Class 11 Chemistry

Organic Chemistry- Some Basic Principles And Techniques

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Exercise 12.1

Given the hybridistaiton state of each carbon in the following compounds :

I. $CH_2 = C = O$ II. CH_3 - $CH = CH_2$

III. $\left(CH_3\right)_2 CO$ IV. $CH_2 = CH = C \equiv N$

v. C_6H_6

(A) `

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Exercise 12.2

Indicate the σ - and π - bonds in the following molecules:

I. C_6H_6 II. C_6H_{12} III. CH_2CI_2

IV. $CH_2 = C = CH_2$ V. CH_3NO_2

VI. $HCONHCH_3$

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Exercise 12.3

Write the bond line formula for the following compounds:

I. Isopropyl alcohol II. 2,3-Dimethyl butanal

III. Heptan-4-one

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Exercise 12.4

Give the IUPAC names of the following compounds :

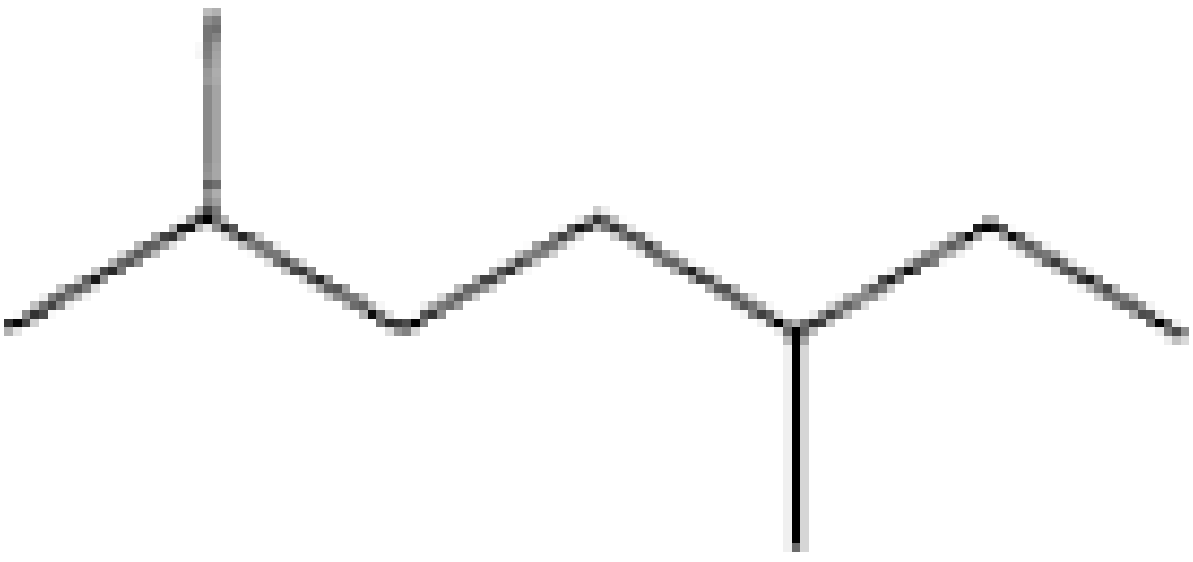
(a)



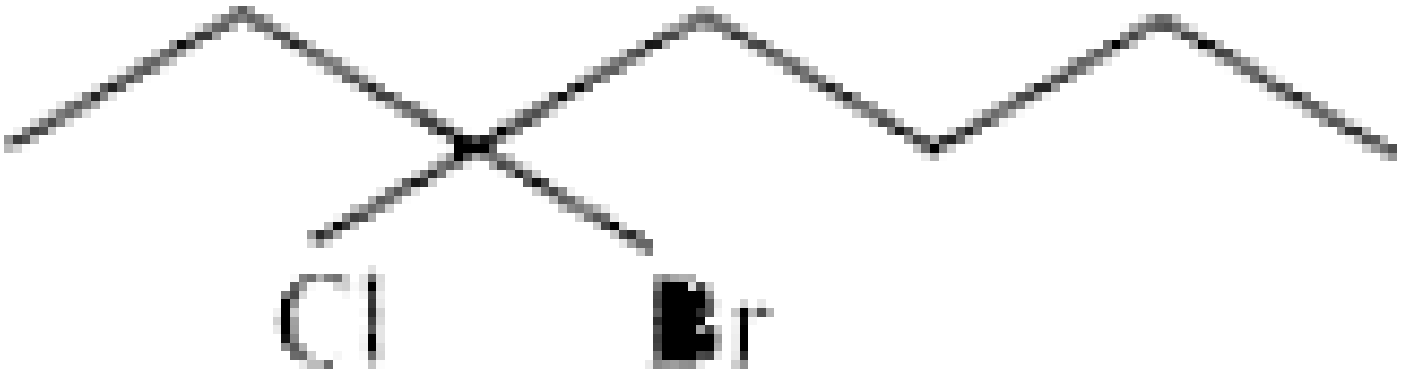
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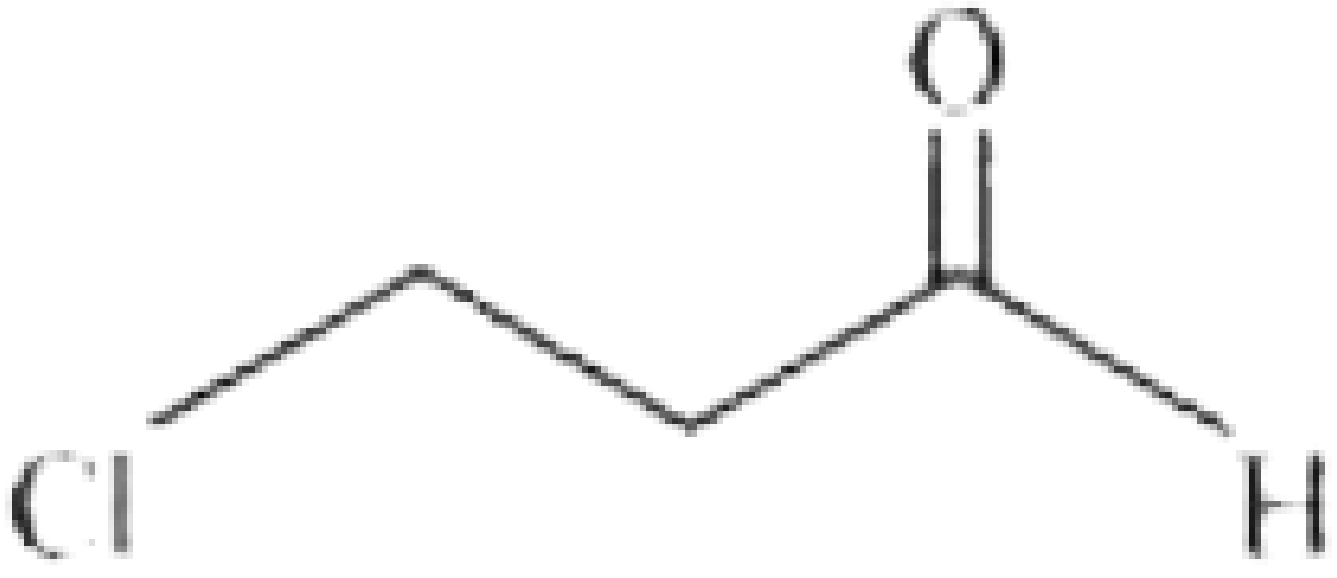
(c)



(d)



(e)



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Exercise 12.5

Which of the following represents the corrcet *IUPAC* name for the compounds concerned?

a. 2,2-Dimethy1 pentane or 2-Dimethy1 pentane

b. 2,4,7-Trimethy1octane or 2,5,7-Trimethyloctane

c. 2-Chloro-4-methy1pentane or 4-Chloro-2-melthypentane

d. But-3-yn-1-ol or But-4-ol-1-yne

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Exercise 12.6

Draw the formulae for the first five numbers of each homologous series beginnig with the following compounds:

a. H - $COOH$

b. CH_3COCH_3

c. H - $CH = CH_2$

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Exercise 12.7

Give condensed and bond line structural formulas and identify the functional group(s) present, if any, for :

(a) 2,2,4-Trimethylpentane

(b) 2-Hydroxy-1,2,3-propanetricarboxylic acid

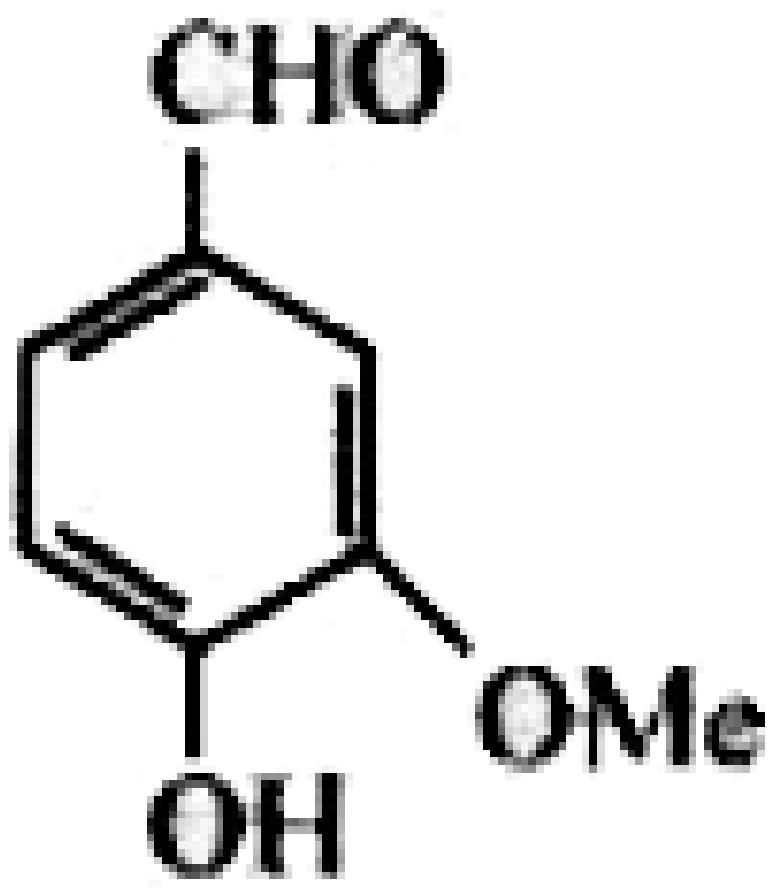
(c) Hexanedial

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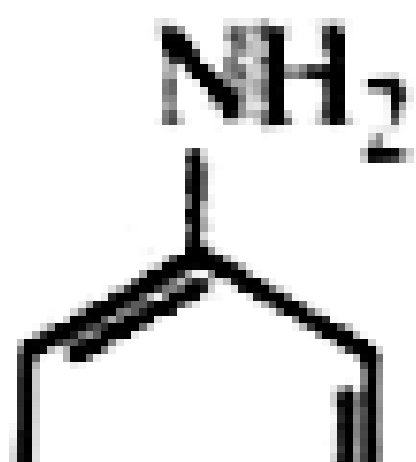
Exercise 12.8

Identify the functional groups in the following compounds

(a)

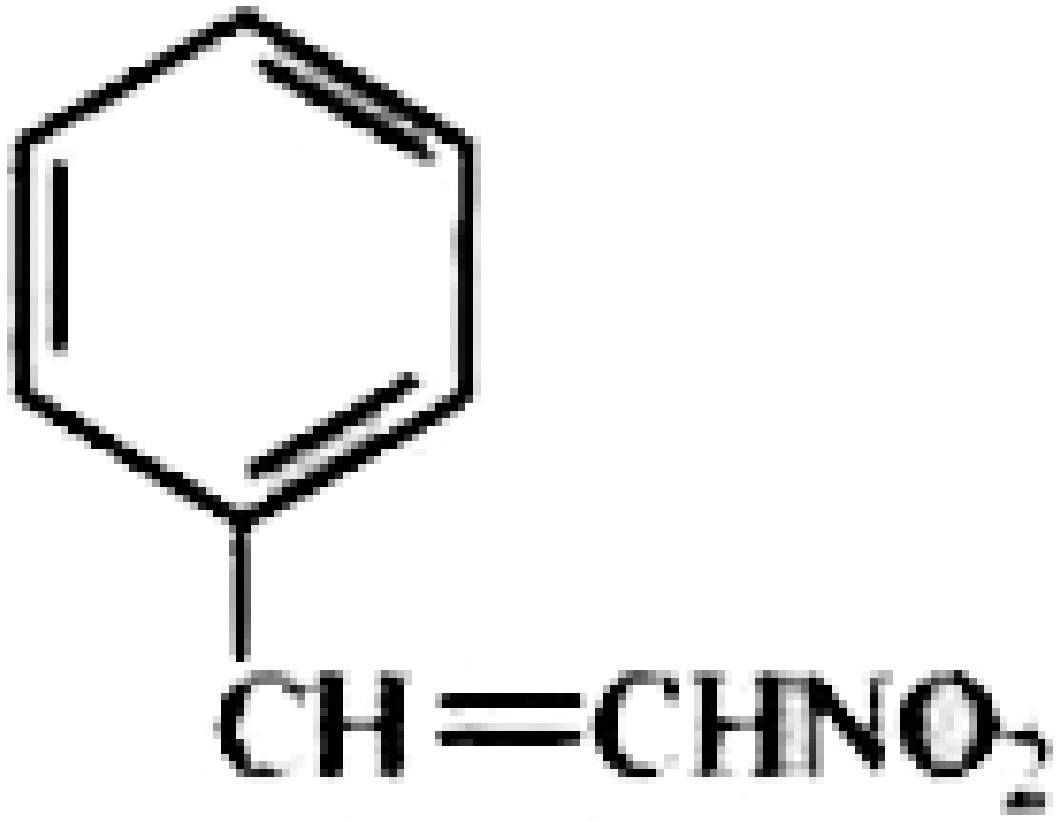


(b)





(c)



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Exercise 12.9

Which of the two: $O_2NCH_2CH_2O$ or CH_3CH_2O is expected to be more stable and why ?

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Exercise 12.10

Explain why alkyl groups act as electron donors when attacted to a π - *system*.

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Exercise 12.11

Draw the resonance structures for the following compounds. Show the electron shift using curved-arrow notation.

(a) C_6H_5OH (b) $C_6H_5NO_2$ (c) $CH_3CH = CHCHO$ (d) C_6H_5CHO

(e) $C_6H_5 - \overset{+}{C}H_2$ (f) $CH_3\overset{+}{C}H = CHCH_2$

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Exercise 12.12

What are electrophiles and nucleophiles ? Explain with examples.

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Exercise 12.13

Identify the reagents shown in bold in the following equations as nucleophiles or electrophiles:

(a) $CH_3COOH + HO^- \rightarrow CH_3COO^- + H_2O$

(b) $CH_3COCH_3 + \overset{-}{C}N \rightarrow \left(CH_3\right)_2C(CN)(OH)$

(c) $C_6H_6 + \overset{+}{C}H_3CO \rightarrow C_6H_5COCH_3$

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Exercise 12.14

Classify the following reactions in one of the reaction type studied in this unit.

(a) $CH_3CH_2Br + HS^- \rightarrow CH_3CH_2SH + Br^-$

(b) $\left(CH_3\right)_2C = CH_2 + HCl \rightarrow \left(CH_3\right)_2ClC - CH_3$

(c) $CH_3CH_2Br + HO^- \rightarrow CH_2 = CH_2 + H_2O + Br^-$

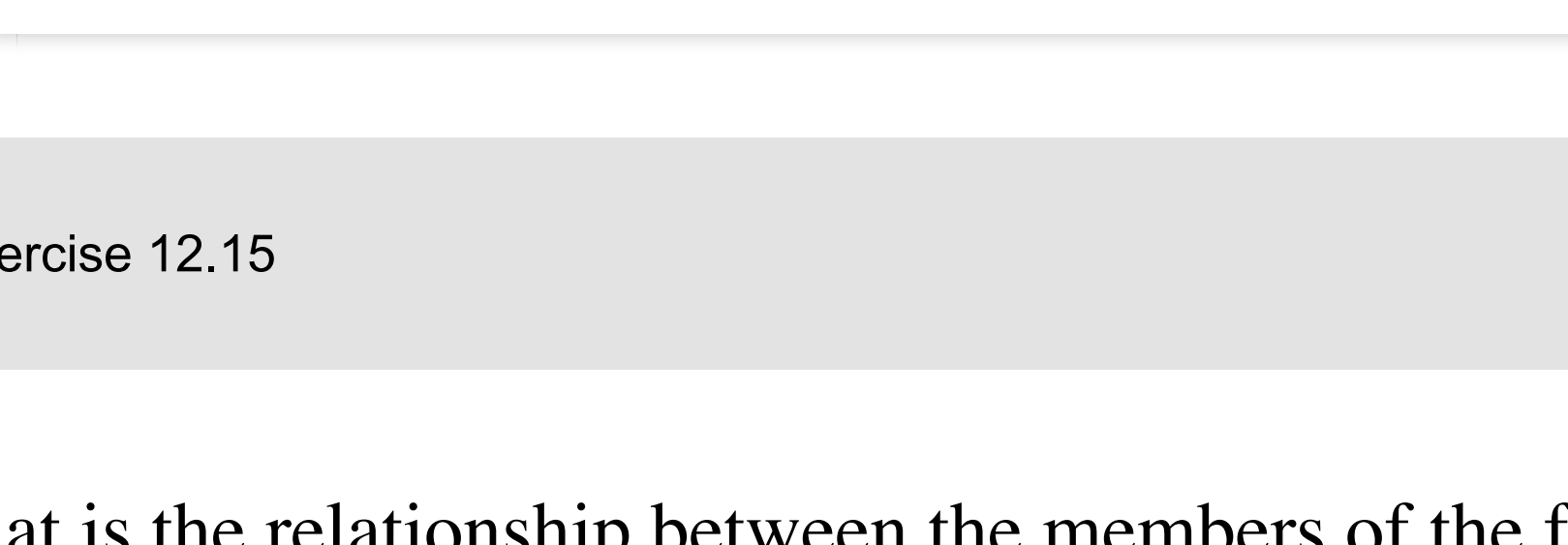
(d)

$$\left(CH_3\right)_3C - CH_2OH + HBr \rightarrow \left(CH_3\right)_2CBrCH_2CH_2CH_3 + H_2O$$

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Exercise 12.15

What is the relationship between the members of the following pairs of structures describing them as identical , structural, or geometrical isomers, or resonance contributors ?

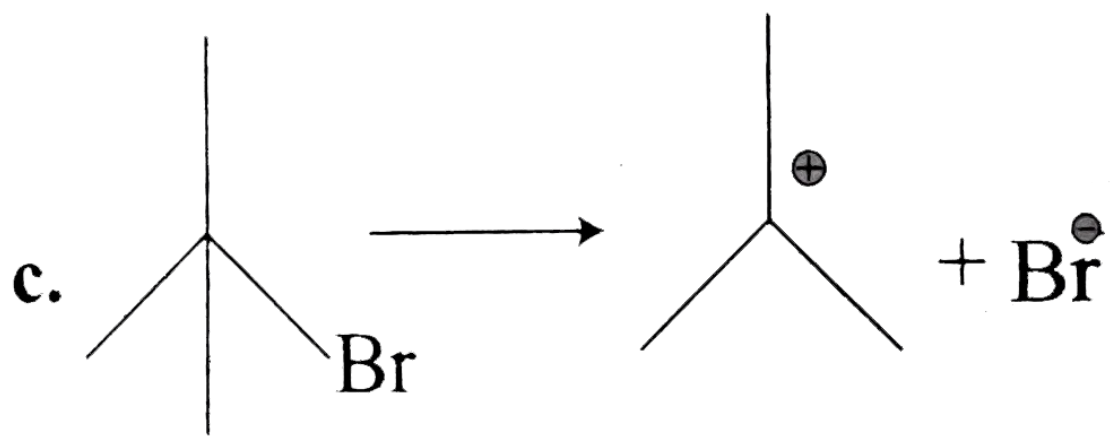


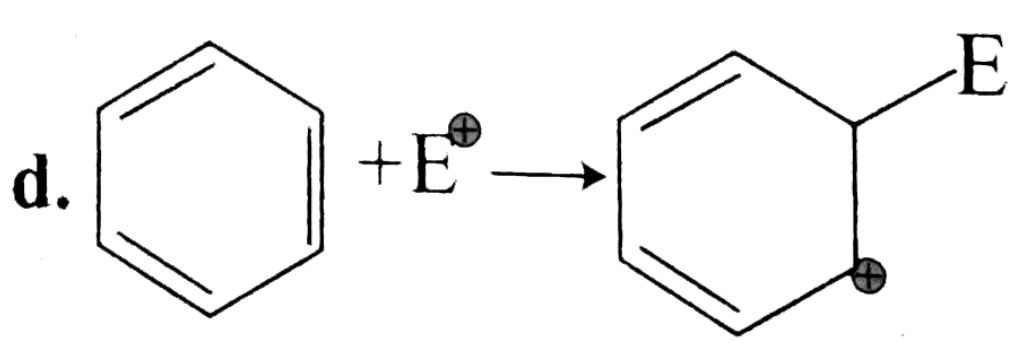
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Exercise 12.16

For the following bond cleavages, use curved-arrow to show the electron flow and classify each as homolysis or heterolysis. Identify intermediate products as free radical, carbocation, and carbanion.

(a) $CH_3O - OCH_3 \rightarrow CH_3O + OCH_3$





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Exercise 12.17

Explain the terms Inductive and Electromeric effects. Which electron displacement effect explains the following correct orders of acidity of the carboxylic acids?

(a) $Cl_3CCOOH > Cl_2CHCOOH > ClCH_2COOH$

(b) $CH_3CH_2COOH > \left(CH_3\right)_2CHCOOH > \left(CH_3\right)_3C.COOH$

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Exercise 12.18

Give a brief description of the principles of the following techniques taking an example in each case.

(a) Crystallisation (b) Distillation (c) Chromatography

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Exercise 12.19

Describe the method, which can be used to separate two compounds with different solubilities in a solvent S.

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Exercise 12.20

What is the difference between distillation, distillation under reduced pressure and steam distillation ?

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Exercise 12.21

Discuss the chemistry of Lassaignes test.

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Exercise 12.22

Differentiate between the principle of estimation of nitrogen in an organic compound by (i) Dumas method and (ii) Kjeldahls method.

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Exercise 12.23

Discuss the principle of estimation of halogens, sulphur and phosphorus present in an organic compound.

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Exercise 12.24

Explain the principle of paper chromatography.

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Exercise 12.25

Why is nitric acid added to sodium extract before adding silver nitrate for testing halogens?

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Exercise 12.26

Explain the reason for the fusion of an organic compound with metallic sodium for testing nitrogen, sulphur and halogens

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Exercise 12.27

Name a suitable technique of the components from a mixture of calcium sulphate and comphor.

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Exercise 12.28

Explain why an organic liquid vaporises at a temperature below its boiling point in steam distillation?

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Exercise 12.29

Will CCl_4 give white precipitate of $AgCl$ on heating with nitrate?

Give reason for your answer

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Exercise 12.30

Why is solution of potassium hydroxide used to absorb carbon dioxide evolved during the estimation of carbon present in an organic compound?

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Exercise 12.31

Why is it necessary to use acetic acid and not suplhuric acid for the acidification of sodium extract for testing suplhur by lead acetate test?

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Exercise 12.32

An organic compound contains 69 % carbon and 4.8 % hydrogen, the remainder being oxygen. Calculate the masses of carbon dioxide and water produced when 0.20 gm of this substance is subjected to complete combustion.

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Exercise 12.33

0.50 gm of an organic compound was treated according to Kjeldahl's meghod. The ammonia evolved was absorbed in 50 ml of 0.5 MH_2SO_4. The residual acid required 60 ml of $\frac{M}{2}NaOH$ solution. Find the percentage of nitrogen in the compound.

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Exercise 12.34

0.3080 gm of and organic chloro compound gave 0.5740 gm of siver chloride in carius estimation. Calculate the percentage of chloride presents in the compound

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Exercise 12.35

In the estimation of sulphur by carius method, 0.468 gm of an organic sulphur compound afforded 0.668 gm of barium sulphate. Find out the percentage of sulphur in the given compound.

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Exercise 12.36

In the organic compound $CH_2 = CHCH_2CH_2C \equiv CH$, the pair of hydridised orbitals involved in the formation of: C_2C_3 bond is:

$(a)spsp_2 (b)spsp_3 (c)sp_2sp_3 (d)sp_3sp_3$

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Exercise 12.37

In the Lassaignes test for nitrogen in an organic compound, the Prussian blue colour is obtained due to the formation of:

(a) $Na_4\left[Fe(CN)_6\right]$ (b) $Fe_4\left[Fe(CN)_6\right]_3$ (c) $Fe_2\left[Fe(CN)_6\right]$ (d)

$Fe_3\left[Fe(CN)_6\right]_4$

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Exercise 12.38

Which of the following carbocation is most stable ?

(a) $\left(CH_3\right)_3C.\overset{+}{C}H_2$ (b) $\left(CH_3\right)_3\overset{+}{C}$ (c) $CH_3CH_2CH_2\overset{+}{}$ (d)

$CH_3\overset{+}{C}HCH_2CH_3$

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Exercise 12.39

For the purification of organic compounds, the latest technique followed is

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Exercise 12.40

The reaction:

$$CH_3CH_2I + KOH(aq) \rightarrow CH_3CH_2OH + KI$$

is classified as :

(a) electrophilic substitution (b) nucleophilic substitution

(c) elimination (d) addition

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Solved Example 1

How many ? and ? bonds are present in each of the following molecules?

(a) $HC \equiv CCH = CHCH_3$ (b) $CH_2 = C = CHCH_3$

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Solved Example 2

What is the type of hybridzation of each carbon in the following compounds?

CH_3Cl (b) $\left(CH_3\right)_2CO$ (c) CH_3CN (d) $HCONH_2$ (e) $CH_3CH = CHCN$

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Solved Example 3

Write the hybridised state of carbon in the following compounds and shapes of each of each of the molecules.

(a) $H_2C = O$ (b) CH_3F (c) H - $C \equiv N$

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Solved Example 4

Expand each of the following condensed formulas into their complete structural formulas.

$(a) CH_3CH_2COCH_2CH_3$

$(b) CH_3CH = CH\left(CH_2\right)_3CH_3$

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Solved Example 5

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

$(a) HOCH_2CH_2CH_2CH\left(CH_3\right)CH\left(CH_3\right)CH_3$

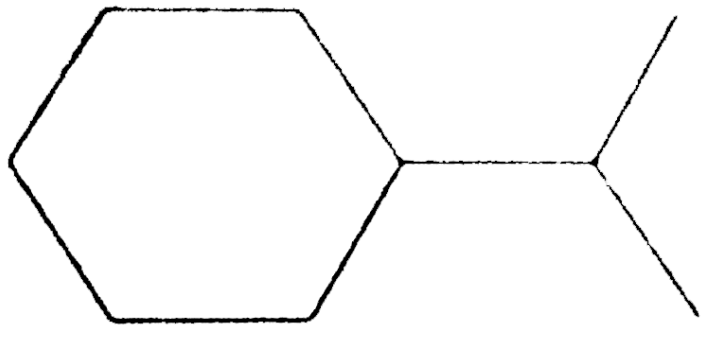
$$(b)\ N \equiv C - \underset{\displaystyle OH}{\underset{|}{CH}} - C \equiv N$$

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Solved Example 6

Expand each of the following bond-line formulas to show all the atoms including carbon and hydrogen

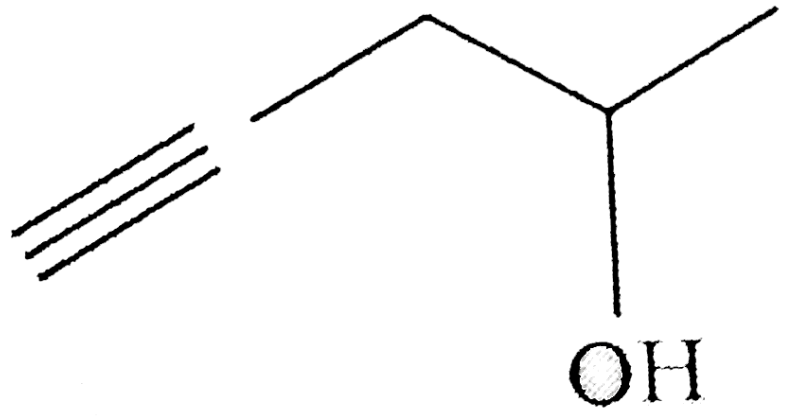
(a)



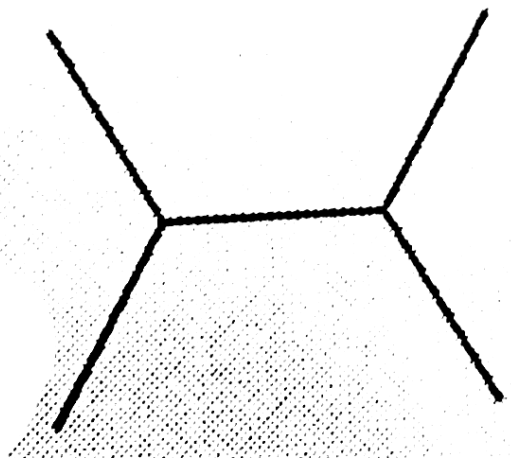
(b)



(c)



(d)



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Solved Example 7

Structures and IUPAC names of some hydrocarbons are given below. Explain why the names given in the parentheses are

incorrect.

CH_3 - $CH|CH_3$ - CH_2 - CH_2 - $CH|CH_3$ - $CH|CH_3$ - CH_2 - $CH_3$2,5,6-

CH_3 - CH_2 - $CH|CH_2CH_3$ - CH_2 - $CH|CH_3$ - CH_2 - $CH_3$3-Ethyl-5-methy

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Solved Example 8

Write the IUPAC names of the compounds i-iv from their given

structures.

(i) $\overset{1}{CH_3}$ - $\overset{2}{CH_2}$ - $\overset{3}{CH}|\overset{}{OH}$ - $\overset{4}{CH_2}$ - $\overset{5}{CH_2}$ - $\overset{6}{CH}|\overset{}{CH_3}$ - $\overset{7}{CH_2}$ - $\overset{8}{CH_3}$

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Solved Example 9

Write the IUPAC names of the compounds i-iv from their given

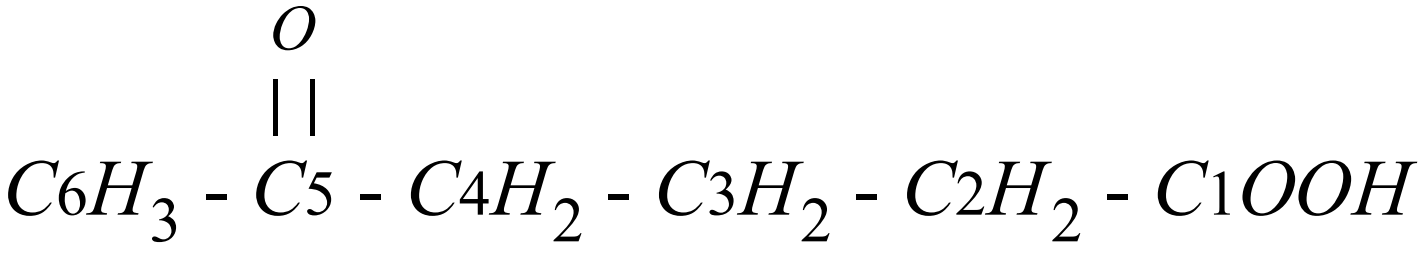
structures.

$C6H_3$ - $C5H_2$ - $\overset{O}{\overset{||}{C}}4$ - $C3H_2$ - $\overset{O}{\overset{||}{C}}2$ - $C1H_3$

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Solved Example 10

Write the IUPAC names of the compounds i-iv from their given structures.



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Solved Example 11

Write the IUPAC names of the compounds i-iv from their given structures.



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Solved Example 12

Derive the structure of (i) 2-Chlorohexane, (ii) Pent-4-en-2-ol, (iii) 3- Nitrocyclohexene, (iv) Cyclohex-2-en-1-ol, (v) 6-Hydroxy-heptanal.

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Solved Example 13

Write the structural formula of:

(a) o-Ethylanisole, (b) p-Nitroaniline,

(c) 2,3 - Dibromo -1 - phenylpentane,

(d) 4-Ethyl-1-fluoro-2-nitrobenzene.

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Solved Example 14

Using the curved-arrow notation, show the formation of reactive

intermediates when the following convalent bonds undergo heterolytic cleavage :

(a) CH_3 - S - CH_3

(b) CH_3 - CN

(c) CH_3 - Cu .

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Solved Example 15

Categorise the following molecules/ions ad nucleophile or electrophile.

(1) $HS^{?}$

(2) BF_3

(3) $C_2H_5O^{?}$

(4) $\left(CH_3\right)_3\ddot{N}$

(5) $C1^{?}$

(6) $CH_3 - \overset{\oplus}{C} = O$

(7) $:\overset{?}{N}H_2$

(8) $\overset{\oplus}{N}O_2$.

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Solved Example 16

Identify electrophilic centre in the following :

(1) $CH_3CH = O$

(2) $CH_3 - CN$

(3) CH_3I.

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Solved Example 17

Which bond is more polar in the following pairs of molecules ?

(a) H_3C - H, H_3C - Br,

(b) H_3C - NH_2, H_3C - OH

(c) H_3C - OH, H_3C - SH.

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Solved Example 18

In which (C - C) bond of $\left(\overset{3}{H_3C} - \overset{2}{CH_2} - \overset{1}{CH_2} - Br\right)$, the inductive effect is expected to be the least ?

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Solved Example 19

Write the resonance structures of (1)$CH_3COO^{?}$ and (2)$CH_2 = CH$ - CHO. Indicate the relative stability of the contributing structures.

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Solved Example 20

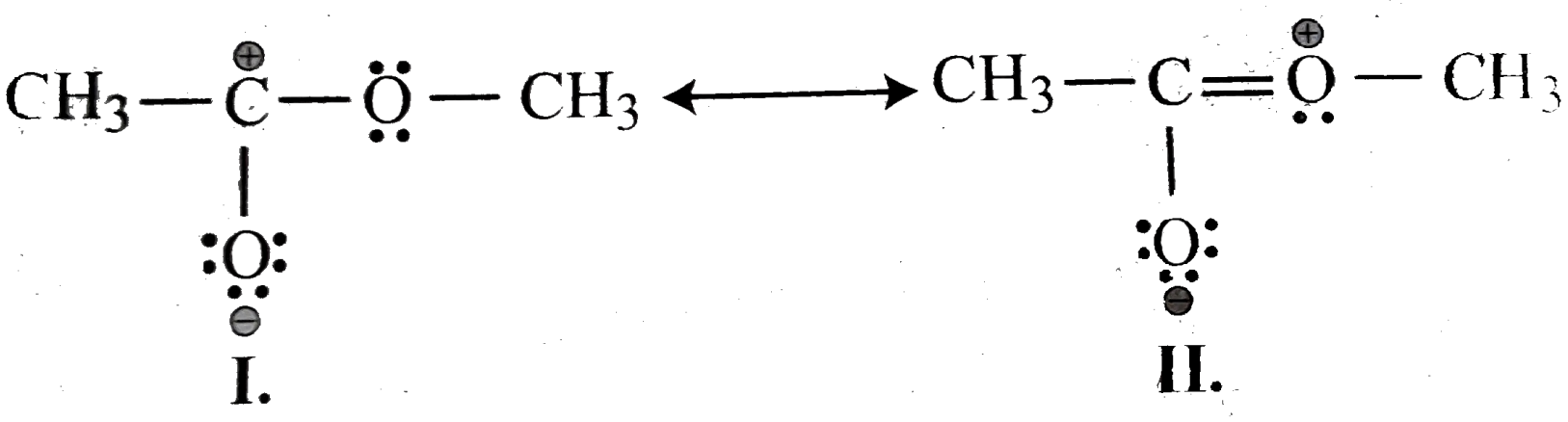
Write the resonance structures of $(1) CH_3COO^{?}$ and

$(2) CH_2 = CH - CHO$. Indicate the relative stability of the contributing structures.

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Solved Example 21

Explain why the following two structures (I) and (II) cannot be the major contributors to the real structures of CH_3COOCH_3.



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Solved Example 22

Explain why $\left(CH_3\right)_3\overset{+}{C}$is more stable than $CH_3\overset{+}{C}H_2$ and CH_3 is the least stable cation

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Solved Example 23

On complete combustion, 0.246 g of an organic compound gave 0.198g of carbon dioxide and 0.1014g of water. Determine the percentage composition of carbon and hydrogen in the compound

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Solved Example 24

In Dumas method for estimation of nitrogen, 0.3g of an organic compound gave 50mL of nitrogen collected at 300K temperature

and 715mm pressure. Calculate the percentage composition of nitrogen in the compound. (Aqueous tension at 300K=15 mm)

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Solved Example 25

During estimation of nitrogen present in an organic compound by Kjeldahls method, the ammonia evolved from 0.5 g of the compound in Kjeldahls estimation of nitrogen, neutralized 10 mL of 1 M H_2SO_4. Find out the percentage of nitrogen in the compound.

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Solved Example 26

0.15 gm of an organic compound gave 0.12 gm of silver bromide by the carius method. Find the percentage of bromine in the compound.

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Solved Example 27

In sulphur estimation, 0.157 g of an organic compound gave 0.4813 g of barium sulphate. What is the percentage of sulphur in the compound?

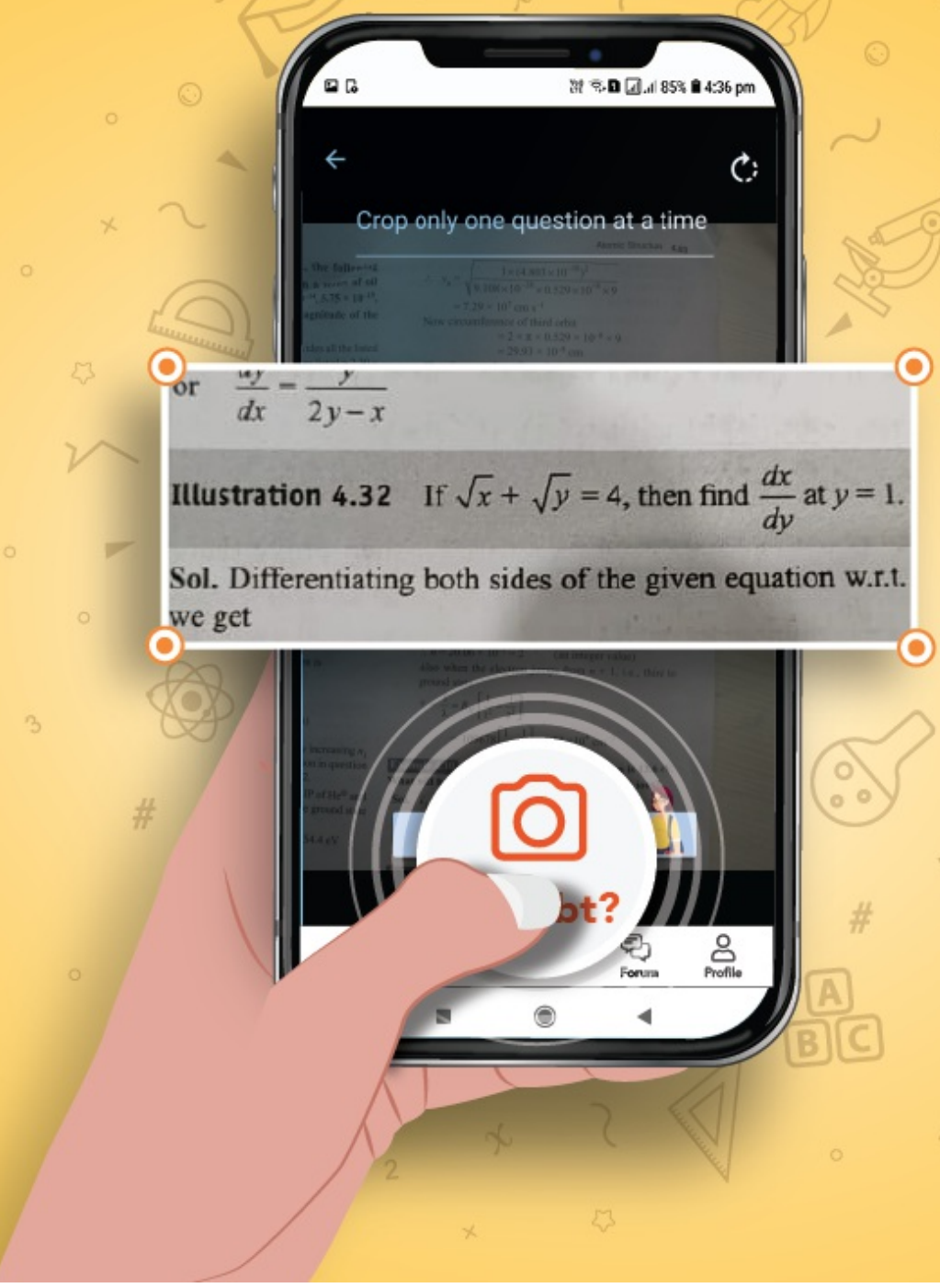
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