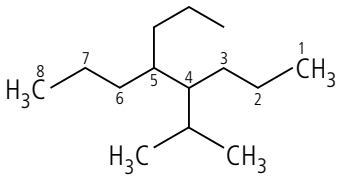
Hydrocarbons

CHAPTER 13

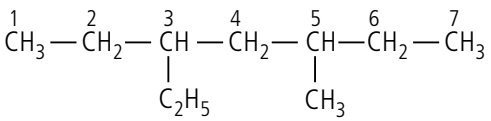
TRY YOURSELF ANSWERS

1. (i)



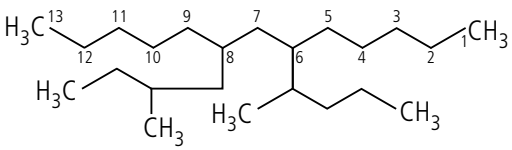
4-*Iso* propyl-5-propyl octane

(ii)



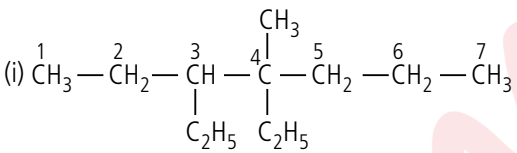
3-Ethyl-5-methylheptane

(iii)

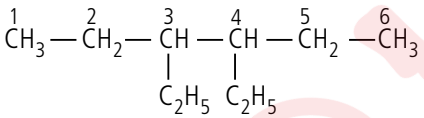


6-(1- Methyl butyl) -8-(2-methyl butyl)tridecane

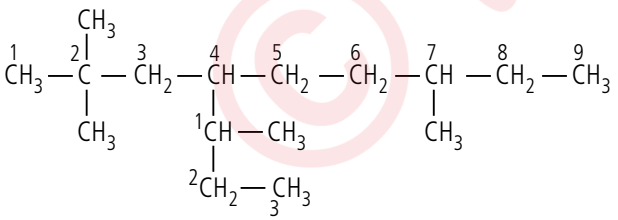
2. (i)



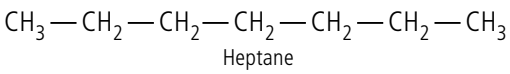
(ii)



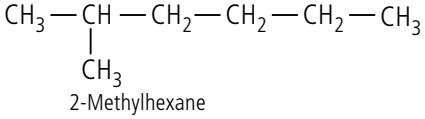
(iii)



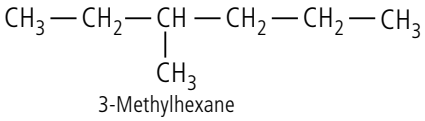
3. Nine isomers are possible for the alkane having molecular formula C_7H_{16}.



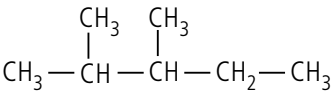
Heptane



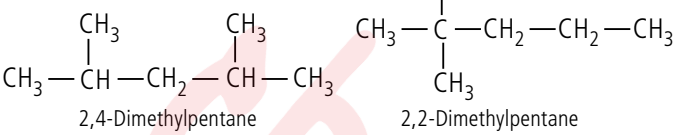
2-Methylhexane



3-Methylhexane

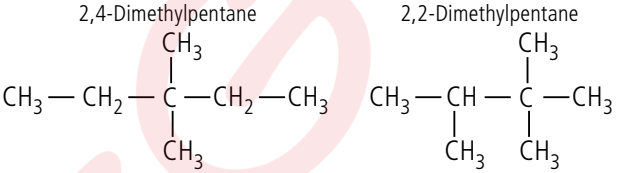


2,3-Dimethylpentane



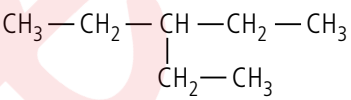
2,4-Dimethylpentane

2,2-Dimethylpentane



3,3-Dimethylpentane

2,2,3-Trimethylbutane

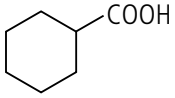


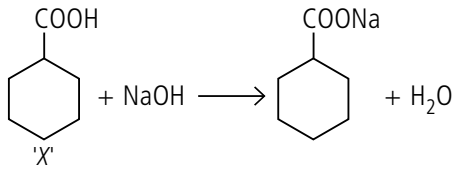
3-Ethylpentane

4. $2R\text{COONa} + 2H_2O \xrightarrow{\text{Electrolysis}} R-R + 2CO_2 + H_2 + 2NaOH$

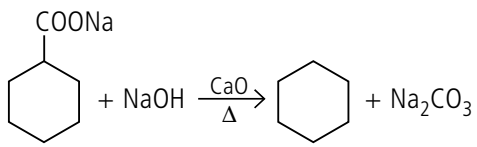
Sodium carboxylate — Alkane

5. Methane, CH_4 cannot be obtained by Kolbe's electrolytic method.

6. The function of sodalime (NaOH + CaO) is to replace —COONa or —COOH group in *R*COONa or *R*COOH by hydrogen, therefore '*X*' is 



'*X*'



7. (i) $CH_3-Cl + H_2 \xrightarrow[H^+]{Zn} CH_4 + HCl$

(ii) $C_2H_5Br + 2Na + BrC_2H_5 \xrightarrow[\text{ether}]{\text{Dry}} \underset{n\text{-Butane}}{C_2H_5-C_2H_5}$

8. Corey-House alkane synthesis.

$CH_3CH_2Br + 2Li \xrightarrow{\text{Dry ether}} CH_3CH_2Li + LiBr$

Ethyl bromide — Ethyllithium

$2CH_3CH_2Li + CuI \xrightarrow{\text{Dry ether}} Li(CH_3CH_2)_2Cu + LiI$

Lithiumdiethyl cuperate

$Li(CH_3CH_2)_2Cu + CH_3CH_2CH_2Br \xrightarrow{\text{Dry ether}}$

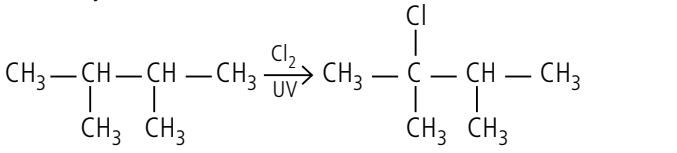
Propyl bromide

$CH_3CH_2CH_2CH_2CH_3 + CH_3CH_2Cu + LiBr$

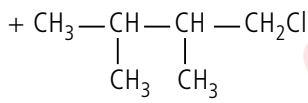
Pentane

For the third step to give a good yield of alkane, the alkyl halide must be methyl halide or a primary alkyl halide or a secondary cycloalkyl halide.

9. Only two.



2,3-dimethylbutane

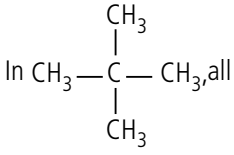


10. Methyl iodide is formed.

$CH_4 + I_2 \underset{}{\overset{HIO_3}{\rightleftharpoons}} CH_3I + HI$

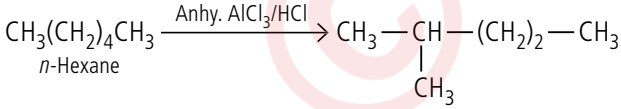
11. A mixture of nitroethane and nitromethane is formed.

12. The alkane is 2, 2-dimethypropane.

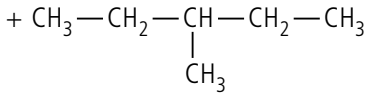


In $CH_3-C(CH_3)_2-CH_3$, all the CH_3 groups are equivalent hence it will give only one monochlorinated product.

13. Isomerisation takes place.



n-Hexane — 2-Methylpentane



3-Methylpentane

14. Increasing order of boiling point :

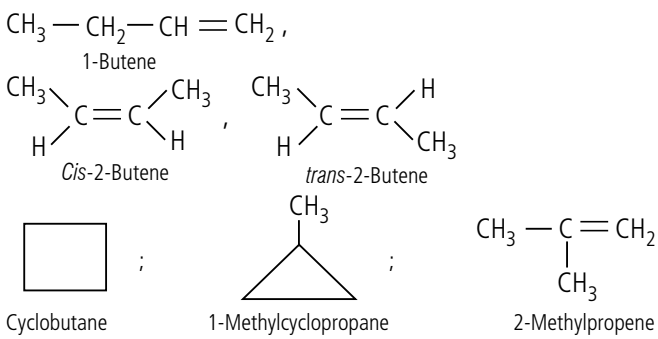
2, 2-dimethylpropane < 2-methylbutane < pentane

15. (a) *n*-Pentane has a greater surface area than *iso*-pentane. Hence, the magnitude of van der Waals' forces is higher in *n*-pentane. Therefore, it has higher boiling point.

(b) Wurtz reaction occurs between two alkyl halides to yield alkane. Methane has only one carbon atom, hence cannot be prepared by using Wurtz reaction.

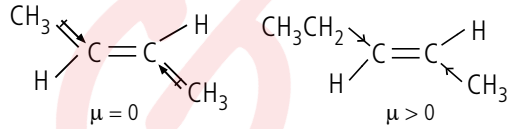
16. (i) Penta-1,3-diene (ii) 2-Methylhex-2-ene

17. 6 (Six)



1-Butene; *Cis*-2-Butene; *trans*-2-Butene; Cyclobutane; 1-Methylcyclopropane; 2-Methylpropene

18. In *trans*-but-2-ene, the dipole moments of the two $C-CH_3$ bonds are equal and opposite and hence they exactly cancel out each other. Thus, *trans*-but-2-ene is non-polar



$\mu = 0$ $\mu > 0$

However, in *trans* pent-2-ene, the + *I*-effect of CH_3CH_2-group is higher than that of CH_3-group, therefore, the dipole moments of $C-CH_3$ and $C-CH_2CH_3$ bonds are unequal. Althogh these two dipoles oppose each other, yet they do not eactly cancel out each other and hence *trans*-pent-2-ene has a small but finite dipole moment and thus is polar.

19. (i) $CH_3-CH_2-CHBr-CH_2Br + Zn \xrightarrow[\Delta]{\text{Alcohol}} ZnBr_2 + CH_2=CHCH_2CH_3$

(ii) $BrCH_2-CH(Br)-CH_2CH_2CH_3 + Zn \xrightarrow[\Delta]{\text{Alcohol}} ZnBr_2 + CH_2=CH-CH_2CH_2CH_3$

20. (i) $CH_3CH_2OH + Al_2O_3 \xrightarrow{400°C} CH_2=CH_2$

(ii) $CH_3CH_2CH_2OH + P_2O_5 \xrightarrow{\Delta} CH_3CH=CH_2$

21. $CH_3CH(Br)CH_2CH_3 \xrightarrow[\Delta]{\text{alc. KOH}} CH_3CH=CHCH_3$

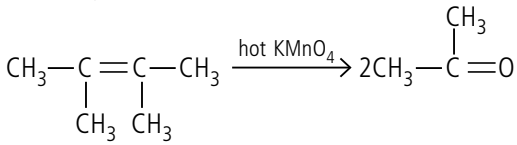
2-Bromobutane — But-2-ene

22. (i) Propanoic acid and ethanoic acids are formed.

$CH_3CH_2CH=CHCH_3 \xrightarrow{\text{hot } KMnO_4} CH_3CH_2COOH + CH_3COOH$

Propanoic acid — Ethanoic acid

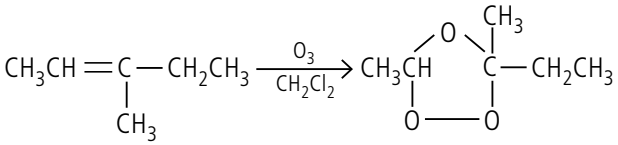
(ii) Propanone is formed.

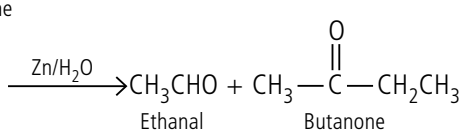


2, 3-Dimethylbut-2-ene

23. $CH_3CH=C(CH_3)-CH_2CH_3$

3-Methylpent-2-ene


3-Methylpent-2-ene


Ethanal Butanone

24. (a) $H_3C-CH_2CH=CH_2 \xrightarrow{B_2H_6,\ H_2O_2,\ HO^-} CH_3CH_2CH_2CH_2OH$

(b) $H_3C-CH_2CH=CH_2 \xrightarrow{\text{alk. } KMnO_4}$ $H_3C-CH_2-\underset{OH}{CH}-CH_2-OH$

25. $CH_3-\underset{\text{2-Methylbut-2-ene}}{\overset{CH_3}{C}}=CH-CH_3 \xrightarrow[\text{Peroxide}]{HBr} CH_3-\underset{\text{2-Bromo-3-methylbutane}}{\overset{CH_3}{CH}}-\underset{Br}{CHCH_3}$

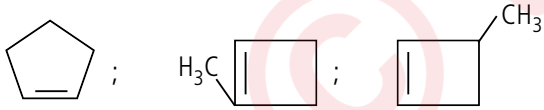
26. $HC\equiv C-CH_2-CH_2-CH_3$ Pent-1-yne

$H_3C-C\equiv C-CH_2-CH_3$ Pent-2-yne

$CH_3-\underset{CH_3}{CH}-C\equiv CH$ 3-Methylbut-1-yne

$CH_2=CH-CH=CH-CH_3$ Penta-1,3-diene; $CH_2=C=CH-CH_2-CH_3$ Penta-1,2-diene;

$CH_2=CH-CH_2-CH=CH_2$ Penta-1,4-diene; $CH_2=\underset{CH_3}{C}-CH=CH_2$ 2-Methyl buta-1,3-diene


Cyclopentene 1-Methylcyclobutene 3-Methylcyclobutene

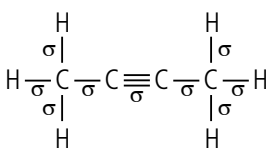
27. (i) 3, 3-Dimethylbut-1-yne

(ii) 4-Methylpent-2-yne

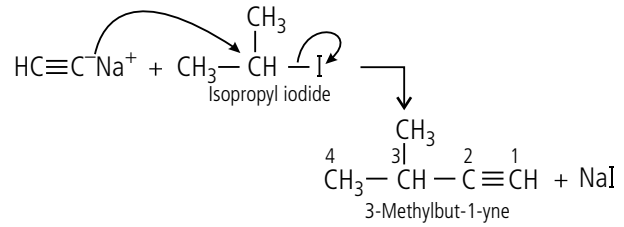
(iii) 7-Methyloct-3-yne

(iv) 3, 3-Dimethylnon-4-yne

(v) 4-Ethyldec-2-yne

28. 
Dimethylacetylene
(Nine σ bonds)

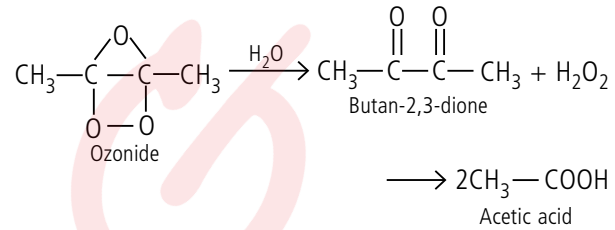
29. $HC\equiv CH \xrightarrow[196\ K]{NaNH_2} HC\equiv C^-Na^+$
Ethyne Sod. acetylide


Isopropyl iodide 3-Methylbut-1-yne

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

31. Acetic acid

$CH_3-C\equiv C-CH_3 + O_3 \xrightarrow[196\text{-}200\ K]{CH_2Cl_2}$
But-2-yne


Ozonide Butan-2,3-dione Acetic acid

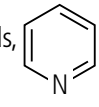
32. 2, 2-Dichloropropane

$CH_3-C\equiv CH + HCl \longrightarrow CH_3-\underset{Cl}{C}=CH_2$
Propyne 2-Chloropropene

$\xrightarrow{HCl} CH_3-\underset{Cl}{\overset{Cl}{C}}-CH_3$
2,2-Dichloropropane

33. *X* = But-1-yne, *A* = 1, 1, 2, 2-Tetrabromobutane,
B = *n*-Butane, C = $CH_3CH_2C\equiv C^-Ag^+$

34. As is does not react with sodamide and ammoniacal cuprous chloride, hence it is not a terminal alkyne.
P is $CH_3C\equiv CCH_3$ (but-2-yne)

35. Among the given compounds,  is aromatic in nature.

36. (i) 1-Butyl-3-ethyl-2-propylbenzene.

(ii) 1, 2-Dimethyl-3-propylbenzene

(iii) 1-Ethyl-4-pentylbenzene

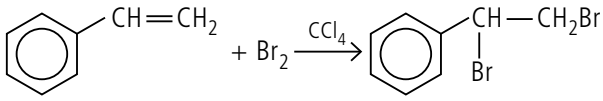
37. Naphthalene is a bicyclic arene. Naphthalene has fused aromatic rings and has the simplest structure when compared with other polycyclic aromatic hydrocarbons.

38. Petroleum and coal tar.

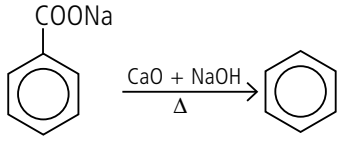
39. (a) 2-Chloro-4-methylanisole

(b) 3-Phenylpropanoic acid

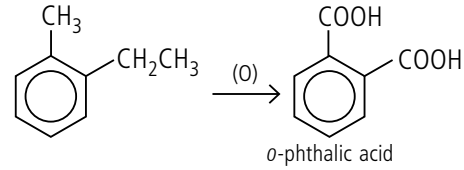
40. 2-Chloro-4-nitrotoluene

41. 

42. Benzene is formed.



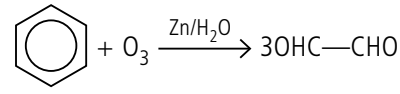
43. The hydrocarbon with formula C_9H_{12} is *o*-ethyltoluene.



o-phthalic acid

44. Because of delocalisation of electrons.

45. Glyoxal



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