HINTS & SOLUTIONS

Basic concepts of Organic Chemistry

[Set-2]

SECTION-A

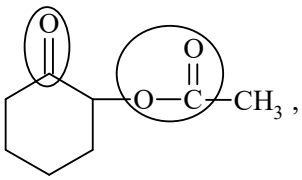
1. (iii): Propyne, $\overset{sp^3}{CH_3}-\overset{sp}{C}\equiv\overset{sp}{CH}$

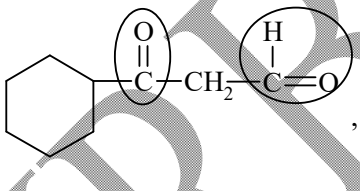
   But-2-yne, $\overset{sp^3}{CH_3}-\overset{sp}{C}\equiv\overset{sp}{C}-\overset{sp^3}{CH_3}$

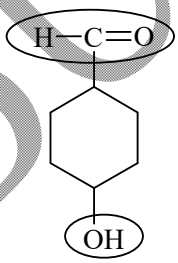
   1, 2- dicyano ethyne, $\overset{sp}{N}\equiv\overset{sp}{C}-\overset{sp}{C}\equiv\overset{sp}{C}-\overset{sp}{C}\equiv N$

2. (iii): Metamers have the same molecular formula, same functional group but different size of the alkyl group attached to the functional group.

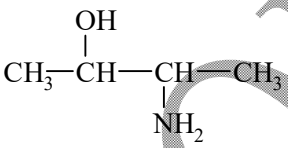
3. (iii):





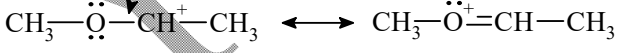


   Two functional groups each.

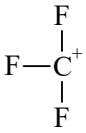
4. (i) 

   OH has a higher priority than NH_2, therefore, NH_2 comes a a prefix amino. The correct name should be

   3-Aminobutan-2-ol

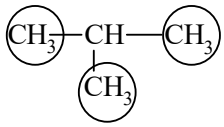
5. (iv): 

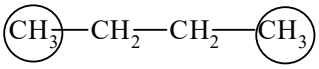
   is stable due to resonance and it is secondary carbocation.

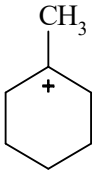
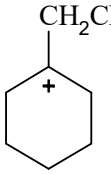
    is unstable due to –I effect of F.

   $(CH_3)_3C^+$ is stable due to hyperconjugation (there are 9 neighbouring C – H σ bonds)

   $(CH_3)_2CH^+$ is a secondary carbocation and is stable due to hyperconjugation

6. (iv): Isobutane →  nine primary hydrogens

n-butane →  six primary hydrogens.

7. (ii):  is more stable than  due to more hyperconjugation although both are tertiary carbocation.

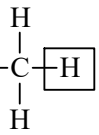
8. (iii): $CH_3CH_2\overset{+}{C}H_2 < CH_3-\overset{+}{C}H-CH_2-CH_3 < CH_3-\overset{+}{C}H(CH_3)-CH_3$

(1°) (2°) (2°)

2 C– H σ bonds 5 C– H σ bonds 9 C– H σ bonds

→ increasing hyperconjugation

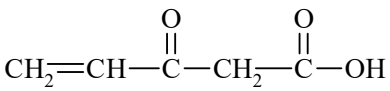
9. (ii): More the stability of the conjugate base, more the acidic nature of hydrogen

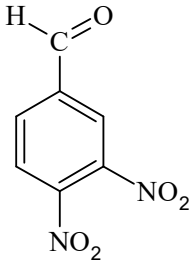
 is the most acidic hydrogen as its conjugate base $O_2N-CH_2^-$ get stabilized by –I effect of NO_2 group

10. (i) $CH_3-\dot{C}H_2$ is the least stable due to +I effect of CH_3. All other three are resonance stabilized.

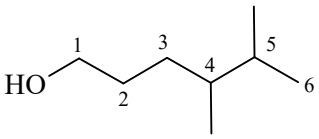
11. (i): $CH_3-\overset{\oplus}{C}H-CH_2-CH_2-CH_3$ is more stable than $CH_3CH_2\overset{\oplus}{C}H-CH_2CH_2$ although both are secondary carbocation due to more number of neighbouring C – H σ bonds present which can participate in hyperconjugation.

(ii) $\overset{\oplus}{C}H_2-CH=CH-\overset{\ominus}{\ddot{O}}:$ is more stable than $\overset{\ominus}{\ddot{C}}H_2-CH=CH-\overset{\oplus}{\ddot{O}}:$ although one of the atom in both the structure have an incomplete octet (CH_2^+ carbon in first structure and $\overset{+}{\ddot{O}}:$ in the second structure) but first structure has negative charge on more electronegative atom oxygen and second structure has negative charge on the less electronegative carbon.

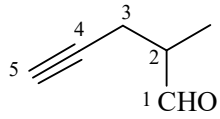
12. (i) 

(ii) 

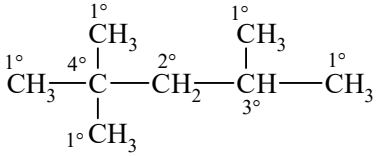
OR

(i) 

4, 5-dimethyl hexan-1-ol

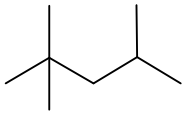
(ii) 

2-methyl pent-4-ynal

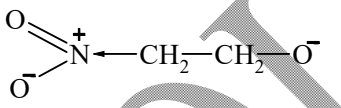
13. 

2,2,4-Trimethyl pentane

Bond-line structure is

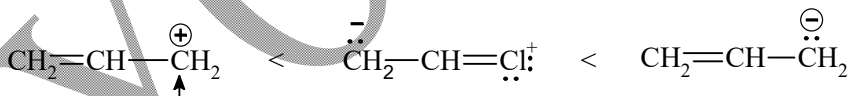


14. (i) $O_2N-CH_2-CH_2-O^-$ is more stable than $CH_3-CH_2-O^-$ due to more dispersal of negative charge by electron withdrawing NO_2 group



$CH_3 \rightarrow CH_2 \rightarrow O^-$ gets destabilized by electron donating alkyl group.

(ii) The order of increasing stability is



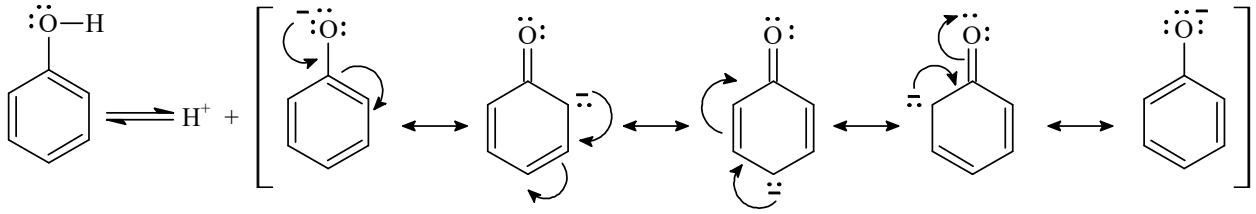
This carbon has incomplete octet

less stable although each and every atom has complete octet but positve charge on more electronegative chlorine

(iii) Phenol is stronger acid than water becasue its conjugate base, phenoxide ion is more stable then OH- due to resonane.

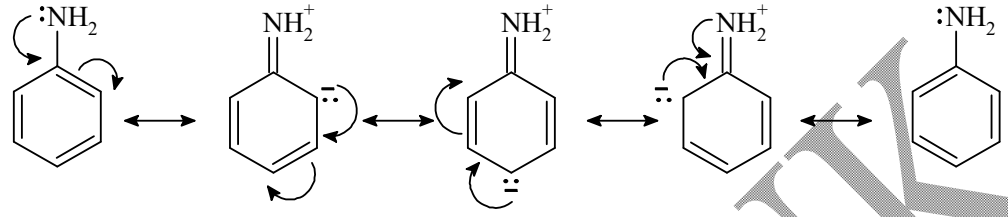
$$H_2O \rightleftharpoons H^+ + OH^-$$

CB



OR

(i)



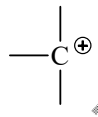
(ii) $H_2C=CH-CH_2-C\equiv N$

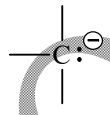
$sp^2 \quad sp^2 \quad sp^3 \quad sp$

15. (i) Reaction intermediates are molecular entities formed from the reactants but are consumed in the next step of the reaction to form products.

These reaction intermediates are short lived and are formed by homolytic or heterolytic cleavage of the bond.

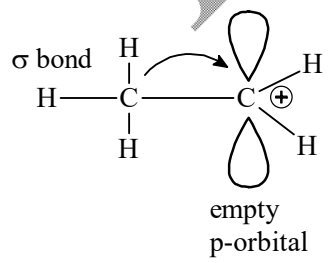
The three important reaction intermediates are

(a) Carbocation 

(b) Carbanion 

(c) Free radiclas 

(ii) **Hyperconjugation** is the stabilizing interaction that result from the interaction of the empty p-orbital of carbon or π-orbital of carbon with an adjacent C – H σ bond to give an extended molecular orbital that increases the stability of the system.



(iii) $CH_3-CH_2-CH_2-CH_2-OH$
Butan-1-ol

$CH_3-CH(CH_3)-CH_2-OH$

2-methyl propan-1-ol

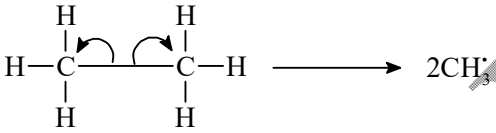
$CH_3-CH_2-CH(OH)-CH_3$
Butan-2-ol

$CH_3-C(OH)(CH_3)-CH_3$

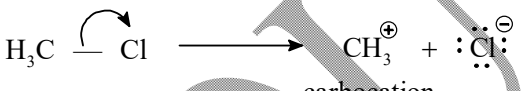
2-methyl propan-2-ol

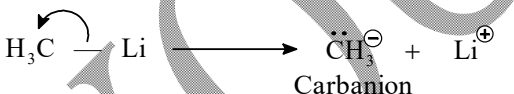
OR

(i) **Homolytic cleavage** of a bond means breaking the covalent bond evenly. The bond pair of electrons is distributed evenly between the two atoms. This happened when the two bonded atoms have same or nearly same electronegativity. This homolytic fission results in the formation of free radicals.



Heterolytic cleavage occurs when the covalent bond break up unevenly and the bond pair shift towards one of the bonded atom. This happens when the two atoms of a covalent bond have a large difference in electronegativity. The heterolytic cleavage results in the formation of carbocation and carbanion.


carbocation


Carbanion

(ii) $H_3C-\overset{\oplus}{C}H_2$ is more stable than $CH_3-\overset{\ominus}{C}H_2$ due to more disperseal of positive charge by the electron donating CH_3 group.

(iii) C_4H_8O

$CH_3-CH_2-CH_2-CHO$
Butanal

$CH_3-C(=O)-CH_2-CH_3$

Butanone

$CH_3-CH(CH_3)-CHO$

2-Methyl propanal

