Important Questions for Class 11

Chemistry

Chapter 12 Organic Chemistry Some Basic Principles and Techniques

Very Short Answer Questions **1 Marks**

1. How many σ and π bonds are present in each of the following molecules?

i. $HC \equiv C - C \equiv CCH_3$

Ans: $\sigma C - C: 4, \sigma C - H: 4, \pi C = C: 4$

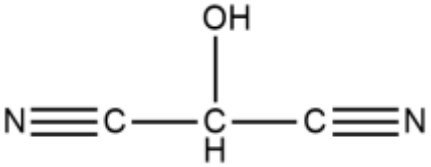
ii. $CH_2 = C = CHCH_3$

Ans: $\sigma C - C: 3, \sigma C - H: 6, \pi C = C: 2$

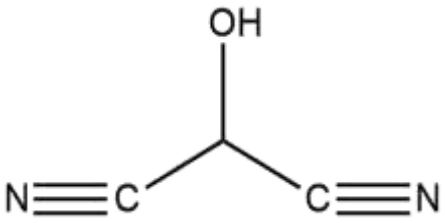
2. Why are electrons easily available to the attacking reagents in $\pi-$ bonds?

Ans: The electron charge cloud of the $\pi-$ bond is located above and below the plane of bonding atoms. This results in the electrons being easily available to the attacking reagents.

3. Write the bond line formula for



Ans:



4. How are organic compounds classified?

Ans:

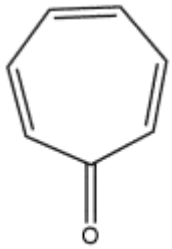
(i) Acyclic or open chain compounds

(ii) Alicyclic or closed chain or ring compounds.

(iii) Aromatic compounds.

5. Define homologous series?
Ans: A group or a series of organic compounds each containing a characteristic functional group forms a homologous series and the members of the series are called homologous.

6. Write an example of a non-benzenoid compound.
Ans:



Tropolene

7. What is the cause of geometrical isomerism in alkenes?
Ans: Alkene has a $\pi-$ bond and the restricted rotation around the $\pi-$ bond gives rise to geometrical isomerism.

8. Name the chain isomers of C_5H_{12} which has a tertiary carbon atom.
Ans: 2-Methyl butane $(CH_3)_2CH-CH_2-CH_3$.

9. Define heterolytic cleavage.
Ans: In heterolytic cleavage the bond breaks in such a fashion that the shared pair of electrons remains with one of the fragments.

10. Define carbocation.
Ans: A species having a carbon atom possessing a sextet of electrons and a positive charge is called carbocation.

11. What are the nucleophiles?
Ans: The electron rich species are called nucleophiles. A nucleophile has affection for a positively charged centre.
Example- OH^-,I^-,CN^-

12. How can the mixture of kerosene oil and water be separated?
Ans: The mixture of kerosene oil and water can be separated by using a separating funnel.

13. Lassaigne's test is not shown by diazonium salts. Why?

Ans: Diazonium salts usually leave N_2 on heating much before they have a chance to react with the fused sodium metal. Therefore, diazonium salts do not show positive Lassaigne's test for nitrogen.

14. In which $C-C$ bond of $CH_3-CH_2-CH_2-Br$, the inductive effect is expected to be the least?

Ans: Magnitude of inductive effect diminishes as the number of intervening bonds increases. Hence the effect is least in third carbon $C-H$ bond.

15. Can you use potassium in place of sodium for fusing an organic compound in Lassaigne's test?

Ans: No, because potassium is more reactive than sodium.

16. Give the reason for the fusion of an organic compound with sodium metal for testing nitrogen, sulphur and halogens.

Ans: The elements present in the compound are converted from covalent form into ionic form by fusing the compound with sodium metal.

17. Write the chemical composition of the compound formed when ferric chloride is added containing both N and S.

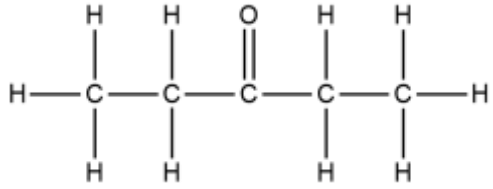
Ans: $FeCl_3 + NaSCN \rightarrow \underset{\text{blood red}}{[Fe(SCN)]^{2+}} + 3NaCl$

Short Answer Questions **2 Marks**

1. Write the expanded form of the following condensed formulas into their complete structural formulas.

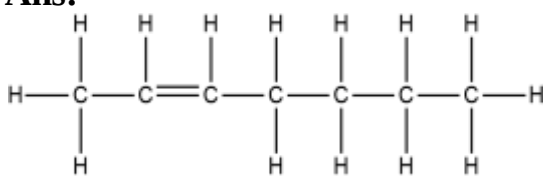
i. $CH_3CH_2COCH_2CH_3$

Ans:



ii. $CH_3CH = CH(CH_2)_3CH_3$

Ans:



2. How does hybridization affect electronegativity?

Ans: The greater the s-character of the hybrid orbitals, the greater is the electronegativity. Thus, a carbon atom having a sp-hybrid orbital with 50% s-character is more electronegative than that possessing sp^2 or sp^3 hybridized orbitals.

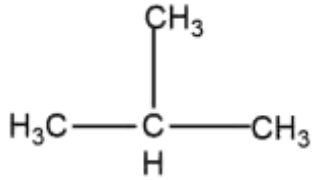
3. Why is sp hybrid orbital more electronegative than sp^2 or sp^3 hybridized orbitals?

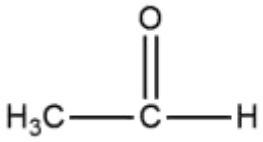
Ans: The greater the s-character of the hybrid orbitals, the greater is the electronegativity. Thus, a carbon atom having a sp-hybrid orbital with 50% s-character is more electronegative than that possessing sp^2 or sp^3 hybridized orbitals.

Example: Hydroxyl group (-OH), Aldehyde group (-CHO), Carboxylic acid group (-COOH), etc.

4. Give two examples of aliphatic compounds.

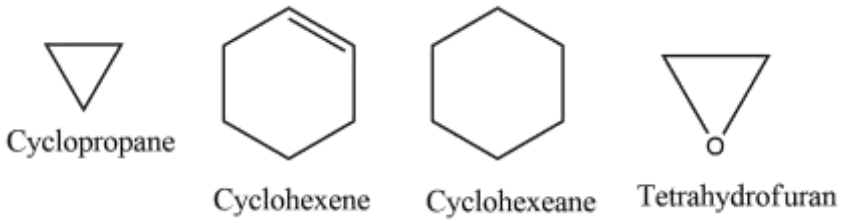
Ans:

(i) 

(ii) 

5. Write an example of an alicyclic compound.

Ans:

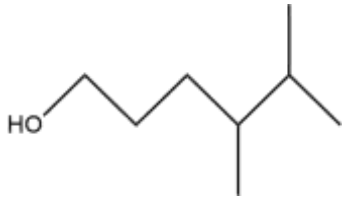


6. For each of the following compounds write a condensed formula and also their bond line formula.

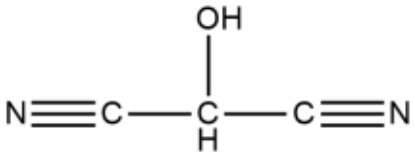
i. **$HOCH_2CH_2CH_2CH(CH_3)CH(CH_3)CH_3$**

Ans: condensed formula - **$HO(CH_2)_5CHCH_3CH(CH_3)_2$**

Bond line formula –

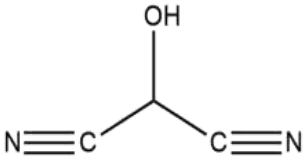


ii.



Ans: condensed formula - $HOCH(CN)_2$

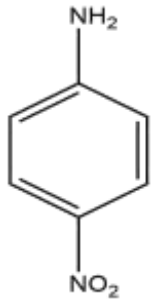
Bond line formula -



7. Write the structural formula of

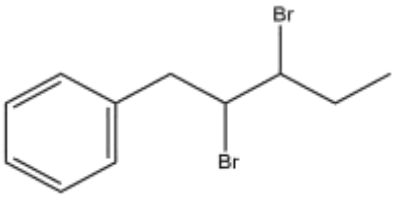
i. p-nitroaniline

Ans:



ii. 2,3- Dibromo-1-phenylpentane

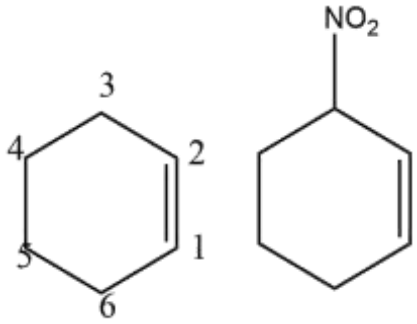
Ans:



8. Derive the structure of 3-nitrocyclohexene

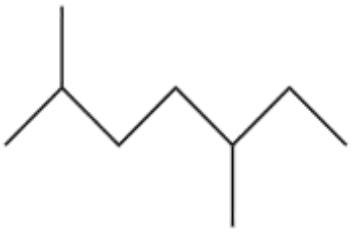
Ans: Six membered ring containing a carbon – carbon double bond is implied by cyclohexene, which is numbered. The prefix 3-nitro means that a nitro group is parent on C-3. Thus, the complete structural formula of the compound is derived.

Double bond is suffixed functional group whereas $-NO_2$ is prefixed functional group; therefore, double bond gets preference over $-NO_2$ group



9. Give the IUPAC name of the following:

i.



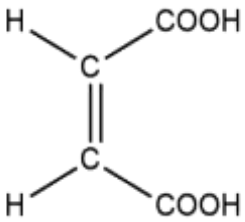
Ans: 2,5-dimethyl heptane

ii. Cl_2CHCH_2OH

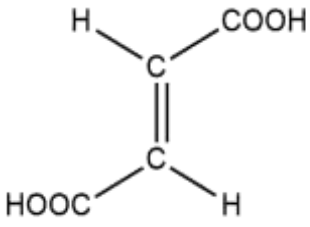
Ans: 2,2-dichloro ethanol

10. Draw the two geometrical isomers of but-2-en-1,4 dioic acid. Which of them will have a higher dipole moment?

Ans:



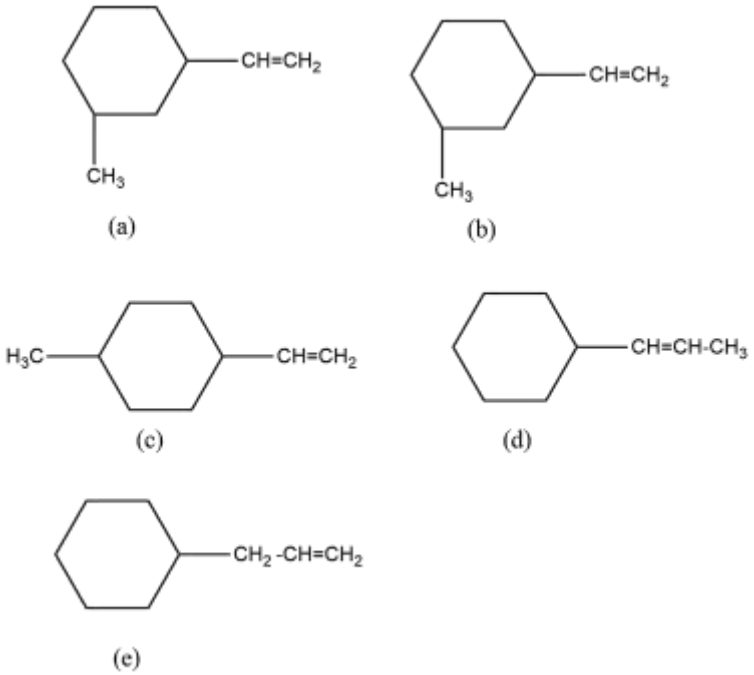
Cis-but-2-en-1,4-dioic acid
more dipole moment



Trans but-2-en-1,4-dioic acid
zero dipole moment

11. How many structural isomers and geometrical isomers are possible for a cyclohexane derivative having the molecular formula C_9H_{16} ?

Ans: five structural isomers



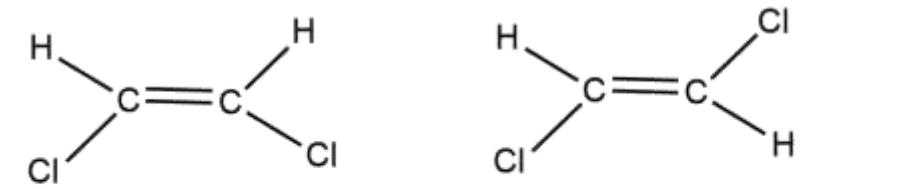
Structure (a) has two geometrical isomers cis and trans.

12. Alkynes does not exhibit geometrical isomers. Give a reason.
Ans: Because of linear geometry alkynes do not exhibit geometrical isomers.

13. Which of the following shows geometrical isomerism?

i. CHCl = CHCl

Ans:



Cis-1,2-dichloroethene Trans-1,2-dichloroethene

ii. $CH_2 = CCl_2$

Ans: This does not show geometric isomerism due to the same molecules on one side.

iii. $CCl_2 = CHCl$

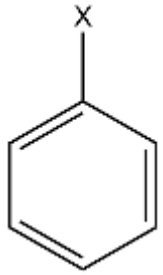
Ans: this does not show geometric isomerism

14. What is a functional group?

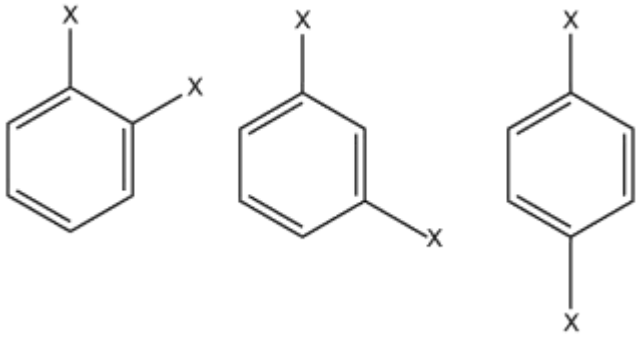
Ans: It may be defined as an atom or group of atoms joined in a specific manner which is responsible for the characteristic chemical properties of the organic compounds.

15. How many isomers are possible for monosubstituted and disubstituted benzene?

Ans: There is one, monosubstituted benzene as



There are three disubstituted benzene as



16. Identify electrophilic centre in the following:

$CH_3CH = O, CH_3C \equiv N, CH_3I$

Ans: The shared carbon atoms are electrophilic centers as they will have partial positive charge due to polarity of the bond.

$CH_3HC = O, H_3CC = N, H_3C - I$

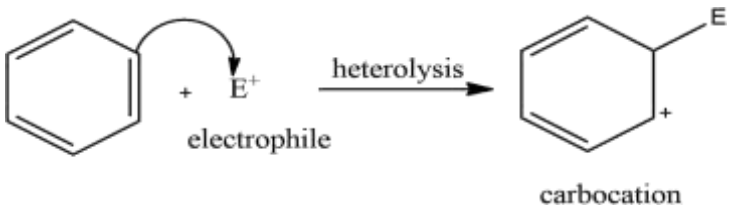
17. For the following bond cleavages, use curved arrows to the electron flow and classify each as photolysis or heterolysis. Identify the reaction intermediates products as free radical carbocation or carbanion.

i. $CH_3O - OCH_3 \rightarrow CH_3O^- + O^-CH_3$

Ans: $CH_3O - OCH_3 \rightarrow CH_3\dot{O} + \dot{O}CH_3$

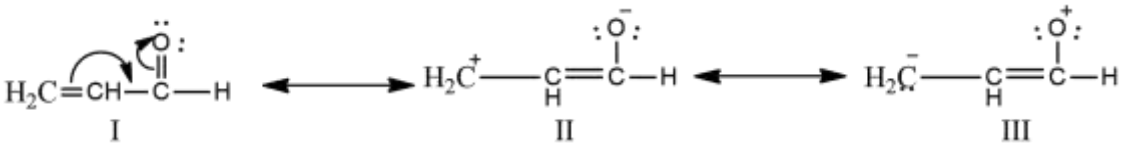
ii.

Ans:



18. Write resonance structures of $CH_2 = CH - CHO$ .Indicate relative stability of the contributing structure.

Ans:



Relative Stability $I > II > III$

19. Write the resonance structure of

i. CH_3NO_2

Ans:

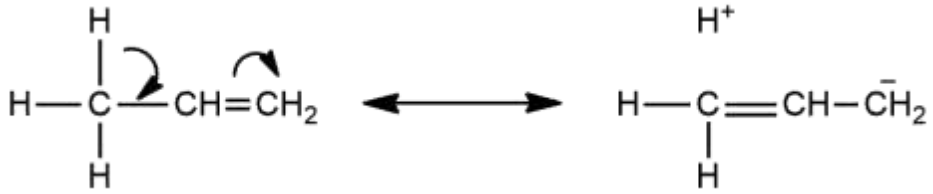
ii. CH_3COO^-

Ans:

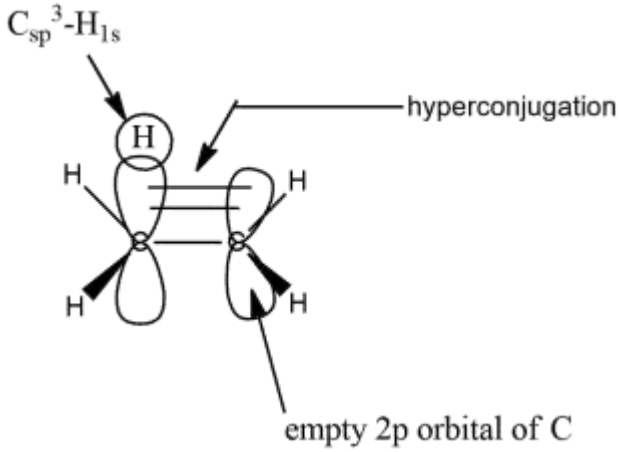
20. Explain why is $(CH_3)_3C^+$ more stable than $CH_3CH_2^+$ and CH_3^+ is the least stable cation.

Ans: Hyper conjugation interaction in $(CH_3)_3C^+$ is greater than in $CH_3CH_2^+$ as $(CH_3)_3C^+$ has nine C-H bonds. In CH_3^+ , the C-H bond the nodal plane of the vacant 2p orbital and hence cannot overlap with it. Thus CH_3^+ locus conjugated stability.

21. Show how hyperconjugation occurs in propene molecules.
Ans:



22. Draw the orbital diagram showing hyperconjugation in ethyl cations.
Ans:



23. Name the common techniques used for purification of organic compounds.
Ans:
(i) Sublimation (ii) Crystallization (iii) Distillation (iv) Differential extraction and (v) Chromatography.

24. Will CCl_4 give white precipitate of AgCl on heating it with $AgNO_3$?
Ans: CCl_4 does not give white precipitate with silver nitrate solution.
$CCl_4 + AgNO_3 \rightarrow$ no reaction
Carbon tetrachloride contains chlorine but it is bonded to carbon by a covalent bond.
Therefore, it is not in ionic form. Hence, it does not combine with silver nitrate solution.

25. without using column chromatography, how will you separate a mixture of camphor and benzoic acid?
Ans: Sublimation cannot be used since both camphor and benzoic acid sublimate on heating. Therefore, a chemical method using $NaHCO_3$ solution is used when

benzoic acid dissolves leaving camphor behind. The filtrate is cooled and then acidified with dilute HCl, to get benzoic acid.

26. A liquid (0.1g) has three components. Which technique will you employ to separate them?
Ans: Column Chromatography is used to separate the three components which are present in the 0.1 g of the given liquid.

27. Name two methods which can be safely used to purify aniline.
Ans: Vacuum distillation and Steam distillation method.

28. What is the basic principle of chromatography?
Ans: The method of chromatography is based on the difference in the rates at which the components of a mixture are adsorbed on a suitable adsorbent.

29. How will you separate a mixture of two organic compounds which have different solubilities in the same solvent?
Ans: by Fractional crystallization.

Long Answer Questions **3 Marks**

1. What is the shape of the following molecules:

i. $\mathbf{H_2C = O}$

Ans: sp^2 hybridized carbon with trigonal planar

ii. $\mathbf{CH_3F}$

Ans: sp^3 hybridized carbon with tetrahedral

iii. $\mathbf{HC \equiv N}$

Ans: sp hybridized carbon with linear structure

2. Giving justification, categories the following molecules or ions as nucleophile or electrophile :

$\mathbf{HS^-, BF_3, C_2H_5O^-, (CH_3)_3N, Cl^-, CH_3C^+ = O, H_2N^-}$

Ans: Nucleophiles: $HS^-, C_2H_5O^-, (CH_3)_3N, H_2N^-$ have an unshared pair of electrons which can be donated and shared with an electrophile.
Electrophile: BF_3, Cl^+, CH_3C^+ have only six electrons which can accept electrons from a nucleophile.

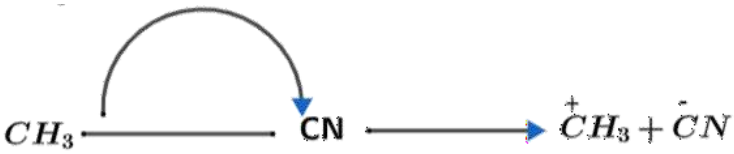
3. Using curved – arrow notation, show the formation of reactive intermediates when the following covalent bond undergo heterolytic cleavage.

i. $CH_3 - SCH_3$

Ans:

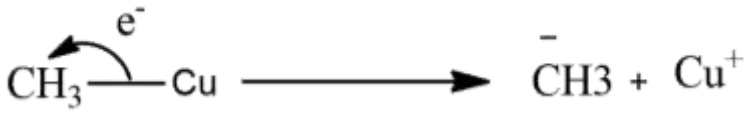
ii. $CH_3 - CN$

Ans:



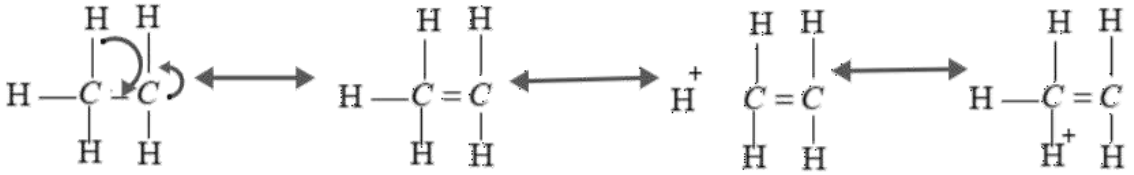
iii. $CH_3 - Cu$

Ans:



4. Benzyl carbocation is more stable than ethyl carbonation. Justify.

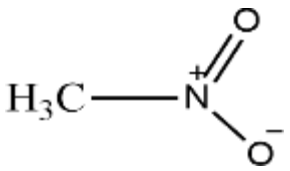
Ans: In ethyl carbocation, there is only hyper conjugation of the three α – hydrogen atoms and as a result, the following contributing structures are feasible.



But benzyl carbocation is more stable due to the presence of resonance and the following resonating structures are possible.

5. Which of the following pairs of structures do not constitute resonance structures?

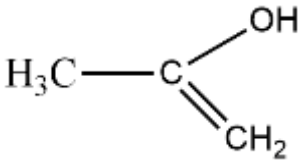
i.



and $CH_3 - O - N = O$

Ans: $CH_3 - O - N = O$

ii.



and $(CH_3)_2CO$

Ans: $(CH_3)_2 CO$

iii. $CH_3CH = CHCH_3$ and $CH_3CH_2CH = CH_2$

Ans: $CH_3CH_2CH = CH_2$

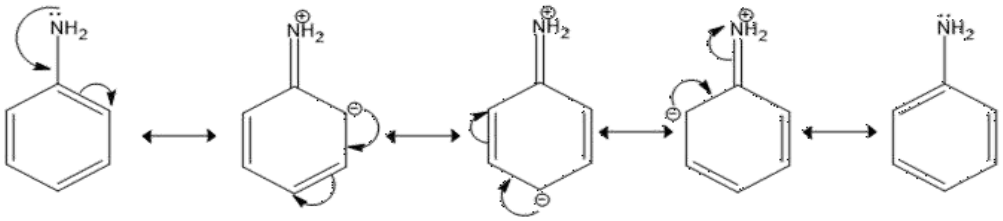
6. Write resonance structures of

i. CH_3COO^-

Ans:

ii. $C_6H_5NH_2$

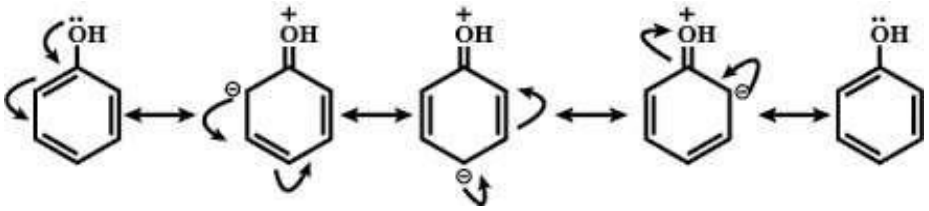
Ans:



7. Draw the resonance structures for the following compounds.

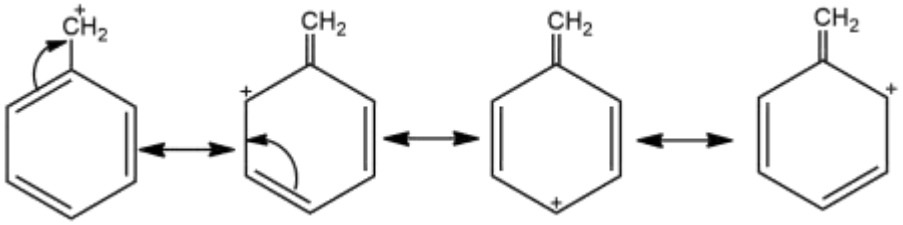
i. C_6H_5OH

Ans:



ii. $C_6H_5-C^+H_2$

Ans:



8. 0.395g of an organic compound by Carius method for the estimation of sulphur gave 0.582g of $BaSO_4$. calculate the percentage of sculpture in the compound.

Ans: Mass of $BaSO_4$ =0.582g

Molecular weight of $BaSO_4$ = 233g/mol

233g of $BaSO_4$ contain sulphur = 32 g

0.582g of $BaSO_4$ contains sulphur = $\frac{32}{233}\times 0.582$

Percentage of sulphur = $\frac{\text{weight of sulphur}}{\text{weight of compound}}\times 100$

$= \frac{32\times 0.582}{233\times 0.395}\times 100 = 20.24\%$

9. 0.40g of an organic compound gave 0.3g of AgBr by Carius method. Find the percentage of bromine in the compound.

Ans: Mass of the compound=0.40g

Now 188g of AgBr will contain Br = 80g

Therefore, 0.3g of AgBr will contain Br = $\frac{80}{188}\times 0.3 = 0.127\text{g}$

The percentage of Br in organic compound= $\frac{0.127}{0.40}\times 100 = 31.75\%$

10. 0.12g of organic compound containing phosphorus gave 0.22g of $Mg_2P_2O_7$ by the usual analysis. Calculate the percentage of phosphorus in the compound.

Ans: Here the mass of the compound taken= 0.12g

Mass of $Mg_2P_2O_7$ formed = 0.22g of atoms of P

Now 1 mole of $Mg_2P_2O_7$ formed = $(2\times 24+2\times 31+1687)$ = 222g of $Mg_2P_2O_7$

=62%

i.e, 222g of $Mg_2P_2O_7$ contain P = 62g

Therefore, 222g of $Mg_2P_2O_7$ will contain Phosphorus = $\frac{62}{222} \times 0.22$

but this is the amount of phosphorus present in 0.12g of organic compound.

Hence, percentage of phosphorous = $\frac{62}{222} \times \frac{0.22}{0.12} \times 100 = 51.20$

11. Ammonia produced when 0.75g of a substance was kjeldahlized, neutralized $30cm^3$ of 0.25N H_2SO_4 . Calculate the percentage of nitrogen in the compound.

Ans: Mass of the organic compound= 0.75g

Volume of H_2SO_4 used = $30cm^3$

Normality of H_2SO_4 = 0.25N

$30cm^3$ of H_2SO_4 of normality 0.25N ≡ 30ml of NH_3 solution of normality 0.25N

But $1000cm^3$ of NH_3 of normality 1 contains 14g of nitrogen.

$\therefore 30cm^3$ of 0.25N NH_3 contains nitrogen= $\frac{14}{1000} \times 30 \times 0.25$

Percentage of nitrogen =

$$\frac{\text{mass of nitrogen}}{\text{mass of substance}} \times 1000 = \frac{14}{1000} \times \frac{30 \times 0.25}{0.75} \times 100 = 14.00$$