JEE Advanced Archive	DTS-1

1. Acetylene can be distinguished from methane using Tollen's reagent:

$$C_2H_2 + AgNO_3 \xrightarrow{NH_3(aq)} \underset{\text{white ppt.}}{H-C \equiv CAg \downarrow}$$

No such reaction occur with methane.

2.(B) Methane is produced due to the decay of vegetables or animal organisms present in swamps and marsh, by the action of bacteria. Due to this method of formation methane is also known as marsh gas.

3.(D) Unsaturated compounds which contain $C=C$ or $C\equiv C$, decolourises the purple colour of alkaline $KMnO_4$ solution.

$$\underset{\substack{\text{purple}\\\text{coloured}}}{CH_2=CH_2 + KMnO_4} \xrightarrow{OH^-} \begin{matrix} CH_2-OH \\ | \\ CH_2-OH \end{matrix} + MnO_2\downarrow$$

4. Terminal alkyne (ethyne) are acidic.

5. Ozonolysis products are the key of identification:

$$\underset{\text{propanone}}{CH_3-\overset{\overset{CH_3}{|}}{C}=O} + \underset{\text{ethanal}}{O=CH-CH_3} \xleftarrow[Zn-H_2O]{O_3} CH_3-\overset{\overset{CH_3}{|}}{C}=CH-CH_3$$

Other products are :

$$CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{OH}{|}}{C}}-\overset{}{\underset{\underset{OH}{|}}{C}}H-CH_3 \xleftarrow[Cold,\ OH^-]{dil\cdot KMnO_4} A \xrightarrow{Br_2} CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{Br}{|}}{C}}-\overset{\overset{Br}{|}}{C}H-CH_3$$

6. $$CH_2=CH_2 + Br_2 \longrightarrow \underset{Br}{\overset{|}{CH_2}}-\underset{Br}{\overset{|}{CH_2}} \xrightarrow[2\,eq.]{NaNH_2} H-C\equiv C-H$$

7.(D) Among alkanes, boiling point increase with molar mass. Among isomeric alkanes, branching decreases boiling point. Therefore, n-hexane has highest boiling point among these.

8. $3C_3H_6 + 2KMnO_4 + 4H_2O \longrightarrow 3CH_3CH(OH)CH_2OH + 2MnO_2 + 2KOH$

9.(F) Concentrated H_2SO_4 is not used to dry ethylene because ethylene reacts with H_2SO_4.

10.(C) Ethylene absorb H_2SO_4 forming $CH_3-CH_2OSO_3H$ and dissolve. Benzene, with warm H_2SO_4, undergo sulphonation and dissolve. Aniline, with H_2SO_4, forms anilinium sulphate salt and dissolve. Hexane, a hydrophobic molecule, does not react with H_2SO_4, remains insoluble.

11.(C) Alkynes undergoes Markovnikov's addition of water in the presence of $H_2SO_4 / HgSO_4$:

$$CH_3-C\equiv C-H + H_2O \xrightarrow[HgSO_4]{H_2SO_4} \underset{\text{unstable enol}}{\left[\begin{matrix} OH \\ | \\ CH_3-C=CH_2 \end{matrix}\right]} \rightleftharpoons \underset{\text{acetone}}{\begin{matrix} O \\ \| \\ CH_3-C-CH_3 \end{matrix}}$$

12.(D) Structural formula of 1, 2-butadiene is $\underset{\substack{\uparrow\\sp^2}}{H_2C}=\underset{\substack{\uparrow\\sp}}{C}=\underset{\substack{\uparrow\\sp^2}}{CH}-\underset{\substack{\uparrow\\sp^3}}{CH_3}$

13. 2-butyne

$$H-C\equiv C-H \xrightarrow[\text{or } NaNH_2]{Na\,/\,Liq.NH_3} \overset{\oplus}{Na}\,\overset{\ominus}{C}\equiv\overset{\ominus}{C}\,\overset{\oplus}{Na} \xrightarrow{CH_3I\,(excess)} H_3C-C\equiv C-CH_3$$

14. **(i)** Free radical chlorination of alkane require energy which is supplied either in the form of heat or radiation.

(ii) Addition of HBr proceeds through carbocation intermediates.

$$CH_3-CH=CH_2 + H^+ \longrightarrow \underset{2^\circ \text{ carbocation}}{CH_3-\overset{+}{C}H-CH_3} \longrightarrow \underset{\text{isopropyl bromide}}{CH_3-\underset{\displaystyle Br}{\underset{|}{CH}}-CH_3}$$

15.(A) Baeyer's reagent is cold, dilute, alkaline permanganate solution, used to detect presence of olefinic bonds.