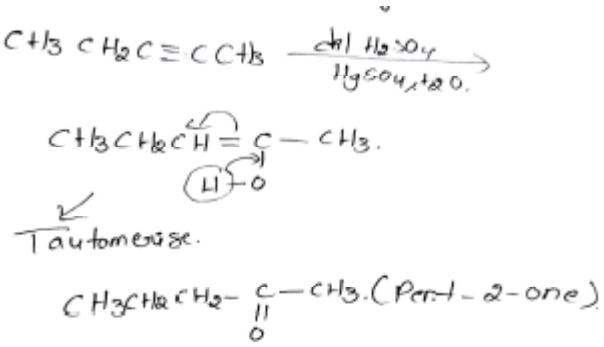
Solution:



27. When 2-pentyne is treated with dilute H_2SO_4 and $HgSO_4$ the product formed is
A) 1-pentanol B) 2-pentanol C) 2-pentanone D) 3-pentanone

Answer:C

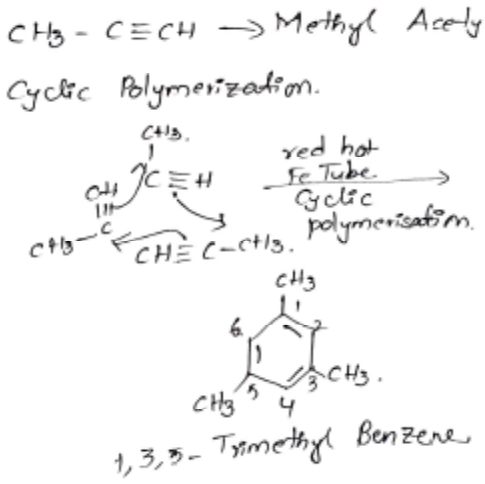
Solution:



28. The cyclic polymerisation of methyl acetylene produces
A) benzene B) O-xylene
C) 1,3,5 - Trimethyl benzene D) 1,3,5 - Tri methyl cyclo hexane

Answer:C

Solution:



29. The compounds 1-butyne and 2-butyne can be distinguished by using

A) Bromine water B) $KMnO_4$ solution

C) Tollen's reagent D) Chlorine gas

Answer:C

Solution:

1-butyne: terminal alkyne ($HC \equiv C–CH_2–CH_3$)

2-butyne: internal alkyne ($CH_3–C \equiv C–CH_3$)

Terminal alkynes react with Tollen's reagent (ammoniacal $AgNO_3$) to form white precipitate of silver acetylide; internal alkynes do not.

Bromine water and $KMnO_4$ react with both (unsaturation tests). Cl_2 gas also reacts with both.

30. Which of the following orders regarding acidic strength is correct

A) $CH_3COOH > CH_3CH_2OH > CH \equiv CH$ B) $CH_3COOH > CH \equiv CH > CH_3CH_2OH$

C) $CH \equiv CH > CH_3COOH > CH_3CH_2OH$ D) $CH \equiv CH > CH_3CH_2OH > CH_3COOH$

Answer:A

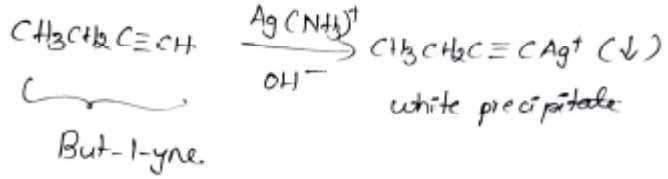
Solution:Acetic acid (pKa ~ 4.8) is far stronger than ethanol (pKa ~ 16), which is stronger than acetylene (pKa ~ 25)

31. An unknown compound 'A' has a molecular formula of C_4H_6 when 'A' is treated with an excess of Br_2 a new substance 'B' with formula $C_4H_6Br_2$ is formed . A forms a white precipitate with ammonical silver nitrate solution 'A' may be

A) Butyne-1 B) Butyne-2 C) Butene-2 D) Butene-1

Answer:A

Solution:A gives a white precipitate with ammoniacal $AgNO_3$ $\rightarrow$ characteristic of a terminal alkyne (forms a silver acetylide). So A is 1-butyne (C_4H_6)



32. The reduction of 4-octyne with H_2 in the presence of $Pd/BaSO_4$ quinoline gives

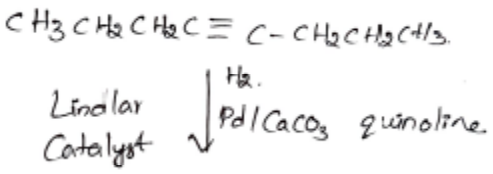
A) trans -4 - octene

B) cis - 4 - octene

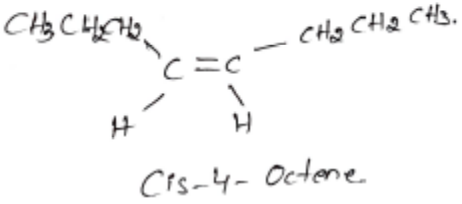
C) a mixture of cis and trans-4octene

D) A completely reduced product C_8H_{18}

Answer:B



Solution:



33. $CH \equiv CH + 2CH_3COOH \rightarrow \underset{(X)}{A} \xrightarrow{\Delta} \underset{(Y)}{B} + C$. B can be obtained from (X) by hydration and C can be obtained from (Y) by heating with P_2O_5. Hence A is

A) $CH_2 = CH - O - COCH_3$ B) $CH_3 - CH\left(O - COCH_3\right)_2$

C) $CH_3CH_2COOCH_3$ D) $CH_3COOCH_2CH_3$

Answer:A

Solution: $CH \equiv CH + 2CH_3COOH \xrightarrow{\Delta} CH_3 - CH(O - COCH_3)_2$

$A = CH_3 - CH(O - COCH_3)_2$

JEE ADVANCED LEVEL QUESTIONS

Multi Correct Answer Type:

1. Which of the following statements about alkynes is/are true?
   A) They contain at least one triple bond between carbon atoms.
   B) They undergo addition reactions readily.
   C) They are more reactive than alkenes.
   D) They can be converted into alkenes by reduction.

Answer:A,B,D

Solution:A) True — definition of alkynes.
B) True — alkynes undergo electrophilic addition (with Br_2, HX, etc.) and catalytic hydrogenation.
C) False — alkynes are generally less reactive than alkenes toward electrophilic addition because the sp-hybridized carbons hold p-electrons more tightly.
D)True — using Lindlar's catalyst (cis-alkene) or Na in liquid NH3 (trans-alkene).

2. Which of the following statements about the bond length and strength in alkynes are true?
   A) The triple bond in alkynes consists of one sigma bond and two pi bonds.

B) The bond length of the triple bond is shorter than that of the double bond in alkenes.
C) The triple bond in alkynes is weaker than the double bond in alkenes.
D) The triple bond in alkynes allows for rotation around its axis.

Answer:A,B

Solution:A) The triple bond in alkynes consists of one sigma bond and two pi bonds. $\rightarrow$True.
B)True — C$\equiv$C bond length ~120 pm, C=C ~134 pm.
C) False — C=C bond is stronger (higher bond energy ~839 kJ/mol) than C=C (~611 kJ/mol).
D) False — rotation is restricted around triple bond just like double bonds (pi bonds prevent free rotation).

Reason And Assertion Type:

A) Both (A) and (R) are true and (R) is the correct explanation of(A)
B) Both (A) and (R) are ture and (R) is not the correct explanation of (A)
C) (A) is true but (R) is false
D) (A) is false but (R) is true

3. **Assertion :** Acetylene is formed when ethylene chloride or ethylidene chloride is heated with alcoholic KOH
Reason : Both gem dihalides and vicinal dihalides on dehydrohalogenation form alkyne

Answer:A

Solution:Assertion (A) is true: heating ethylene chloride (vicinal dihalide) or ethylidene chloride (geminal dihalide) with alcoholic KOH leads to successive dehydrohalogenations giving acetylene (terminal alkyne).
Reason (R) is true: both vicinal and geminal dihalides can undergo successive eliminations to form an alkyne.
R correctly explains A

4. **Assertion :** Heavy metal acetylides can be used to purify alkynes
Reason : Terminal alkynes form acetylides which are soluble in acids

Answer:C

Solution:Assertion (A) is true: heavy-metal acetylides (Ag, Cu salts) are used in detection/purification of terminal alkynes — the terminal alkyne is precipitated as a metal-acetylide and can be reconverted back to the alkyne.
Reason (R) is false as stated: terminal alkynes form metal-acetylides which are insoluble salts (not "soluble in acids"). In practice the metal salt is decomposed (protonated) by acid to regenerate the alkyne

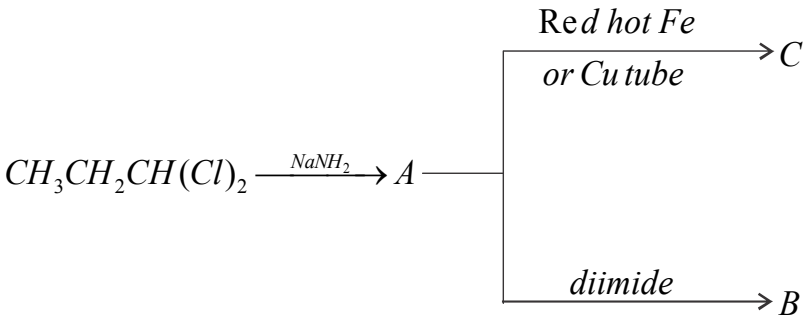
5. **Assertion :** Disubstituted acetylene on partial hydrogenation may give trans isomer
Reason : Lindlar's catalyst is used for Partial hydrogenation

Answer:B

Solution:Assertion (A) is true: a disubstituted alkyne on partial hydrogenation may give a trans alkene (for example, using Na/NH_3 gives the trans (E) alkene).

Reason (R) is true in itself: Lindlar's catalyst is used for partial hydrogenation — but Lindlar's gives the cis (Z) alkene, not the trans.
Therefore R does not correctly explain A

Comprehension Type:



6. A is
A)Propyne B) Propene C)Propanal D)Propanone

Answer:A

Solution:The reactant $CH_3CH_2CH(Cl)_2$, 1,1-dichloropropane, undergoes dehydrohalogenation with a strong base like $NaNH_2$ to form an alkyne. Two molecules of HCl are removed to form $CH_3C \equiv CH$, which is propyne.

7. B is
A) $CH_3CH = CH_2$ B) $CH_3CH_2CH_3$ C) CH_3COCH_3 D) CH_3CH_3

Answer:B

Solution:Product A (propyne) undergoes catalytic hydrogenation using diimide N_2H_2, which is a selective reducing agent that reduces alkynes to alkanes ($CH_3CH_2CH_3$, propane) under these conditions.

8. C is
A)Mesitylene B)Benzene
C)Cyclooctatetraene D)Benzaldehyde

Answer:A

Solution:When propyne is passed through a red-hot iron or copper tube, it undergoes cyclic polymerization (trimerization) to form 1,3,5-trimethylbenzene, commonly known as mesitylene.

Integer Type:

9. Determine the total number of sigma and pi bonds in the molecule of ethyne.

Answer:5

Solution:Structure: $H-C \equiv C-H$
Sigma bonds:2 × C–H bonds
1 × C–C (sigma part of triple bond)
Total sigma bonds = 3

Pi bonds:
Triple bond has 2 pi bonds
Total pi bonds = 2
Total sigma + pi bonds = 3 + 2 = 5

10. What is the number of sp hybridized carbon atoms in 2-butyne?

Answer:2

Solution:Structure: $CH_3–C\equiv C–CH_3$

Each triple-bonded carbon is sp hybridized.

There are 2 such carbons (the ones in $C\equiv C$).
The CH_3 carbons are sp^3 hybridized.

So sp hybridized carbon atoms = 2

Matrix Matching Type:

11.

Column I	**Column II**
A) $R-CH=CH-R \xrightarrow[KMnO_4]{cold\ dil}$ *cis*	P) Meso
B) $R-CH=CH-R \xrightarrow[CCl_4]{Br_2}$ *trans*	Q) cis-alkene
C) $RC\equiv CR \xrightarrow[Ni_2B]{H_2}$	R) trans-alkene
D) $RC\equiv CR \xrightarrow[Liq.NH_3]{Li}$	S) controlled reduction
	T) Oxidation

Answer:A-T,B-P,C-Q,D-R

Solution:A) $R-CH=CH-R \xrightarrow[KMnO_4]{cold\ dil}$ *cis*	T) Oxidation
B) $R-CH=CH-R \xrightarrow[CCl_4]{Br_2}$ *trans*	P) Meso
C) $RC\equiv CR \xrightarrow[Ni_2B]{H_2}$	Q) cis-alkene
D) $RC\equiv CR \xrightarrow[Liq.NH_3]{Li}$	R) trans-alkene

LEARNERS TASK

CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ'S)

1. The IUPAC name of the compound having the formula $CH \equiv C - CH = CH_2$

   A) Butene -2- yne B) But-2-yne-3-ene
   C) 3- butane 1- ene D) But-1-ene - 3- yne

Answer:D

Solution:IUPAC name of the compound (structure given as a molecule containing both a C=C and a C=C) — best systematic name is But-1-ene-3-yne (double at C-1 and triple at C-3), written as but-1-ene-3-yne.

2. Alkynes exhibit.

   A) Chain isomerism B)Position isomerism
   C)Functional isomerism D) All the above

Answer:D

Solution:Alkynes show chain, position and functional isomerism (they have all those types)

3. Alkynes exhibit functional isomerism with

   A) Alkanes B) Alkenes C) alkadienes D) Alcohols

Answer:C

Solution:

Functional isomers: alkynes $\rightarrow$ alkadienes (same molecular formula C_nH_{2n-2})

4. The isomer of propyne

   A) Allene B) Propene C) Cyclo propane D) Propane

Answer:A

Solution:The isomer of propyne (CH_3–C=CH) is allene (propadiene, CH_2=C=CH_2)

5. Bond angle between C - C in alkyne

   A) $109^0.28'$ B) 120° C) 180° D) 60°

Answer:C

Solution:Bond angle about the C–C axis in an alkyne (sp-hybridised carbon) is 180° (linear)

6. The molecule having linear structure is

   A) Methane B) Ethylene C) Acetylene D) Water

Answer:C

Solution:Methane $\rightarrow$ tetrahedral
Ethylene $\rightarrow$ trigonal planar
Acetylene $\rightarrow$ linear
Water $\rightarrow$bent

7. The C - C bond length is shortest in

   A) C_2H_6 B) C_2H_2 C) C_6H_6 D) C_2H_4

Answer:B

Solution:A) C_2H_6 → Ethane →C–C single bond → ~1.54A^0

B) C_2H_2 → Acetylene → C=C triple bond → ~1.20 Å

C) C_6H_6 → Benzene → C–C bond in aromatic ring → ~1.39 Å (intermediate between single and double)

D) C_2H_4 Ethene → C=C double bond → ~1.34 Å

8. The hydrolysis of Mg_2C_3 produces

A) acetylene B) propyne C) butyne D) ethylene

Answer:B

Solution: $Mg_2C_3 + 4H_2O \rightarrow 2Mg(OH)_2 + CH_3-C\equiv CH$ (propyne) .

9. The number of possible alkynes with molecular formula C_5H_8 is

A) 3 B) 4 C) 5 D) 6

Answer:A

$CH_3-CH_2-CH_2-C\equiv CH \rightarrow Pent-1-yne$

$CH_3-CH_2-C\equiv C-CH_3 \rightarrow Pent-2-yne$

Solution:

$$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-C\equiv CH \rightarrow 2-metylBut-1-yne$$

10. Iodoform on heating with silver powder gives

A) CH_4 B) C_2H_2 C) C_2H_4 D) C_6H_6

Answer:B

Solution: $2CHI_3 + 6Ag \rightarrow C_2H_2$ (acetylene) $+ 6AgI$

11. Acetylene is stored and transported in

A) Ethanol solution B) Methanol solution

C) Ethanal solution D) Propanone solution

Answer:D

Solution:Acetylene is unstable under pressure and can decompose explosively. For safe storage and transportation, it is dissolved in acetone (propanone) in cylinders containing a porous material (like diatomaceous earth) to prevent high pressure buildup.

12. PVC is the polymer of the following

A) Ethyl chloride B) Vinyl chloride

C) Allyl chloride D) Ethynyl chloride

Answer:B

Solution:PVC (Polyvinyl chloride) is formed by polymerization of vinyl chloride

(CH_2=CHCl).

13. Hydrocarbon which gives oxyacetylene flame

A) ethane B) ethene C) ethyne D) ethanal

Answer:C

Solution:Ethyne is the hydrocarbon that produces the oxy-acetylene flame used for welding and cutting metal. This is because the high-temperature flame from burning ethyne (acetylene) in oxygen provides the heat needed to melt metals. Ethane and ethene are not suitable for this purpose

14. The gas obtained when ethylene chloride reacts with alcoholic potash and sodamide is

A) C_2H_4 B) C_2H_6 C) C_2H_2 D) C_2H_5Cl

Answer:C

Solution:Ethylene chloride with alcoholic KOH / sodamide gives dehydrohalogenation $\rightarrow$ acetylene

15. Iodoform on heating with silver powder gives

A) CH_4 B) C_2H_2 C) C_2H_4 D) C_6H_6

Answer:B

Solution: $2CHI_3 + 6Ag \rightarrow C_2H_2(\text{acetylene}) + 6AgI$

JEE MAINS LEVEL QUESTIONS

1. Pure acetylene has sweet smell, where as impure gives garlic odour due to presence of

A) NH_3 B) PH_3 C) SbH_3 D) HCl

Answer:B

Solution:Pure acetylene has a sweet smell.
Commercial or impure acetylene (prepared from calcium carbide and water) often contains traces of phosphine (PH_3) and arsine (AsH_3).
These impurities are responsible for the garlic-like odor of impure acetylene.

2. Which of the following possess acidic hydrogen

A) C_2H_6 B) C_2H_4 C) C_2H_2 D) CH_4

Answer:C

Solution:Acidic hydrogen is present in terminal alkynes (C_2H_2) due to sp-hybridized carbon.

3. The reagent used for obtaining trans alkene from alkyl substituted acetylene with hydrogen is **(FA & SA- 3 Marks/4 Marks)**

A) Na in liq. NH_3 B) $LiAlH_4$

C) $Zn + HCl$ D) H_2 in presence of Ni

Answer:A

Solution:Na in liq. NH_3 — Dissolving-metal hydrogenation (Na / liquid NH_3) of an alkyl-substituted alkyne gives the trans alkene

4. The stronger base is **(FA & SA- 5 Marks/8 Marks)**

A) $CH_3CH_2^-$ B) $CH_2 = CH^-$ C) $CH \equiv C^-$ D) Cl^-

Answer:A

Solution:The strength of a base is inversely related to the stability of its conjugate acid. A stronger base will have a weaker, less stable conjugate acid.

The order of stability of the anions (from least stable to most stable) is:

$CH_3\ CH_2^- < CH_2 = CH^- < CH \equiv C^- < Cl^-$

Since the strongest base corresponds to the least stable negative charge, the strongest base among the options is $CH_3\ CH_2^-$.

5. Gem dihalides on treatment with alcoholicKOH give

A) Alkyne B) Alkene C) Alkane D) Cyclo alkanes

Answer:A

Solution:Gem-dihalides (both halogen atoms on the same carbon) on treatment with alcoholic KOH undergo double dehydrohalogenation, forming an alkyne

6. $X + 2Zn \xrightarrow{Alcohol} H - C \equiv C - H$ here 'X' is

A) 1, 1-Dibromoethane B) 1, 2-Dibromoethane

C) Di bromo ethane D) 1, 1, 2, 2-Tetra - bromoethane

Answer:D

$Dehalogenation: 1\ mole\ Zn\ reactwith\ 2\ moles\ Br$

$$H_2C(Br)-CH_2(Br) \xrightarrow{Zn} CH_2 = CH_2 + ZnBr_2$$

$2\ moles\ Znreactwith\ 4\ moles\ Br$

Solution:

$$HC(Br)_2-CH(Br)_2 \xrightarrow{2Zn} CH \equiv CH + 2ZnBr_2$$

7. 2- Butyne when treated with lithium in presence of liquid ammonia gives

A) cis-2-butene B) trans-2-butene

C) n-butane D) I-butyne

Answer:B

Solution:The reaction of 2-butyne (a non-terminal alkyne) with lithium in the presence of liquid ammonia is a dissolving metal reduction (also known as a modified Birch reduction).

This reaction is stereoselective and proceeds via an anti-addition mechanism due to the stability of the intermediate radical anion and vinylic anion species,

where the bulky groups prefer to be on opposite sides of the forming double bond.

The result of this anti-addition across the triple bond is the formation of a trans-alkene, which in this case is trans-2-butene

8. Which one of the following possess the minimum boiling point (AIEEE 200D)

(FA & SA- 2 Marks)

A) 1-Pentyne B) 1-Butyne C) n-Butane D) Isobutane

Answer:D

Solution:Boiling point increases with molar mass and decreases with branching. n-Butane BP ~0°C, Isobutane BP ~ -12°C (lowest), 1-Butyne BP ~ 8°C, 1-Pentyne BP ~ 40°C.

9. 1- pentyne and 2-pentyne can be distinguished by

A) Silver mirror test B) Iodoform test

C) Addition of H_2 D) Baeyers test

Answer:A

Solution:Terminal alkyne (1-pentyne) gives a precipitate with ammoniacal Ag^+ (forms Ag-acetylide), whereas internal alkyne (2-pentyne) does not

10. Acetylene on reaction with silvernitrate shows

A) Oxidizing property B) Reducing property

C) Basic nature D) Acidic nature

Answer:D

Solution:Acetylene (C_2H_2) reacts with ammoniacal silver nitrate solution (Tollens' reagent) to form a white precipitate of silver acetylide (C_2Ag_2). This reaction occurs because the hydrogen atoms attached to the sp-hybridized carbon atoms in acetylene are weakly acidic and can be replaced by metal ions (in this case, silver). The ability to donate a hydrogen ion (H^+) is the defining characteristic of an acid, thus demonstrating the acidic nature of acetylene.

11. The compound used in Hawker's lamp and in light houses for illumination purpose is

A) methane B) ethane C) ethylene D) acetylene

Answer:D

Solution:Acetylene (from calcium carbide) was widely used in Hawker's lamps and early lighthouse illumination.

$$CaC_2 + H_2O \rightarrow CH \equiv CH + Ca(OH)_2$$

$$CH \equiv CH \xrightarrow[Combustion]{O_2} Light$$

12. Cold and dil.Alk. $KMnO_4$ will oxidise acytylene to

A) Ethylene glycol B) Ethyl alcohol C) Oxalic acid D) Acetic acid

Answer:D

Solution:Cold, dilute alkaline KMnO4 oxidises C2H2 to oxalic acid (HOOC–COOH).

13. $X + 2KOH \xrightarrow{\text{Alcohol}} H - C \equiv C - H$ here "X' is
A) 1, 1–Dibromoethane B) 1, 2–Dibromoethane
C) Both (A) and (B) D) 1, 1, 2, 2 – Tetrabromoethane

Answer:C

Solution:From vicinal dihalide (1,2-dibromoethane) or geminal dihalide (1,1-dibromoethane), alcoholic KOH causes double dehydrohalogenation to form acetylene.
So both (A) and (B) can give acetylene.

14. Westrosol is
A) $Cl_2C = CHCl$ B) $CHCl_2 - CHCl_2$ C) $CH_2Cl - CH_2Cl$ D) $CH_3 - CCl_3$

Answer:A

Solution:Westrosol is trichloroethene (structure: CCl_2=CHCl)

15. Acetylene gives white precipitate with ammonical silver nitrate but ethylene cannot give because
A) Acetylene possess sp^2 carbon
B) Acetylene posses acidic hydrogen
C) Acetylene possess low electronegative carbon
D) Acetylene posess $-C \equiv C-$ triple bond

Answer:B

Solution:Acetylene (C_2H_2) has acidic hydrogens attached to sp-hybridized carbons, which can be removed by strong bases or metal ions like Ag^+ (from ammoniacal $AgNO_3$).
This forms a white precipitate of silver acetylide (Ag_2C_2).
Ethylene (C_2H_4) lacks such acidic hydrogens, so it does not react with ammoniacal $AgNO_3$

16. Which of these will not react with acetylene? **(AIEEE 200B)**
A) NaOH B) Na
C) Ammonical $AgNO_3$ D) HCl

Answer:A

Solution:Acetylene is a weak acid and NaOH is a strong base, so the reaction between them is not favorable.

JEE ADVANCED LEVEL QUESTIONS

Multicorrect Answer Type:

1. Which of the following are false
A) Acetylene is more reactive than ethylene to an electrophilic attack
B) Acetylene is less reactive than ethylene towards electrophilic attack
C) Acetylene may show more reactivity or less reactivity towards electrophilic reagent.
D) Acetylene and ethylene show identical reactivities towards an electrophilic attack

Answer:A,C,D

Solution:A)False — acetylene is less reactive than ethylene toward electrophilic

addition because the sp-hybridized carbons hold p-electrons more tightly, and the intermediate vinylic carbocation is less stable.

B) Acetylene is less reactive than ethylene towards electrophilic attack
True — so this is not false.

C) False — in general, it's less reactive; "may show more" is not correct in normal electrophilic addition.

D) False — they do not have identical reactivity.

2. Which of the following statements regarding the physical properties of alkynes are true?

A) Alkynes have higher boiling points than alkanes of similar molecular weight.

B) Alkynes have lower boiling points than alkenes of similar molecular weight.

C) Alkynes are less dense than water.

D) Alkynes are soluble in nonpolar solvents like hexane.

Answer:A,C,D

Solution:A) True — alkynes are more polarizable (linear, triple bond) and have stronger intermolecular forces than alkanes.

B) False — alkynes generally have slightly higher boiling points than alkenes due to higher linearity and polarizability.

C)True — like most hydrocarbons, they float on water (density < 1 g/mL).

D) True — they are nonpolar or weakly polar, so soluble in organic solvents.

Assertion and Reason Type:

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

B) Both (A) and (R) are ture and (R) is not the correct explanation of (A)

C) (A) is true but (R) is false

D) (A) is false but (R) is true

3. **Assertion :** Alkynes are more reactive than alkene towards catalytic hydrogenation

Reason : Alkynes are less reactive towards electrophilic reaction than alkenes

Answer:B

Solution:

Assertion true: Alkynes are easier to hydrogenate (consume H2) under catalytic hydrogenation conditions than alkenes (they are more readily reduced to alkenes/alkanes).

Reason true but irrelevant: Alkynes being less reactive than alkenes toward electrophilic addition is correct, but that fact does not explain their greater reactivity in catalytic (heterogeneous) hydrogenation — catalytic hydrogenation proceeds by surface adsorption and electron transfer, a different mechanism

4. **Assertion :** Addition of HBr to $HC \equiv CCH_2CH = CH_2$ give

$HC \equiv CCH_2CHBr - CH_3$ and not $H_2C = CBrCH_2CH = CH_2$

Reason : A triple bond is less reactive than a double bond towards electrophilic

Answer:A

Solution:Assertion true: In a molecule containing both a C≡C and a C=C, electrophilic addition (HBr) attacks the double bond preferentially, giving the product with HBr added to the alkene unit rather than adding to the triple bond.

Reason true and explanatory: The triple bond is generally less reactive than the double bond toward simple electrophilic addition (vinyl cations are less stabilized), so the double bond reacts first — R correctly explains A

5. **Assertion** : Reaction of but-2-yne by $Na/liqNH_3$ gives trans But-2-ene

Reason : It is syn addition

Answer:C

Solution:Assertion true: But-2-yne reduced with Na / liq NH_3 (dissolving-metal reduction) gives trans-2-butene.

Reason false: The reaction proceeds by an anti-addition (stepwise electron/ proton transfers producing radical anion intermediates), not by syn addition. Anti-addition is why the trans alkene is formed

Comprehension Type:

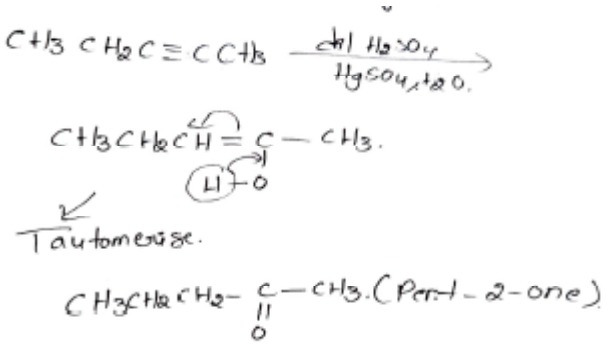
Terminal alkynes have acidic hydrogen/s. Sodium salt of terminal alkynes behave as nucleophile as well as strong base. For primary alkyl halides it behave as nucleophile. Thus primary alkyl halides give SN reaction with its salt. Alkynes undergo electrophilic as well as nucleophilic addition reactions. They also undergo hydroboration, oxidation and ozonolysis.

6. When 2-pentyne is treated with dil. H_2SO_4 and $HgSO_4$, the product formed is

A) 1-pentanol B) 2-pentanol C) 2-pentanone D) 3-pentanone.

Answer:C

Solution:



7. $CH_3C \equiv CH + HOX \longrightarrow Y.Y\ is$

A) CH_3COCH_2X B) CH_3COCH_3 C) $CH_3COCOOH$ D) $CH_3CHXCHO$

Answer:A

Solution:HOX adds Markovnikov across the terminal C≡C. The enol/halovinyl intermediate formed is converted by tautomerization to the α-halo ketone

CH_3COCH_2X

Integer Type:

8. Determine the number of pi bonds present in 1-butyne.

Answer:2

Solution:1-butyne.-----> CH_3-C≡C-H

A triple bond contains:1 sigma bond,2 pi bonds

Therefore, in 1-butyne:Number of pi bonds = 2

9. Determine the total number of sigma and pi bonds in 1,3-butadiyne.

Answer:9

Solution: $H-C\equiv C-C\equiv C-H$

Total sigma + pi bonds = 5+4=9

Matrix Matching Type:

10.

Compound	**Ozonolysis products**
A) Acetylene	1) $HCHO$ & CH_3CHO
B) Ethylene	2) CH_3CHO
C) Benzene	3) One mole of $(CHO)_2$
D) 2-Butene	4) 3 moles of $(CHO)_2$
	5) CH_2O

Answer:A–3, B–5, C–4, D–2

Solution:

A) Acetylene

$CH\equiv CH+O_3\rightarrow Ozonide\xrightarrow{Hydrolysis}CHO-CHO$ 3) One mole of $(CHO)_2$

B) Ethylene

$CH_2=CH_2+O_3\rightarrow \text{Ozonide}\xrightarrow{\text{Hydrolysis/Reduction}}2HCHO$ 5) CH_2O

C) Benzene

$C_6H_6+3O_3\rightarrow \text{Ozonide}\xrightarrow{\text{Hydrolysis/Reduction}}3CHO\text{-}CHO$ 4) 3 moles of $(CHO)_2$

D) 2-Butene

$CH_3CH=CHCH_3+O_3\rightarrow \text{Ozonide}\xrightarrow{\text{Hydrolysis/Reduction}}2CH_3CHO$ 2) CH_3CHO

KEY

				TEACHING TASK					
			JEE MAINS LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
D	B	B	B	B	D	B	A	A	A
11	12	13	14	15	16	17	18	19	20
C	B	B	A	B	B	C	B	B	B
21	22	23	24	25	26	27	28	29	30
C	B	D	C	B	B	C	C	C	A
31	32	33							
A	B	A							
			JEE ADVANCED LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
A,B,D	A,B	A	C	B	A	B	A	5	2
11									
A-T,B-P,C-Q,D-R									
				LEARNERS TASK					
			CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ'S)						
1	2	3	4	5	6	7	8	9	10
D	D	C	A	C	C	B	B	A	B
11	12	13	14	15					
D	B	C	C	B					
			JEE MAINS LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
B	C	A	A	A	D	B	D	A	D
11	12	13	14	15	16				
D	D	C	A	B	A				
			JEE ADVANCED LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	
A,C,D	A,C,D	B	A	C	C	A	2	9	
10									
A–3, B–5, C–4, D–2									