Chapter - 4
Carbon and
Its Compounds

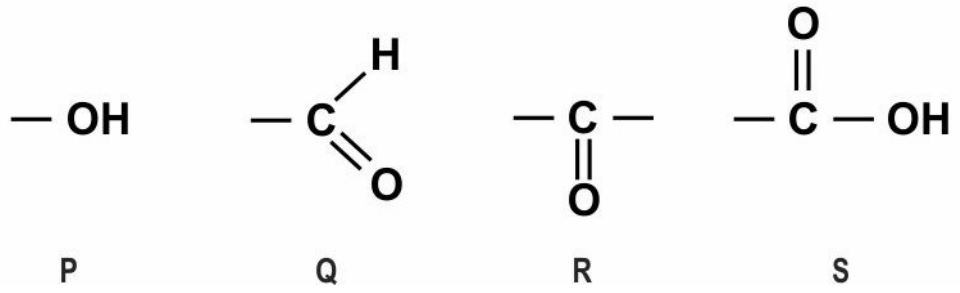
Q: 1 **On undergoing complete combustion in an adequate supply of oxygen, an organic compound produces only carbon dioxide and water vapour as the products.**

Based on this information, which of the following homologous series could the compound belong to?

P) alkanes
Q) alcohols
R) aldehydes

1 only P **2** only P or Q **3** only Q or R **4** any - P, Q or R

Q: 2 **A compound with which of the following functional groups is MOST LIKELY to cause the decomposition of baking soda to produce carbon dioxide?**



1 P **2** Q **3** R **4** S

Q: 3 **1 mole of ethene and 1 mole of ethyne are separately made to completely undergo addition reaction to form the respective saturated compound.**

Which of the following will be DIFFERENT for the two reactions?

P) the number of moles of the saturated compound formed
Q) the number of moles of the hydrogen consumed

1 only P **2** only Q **3** both P and Q **4** neither P nor Q

Q: 4 **Two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements A and R.**

Assertion (A): Vegetable oils are healthier than animal fats.
Reason (R): Vegetable oils generally have long unsaturated carbon chains while animal fats have saturated carbon chains.

1 Both A and R are true and R is the correct explanation for A.
2 Both A and R are true and R is not the correct explanation for A.
3 A is true but R is false.
4 A is false but R is true.

Q: 5 **[3]**

Alkanes are saturated compounds of carbon and hydrogen that can be represented by the general formula C_nH_{2n+2} where 'n' is the number of carbon atoms. An example of such a compound is ethane C_2H_6.

Maya has a compound of carbon and hydrogen whose formula is C_3H_4.

(i) What is true about the type of flame this compound will give on combustion?

(ii) Draw all the possible straight chain structures of this compound.

Q: 6 **[1]**

Bromine water is a reddish solution of bromine (Br_2) in water. When shaken with an unsaturated hydrocarbon, the red colour of the bromine water disappears because the bromine is used up in an addition reaction.

Kohli has three test tubes containing hexane, hexene and hexyne respectively. Which of the three compounds can he identify using the bromine water test? Give a reason for your answer.

Q: 7 **[3]**

A carbon compound of molecular formula $C_5H_{10}O$ contains a ketone functional group.

Draw the structures of three isomers of this compound having a ketone group.

Q: 8 **[3]**

Ethanol, C_2H_5OH is heated with alkaline potassium permanganate to give a compound X.

$$C_2H_5OH \xrightarrow{\text{alkaline } KMnO_4 + \text{heat}} X$$

(a) How many carbon atoms will compound X contain?

(b) Compound X is now reacted with ethanol in the presence of an acid catalyst to give a compound Y.

$$X + C_2H_5OH \xrightarrow{\text{acid}} Y$$

(i) Name the type of compound formed in the above reaction with respect to the functional group it contains.
(ii) State one characteristic property of compounds of the type of compound Y.
(iii) State one use of compounds of this type.

Q: 9 **Compounds with identical molecular formula but different structures are called structural isomers.** **[3]**

(a) In the case of saturated hydrocarbons, what is the MINIMUM number of carbon atoms needed in a molecule for it to have a structural isomer?
(b) Draw the structural isomers of the saturated hydrocarbon having the minimum number of carbon atoms mentioned in (a).

Q: 10 **An open-chain hydrocarbon X having the general formula of C_nH_{2n-2} is hydrogenated in the presence of a catalyst.** **[3]**

(a) State the number of moles of hydrogen required to completely saturate 1 mole of compound X.
(b) The hydrocarbon X contains carbon-carbon single bonds. Apart from the single bonds, state the number and the type of other carbon-carbon bonds that could possibly be present in the compound X.

Q: 11 **Shown below are the structural formulae of four carbon compounds.** **[3]**

$CH_3-\underset{\underset{O}{\|\|}}{C}-CH_3$	$CH_3-\underset{\underset{OH}{\|}}{CH}-CH_3$	$CH_3-CH_2-\underset{\underset{O}{\|\|}}{C}-OH$	CH_3-OH
P	Q	R	S

(a) Two of these compounds are more likely to have similar chemical properties. Identify these two compounds. Give a reason for your answer.
(b) Identify which of these compounds are likely to have the same boiling point. Justify your answer.

Q: 12 **Heating an alcohol with concentrated sulphuric acid results in the dehydration of the alcohol to give the alkene as shown by the reaction of ethanol to give ethene.** **[2]**

$$CH_3CH_2OH \xrightarrow{\text{Hot conc. sulphuric acid}} CH_2=CH_2$$

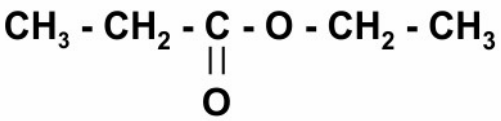
Pramila heated 2-butanol (shown below) with concentrated sulphuric acid.

$$CH_3CH_2\underset{\underset{OH}{|}}{C}HCH_3$$

Write the structural formulae of all the possible products of the reaction.

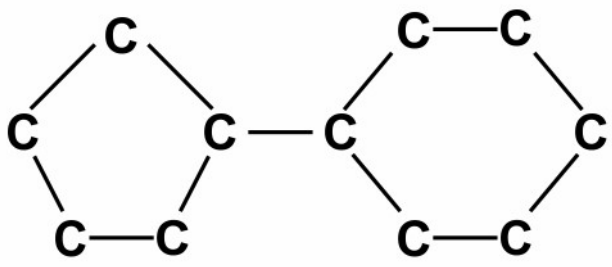
Q: 13 **Ethyl propanoate is a colourless compound with a pineapple-like smell. It is present naturally in some fruits such as kiwis and strawberries.** **[4]**

The structural formula of ethyl propanoate is given below.



(a) Write the names of the carboxylic acid and the alcohol from which this compound is formed.
(b) Apart from mixing the carboxylic acid and the alcohol, what should be done to form this compound?

Q: 14 **An alkane has 11 carbon atoms arranged within ring structures as shown below.** **[1]**



What is the molecular formula of the alkane?

Q: 15 **Manasi wrote the names of four compounds as the first members of their respective homologous series.** **[3]**

- methanol
- methanal
- methanone
- methanoic acid

(a) Which name has she written incorrectly? Justify your answer.
(b) What name should she have written instead?

Q: 16 **Organic compounds belonging to different homologous series can be isomers. For example, propanal and propanone are isomers.** **[2]**

Can an alkane and an alcohol be isomers? Why or why not?

Q: 17 **Home-made vinegar is produced from wine. The wine is taken in a clean glass jar and shaken well to aerate it. Some water is added to the jar and then it is kept undisturbed in a dark place at room temperature to undergo fermentation. After 3-4 weeks, the vinegar would be ready to use.** **[4]**

(a) Name the functional groups of the MAIN organic compounds present in wine and vinegar.
(b) Based on the atoms getting added/removed when wine is converted to vinegar, name the type of reaction that happens.
(c) Name any chemical reagent that would be used for the same reaction if it is carried out in the laboratory.

Q: 18 **Polythene is a plastic made from ethene ($CH_2=CH_2$). When ethene is subjected to high pressure and moderately high temperatures, ethene molecules react with each other to form large molecules hundreds of times bigger, forming the plastic.** **[1]**

Which property of carbon atoms is instrumental in the formation of polythene?

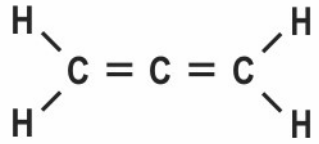
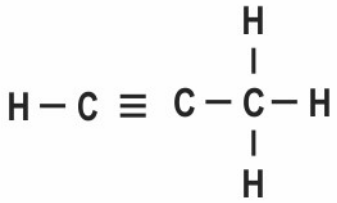
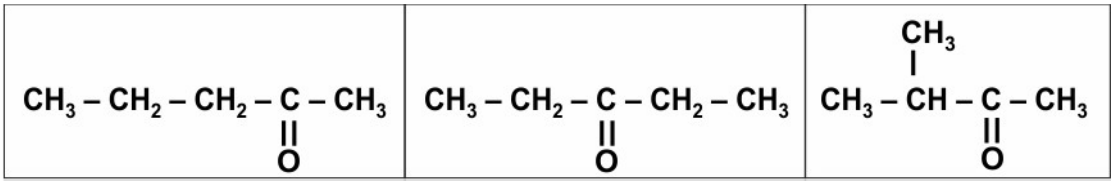
Q: 19 **Study the following information given and answer the questions that follow.** **[3]**

Ethanol is a renewable biofuel because it is made from biomass. Ethanol is a clear, colourless alcohol made from a variety of biomass materials. Ethanol producers mostly use food grains and crops with high starch and sugar content such as corn, sorghum, barley, sugar cane, and sugar beets. The most common ethanol production processes today use yeast to ferment the starch and sugars in corn, sugar cane, and sugar beets.

(a) What is the chemical formula for ethanol?
(b) What other compound is obtained as a by-product when ethanol is obtained from a sugar?
(c) What would be the products formed when ethanol undergoes complete combustion? Support your answer with a balanced chemical equation.

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	4
2	4
3	2
4	1

Q.No	Teacher should award marks if students have done the following:	Marks
5	(i) The compound being unsaturated will burn with a sooty or smoky flame.	1
	(ii) 1 mark each for the following:  	2
6	- hexane [0.5 marks] - Only hexane will not decolourise the bromine water. [0.5 marks]	1
7	1 mark for each of the following structures: 	3
8	(a) two	1
	(b) (i) ester [1 mark] (ii) sweet smell [0.5 marks] (iii) 0.5 marks for any of the following: - perfumes - flavouring agents (any other correct use should also be awarded full marks)	2

Q.No	Teacher should award marks if students have done the following:	Marks
9	(a) four	1
	(b) 1 mark each for the following isomers: $CH_3 - CH_2 - CH_2 - CH_3$ | $CH_3 - \underset{\displaystyle CH_3}{\underset{\vert}{CH}} - CH_3$	2
10	(a) 2 moles	1
	(b) 1 mark for each of the following: - two C-C double bonds - one C-C triple bond	2
11	(a) - Q and S [0.5 marks] - They have the same functional group. [1 mark]	1.5
	(b) - none of them [0.5 marks] - They are all different chemical substances. [1 mark]	1.5
12	1 mark each for the following: $CH_3CH = CHCH_3$ $CH_3CH_2CH = CH_2$	2
13	(a) 1 mark for each name: acid - propanoic acid / propionic acid alcohol - ethanol / ethyl alcohol	2

Q.No	Teacher should award marks if students have done the following:	Marks
	(b) 1 mark for each of the following: - add an acid catalyst - heat the reaction mixture	2
14	$C_{11}H_{20}$	1
15	(a) 1 mark for each of the following: - methanone - The smallest ketone has three carbon atoms. OR There is no compound named methanone.	2
	(b) propanone	1
16	1 mark for each of the following points: - No, they cannot be isomers. - Alkanes have only carbon and hydrogen atoms, while alcohols have oxygen atoms too.	2
17	(a) 1 mark for each of the following: wine - hydroxyl / alcohol / -OH vinegar - carboxyl / carboxylic acid / -COOH	2
	(b) oxidation	1
	(c) any oxidising agent such as: - potassium permanganate / $KMnO_4$ - potassium dichromate / $K_2Cr_2O_7$	1
18	catenation OR the ability of carbon atoms to link with each other to form long chains	1

Q.No	Teacher should award marks if students have done the following:	Marks
19	(a) CH_3CH_2OH	0.5
	(b) carbon dioxide / CO_2	0.5
	(c) carbon dioxide and water / CO_2 and H_2O [0.5 mark for each product] $CH_3CH_2OH + 3\ O_2 \rightarrow 2\ CO_2 + 3\ H_2O$ [1 mark]	2