

HINTS & SOLUTIONS

Basic concepts of Organic Chemistry

[Set-1]

SECTION-A

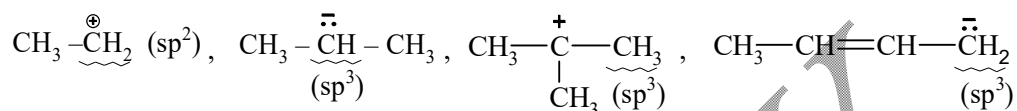
- (iv): Chain isomers are the isomers having same molecular formula but different order of arrangement of carbon atoms.
- (iii): Hydrogen atom at secondary carbon are called secondary hydrogen.

Name	Structure	No. of secondary H
2-Methyl pentane	$\begin{array}{ccccccc} \text{CH}_3 & - & \text{CH} & - & \text{CH}_2 & - & \text{CH}_2 & - & \text{CH}_3 \\ & & & & & & & & \\ & & \text{CH}_3 & & & & & & \end{array}$	4
2,3-Dimethyl pentane	$\begin{array}{ccccccc} \text{CH}_3 & - & \text{CH} & - & \text{CH} & - & \text{CH}_2 & - & \text{CH}_3 \\ & & & & & & & & \\ & & \text{CH}_3 & & \text{CH}_3 & & & & \end{array}$	2
3-Methyl hexane	$\begin{array}{ccccccc} \text{CH}_3 & - & \text{CH}_2 & - & \text{CH} & - & \text{CH}_2 & - & \text{CH}_2 & - & \text{CH}_3 \\ & & & & & & & & & & \\ & & & & \text{CH}_3 & & & & & & \end{array}$	6
2, 2-Dimethyl propane	$\begin{array}{c} \text{CH}_3 \\ \\ \text{H}_3\text{C} - \text{C} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array}$	zero

- (i): $\text{CH}_3 - \overset{\oplus}{\text{C}} = \ddot{\text{O}}$: is the least stable out of the four given due to incomplete octet of positively charged carbon.
- (iii): $\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$, each carbon atoms is doubly bonded ($3\sigma + 1\pi$) and is sp^2 hybridised.
- (i): Free radical, $\text{R}^\cdot \rightarrow sp^2 \rightarrow$ trigonal planar (AX_3)
Carbocation, $\text{R}^+ \rightarrow sp^2 \rightarrow$ trigonal planar (AX_3)
Carbanion, $\text{R}^- \rightarrow sp^3 \rightarrow$ trigonal pyramidal (AX_3E)
- (iv): $\text{CH}_3 - \text{CH}^+ - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$ and $\text{CH}_3 - \text{CH}_2 - \text{CH}^+ - \text{CH}_2 - \text{CH}_3$ both are secondary carbocations but $\text{CH}_3 - \text{CH}^+ - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$ is more stable due to more number of neighbouring C - H σ bonds (five C - H σ bonds), more hyperconjugation and more stability.

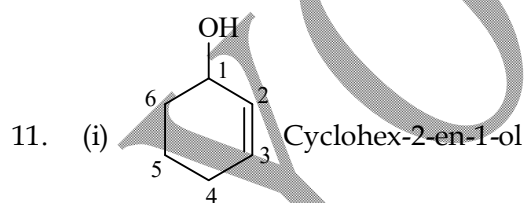
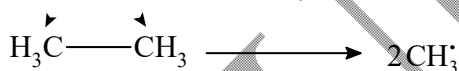
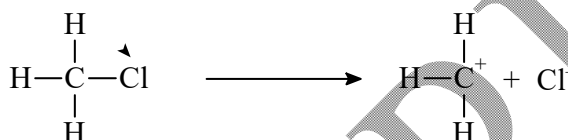
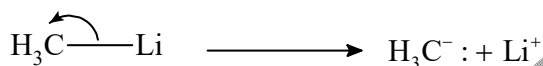
7 (iii): $\text{H}_3\text{C}-\overset{\text{OH}}{\underset{\text{CH}_3}{\text{C}}}-\text{CH}_3$ and $\text{CH}_3-\overset{\text{CH}_3}{\underset{\text{CH}_3}{\text{C}}}-\text{CH}_2\text{OH}$ have same molecular formula, same arrangement of carbon atoms but different position of the functional group (OH). These are position isomers.

8. (i): Carbon can have a trigonal planar geometry when carbon is sp^2 hybridised with three bond pair of AX_3 type.

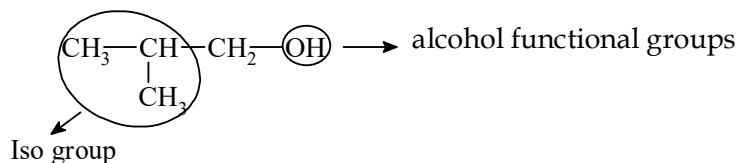


9. (iii): In CH_3^+ carbon has an incomplete octet with one empty p-atomic orbital

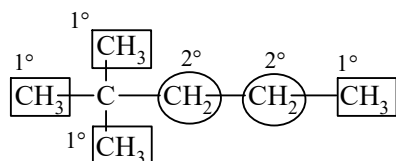
10. (ii): Carbon is more electronegative than Li



(ii) Isobutyl alcohol



12. (i) 2,2-Dimethyl pentane



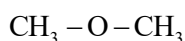
Number of primary carbon atoms = 4

Number of secondary hydrogen atom = 4

Ratio of number of primary carbon atoms to the number of secondary hydrogen atoms is 1 : 1

(ii) Monohydric alcohols (one OH) and ethers are functional isomers.

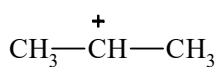
The functional isomer of ethyl alcohol, C_2H_5OH is



IUPAC name: Methoxy methane

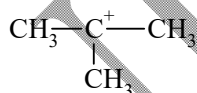
OR

(i)



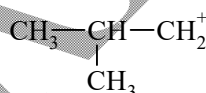
(A)

6 neighbouring C - H
 σ bonds



(B)

9 neighbouring C - H
 σ bonds



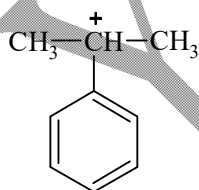
(C)

1 neighbouring C - H
 σ bonds

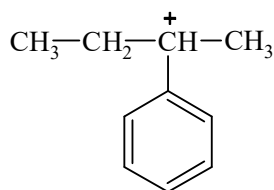
The increasing stability order is



(ii)

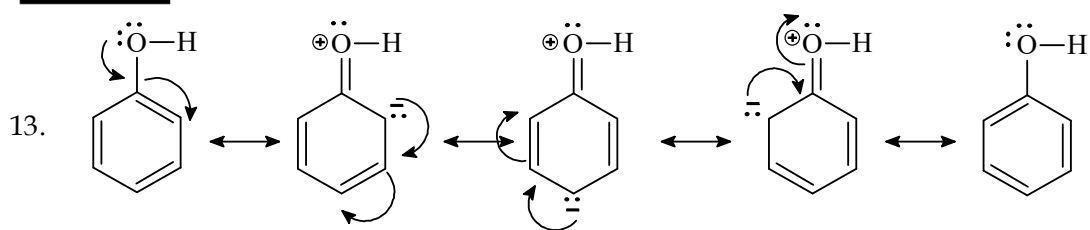


is more stable than

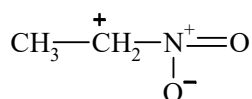


although both are secondary

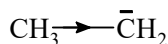
carbocations. The first one has 6 neighbouring C - H σ bonds, there is more hyperconjugation and hence more stability



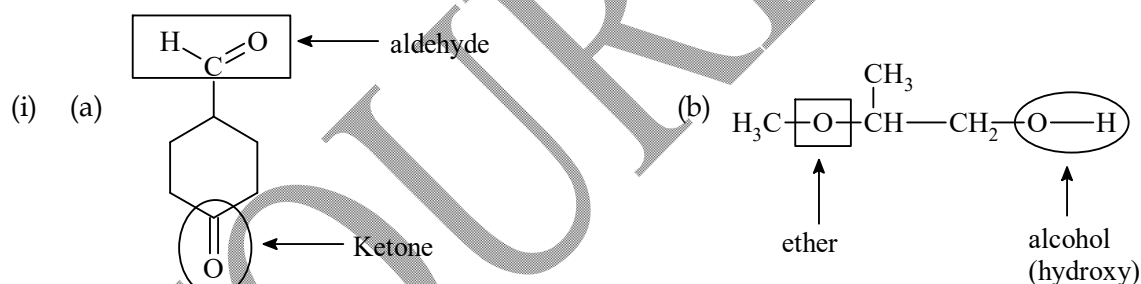
14. (i) $\text{CH}_3-\overset{+}{\text{C}}\text{H}-\text{NO}_2$ is less stable than $\text{O}_2\text{N}-\text{CH}_2-\overset{+}{\text{C}}\text{H}_2$ because the electron withdrawing nitro group is directly attached to the positively charged carbon atom. Also, there is a repulsion between the two adjacent positively charged atoms.



- (ii) The conjugate base of methane is CH_3^- and the conjugate base of ethane is $\text{CH}_3-\overset{-}{\text{C}}\text{H}_2$. CH_3^- does not have any electron donating group attached to carbon whereas one electron donating group attached to negatively charged carbon and makes the carbanion less stable. Hence, CH_3^- is more stable than $\text{CH}_3-\overset{-}{\text{C}}\text{H}_2$



OR



- (ii) Isomers having the same molecular formula same functional group but different size of the alkyl group attached to the functional group are called **metamers** and the phenomenon is called **metamerism**.

$\text{CH}_3-\text{O}-\text{CH}_2-\text{CH}_2-\text{CH}_3$ and $\text{CH}_3-\text{CH}_2-\text{O}-\text{CH}_2-\text{CH}_3$ are metamers.

15. (i) $\text{CH}_3-\text{CH}_2-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$, its chain isomers is $\text{CH}_3-\underset{\text{CH}_3}{\text{CH}}-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$

- (ii) Position isomer of methoxy propane is

