

# Chapter 11

## Carbon and its Compounds

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### I. Choose the best Answer:

**Question 1.**

The molecular formula of an open-chain organic compound is  $C_3H_6$ . The class of the compound is:

- (a) alkane
- (b) alkene
- (c) alkyne
- (d) alcohol

**Answer:**

- (b) alkene

**Question 2.**

The IUPAC name of an organic compound is 3-Methyl butan-1-ol. What type of compound it is?

- (a) Aldehyde
- (b) Carboxylic acid
- (c) Ketone
- (d) Alcohol

**Answer:**

- (d) Alcohol

**Question 3.**

The secondary suffix used in IUPAC nomenclature of an aldehyde is:

- (a) - ol
- (b) - oic acid
- (c) - al
- (d) - one

**Answer:**

- (c) - al

**Question 4.**

Which of the following pairs can be the successive members of a homologous series?

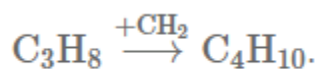
- (a)  $C_3H_8$  and  $C_4H_{10}$
- (b)  $C_2H_2$  and  $C_2H_4$
- (c)  $CH_4$  and  $C_3H_6$
- (d)  $C_2H_5OH$  and  $C_4H_8OH$ .

**Answer:**

- (a)  $C_3H_8$  and  $C_4H_{10}$

Hint: Two successive members of a homologous series must have a difference of  $-CH_2$  in the

molecular formula.



**Question 5.**

$\text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$  is a:

- (a) Reduction of ethanol
- (b) Combustion of ethanol
- (c) Oxidation of ethanoic acid
- (d) Oxidation of ethanal

**Answer:**

- (b) Combustion of ethanol

**Question 6.**

Rectified spirit is an aqueous solution which contains about \_\_\_\_ of ethanol.

- (a) 95.5 %
- (b) 75.5 %
- (c) 55.5 %
- (d) 45.5 %.

**Answer:**

- (a) 95.5 %

Rectified spirit is a mixture of 95.5 % of ethanol and 4.5 % of water.

**Question 7.**

Which of the following are used as anaesthetics?

- (a) Carboxylic acids
- (b) Ethers
- (c) Esters
- (d) Aldehydes

**Answer:**

- (b) Ethers

**Question 8.**

TFM in soaps represents \_\_\_\_ content in soap.

- (a) mineral
- (b) vitamin
- (c) fatty acid
- (d) carbohydrate.

**Answer:**

- (c) fatty acid

Hint: TFM – Total Fatty Matter. It corresponds the fatty acid (oil).

**Question 9.**

Which of the following statements is wrong about detergents?

- (a) It is a sodium salt of long chain fatty acids
- (b) It is sodium salts of sulphonic acids

- (c) The ionic part in a detergent is  $\text{SO}_3^- \text{Na}^+$   
 (d) It is effective even in hard water.

**Answer:**

- (a) It is a sodium salt of long-chain fatty acids

## II. Fill in the blanks:

1. An atom or a group of atoms which is responsible for chemical characteristics of an organic compound is called .....
2. The general molecular formula of alkynes is .....
3. In IUPAC name, the carbon skeleton of a compound is represented by ..... (root word / prefix / suffix)
4. (Saturated / Unsaturated) ..... compounds decolourize bromine water.
5. Dehydration of ethanol by cone. Sulphuric acid forms ..... (ethene/ ethane)
6. 100 % pure ethanol is called .....
7. Ethanoic acid turns ..... litmus to .....
8. The alkaline hydrolysis of fatty acids is termed as .....
9. Biodegradable detergents are made of ..... (branched / straight) chain hydrocarbons.

**Answer:**

1. Functional group
- 2-  $\text{C}_n\text{H}_{2n-2}$
3. root word
4. unsaturated
5. ethene
6. absolute alcohol
7. Blue, red
8. Saponification
9. straight

## III Match the following:

**Question 1.**

Match the Column I and Column II.

Column I		Column II	
A	Functional group – OH	(i)	Benzene
B	Heterocyclic	(ii)	Potassium stearate
C	Unsaturated	(iii)	Alcohol
D	Soap	(iv)	Furan
E	Carbocyclic	(v)	Ethene

**Answer:**

- A. (iii)  
 B. (iv)

- C. (v)
- D. (ii)
- E. (i)

#### IV. Assertion and Reason:

Answer the following Questions using the data given below:

**Question 1.**

Assertion: Detergents are more effective cleansing agents than soaps in hard water.

Reason: Calcium and magnesium salts of detergents are water soluble.

- (a) Assertion and Reason are correct, Reason explains the Assertion.
- (b) Assertion is correct, Reason is wrong.
- (c) Assertion is wrong, Reason is correct.
- (d) Assertion and Reason are correct, Reason doesn't explain Assertion.

**Answer:**

- (a) Assertion and Reason are correct, Reason explains the Assertion.

**Question 2.**

Assertion: Alkanes are saturated hydrocarbons.

Reason: Hydrocarbons consist of covalent bonds.

- (a) Assertion and Reason are correct, Reason explains the Assertion.
- (b) Assertion is correct, Reason is wrong.
- (c) Assertion is wrong, Reason is correct.
- (d) Assertion and Reason are correct, Reason doesn't explain Assertion.

**Answer:**

- (d) Assertion and Reason are correct, Reason doesn't explain Assertion.

#### V. Short Answer Questions:

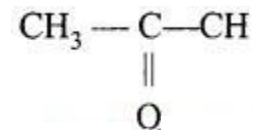
**Question 1.**

Name the simplest ketone and give its structural formula.

**Answer:**

The simplest ketone is Propanone.

Its structural formula:



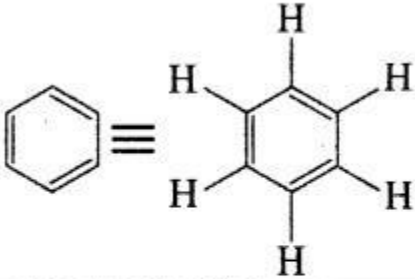
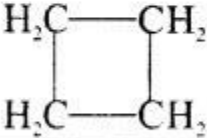
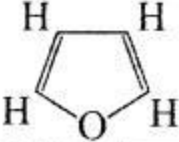
**Question 2.**

Classify the following compounds based on the pattern of carbon chain and give their structural formula:

- (i) Propane
- (ii) Benzene
- (iii) Cyclobutane

(iv) Furan.

**Answer:**

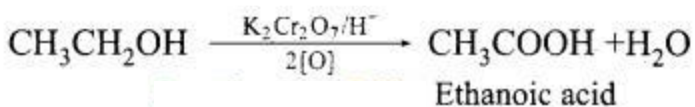
(i)	Propane	Acyclic or open chain compound	$\text{CH}_3\text{—CH}_2\text{—CH}_3$
(ii)	Benzene	Carbocyclic, aromatic	
(iii)	Cyclo butane	Alicyclic compound	
(iv)	Furan	Heterocyclic compound	

**Question 3.**

How is ethanoic acid prepared from ethanol? Give the chemical equation.

**Answer:**

Ethanol is oxidized to ethanoic acid with alkaline  $\text{KMnO}_4$  or acidified  $\text{K}_2\text{Cr}_2\text{O}_7$ .



**Question 4.**

How do detergents cause water pollution? Suggest remedial measures to prevent this pollution?

**Answer:**

- Some detergents having a branched hydrocarbon chain are not fully biodegradable by microorganisms present in water. So, they cause water pollution.
- They have straight hydrocarbon chains, in biodegradable detergents, which can be easily degraded by bacteria.

**Question 5.**

Differentiate soaps and detergents.

**Answer:**

Soap	Detergent
It is a sodium salt of long chain fatty acids.	It is sodium salts of sulphonic acids.
The ionic part of a soap is $-\text{COO}^-\text{Na}^+$ .	The ionic part in a detergent is $-\text{SO}_3^-\text{Na}^+$ .
It is prepared from animal fats or vegetable oils.	It is prepared from hydrocarbons obtained from crude oil.
Its effectiveness is reduced when used in hard water.	It is effective even in hard water.
It forms a scum in hard water.	Does not form a scum in hard water.
It has poor foaming capacity.	It has rich foaming capacity.
Soaps are biodegradable.	Most of the detergents are non-biodegradable.

## VI. Long Answer Questions.

**Question 1.**

What is called a homologous series? Give any three of its characteristics?

**Answer:**

A homologous series is a group or a class of organic compounds having the same general formula and similar chemical properties in which the successive members differ by a  $-\text{CH}_2$  group.

Characteristics of homologous series:

- All members of a homologous series contain the same elements and functional group.
- All members of a homologous series can be prepared by a common method.
- Chemical properties of the members of a homologous series are similar.

**Question 2.**

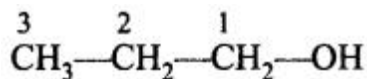
Arrive at, systematically, the IUPAC name of the compound:  $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-OH}$ .

**Answer:**

Step 1: The parent chain consists of 3 carbon atoms. The root word is 'Prop'.

Step 2: There are single bonds between the carbon atoms of the chain. So, the primary suffix is 'ane'.

Step 3: Since, the compound contains  $-\text{OH}$  group, it is an alcohol. The carbon chain is numbered from the end which is closest to  $-\text{OH}$  group. (Rule 3)



Step 4: The locant number of – OH group is 1 and thus the secondary suffix is ‘1-ol’.  
The name of the compound is Prop + ane + (1 – ol) = Propan-1-ol

### Question 3.

How is ethanol manufactured from sugarcane?

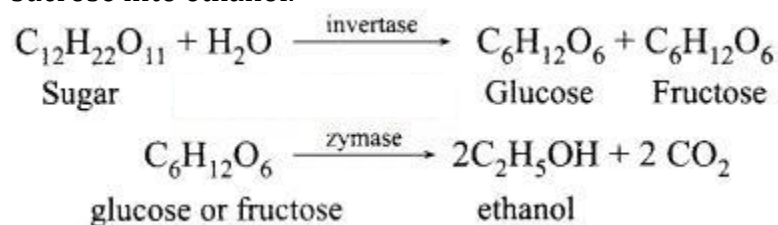
#### Answer:

Ethanol is manufactured in industries by the fermentation of molasses, which is a by-product obtained during the manufacture of sugar from sugarcane. Molasses is a dark coloured syrupy liquid left after the crystallization of sugar from the concentrated sugarcane juice. Molasses contain about 30% of sucrose, which cannot be separated by crystallization. It is converted into ethanol by the following steps:

(i) Dilution of molasses : Molasses is first diluted with water to bring down the concentration of sugar to about 8 to 10 percent.

(ii) Addition of Nitrogen source : Molasses usually contains enough nitrogenous matter to act as food for yeast during the fermentation process. If the nitrogen content of the molasses is poor, it may be fortified by the addition of ammonium sulphate or ammonium phosphate.

(iii) Addition of Yeast The solution obtained in step (ii) is collected in large ‘fermentation tanks’ and yeast is added to it. The mixture is kept at about 303K for a few days. During this period, the enzymes invertase and zymase present in yeast, bring about the conversion of sucrose into ethanol.



The fermented liquid is technically called wash.

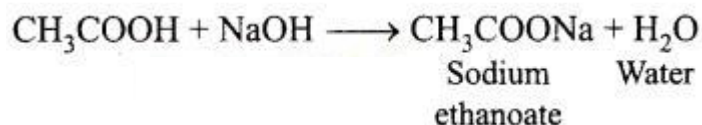
(iv) Distillation of ‘Wash’: The fermented liquid (i.e., wash), containing 15 to 18 percent alcohol, is now subjected to fractional distillation. The main fraction drawn is an aqueous solution of ethanol which contains 95.5% of ethanol and 4.5% of water. This is called rectified spirit. This mixture is then refluxed over quicklime for about 5 to 6 hours and then allowed to stand for 12 hours. On distillation of this mixture, pure alcohol (100%) is obtained. This is called absolute alcohol.

### Question 4.

Give the balanced chemical equation of the following reactions:

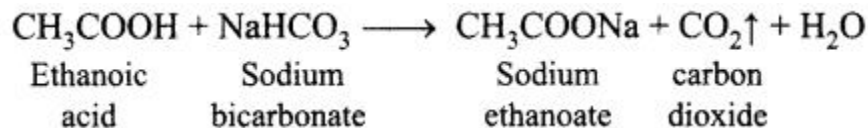
(i) Neutralization of NaOH with ethanoic acid.

**Answer:**



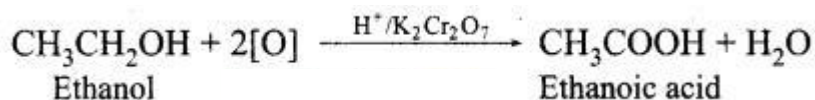
(ii) Evolution of carbon dioxide by the action of ethanoic acid with  $\text{NaHCO}_3$ .

**Answer:**



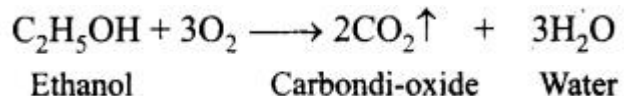
(iii) Oxidation of ethanol by acidified potassium dichromate.

**Answer:**



(iv) Combustion of ethanol.

**Answer:**



### Question 5.

Explain the mechanism of cleansing action of soap.

**Answer:**

A soap molecule contains two chemically distinct parts that interact differently with water. It has one polar end, which is a short head with a carboxylate group ( $-\text{COONa}$ ) and one non – polar end having the long tail made of the hydrocarbon chain.

The polar end is hydrophilic (Water-loving) in nature and this end is attracted towards the water. The non – polar end is hydrophobic (Water hating) in nature and it is attracted towards dirt or oil on the cloth, but not attracted towards the water. Thus, the hydrophobic part of the soap molecule traps the dirt and the hydrophilic part makes the entire molecule soluble in water.

When soap or detergent is dissolved in water, the molecules join together as clusters called 'micelles'. Their long hydrocarbon chains attach themselves to the oil and dirt. The dirt is thus surrounded by the non-polar end of the soap molecules. The charged carboxylate end of the soap molecules makes the micelles soluble in water. Thus, the dirt is washed away with the soap.

## VII. Hot Questions.

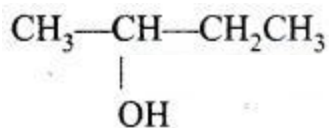


**Question 1.**

The molecular formula of an alcohol is  $C_4H_{10}O$ . The locant number of its  $-OH$  group is 2.

(i) Draw its structural formula.

**Answer:**



(ii) Give its IUPAC name.

**Answer:**

Butan-2-ol

(iii) Is it saturated or unsaturated?

**Answer:**

Saturated

**Question 2.**

An organic compound 'A' is widely used as a preservative and has the molecular formula  $C_2H_4O_2$ . This compound reacts with ethanol to form a sweet smelling compound 'B'.

(i) Identify the compound 'A'.

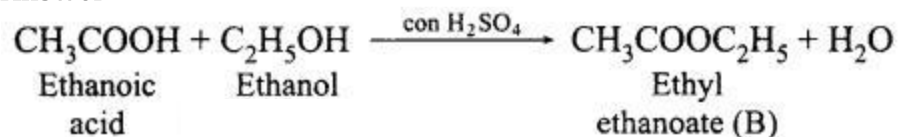
**Answer:**

Organic Compound 'A' with the molecules formula  $C_2H_4O_2$  which is a preservative is acetic acid (or) ethanoic acid.

A –  $CH_3COOH$

(ii) Write the chemical equation for its reaction with ethanol to form compound 'B'.

**Answer:**



B – Ethyl ethanoate (ester – sweet smelling)

(iii) Name the process.

**Answer:**

Esterification