III. Long Answer Type Questions (5 Marks)

Question 1. Explain hyperconjugation effect. How does hyperconjugation effect explain the stability ofalkenes ?
Answer:
Hyperconjugation: The relative stability of various classes of carbonium ions may be explained by the number of no-bond resonance structures that can be written for them. Such structures are arrived by shifting the bonding electrons from an adjacent C—H bond to the electron-deficient carbon. In this way, the positive charge originally on carbon is dispersed to the hydrogen. This manner of electron release by assuming no-bond character in the adjacent C—H bond is called Hyperconjugation or No-Bond Resonance. The greater the hyperconjugation, the greater will be the stability of the compound. The increasing order of stability can be shown as.

$$CH_3-CH=CH-CH_3 < CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}=CH-CH_3 < CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}=\underset{\displaystyle CH_3}{\underset{|}{C}}-CH_3$$

Question 2. (a) What is the basic principle involved in the estimation of nitrogen by Dumas method.
(b) In a Dumas nitrogen estimation method, 0.30 g of an organic compound gave 50 cm^3 of N_2 collected at 300 K and 715 mm Hg pressure. Calculate the percentage composition of nitrogen in the compound. (Vapour pressure of water at 300 K is 15 mm Hg)
Answer: (a) This method is based upon the fact that nitrogenous compound is heated with
copper oxide in an atmosphere of carbon dioxide yield free nitrogen.

$$C_xH_yN_z + CuO \longrightarrow xCO_2 + \frac{y}{2}H_2O + \frac{z}{2}N_2 + (Cu)$$

(*b*) $P_1 = 715 - 15 = 700$ mm Hg, $P_2 = 760$ mm Hg

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$T_1 = 300$ K, $T_2 = 273$ K
$V_1 = 50\ cm^3$, $V_2 = ?$

$$V_2 = \frac{700 \times 50 \times 273}{300 \times 760}$$

$$= 41.9\ cm^3$$

$$\% \text{ of } N = \frac{28}{22400} \times 41.9 \times \frac{100}{W}$$

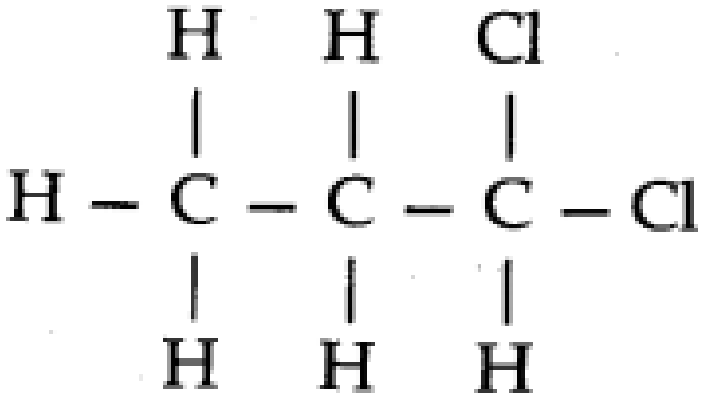
$$= 17.46\%$$

Question 3. (a) What is Lassaigne's extract? Will NaCN give a positive Lassaigne's test for nitrogen?
(b) Which colour will appear in the Lassaigne's test if the compound contains both nitrogen and sulphur.
(c) Why is Lassaigne's extract prepared in distilled water? Can we detect oxygen in a compound by Lassaigne's test?
Answer:

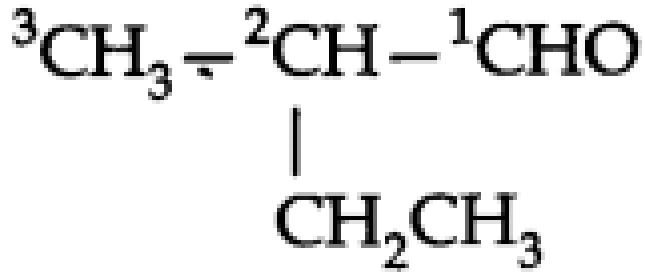
(a) When organic compound is fused with sodium metal and then extracted by water, it is called Lassaigne's extract. Yes.
(b) Blood red colour.
(c) Lassaigne's extract is prepared in distilled water since tap water contains Cl ions. No, oxygen cannot be detected by Lassaigne's test.

IV. Multiple Choice Questions

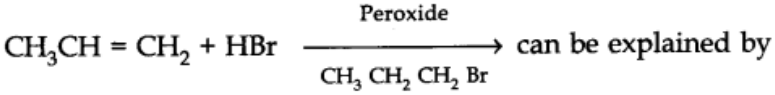
Question 1. The large number of organic compounds is due to
(a) the valency of carbon
(b) a small size of carbon
(c) a special property of carbon known as catenation
Question 2. The IUPAC name of



(a) 1, 2-dichloropropane
(b) 3, 3-dichloropropane
(c) 1, 1-dichloropropane
(d) dichloropropane
Question 3. The IUPAC name of



(a) 2-methyl butanal
(b) butan-2-aldehyde
(c) 2-ethylpropanal
(d) 3-methyl isobutraldehyde
Question 4. The bond that undergoes heterolytic cleavage most readily is
(a) C-C (b) C-O (c) C-H (d) O-H
Question 5. The reaction

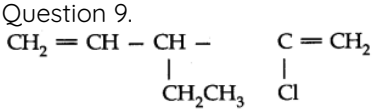


(a)carbocation formation
(b) free-radical mechanism
(c) carbanion formation
(d) none of these
Question 6. The hybridization state of a carbocation is
(a) sp^4 (b) sp^3 (c) sp^2 (d) sp
Question 7. Which of the following are electrophiles?
(a) Dimethyl sulphide
(b) Bromides
(c) Carbon dioxide
(d) Ammonia

Question 8. Which of the following compounds will exhibit cis-trans isomerism?

(a) 2-Butene
(b) 2-Butyne
(c) 1-Butene
(d) 2-Butanol

Question 9.



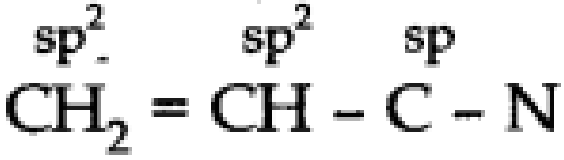
The IUPAC name of this compound is

(a) 3-ethyl-4-chloro-1, 4-pentadiene (b) 2-chloro-3-ethyl-1, 4-pentadiene
(c) 4-chloro ethyl-1-pentene (d) 3-ethyl-4-chloro-4-pentene

Answer:
1. (c)
2. (c)
3. (c)
4. (d)
5. (b)
6. (c)
7. (a) and (c)
8. (a)
9. (b)

V. Hots Questions

Question 1. Write the hybridized state of C atoms in the following
CH_2 = CH - C-N
Answer:



Question 2. Explain why $(CH_3)_3C+$ is more stable than $CH_3C^+H_2$.
Answer: $(CH_3)_3C^+$ has nine alpha hydrogens and has nine hyperconjugation structures while $CH_3C^+H_2$ has three alpha hydrogens and has three hyperconjugation structures, therefore$(CH_3)_3C^+$ is more stable than $CH_3C^+H_2$.

Question 3. Why is an organic compound fused with Sodium for testing nitrogen, halogens and sulphur?
Answer: On fusing with sodium metal the elements present in an organic compound are converted into sodium salts which are water soluble which can be filtered and detected by the respective tests.

Question 4. Under what conditions can the process of steam distillation is used?
Answer: Steam distillation is used to purify the liquids which are steam volatile and not miscible with water!

Question 5. Explain hyperconjugation effect. How does hyperconjugation effect explain the stability ofalkenes?
Answer: The relative stability of various classes of carbonium ions may be explained by the number of no-bond resonance structures that can be written for them. Such structures are obtained by shifting the bonding electrons from an adjacent C-H bond to the electron deficient carbon so the positive charge originally on carbon is dispersed to the hydrogen. This manner of electron release by assuming no bond character in the adjacent C-H bond is called Hyperconjugation. Greater the hyperconjugation, greater will be the stability of alkenes.

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