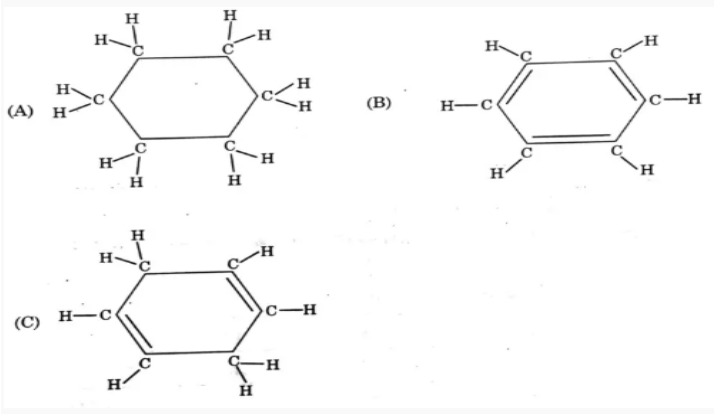
	INDIAN SCHOOL AL WADI AL KABIR	
Class: X	**Department: SCIENCE 2026 – 27** **SUBJECT: SCIENCE(CHEMISTRY)**	**Date: 09/11/2026**
Worksheet No: 04 **WITH ANSWERS**	**CHAPTER / UNIT: CARBON AND ITS COMPOUNDS**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT:	**CLASS & SEC:**	**ROLL NO.**

OBJECTIVE TYPE QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. The molecular mass of propanol (C_3H_7OH) is 60 u. The molecular mass of the next member of its homologous series is:
   (a) 72 u
   (b) 74 u
   (c) 76 u
   (d) 78 u
2. The IUPAC name of the compound $CH_3–CH_2–CH_2–CHO$ is:
   (a) Butanone
   (b) Butanal
   (c) Butanol
   (d) Butanoic acid
3. A student burns a hydrocarbon and observes a yellow, sooty flame. The hydrocarbon is most likely:
   (a) C_2H_6
   (b) CH_4
   (c) C_2H_2
   (d) C_3H_8
4. Consider the structures of the three cyclic carbon compounds A, B, and C given below and select the correct option from the following:



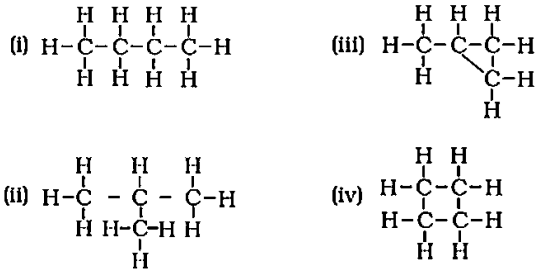
(a) A and C are isomers of hexane and B is benzene
(b) A is an isomer of hexane, B is benzene, and C is an isomer of hexene
(c) A is a saturated cyclic hydrocarbon and B and C are unsaturated cyclic hydrocarbons
(d) A is cyclohexane and B and C are isomers of benzene

5. An organic compound X with molecular formula $C_2H_4O_2$ turns blue litmus red and gives brisk effervescence with sodium bicarbonate. Identify the compound.
(a) Methanoic acid
(b) Ethanoic acid
(c) Ethanol
(d) Methanol

6. Which of the following will **not** react with hydrogen in the presence of a nickel catalyst?
(a) C_2H_4
(b) C_2H_2
(c) C_3H_6
(d) C_3H_8

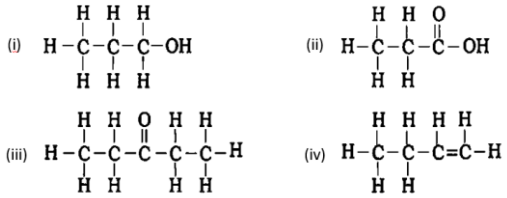
7. Which pair represents consecutive members of the same homologous series?
(a) CH_4 and C_2H_4
(b) C_2H_6 and C_3H_8
(c) C_2H_2 and C_3H_8
(d) CH_3OH and C_2H_6

8. Which of the following are correct structural isomers of butane?



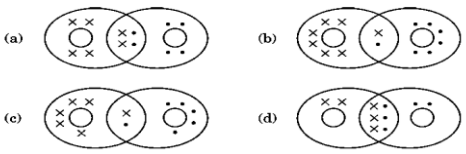
(a) (i) and (iii)
(b) (ii) and (iv)
(c) (i) and (ii)
(d) (iii) and (iv)

9. Identify and name the functional group present in the following compounds.



(a) (i)Alcohol, (ii)carboxylic acid, (iii)ketone, (iv)double bond
(b) (i)Alcohol, (ii)ketone, (iii)double bond, (iv)carboxylic acid
(c) (i)Ketone, (ii)Alcohol, (iii)carboxylic acid, (iv)double bond
(d) (i)Carboxylic acid, (ii)double bond, (iii)alcohol, (iv)ketone

10. The correct representation of covalent bonding in an oxygen molecule is:



ASSERTION-REASONING QUESTIONS

For the following questions, two statements are given-one labelled Assertion (A) and the other labelled Reason(R). Select the correct answer to these questions from the options (i), (ii), (iii) and (iv)as given below:

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

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

(iii)A is true, but R is false.

(iv)A is false, but R is true.

11. Assertion: Most of the carbon compounds are good conductors of electricity.
    Reason: They do not dissociate to form ions and remain as molecules.
12. Assertion: -C_3H_8 and C_4H_{10} are successive members of the alkane homologous series.
    Reason: Successive members in a homologous series differ by CH_3 unit.
13. Assertion(A): Esterification is a process in which a sweet-smelling substance is produced.
    Reason (R): When esters react with sodium hydroxide, an alcohol and sodium salt of carboxylic acid are obtained.
14. Assertion (A): Heating ethanol with excess concentrated sulphuric acid at 443 K gives ethene.
    Reason (R): The reaction is an oxidation reaction in which concentrated H_2SO_4 acts as an oxidising agent.

TWO MARKS QUESTIONS

15. Explain the nature of the covalent bond using the bond formation in CH_3Cl.
16. Define the term structural isomerism. Explain why propane cannot exhibit this property.
17. What is a homologous series? State any three characteristics, using the alcohol series (CH_3OH, C_2H_5OH, C_3H_7OH, C_4H_9OH) as an example.
18. Using general formulae, write the molecular formulae of the alkane, alkene and alkyne containing seven carbon atoms.
19. Draw the electron dot structure for ethanoic acid.

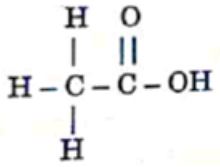
THREE MARK QUESTIONS

20. (i) Select saturated hydrocarbons from the following: -
    C_2H_2, C_5H_8, C_4H_{10}, C_6H_{14}, C_2H_4
    (ii) Select alkenes and alkynes from the following: -
    C_6H_{12}, C_3H_4, C_2H_4, CH_4, C_4H_8, C_5H_8
21. Explain why carbon generally forms compounds by covalent bonds.
22. C_3H_6, C_4H_8 and C_5H_{10} belong to the same homologous series.
    (i) Why are the melting and boiling points of C_5H_{10} higher than C_4H_8?
    (ii) Arrange these hydrocarbons in order of increasing boiling points.
23. Soaps and detergents are both types of salts. State the difference between the two. Write the mechanism of the cleansing action of soaps. Why do soaps not form lather (foam) with hard water?
24. Give reason why carbon neither forms C^{4+} cations nor C^{4-} anions, but forms covalent compounds which are bad conductors of electricity and have low melting and boiling points.

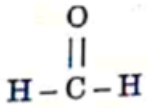
FIVE MARK QUESTIONS

25. Carry out the following conversions, stating the condition(s) for each:
    (i) Ethanol→ Ethene
    (ii)Ethene→ Ethane
    (iii) Ethane →Chloroethane
    (iv) Ethanol →Ethanoic acid
    (v) Ethanoic acid → Ethyl ethanoate

26. (i)Write the formula and molecular mass of the third homologue of alcohols. State how the boiling point of an alcohol changes as one moves from lower to higher homologues.
(ii)Identify the functional groups present in the following and name them.



(a)



(b)

27. A saturated organic compound 'A' belongs to the homologous series of alcohols. On heating 'A' with concentrated sulphuric acid at 443 K, it forms an unsaturated compound 'B' with molecular mass 28 u.
The compound 'B' on addition of one mole of hydrogen in the presence of Nickel, changes to a saturated hydrocarbon 'C'.
(i) Identify A, B and C.
(ii) Write the chemical equations showing the conversion of A into B.
(iii) What happens when compound C undergoes combustion?
(iv) State one industrial application of the hydrogenation reaction.
(v) Name the products formed when compound A reacts with sodium.

28. An acid 'X' and an alcohol Y react with each other in the presence of an acid catalyst to form a sweet-smelling substance Z. Identify X, Y and Z. Write the chemical equation for the reaction involved and name it. The substance Z, on treatment with sodium hydroxide, produces back the alcohol Y and sodium ethanoate. Write the chemical equation for the reaction involved and name it, giving justification for the name.

PREVIOUS YEAR BOARD QUESTIONS

29. A carbon compound ‘P’ of molecular formula C_2H_6O is found to be neutral when tested with red and blue litmus. A gas that burns with a pop sound is produced when sodium metal reacts with compound ‘P’.
(i) Identify the compound ‘P’.
(ii) The carbon compound ‘P’ is heated with conc. H_2SO_4 at 443 K to produce compound ‘Q’.
(iii) Write the chemical equation for the reaction.
(iv) What is the role of conc. H_2SO_4 in this reaction?
(v) What is likely to be observed on heating compound ‘P’ with ethanoic acid with an acid as a catalyst? Write the chemical equation for the reaction. (CPBE 2025-26)

30. (i) Write the structural formula of benzene.
(ii) State the reason why carbon can neither form C^{4+} cation nor C^{4-} anion.
(iii) What type of bond is formed between carbon and hydrogen?
(iv) How is ethanol converted to ethanoic acid?
(v) Complete the following chemical equation:

$$CH_3COOC_2H_5 + NaOH \longrightarrow$$ (CBSE 2025-26)

31. A saturated organic compound 'A' with two carbon atoms belongs to the homologous series of alcohols. On oxidation, it forms an organic acid 'B' with molecular mass 60 u. On heating 'A' with excess concentrated sulphuric acid at 443 K, an unsaturated hydrocarbon 'C' is formed.
(i) Name A, B, and C.
(ii) Calculate the molecular mass of C.
(iii) What happens when a pinch of sodium carbonate is added to compound B? Write

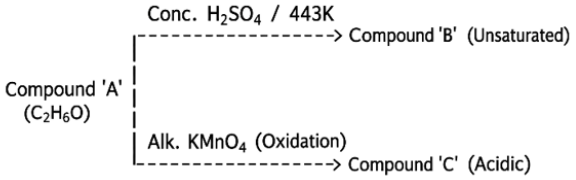
chemical equation for the reaction.

(iv) Draw the electron dot structure of compound B.(CBSE 2024-25)

32. (i) A compound 'X' having two carbon atoms in its molecule turns blue litmus red, and a 5-8% solution of 'X' in water is widely used as a preservative. Identify the compound 'X' and write its structure.
(ii) Compare its pH nature with a mineral acid.
(iii) 'X' on reacting with alcohols, produces sweet-smelling compounds used in making perfumes. Name the reaction and write its chemical equation.
(iv) When sodium carbonate is added to 'X', a colourless gas is produced which turns lime water milky. Write the chemical equation for the reaction, giving the name of the salt produced. (CBSE 2024-2025)

CASE STUDY BASED QUESTIONS

33. An organic compound 'A' with the molecular formula C_2H_6O is an active ingredient in all alcoholic drinks and is highly soluble in water. When compound 'A' is heated with excess concentrated sulfuric acid (conc. H_2SO_4 at 443K), it forms an unsaturated hydrocarbon 'B'. Compound 'A' on reaction with alkaline KMnO4, undergoes oxidation to form an acidic compound 'C' with the same number of carbon atoms.



(a) Identify compounds 'A', 'B', and 'C'.

(b) Write the chemical equation for the conversion of compound 'A' to compound 'B'. What is the role of conc. H_2SO_4 in this reaction?

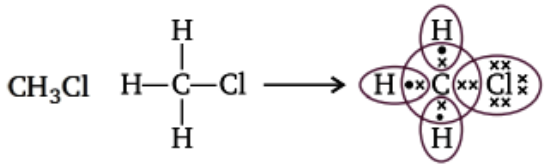
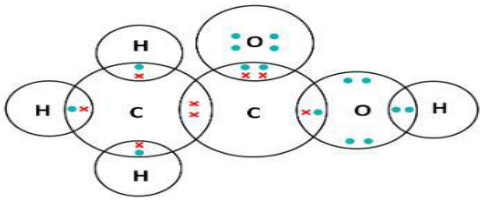
(c) What will you observe when a small piece of sodium metal is dropped into a test tube containing compound 'A'? Name the gas evolved.

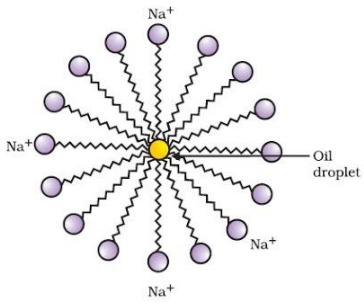
OR

(d) Write the chemical equation for the conversion of compound A to compound C. What is the role of alkaline $KMnO_4$ in this reaction?

ANSWERS

Q.no	Answers
1	(b) 74 u
2	(b) Butanal
3	(c) C_2H_2
4.	(c) A is a saturated cyclic hydrocarbon, and B and C are unsaturated cyclic hydrocarbons
5	(b) Ethanoic acid
6	(d) C_3H_8
7	(b) C_2H_6 and C_3H_8
8	(c)(i) and (ii)
9	(a)(i)Alcohol, (ii)carboxylic acid, (iii)ketone, (iv)double bond
10	(a)
11	(iv)A is false but R is true.
12	(iii)A is true but R is false
13	(ii)Both A and R are true, but R is not the correct explanation of the Assertion.
14	(iii)A is true but R is false

15	Carbon has four valence electrons. Carbon shares one electron with each of three hydrogen atoms and one electron with chlorine. Thus, four single covalent bonds are formed in CH_3Cl. Each shared pair of electrons forms a covalent bond. 
16	The phenomenon in which compounds have the same molecular formula but different structures is called structural isomerism. Lower alkanes till propane (ie, first three members of alkane series) do not show isomerism. They cannot have a branched chain structure to exhibit isomerism.
17	"A homologous series is a group of organic compounds having the same functional group and the same general formula, in which successive members differ by a $–CH_2–$ unit." Characteristics: (i) successive members differ by a $–CH_2–$ unit (14 u in mass); (ii) all members have the same functional group (–OH) and similar chemical properties; (iii) physical properties such as melting and boiling points show a gradation with increasing molecular mass.
18	Alkane $C_nH_{2n+2} \rightarrow C_7H_{16}$; alkene $C_nH_{2n} \rightarrow C_7H_{14}$; alkyne $C_nH_{2n-2} \rightarrow C_7H_{12}$.
19	
20	(i) C_6H_{14} and C_4H_{10} are saturated hydrocarbons. (ii) Alkenes:- C_6H_{12}, C_2H_4, C_4H_8 Alkynes:- C_3H_4, C_5H_8
21	Carbon cannot lose four electrons easily because very high energy is required. It cannot gain four electrons easily because 6 protons cannot hold 10 electrons. Carbon can easily share four electrons, forming covalent bonds.
22	(i) It is because C_5H_{10} has a higher molecular weight, stronger intermolecular forces of attraction and higher boiling points and melting points. (C_5H_{10} has a higher molecular mass than C_4H_8. Therefore, it has stronger intermolecular forces of attraction and a higher boiling point.) (ii) $C_3H_6 < C_4H_8 < C_5H_{10}$
23	The molecules of soap are sodium or potassium salts of long-chain carboxylic acids. Detergents are generally ammonium or sulphonate salts of long-chain carboxylic acids. The ionic group in soaps is $-COO^-Na^+$. The ionic group in synthetic detergents is $-SO_3^-\ Na^+$ or $-OSO_3^-Na^+$ **Cleansing action of soap:** A soap molecule contains a polar part (COO^-Na^+) called polar end and a non-polar part consisting of a long chain of carbon atom. This part is called hydrocarbon end. The polar end is water soluble whereas hydrocarbon part is water-repellent and oil soluble. When an oily (dirty) piece of cloth is put into soap solution, the hydrocarbon part of the molecule attaches itself to the oily drop and the $-COO^-$ end orients itself towards water. Na^+ ions in solution arrange themselves around the $-COO^-$ ions. The negatively charged micelle so formed entraps the oily dirt. The negatively charged micelle repel each other due to the electrostatic repulsion. As a result, the tiny oily dirt particles do not come together and get washed away in water during rinsing.



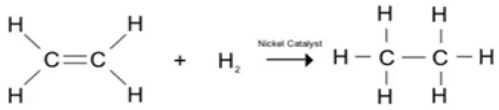
In hard water, soap does not form lather as hard water contains $Ca^{2+}$and Mg^{2+} ions. Soap reacts with these ions to form insoluble calcium and magnesium salts of fatty acids.
Two problems which arise due to the use of detergents instead of soaps are:
(i) Synthetic detergents are non-biodegradable and hence cause water pollution.
(ii) Synthetic detergents also cause skin-related problems.

24 Carbon cannot lose 4 electrons to form C^{4+} ions as very high energy is required to remove 4 electrons. Carbon cannot gain four electrons to form C^{4-} ions as 6 protons cannot hold 10 electrons.
Carbon can share 4 electrons to form covalent compounds. Carbon compounds do not conduct electricity as they do not form ions.
They have low melting and boiling points due to weak force of attraction between molecules.

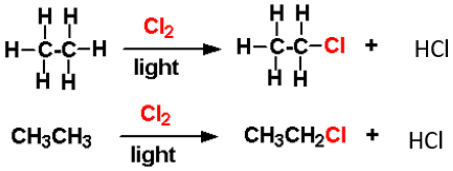
25 (i) Ethanol reacts with conc. H_2SO_4 to give unsaturated hydrocarbon(ethene)

$$CH_3-CH_2OH \xrightarrow[H_2SO_4]{\text{Hot conc.}} CH_2=CH_2 + H_2O$$

(ii)



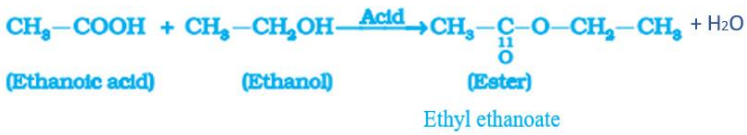
(iii)



(iv)

$$CH_3-CH_2OH \xrightarrow[\text{Or acidified } K_2Cr_2O_7 + \text{Heat}]{\text{Alkaline } KMnO_4 + \text{Heat}} CH_3COOH$$

(v)

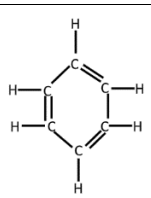


Ethyl ethanoate

26 (i) [The general formula of alcohols = $C_nH_{(2n+1)}OH$
The first homologue of alcohols ($n = 1$) = CH_3OH (methanol)

	The second homologue of alcohols ($n = 2$) = C_2H_5OH (ethanol)] The third homologue of alcohols ($n = 3$) = C_3H_7OH (propanol, CH_3-CH_2-CH_2-OH) The atomic masses: Carbon (C) = 12 $\frac{g}{mol}$ Hydrogen (H) = 1 $\frac{g}{mol}$ Oxygen (O) = 16 $\frac{g}{mol}$ The molecular mass of C_3H_8O = $(3 \times 12\ \frac{g}{mol}) + (8 \times 1\ \frac{g}{mol}) + 16\ \frac{g}{mol}$ $= 36\ \frac{g}{mol} + 8\ \frac{g}{mol} + 16\ \frac{g}{mol}$ $= 60\ \frac{g}{mol}$ Hence, the formula and the molecular mass of the third homologue of alcohols is C_3H_8O and 60 g mol^{-1} respectively. The boiling point of the successive members of the homologous series of alcohols increases with the increase in molecular mass (lower to higher members). (ii)(a)COOH-Carboxylic acid (Name of the compound-Ethanoic acid) (b)CHO-Aldehyde (Name of the compound- Methanal)
27	(i) Compounds A, B and C are: A → Ethanol B → Ethene C → Ethane $C_2H_5OH \xrightarrow{\text{Conc. sulphuric acid}} CH_2{=}CH_2$ $CH_2{=}CH_2 + H_2 \xrightarrow{Ni} CH_3{-}CH_3$ (ii) $C_2H_5OH \xrightarrow{\text{Conc. sulphuric acid}} CH_2{=}CH_2$ (iii) When ethane undergoes combustion, carbon dioxide is produced along with water and heat. $2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$ + Heat (iv) In industry, the hydrogenation reaction is used for preparing vegetable ghee from vegetable oils (v) Sodium ethoxide and Hydrogen $2Na + 2C_2H_5OH \longrightarrow 2C_2H_5ONa + H_2$
28	X: The acid X is likely to be a carboxylic acid, such as ethanoic acid(acetic acid, CH_3COOH). Y: The alcohol Y is likely to be a simple alcohol, such as ethanol (C_2H_5OH). Z: The sweet-smelling substance Z is an ester, specifically ethyl ethanoate ($CH_3COOCH_2CH_3$). Explanation: The ethanoic acid and ethanol react with each other in the presence of an acid catalyst to form an ester (ethyl ethanoate). Chemical equation for the reaction: $CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$ This reaction is called **esterification**.

	The substance Z, ethyl ethanoate, on treatment with sodium hydroxide (NaOH) produces the alcohol Y, ethanol, and sodium ethanoate (CH_3COONa). Chemical equation for the reaction: $CH_3COOCH_2CH_3 + NaOH \rightarrow C_2H_5OH + CH_3COONa$ This reaction is called **saponification**. **Saponification** The term "saponification" comes from the Latin word "sapo", which means soap. This is because the reaction is commonly used in the production of soap, where fats (which are esters) are hydrolysed by a strong base (such as NaOH) to form soap and glycerol.
29	(i)The compound 'P' is Ethanol (C_2H_5OH). Reason: • Ethanol is neutral in nature, so it does not change the colour of red or blue litmus. • It reacts with sodium metal to produce hydrogen gas, which burns with a pop sound. Chemical equation: $2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2\uparrow$ (ii) The carbon compound 'P' is heated with concentrated H_2SO_4 at 443 K to produce compound 'Q'. (iii) Write the chemical equation for the reaction. Ethanol undergoes dehydration in the presence of concentrated sulphuric acid at 443 K to form ethene (C_2H_4). Therefore, compound 'Q' is Ethene (C_2H_4). $C_2H_5OH \xrightarrow[443\,K]{Conc.\ H_2SO_4} C_2H_4 + H_2O$ (iv) What is the role of concentrated H_2SO_4 in this reaction? Concentrated H_2SO_4 acts as a dehydrating agent. It removes a water molecule from ethanol to produce ethene. (v) What is likely to be observed on heating compound 'P' with ethanoic acid with an acid as a catalyst? Write the chemical equation. Ethanol reacts with ethanoic acid in the presence of concentrated sulphuric acid to form an ester called ethyl ethanoate and water. This reaction is called esterification. Chemical equation: $CH_3COOH + C_2H_5OH \xrightarrow{Conc.\ H_2SO_4} CH_3COOC_2H_5 + H_2O$ Observation: A sweet, fruity smell is produced due to the formation of the ester (ethyl ethanoate).
30	(i)The molecular formula of benzene is C_6H_6. It consists of six carbon atoms arranged in a hexagonal ring with alternate single and double bonds.



(ii) State the reason why carbon can neither form C^{4+} cation nor C^{4-} anion.

- Formation of C^{4+}: Carbon has four valence electrons. It would require a very large amount of energy to remove all four electrons.
- Formation of C^{4-}: Carbon would have to gain four electrons. This would result in a highly unstable ion due to strong repulsion between the electrons.

Therefore, carbon neither forms C^{4+} nor C^{4-} ions. Instead, it shares electrons to form covalent bonds.

(iii) What type of bond is formed between carbon and hydrogen?

A covalent bond is formed between carbon and hydrogen by sharing electrons.

(iv) How is ethanol converted to ethanoic acid?

Ethanol is converted into ethanoic acid by oxidation using oxidising agents such as alkaline potassium permanganate ($KMnO_4$) or acidified potassium dichromate ($K_2Cr_2O_7$).

Chemical equation:

$$CH_3CH_2OH + 2[O] \rightarrow CH_3COOH + H_2O$$

(v) Complete the following chemical equation:

$$CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$$

Explanation:

Ethyl ethanoate reacts with sodium hydroxide to form sodium ethanoate and ethanol.

This reaction is called saponification (alkaline hydrolysis of an ester).

31

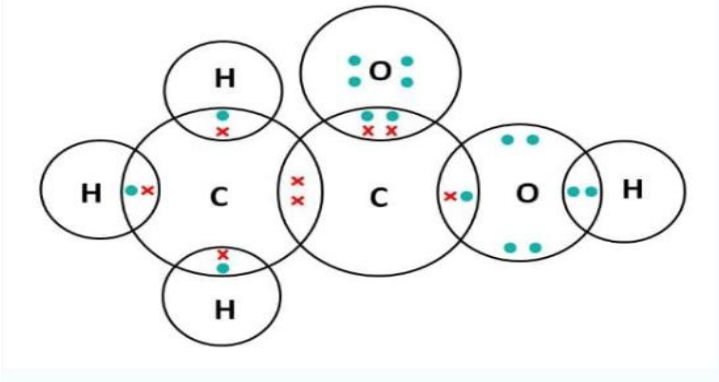
(i)A: Ethanol (C_2H_5OH); B: Ethanoic acid (CH_3COOH); C: Ethene (C_2H_4).

(ii) Molecular Mass of C: $C_2H_4 = (2\times12) + (4\times1) = 28$ u.

(iii)Reaction: CO_2 gas evolves, turning lime water milky.

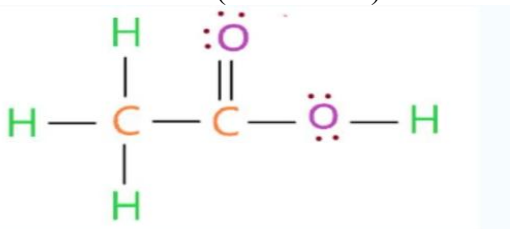
$$2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$$

(iv) Electron Dot Structure of B (CH_3COOH):



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(i) X: Ethanoic acid (CH_3COOH).



(ii) pH Comparison: Ethanoic acid (weak acid, pH ~3-4) is less acidic than mineral acids (e.g., HCl, pH ~1).

	(iii) Reaction: Esterification; $CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$. (iv) Equation: $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa$ (sodium ethanoate) $+ H_2O + CO_2$.
33	(a) Identification: Compound A is Ethanol, CH_3CH_2OH. Compound B is Ethene, CH2=CH2. Compound C is Ethanoic Acid / Acetic Acid, CH_3COOH. (b)Chemical Equation: $CH_3CH_2OH \xrightarrow{\text{Conc. } H_2SO_4,\ 443\ K} CH_2 = CH_2 + H_2O$ Role of conc. H_2SO_4: It acts as a dehydrating agent because it removes water from ethanol. (c)Sodium reacts with ethanol to form sodium ethoxide, evolving Hydrogen gas bubbles which burn with a characteristic 'pop' sound. $2CH_3CH_2OH + 2Na \rightarrow 2CH_3CH_2ONa + H_2 \uparrow$ OR $CH_3—CH_2OH \xrightarrow[\text{Or acidified } K_2Cr_2O_7 + \text{Heat}]{\text{Alkaline } KMnO_4 + \text{Heat}} CH_3COOH$ (c) Alkaline KMnO4 is an oxidising agent.

Prepared by: *Ms Asha John*	*Checked by:* *HOD Science*