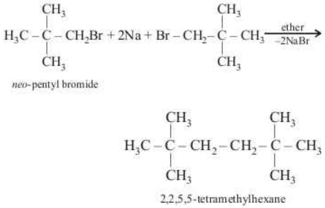
Speed Test-41

1. **(c)**



$$H_3C-\underset{CH_3}{\overset{CH_3}{C}}-CH_2Br + 2Na + Br-CH_2-\underset{CH_3}{\overset{CH_3}{C}}-CH_3 \xrightarrow[-2NaBr]{ether}$$

neo-pentyl bromide

$$H_3C-\underset{CH_3}{\overset{CH_3}{C}}-CH_2-CH_2-\underset{CH_3}{\overset{CH_3}{C}}-CH_3$$

2,2,5,5-tetramethylhexane

2. **(c)** $CH_3CHBrCHBrCH_3 \xrightarrow{Zn/alcohol} CH_3CH=CHCH_3$

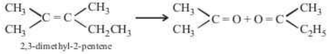
Since two bromine atoms are lost from different carbon atom, the reaction is known as β-elimination.

3. **(a)** The intermediate 2° carbocation shows resonance

$$CH_2=CH-CH=CH_2 \xrightarrow{Br^+} \left[CH_2Br-\overset{+}{C}H-CH=CH_2 \longleftrightarrow CH_2Br-CH=CH-\overset{+}{C}H_2\right]$$

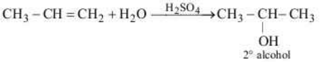
$$\xrightarrow{Br^-} \underset{\text{1,4-dibromo-2-butene}}{CH_2Br\text{-}CH=CH\text{-}CH_2Br}$$

4. **(d)**



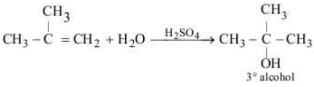
2,3-dimethyl-2-pentene

5. **(c)**



$$CH_3-CH=CH_2+H_2O \xrightarrow{H_2SO_4} CH_3-\underset{OH}{CH}-CH_3$$

2° alcohol

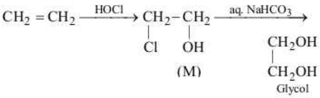


$$CH_3-\overset{CH_3}{C}=CH_2+H_2O \xrightarrow{H_2SO_4} CH_3-\underset{OH}{\overset{CH_3}{C}}-CH_3$$

3° alcohol

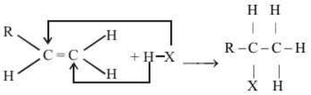
Addition follows Markownikoff's rule.

6. **(b)**



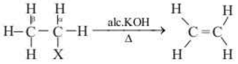
$$CH_2=CH_2 \xrightarrow{HOCl} \underset{(M)}{\underset{Cl\quad\; OH}{CH_2-CH_2}} \xrightarrow{aq.\ NaHCO_3} \underset{\text{Glycol}}{\begin{matrix}CH_2OH\\|\\CH_2OH\end{matrix}}$$

7. **(c)** According to Markownikoff's rule, "in case of addition of an unsymmetrical reagent (H– X), the positive part get attached to the C which is least substituted or which bears larger number of hydrogen atoms."



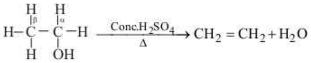
Markownikoff's rule is based on the stability of carbocations (3° > 2° > 1° > methyl).

8. **(a)** $\underset{\text{Ethyne}}{CH\equiv CH}+H_2 \xrightarrow{Pd/C} \underset{\text{Ethene}}{CH_2=CH_2}$



$(X = Cl, Br, I)$

$CH_2Br-CH_2Br+Zn \longrightarrow CH_2=CH_2+ZnBr_2$

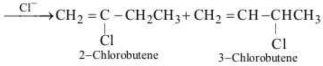


$$H-\underset{H}{\overset{H}{\underset{|}{\overset{|\beta}{C}}}}-\underset{OH}{\overset{H}{\underset{|}{\overset{|\alpha}{C}}}}-H \xrightarrow[\Delta]{Conc.H_2SO_4} CH_2=CH_2+H_2O$$

Ethanol

9. **(a)** $CH_2=C=CH-CH_3 \xrightarrow{H^+}$

$$\left[CH_2=\overset{+}{C}-CH_2CH_3+CH_2=CH-\overset{+}{C}HCH_3\right]$$



$$\xrightarrow{Cl^-} \underset{\text{2–Chlorobutene}}{CH_2=\underset{Cl}{C}-CH_2CH_3} + \underset{\text{3–Chlorobutene}}{CH_2=CH-\underset{Cl}{C}HCH_3}$$

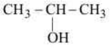
10. **(c)**

11. **(d)** Writing the reaction we get

$$CH_3MgX+CH_3-C\equiv C-H \longrightarrow CH_3-C\equiv CMgX+CH_4(g)$$

12. **(b)** –Cl group is o-, p-directing due to +R effect ; however it is deactivating due to strong –I effect of Cl (different from other o-, p-directing groups which are activating). The net result is that chlorobenzene undergoes o-, p-substitution, with difficulty.

13. (b) $CH_3\text{-}CH=CH_2+H_2O\xrightarrow[\text{Markonikoff's rule}]{\text{conc. }H_2SO_4}$



$CH_3-\underset{\substack{| \\ OH}}{CH}-CH_3$

Isopropyl alcohol

14. (b) Dihydrogen gas adds to alkenes and alkynes in the presence of finely divided catalysts like platinum, palladium or nickel to form alkanes. These metals adsorb dihydrogen gas on their surfaces and activate the hydrogen-hydrogen bond. Platinum and palladium catalyse the reaction at room temperature but relatively higher temperature and pressure are required with nickel catalyst.

15. (a) Electrolysis of a concentrated aqueous solution of either sodium or potassium salts of saturated non-carboxylic acids yields higher alkane at anode.

$$2RCOOK\xrightarrow[\text{Oxidation}]{\text{Electrolytic}}\underset{\text{Anode}}{2RCOO^-}+\underset{\text{Cathode}}{2K^+}$$

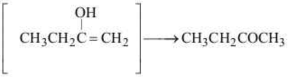
$$\text{At anode : } 2RCOO^- \rightarrow 2RCOO+2e^- \longrightarrow R-R+2CO_2$$

$$\text{At Cathode : } \begin{array}{l}2K^+ + 2e^- \longrightarrow 2K \\ 2K+H_2O\rightarrow 2KOH+H_2\uparrow\end{array}$$

16. (c) Both (a) and (b) are correct. Wet CH_3COOH gives cis addition and dry CH_3COOH gives trans addition products.

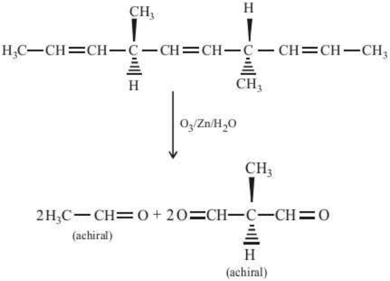
17. (a) Oxymercuration leads to hydration according to Markownikoff's rule.

$CH_3CH_2C\equiv CH\xrightarrow{HgSO_4+H_2SO_4}$

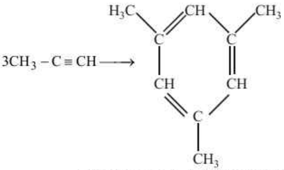


$$\left[CH_3CH_2\overset{\substack{OH \\ |}}{C}=CH_2\right]\longrightarrow CH_3CH_2COCH_3$$

18. (a)



19.



Mesitylene or 1, 3, 5-trimethyl benzene

20. (a) According to experimental evidences, electrophilic substitution reactions are supposed to proceed via the following three steps:

(1) Generation of the electrophile

(2) Formation of carbocation intermediate

(3) Removal of proton from the carbocation intermediate

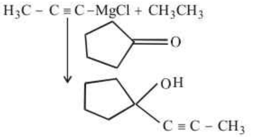
21. (a) Determine the empirical formula of the two compounds

$$C:H=\left(\frac{12}{13}\times100\right):\left(\frac{1}{13}\times100\right)=92.3:7.7$$

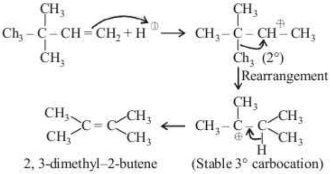
$$=\frac{92.3}{12}:\frac{7.7}{1}=7.7:7.7=1:1$$

∴ The empirical formula of the two compounds is CH. Thus the molecular formula of A and B will be the simple multiple of CH, i.e. C_2H_2, C_3H_3, C_4H_4, C_6H_6, etc. Thus options (c) and (d) are discarded. Further since A decolourises bromine water and B does not, A and B should be C_2H_2 (acetylene) and C_6H_6 (benzene) respectively.

22. (d) $H_3C-C\equiv C\,\boxed{H+CH_3CH_2}\,MgCl\longrightarrow$



23. (b) $(CH_3)_2CH-\underset{\substack{| \\ CH_3}}{CH}-CH=CH_2$ contain 7 carbon atoms



2, 3-dimethyl–2-butene (Stable 3° carbocation)

24. **(a)** As the number of bonds between carbon atoms increases, electronegativity of that carbon also increases due to increasing active power of electrons. Also *sp* hybrid is more electronegative than sp^2 which is more electronegative than sp^3($\because$ *s* character decreases) Hence, option (a) is correct.

25. **(a)** Ethylene has restricted rotation, acetylene has no rotation, hexachloroethane has more rotation than ethylene but less than ethane because of greater size of the substituent (chlorine) in hexachloroethane than in ethane (substituent is hydrogen).

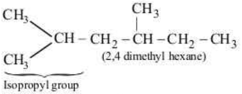
26. **(d)**

27. **(a)** In $H_2C = C = CH_2$ hybridisation of C atoms is sp^2 and sp. The molecule is monoplanar but H–atoms lie in different planes.

28. **(a)** $CH \equiv CH \xrightarrow[Hg^{2+}]{CH_3COOH} CH_2 = CHOCOCH_3$

$$\xrightarrow{CH_3COOH} CH_3CH(OCOCH_3)_2$$

29. **(b)**

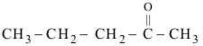


$$\underbrace{(CH_3)_2CH}_{\text{Isopropyl group}}-CH_2-\overset{CH_3}{\overset{|}{C}H}-CH_2-CH_3$$

(2,4 dimethyl hexane)

It contains isopropyl group.

30. **(c)** In the given reactions, X is



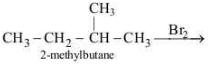
$$CH_3-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$$ and Y is

$CH_3CH_2CH_2CH_2CHO$, X will give +ve iodoform test and Y will give +ve silver mirror test.

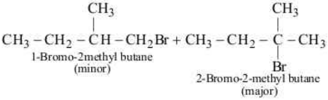
31. **(d)** The order of substitution in different alkanes is

$3° > 2° > 1°$

Thus the bromination of 2-methylbutane mainly gives 2-Bromo - 2 - methyl butane



$$\underset{\text{2-methylbutane}}{CH_3-CH_2-\overset{CH_3}{\overset{|}{C}H}-CH_3} \xrightarrow{Br_2}$$



$$\underset{\substack{\text{1-Bromo-2methyl butane}\\ \text{(minor)}}}{CH_3-CH_2-\overset{CH_3}{\overset{|}{C}H}-CH_2Br} + \underset{\substack{\text{2-Bromo-2-methyl butane}\\ \text{(major)}}}{CH_3-CH_2-\overset{CH_3}{\overset{|}{\underset{Br}{\underset{|}{C}}}}-CH_3}$$

32. **(a)** The acidity of acetylene or 1–alkyne can be explained on the basis of molecular orbital concept according to which formation of C—H bond in acetylene involves *sp*-hybridised carbon atom. Now since s electrons are closer to the nucleus than *p* electrons, the electrons present in a bond having more *s* character will be correspondingly more closer to the nucleus. Thus owing to high *s* character of the C—H bond in alkynes ($s = 50\%$), the electrons constituting this bond are more strongly held by the carbon nucleus i.e., the acetylenic carbon atom or the *sp* orbital acts as more electronegative species than the sp^2 and sp^3 with the result the hydrogen present on such a carbon atom ($\equiv$C—H) can be easily removed as a proton.

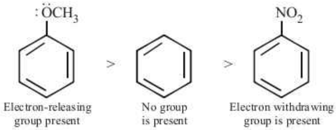
33. **(c)** Phenol as well as toluene have electron-releasing groups, however –OH group, in phenol, is more electron-releasing (due to +R effect) than the $-CH_3$ group in toluene, so phenol is more easily attacked by an electrophile.

34. **(b)** The given reaction is Diel's Alder reaction. This reaction involves a cycloaddition between a conjugated diene and a substituted alkene.

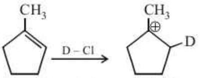
35. **(a)** Reduction of alkynes with Lindar's catalyst ($Pd\text{-}BaSO_4$) gives cis-alkenes.

36. **(b)** $HC \equiv C-CH_2-CH_2NH_2$ contains three active hydrogen atoms (one attached to sp hybridised carbon atom and two attached to N). Hence, Et.MgBr will give three moles of C_2H_6.

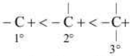
37. **(c)**



38. **(b)**

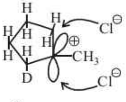


Formation of above species is more favourable. The stability order of carbocations is

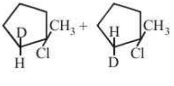


$$\underset{1°}{-C+} < \underset{2°}{-\overset{|}{C}+} < \underset{3°}{-\overset{|}{\underset{|}{C}}+}$$

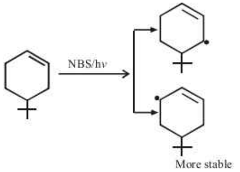
Now, carbocation formed is sp^2 hybridised that is triangular planar as shown below

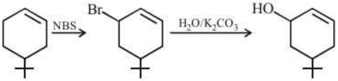


Either the $Cl^{\ominus}$ attack from above or below formation of the plane of the molecule, so there is probability of resultant product as shown below i.e., both product will form.

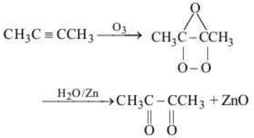


39. (d) N – bromosuccinimide results into bromination at allylic and benzylic positions





40. (c)

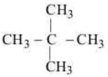


$$CH_3C\equiv CCH_3 \xrightarrow{O_3} CH_3\underset{O-O}{C}(O)CCH_3 \xrightarrow{H_2O/Zn} CH_3\underset{\underset{O}{\|}}{C}-\underset{\underset{O}{\|}}{C}CH_3 + ZnO$$

41. (c) Due to the maximum percentage of *s* character (50%), the *sp* hybridised orbitals of carbon atoms in ethyne molecules have highest electronegativity; hence, these attract the shared electron pair of the C-H bond of ethyne to a greater extent than that of the sp^2 hybridised orbitals of carbon in ethene and the sp^3 hybridised orbital of carbon in ethane. Thus in ethyne, hydrogen atoms can be liberated as protons more easily as compared to ethene and ethane.

42. (a) The heat of hydrogenation of an alkene depends upon its stability. Higher the stability, lower the heat of hydrogenation. Since $CH_2=CH_2$ has no substituent, it is the least stable alkene and hence has the highest heat of hydrogenation.

43. (c) In neopentane all the H atoms are same (1°).



$$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_3$$

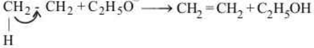
44. (a) This is due to acidity of the alkyne hydrogen

$$\begin{tikzcd} CH\equiv CH+Cu_2Cl_2 \arrow[r] \arrow[d, "AgNO_3"] & \underset{\substack{\text{Copper acetylide}\\ \text{(Red)}}}{HC\equiv C^{-}Cu^{+}} \\ HC\equiv C^{\ominus}Ag^{+} & \end{tikzcd}$$

The above reactions forms basis of test to distinguish between terminal and non-terminal alkynes, since non-terminal alkynes $(R-C\equiv C-R')$ do not react with these metal salts.

45. (c) $CH_3CH_2Br \xrightarrow{C_2H_5O^-Na^+} CH_3\overset{\oplus}{C}H_2 + C_2H_5O^{\ominus}$

Ethoxide ion is a strong base which abstracts proton from carbocation to form alkene.



$$\underset{\underset{H}{|}}{CH_2}-\overset{\oplus}{C}H_2 + C_2H_5O^{\ominus} \longrightarrow CH_2=CH_2 + C_2H_5OH$$

Thus, there is a loss of hydrogen and halogen both leading to dehydrohalogenation.