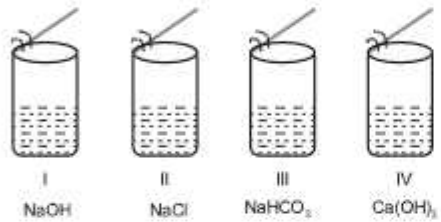
4 : Carbon and its Compounds

1. State two characteristic features of carbon which when put together give rise to large number of carbon compounds. **[2010] ...[1M]**

2. Draw the structure of Butanone molecule, $CH_3COC_2H_5$ **[2011] ...[1M]**

3. A student added acetic acid to test tubes I, II, III and IV containing the labelled substances and then brought a burning splinter near the mouth of each test tube.



The splinter would be extinguished when brought near the mouth of test tube. **[2011] ...[1M]**

(a) I (b) II

(c) III (d) IV

4. Acetic acid reacts with solid sodium hydrogen carbonate, **[2011] ...[1M]**

(a) Slowly forming no gas

(b) Vigorously with effervescence

(c) Slowly without effervescence

(d) Vigorously without gas formation

5. Vapours of acetic acid smell: **[2011] ...[1M]**

(a) Pungent like vinegar

(b) Sweet like rose

(c) Suffocating like sulphur dioxide

(d) Odorless like water

6. A student takes Na_2CO_3 powder in a test tube and pours some drops of acetic acid in it.

He observes: **[2012] ...[1M]**

(a) No reaction in the test tube

(b) Colourless gas with pungent smell

(c) Bubbles of a colourless and odourless gas

(d) White fumes with smell of vinegar

7. Hard water required for an experiment is not available in a school laboratory. However, following salts are available in the laboratory. Select the salts which may be dissolved in water to make it hard for the experiment.

1. Calcium Sulphate
2. Sodium Sulphate
3. Calcium Chloride
4. Potassium Sulphate
5. Sodium Hydrogen Carbonate
6. Magnesium Chloride **[2013] ...[1M]**

(a) 1, 2 and 4 (b) 1, 3 and 6

(c) 3, 5 and 6 (d) 2, 4 and 5

8. A student takes 2 ml acetic acid in a dry test tube and adds a pinch of sodium hydrogen carbonate to it. He makes the following observations:

(I) A colourless and odourless gas evolves with a brisk effervescence.

(II) The gas turns lime water milky when passed through it.

(III) The gas burns with an explosion when a burning splinter is brought near it.

(IV) The gas extinguishes the burning splinter which is brought near it.

The correct observations are : **[2013] ...[1M]**

(a) (I), (II) and (III) (b) (II), (III) and (IV)

(c) (III), (IV) and (I) (d) (IV), (I) and (II)

9. In an experiment to study the properties of ethanoic acid, a student takes about 3 mL of ethanoic acid in a dry test tube. He adds an equal amount of distilled water to it and shakes the test tube well. After some time he is likely to observe that **[2014] ...[1M]**

(a) A colloid is formed in the test tube

(b) The ethanoic acid dissolves readily in water

(c) The solution becomes light orange

(d) Water floats over the surface of ethanoic acid

10. We need 20% aqueous solution of sodium hydroxide for the study of saponification reaction. When we open the lid of the bottle containing solid sodium hydroxide we observe it in which form?

[2014] ...[1M]

(a) Colourless transparent beads

(b) Small white beads

(c) White pellets/flakes

(d) Fine white powder

11. While studying saponification reaction, a student measures the temperature of the reaction mixture and also finds its nature using blue/red litmus paper. On the basis of his observations the correct conclusion would be

[2014] ...[1M]

(a) The reaction is exothermic and the reaction mixture is acidic

(b) The reaction is endothermic and the reaction mixture is acidic

(c) The reaction is endothermic and the reaction mixture is basic

(d) The reaction is exothermic and the reaction mixture is basic

12. In a locality, hard water, required for an experiment, is not available. However, the following salts are available in the school laboratory :

1. Sodium sulphate
2. Calcium sulphate
3. Magnesium chloride
4. Sodium chloride
5. Calcium chloride
6. Potassium sulphate

Which of the above salts may be dissolved in water to obtain hard water for the experiment?

[2014] ...[1M]

(a) 2, 3 and 5 (b) 1, 2 and 5

(c) 1, 2, 4 and 6 (d) 3 and 5 only

13. Write the number of covalent bonds in the molecule of butane, C_4H_{10}.

[2015] ...[1M]

14. While preparing soap a small quantity of common salt is generally added to the reaction mixture of vegetable oil and sodium hydroxide. Which one of the following may be the purpose of adding common salt? **[2015] ...[1M]**

(a) To reduce the basic nature of the soap

(b) To make the soap neutral

(c) To enhance the cleansing power of the soap

(d) To favour the precipitation of the soap

15. A student takes about 4 ml of distilled water in four test tubes marked P, Q, R and S. He then dissolves in each test tube an equal amount of one salt in one test tube, namely sodium sulphate in P, potassium sulphate in Q, calcium sulphate in R and magnesium sulphate in S. After that he adds an equal amount of soap solution in each test tube. On shaking each of these test tubes well, he observes a good amount of lather (foam) in the test tube marked.

[2015] ...[1M]

(a) P and Q

(b) Q and R

(c) P, Q and S

(d) P, R and S

16. When you add sodium hydrogen carbonate to acetic acid in a test tube, a gas liberates immediately with brisk effervescence. Name this gas. Describe the method of testing this gas.

[2015] ...[1M]

17. Write the name and structure of an aldehyde with four carbon atoms in its molecule.

[2016] ...[1M]

18. Write the molecular formula of the 2nd and 3rd member of the homologous series where the first member is ethyne. **[2017] ...[1M]**

19. A student requires hard water for an experiment in his laboratory which is not available in the neighbouring area. In the laboratory there are some salts, which when dissolved in distilled water can convert it into hard water. Select from the following groups of salts, a group, each salt of which when dissolved in distilled water will make it hard. **[2017] ...[1M]**

(a) Sodium chloride, Potassium chloride

(b) Sodium sulphate, Potassium sulphate

(c) Sodium sulphate, Calcium sulphate

(d) Calcium sulphate, Calcium chloride

20. Name the functional group present in propanone. **[2020] ...[1M]**

21. **Assertion (A) :** In a homologous series of alcohols, the formula for the second member is C_2H_5OH and the third member is C_3H_7OH.

Reason (R) : The difference between the molecular masses of the two consecutive members of a homologous series is 144.

[2020] ...[1M]

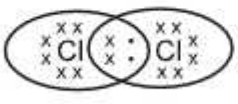
(a) Both A and R are true and R is the correct explanation of the Assertion.

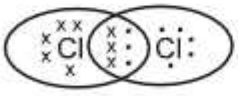
(b) Both A and R are true but R is not the correct explanation of the Assertion.

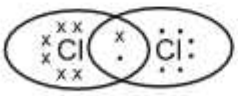
(c) A is true but R is false.

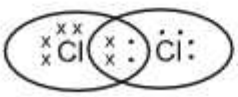
(d) A is false but R is true.

22. The electron dot structure of chlorine molecule is: **[2023] ...[1M]**

(a) 

(b) 

(c) 

(d) 

23. Write the name and general formula of a chain of hydrocarbons in which an addition reaction with hydrogen is possible. State the essential condition for an addition reaction. Stating this condition, write a chemical equation giving the name of the reactant and the product of the reaction. **[2015] ...[2M]**

24. A student adds a spoon full of powdered sodium hydrogen carbonate to a flask containing ethanoic acid. List two main observations, he must note in his note book, about the reaction that takes place. Also write chemical equation for the reaction. **[2016] ...[2M]**

25. Mention the essential material (chemicals) to prepare soap in the laboratory. Describe in brief the test of determining the nature (acidic/ alkaline) of the reaction mixture of saponification reaction. **[2017] ...[2M]**

26. A compound 'X' on heating with excess conc. sulphuric acid at 443 K gives an unsaturated compound 'Y'. 'X' also reacts with sodium metal to evolve a colourless gas 'Z'. Identify 'X', 'Y' and 'Z'. Write the equation of the chemical reaction of formation of 'Y' and also write the role of sulphuric acid in the reaction.

[2018] ...[2M]

27. In three test tubes A, B and C, three different liquids namely, distilled water, underground water and distilled water in which a pinch of calcium sulphate is dissolved, respectively are taken. Equal amount of soap solution is added to each test tube and the contents are shaken. In which test tube will the length of the foam (lather) be longest? Justify your answer.

[2019] ...[2M]

28. "Carbon prefers to share its valence electrons with other atoms of carbon or with atoms of other elements rather than gaining or losing the valence electrons in order to attain noble gas configuration." Give reasons to justify this statement. **[2022] ...[2M]**

29. The atomic number of an element 'X' is 11.

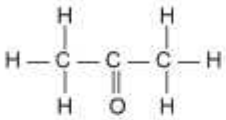
(i) Write the electronic configurations of X and find its valency.

(ii) Write the formula and nature of its oxide.

[2022] ...[2M]

30. (i) Why are covalent compounds generally poor conductors of electricity?

(ii) Name the following compound:



(iii) Name the gas evolved when ethanoic acid is added to sodium carbonate. How would you prove the presence of this gas?

[2008] ...[3M]

31. Give reasons for the following observations :

(i) The element carbon forms a very large number of compounds.

(ii) Air holes of a gas burner have to be adjusted when the heated vessels get blackened by the flame.

(iii) Use of synthetic detergents causes pollution of water. **[2009] ...[3M]**

32. Name the functional group of organic compounds that can be hydrogenated. With the help of suitable example, explain the process of hydrogenation mentioning the conditions of the reaction any one change in physical property with the formation of the product. Name any one natural source of organic compounds that are hydrogenated. **[2010] ...[3M]**

33. Write chemical equations to show what happens when:

(i) Ethanol is heated with concentrated sulphuric acid at 443 K.

(ii) Ethanol reacts with ethanoic acid in the presence of an acid acting as a catalyst.

(iii) An ester reacts with a base **[2011] ...[3M]**

34. Complete the following equations:

(i) $CH_4 + O_2 \longrightarrow$

(ii) $C_2H_5OH \xrightarrow{\text{Hot conc. } H_2SO_4}$

(iii) $CH_3COOH + NaOH \longrightarrow$ **[2012] ...[3M]**

35. Name the oxidising agent used for the conversion of ethanol to ethanoic acid. Distinguish between ethanol and ethanoic acid on the basis of

(i) Litmus test

(ii) Reaction with sodium carbonate

[2013] ...[3M]

36. (i) Differentiate between alkanes and alkenes. Name and draw the structure of one member of each.

(ii) Alkanes generally burn with clean flame. Why? **[2013] ...[3M]**

37. A carboxylic acid (molecular formula $C_2H_4O_2$) reacts with an alcohol in the presence of an acid catalyst to form a compound 'X'. The alcohol on oxidation with alkaline $KMnO_4$ followed by acidification gives the same carboxylic acid $C_2H_4O_2$.

Write the name and structure of

(i) carboxylic acid,

(ii) alcohol and

(iii) the compound 'X'. **[2014] ...[3M]**

38. Define the term 'structural' isomerism'. Explain why propane cannot exhibit this property. Draw the structures of possible isomers of butane, C_4H_{10} **[2014] ...[3M]**

39. List two tests for experimentally distinguishing between an alcohol and a carboxylic acid and describe how these tests are performed.

[2015] ...[3M]

40. Write three different chemical reactions showing the conversion of ethanoic acid to sodium ethanoate. Write balanced chemical equation in each case. Write the name of the reactants and the products other than ethanoic acid and sodium ethanoate in each case.

[2016] ...[3M]

41. Distinguish between esterification and saponification reactions with the help of the chemical equations for each. State one use of each (i) Esters, and (ii) Saponification process.

[2017] ...[3M]

42. Write the structural formula of ethanol. What happens when it is heated with excess of conc. H_2SO_4 at 443 K? Write the chemical equation for the reaction stating the role of conc. H_2SO_4 in this reaction. **[2017] ...[3M]**

43. (i) Why are most carbon compounds poor conductors of electricity?

(ii) Write the name and structure of a saturated compound in which the carbon atoms are arranged in a ring. Give the number of single bonds present in this compound.

[2018] ...[3M]

44. 3 mL of ethanol is taken in a test tube and warmed gently in a water bath. A 5% solution of alkaline potassium permanganate is added first drop by drop to this solution, then in excess.

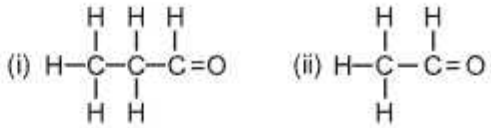
(i) How is 5% solution of $KMnO_4$ prepared?

(ii) State the role of alkaline potassium permanganate in this reaction. What happens on adding it in excess?

(iii) Write chemical equation of this reaction.

[2020] ...[3M]

45. Consider the following organic compounds:



(a) Name the functional group present in these compounds.

(b) Write the general formula for the compounds of this functional group.

(c) State the relationship between these compounds and draw the structure of any other compound having similar functional group. **[2022] ...[3M]**

46. (a) Draw the electron dot structure for ethyne.

(b) List two differences between the properties exhibited by covalent compounds and ionic compounds.

[2022] ...[1+2=3M]

47. (i) State two properties of carbon which lead to a very large number of carbon compounds.

(ii) Why does micelle formation take place when soap is added to water? Why are micelles not formed when soap is added to ethanol?

[2011] ...[5M]

48. Explain isomerism. State any four characteristics of isomers. Draw the structures of possible isomers of butane, C_4H_{10}. **[2011] ...[5M]**

49. List in tabular form three physical and two chemical properties on the basis of which ethanol and ethanoic acid can be differentiated.

[2012] ...[5M]

50. (i) Define the term 'isomers'

(ii) Draw two possible isomers of the compound with molecular formula C_3H_6O and write their names.

(iii) Give the electron dot structures of the above two compounds **[2013] ...[5M]**

51. Both soap and detergent are some type of salts. What is the difference between them? Describe in brief the cleansing action of soap. Why do soaps not form lather in hard water? List two problems that arise due to the use of detergents instead of soaps. **[2015] ...[5M]**

52. A carbon compound 'P' on heating with excess conc. H_2SO_4 forms another carbon compound 'Q' which on addition of hydrogen in the presence of nickel catalyst forms a saturated carbon compound 'R'. One molecule of 'R' on combustion forms two molecules of carbon dioxide and three molecules of water. Identify P, Q and R and write chemical equations for the reactions involved.

[2016] ...[5M]

53. Why certain compounds are called hydrocarbons? Write the general formula for homologous series of alkanes, alkenes and alkynes and also draw the structure of the first member of each series. Write the name of the reaction that converts alkenes into alkanes and also write a chemical equation to show the necessary conditions for the reaction to occur.

[2017] ...[5M]

54. Write the chemical formula and name of the compound which is the active ingredient of all alcoholic drinks. List its two uses. Write chemical equation and name of the product formed when this compound reacts with

(i) Sodium metal

(ii) Hot concentrated sulphuric acid

[2019] ...[5M]

55. What is methane? Draw its electron dot structure. Name the type of bonds formed in this compound.

Why are such compounds :

(i) Poor conductors of electricity? and

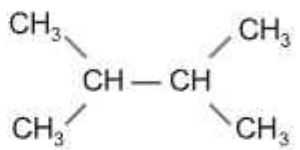
(ii) Have low melting and boiling points? What happens when this compound burns in oxygen? **[2019] ...[5M]**

56. (A) (i) Draw the structure of the following compounds : **[2023] ...[5M]**

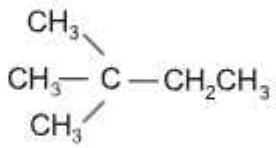
(a) Butanoic acid

(b) Chloropentane

(ii) How are structure (i) and structure (ii) given below related to one another? Give reason to justify your answer.



Structure (i)



Structure (ii)

Draw one more possible structure for above case.

(iii) Differentiate between saturated and unsaturated carbon compounds on the basis of their general formula.

OR

(B) (i) What happens when a small piece of sodium is dropped in ethanol? Write the equation for this reaction.

(ii) Why is glacial acetic acid called so?

(iii) What happens when ethanol is heated at 443 K in the presence of conc. H_2SO_4? Write the role of conc. H_2SO_4 in this case.

(iv) Write an equation showing saponification.