CBSE Test Paper-01

Chapter 04 Carbon and its Compound

1. The by-product in soap industry is**: (1)**

   a. Glycerol
   b. Isoprene
   c. Ethylene glycol
   d. Butane

2. While cooking, if the bottom of the vessels is getting blackened on the outside, it means that**: (1)**

   a. The food is not cooked completely
   b. The fuel is not burning completely.
   c. The fuel is burning completely.
   d. The fuel is wet.

3. Which of the following is used for antifreeze mixture? **(1)**

   a. C_2H_5OH
   b. CH_3OH
   c. HCHO
   d. CH_3COOH

4. Hardness of water is caused by**: (1)**

   a. All of these
   b. $Mg(HCO_3)_2$
   c. $CaCl_2$
   d. $CaSO_4$

5. **Statement A:** Acetic acid freezes at 290K.
   Statement B: Acetic is also called as glacial acetic acid. **(1)**

   a. Statement A is true; Statement B is false.

b. Statement B is True; Statement A is false.
c. Both the statements A and B are true.
d. Neither Statement A nor Statement B is true.

6. Name the chemical reagent which oxidises ethanol to ethanoic acid. **(1)**

7. What is the functional group of HCHO? **(1)**

8. State the part of soap molecule that attaches itself to dirt when soap is dissolved in water. **(1)**

9. An organic compound is a constituent of beer, whisky and some cough syrup. It is produced by the fermentation of sugar. Identify the organic compound. **(1)**

10. Explain why soaps are not effective cleansing agents in hard water? **(3)**

11. i. Write the formula and draw the electron dot structure of carbon tetrachloride.
    ii. What is saponification? Write the reaction involved in this process. **(3)**

12. Explain the formation of scum when hard water is treated with soap. **(3)**

13. Mention four differences between saturated and unsaturated hydrocarbons. **(3)**

14. i. What are hydrocarbons? Give examples.
    ii. Give the structural differences between saturated and unsaturated hydrocarbons with two examples each.
    iii. What is functional group? Give examples of four different functional groups. **(5)**

15. Describe the addition reaction of carbon compounds with its application. State the function of catalyst in this reaction. How this reaction is different from a substitution reaction? Explain with an example. **(5)**

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Answers

1. a. Glycerol

   Explanation: Glycerol Is a colourless, sweet, viscous liquid formed as a by-product in soap manufacture. It is used as an emollient and laxative, and for making explosives and antifreeze. The main product is soap.
   Fat or Oil + Alkali $\rightarrow$ Soap + Glycerol

2. b. The fuel is not burning completely.

   Explanation: If the bottom of the vessels is getting blackened (due to deposit of soot) on the outside while cooking, it is an indication that the fuel is not burning completely. When the fuel does not burn completely, some carbon particles remain un-oxidised and form soot.

3. a. C_2H_5OH

   Explanation: Ethanol (C_2H_5OH) is used for antifreeze mixture. Antifreeze is an additive which lowers the freezing point of a water-based liquid. At room temperature, ethanol is a polar solvent and is used as antifreeze.

4. a. All of these

   Explanation: Hardness of water is caused by magnesium and calcium salts. Calcium and magnesium dissolved in water are the two most common minerals that make water hard. Temporary hardness is a type of water hardness caused by the presence of dissolved bicarbonate minerals (calcium bicarbonate and magnesium bicarbonate).

5. c. Both the statements A and B are true.

   Explanation: Freezing point of ethanoic acid is 17 °C (290 K). When ethanoic acid (acetic acid) is cooled, it freezes to form a colourless, ice-like solid. The solid looks like a glacier and hence pure ethanoic acid is also called glacial ethanoic acid (or glacial acetic acid).

6. Ethanol is oxidised by acidifed sodium dichromate in a test-tube reaction, firstly to

form ethanal and, with further oxidation, ethanoic acid.

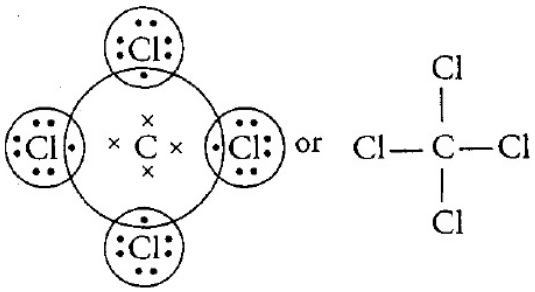
7. The functional group of HCHO is -CHO.

8. Hydrophobic end also called as tail, i.e.long hydrocarbon chain moves away from water but attaches to dirt.

9. Ethanol is a constituent of beer, whisky and some cough syrup. Ethanol is produced by the fermentation of sugar.

10. It is because detergents form lot of lather even with hard water. Hard water contains Ca^{2+} and Mg^{2+} ions which react with soap to form Insoluble salts of calcium and magnesium called scum and soap goes waste. Detergents do not form insoluble compounds with Ca^{2+} and Mg^{2+} ions therefore. These are more effective.

11. i. Electronic configuration of carbon, C(6) is $\overset{K\ L}{2,4}$
    Electronic configuration of chlorine, Cl (17) is $\overset{K\ L\ M}{2,8,7}$
    To attain octet configuration, carbon needs 4 electron and chlorine needs 1 electron.
    So,carbon forms carbon tetra chloride(CCl_4)



    ii. The reaction of an ester in the presence of base to give sodium salt of carboxylic acid and alcohol is known as saponification and this process is used in the preparation of soap

$$\underset{Ester}{CH_3COOC_2H_5} \xrightarrow{NaOH} \underset{Sodium\ ethanoate}{CH_3COO^-Na^+} + \underset{Alcohol}{C_2H_5OH}$$

12. Soap does not work properly when the water is hard. A soap is a sodium or potassium salt of long chain fatty acids. Hard water contains salts of calcium and magnesium. When soap is added to hard water, calcium and magnesium ions present in water displace sodium or potassium ions from the soap molecules forming an insoluble

substance called scum. A lot of soap is wasted in the process.

13. Difference between saturated and unsaturated hydrocarbons:

Saturated Hydrocarbons	**Unsaturated Hydrocarbons**
Only single bond is present in between carbon-carbon atoms.	Double or triple bond is present in between carbon-carbon atoms.
Substitution reaction occurs.	Addition reaction occurs.
They burn with blue flame.	They burn with sooty flame.
These are Less reactive.	These are Highly reactive.

14. i. The compounds that are made up of carbon and hydrogen atoms are called hydrocarbons, e.g. methane (CH_4), ethane (CH_2 = CH_2). Ethyne (C_2H_2), cyclohexane (C_6H_{12}), benzene (C_6H_6)etc.

    ii. In saturated hydrocarbons, all the four valencies of carbon are satisfied by a single covalent bond while in unsaturated hydrocarbons, double or triple bonds are required to satisfy the valencies of carbon, e.g.

        a. Saturated hydrocarbons
        Methane (CH_4), Ethane (CH_3 — CH_3)

        b. Unsaturated hydrocarbons
        Ethene (H_2C = CH_2), Ethyne (HC ≡ CH)

    iii. A functional group is an atom or group of atoms that define the structure (or the properties) of organic compounds. The four examples are:

        a. -OH Alcohol
        b. -COOH Carboxylic acid
        c. -CHO Aldehyde
        d. -X Halogen

15. The addition reaction can be seen only with unsaturated carbon compounds. One example of addition reaction is hydrogenation reaction, which is used to obtain ghee from vegetable oil.

e.g. $\underset{Ethene}{CH_2 = CH_2} + H_2 \xrightarrow[Ni]{200^0 C} \underset{Ethane}{CH_3 - CH_3}$

$$\underset{(Unsaturated)}{Vegetable\ oil} \xrightarrow[200^0C]{H_2/Ni} \underset{(Saturated)}{Ghee}$$

The rate of reaction increases in the presence of catalyst (Ni or Pt), they adsorb the hydrogen molecule over their surface thus increasing the rate of reaction.

In subsitution reaction, a reagent substitutes on atom or a group of atoms from the reactant instead of addition.

e.g. $CH_4 + Cl_2 \xrightarrow{Sunlight} Ch_3Cl + HCl$

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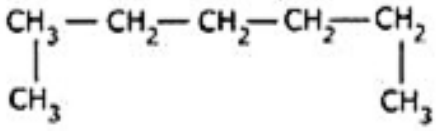
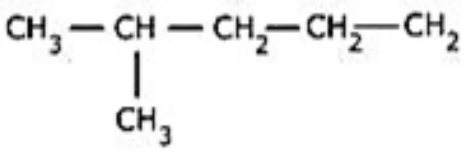
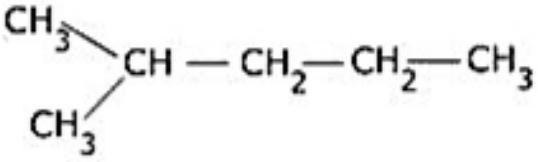
1. Which of the following are not straight chain compounds? **(1)**

A

B 

C 

D 

   a. A, B and D
   b. C and D
   c. A and B
   d. A and C

2. The odour of ethanoic acid resembles which one of the following**: (1)**

   a. Kerosene
   b. Pungent
   c. Rose
   d. Vinegar

3. What is denatured spirit? **(1)**

   a. None of these
   b. Ethanol only
   c. Methanol only
   d. Ethanol + Methanol (5%)

4. Which of the following statements are usually correct for carbon compounds?
   A. They are good conductors of heat and electricity.
   B. They are poor conductors of heat and electricity.
   C. They have strong forces of attraction between their molecules.

D. They do not have strong forces of attraction between their molecules. **(1)**

a. B and C
b. All of these
c. B and D
d. A, B and D

5. Alcohols can be produced by the hydration of**: (1)**

a. Alkenes
b. Alkanes
c. Acids
d. Alkynes

6. Which of the following will turn blue litmus solution red? CH_3OH, CH_3COOH, CH_3COOCH_3 **(1)**

7. Why is pure ethanoic acid called glacial ethanoic acid (or glacial acetic acid)? **(1)**

8. What is a detergent? **(1)**

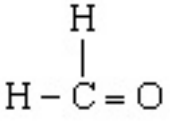
9. State the general formula of carboxylic acids. **(1)**

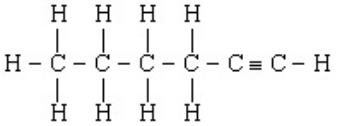
10. Out of sodium chloride (NaCl) or methyl chloride (CH_3 Cl), which has higher melting and boiling points? Why? **(3)**

11. Write the molecular formula and structural formula of acetaldehyde. **(3)**

12. How would you name the following compounds? **(3)**

i. CH_3-CH_2 -Br

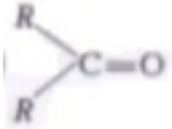
ii. 

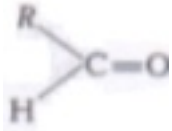
iii. 

13. How would you distinguish experimentally between an alcohol and a carboxylic acid? **(3)**

14. Define structural isomer and draw the isomeric structures of butane. Compare the structure of benzene and cyclohexane by drawing them. **(5)**

15. i. Write the names of the functional groups in

    1. 

    2. 

    ii. Describe a chemical test to distinguish between ethanol and ethanoic acid.

    iii. Write a chemical equation to represent what happens when hydrogen gas is passed through an unsaturated hydrocarbons in the presence of nickel as a catalyst? **(5)**

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Answers

1. b. C and D

   Explanation: A and B are straight chain compounds. A has a straight chain of 5 carbon atoms. B has a straight chain of 7 carbon atoms. C and D are not straight chain compounds.

2. d. Vinegar

   Explanation: The odour of ethanoic acid (CH_3COOH) resembles vinegar. A dilute solution of ethanoic acid in water is called vinegar. Vinegar contains about 5 to 8 % ethanoic acid.

3. d. Ethanol + Methanol (5%)

   Explanation: Alcohol meant for industrial purposes is made unfit for human consumption by adding small amounts (about 5%) of methanol to ethanol. The mixture is known as **denatured spirit** or **denatured alcohol**. Addition of small amount of copper sulphate is added to impart a blue colour to denatured spirit so that it can be identified easily.

4. c. B and D

   Explanation: Carbon compounds are usually poor conductors of heat and electricity. Carbon compounds are covalent compounds that have been formed by the sharing of electrons. They do not have strong forces of attraction between their molecules. They have weak interactions between their molecules. This leads to low melting points and boiling points.

5. a. Alkenes

   Explanation: Alcohols can be produced by the **hydration of alkenes**. Hydration of alkenes is an addition reaction. The reaction is highly exothermic. E.g. Ethanol is manufactured by reacting ethene with steam.

6. Blue litmus paper turns red under acidic conditions. CH_3COOH will turn blue litmus solution red because it is acidic.

7. The melting point of pure ethanoic acid is 290 K. When ethanoic acid (acetic acid) is cooled below 10 °C, it freezes to form a colourless, ice-like solid. The solid looks like glacier and hence pure ethanoic acid is called glacial ethanoic acid (or glacial acetic acid).

8. Detergents are ammonium or sulphonate salts of long chain carboxylic acids. Detergent is also known as soapless soap. Soap cannot form lather in hard water. To overcome this problem, detergents were introduced.

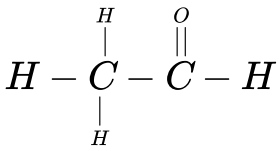
9. The general formula of carboxylic acids is $C_nH_{2n+1}COOH$.

10. The intermolecular forces are small in the covalent compounds.So, These bonds break easily. Hence, covalent compounds have low melting and boiling point.The intermolecular forces are small in the covalent compounds. These bonds break easily. Hence, covalent compounds have low melting and boiling point.

    Sodium chloride (Na^+Cl^-) is an ionic compound, therefore it's melting and boiling points are higher than methyl chloride (CH_3Cl) which is a covalent compound.

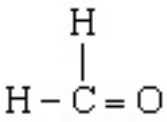
11. Molecular formula of acetaldehyde : CH_3CHO

    Structural formula of acetaldehyde:

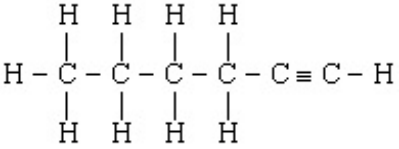


12. i. CH_3-CH_2 -Br : Bromoethane

    ii. Methanal:



    iii. Hex-1-yne:

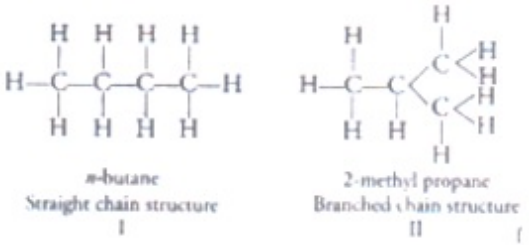


13. The following two tests are used:

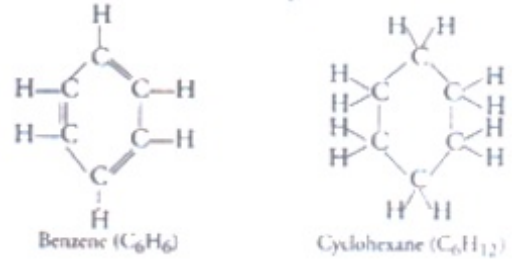
i. **Litmus test**: Treat the given compound with blue litmus solutions. If the blue litmus solution turns red, it is a carboxylic acid and if does not turn red, it is an alcohol.

ii. **Sodium bicarbonate test:** Add some sodium bicarbonate solution to the given compound. If there is a brick evolution of a colourless and odourless gas (CO_2) which turns freshly prepared lime water milk, it is carboxylic acid and if there is no effervescence, it is an alcohol.

14. Compounds having same molecular formula but different structural formula are called structural isomers.
e.g. butane (C_4H_{10}) shows the following two structural isomers. One of which is straight chain n-butane and other is iso-butane.



Structure of benzene and cyclohexane are:



Benzene (C_6H_6) has six C-atoms and six H-atoms, it contains three double bonds alternately between two Carbon atoms and each carbon atoms bonds with one hydrogen. Cyclohexane (C_6H_{12}) has six C-atoms each possessing two H-atoms, thus, 12 H-atoms in total. It does not consist of any double bond it is saturated compound.

15. i. a. Ketone (R-CO-R)
b. Aldehyde (R-CHO)

ii. Distinguish between ethanol and ethanoic acid:
a. Ethanol does not react with metal carbonate while ethanoic acid reacts with metal carbonates to form salt, water and CO_2.
e.g. $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + CO_2 + H_2O$

b. Ethanol does not react with NaOH while ethanoic acid reacts with NaOH to form sodium ethanoate and water
e.g. $CH_3COOH+NaOH \rightarrow CH_3COONa + H_2O$

c. Ethanol can undrergo oxidation to produce aldehyde and futher it can oxidize to produce acid.

iii. saturated hydrocarbon is obtained as hydrogen gas passed through unsaturated hydrocarbon. The reaction is an example of addition reaction better known by the name of hydrogenation reaction.

$$\underset{\substack{Ethene\\(Unsaturated\\hydrocarbon)}}{CH_2=CH_2} + H_2 \xrightarrow[Catalyst]{Ni} \underset{\substack{Ethane\\(Saturated\\hydrocarbon)}}{CH_3-CH_3}$$

CBSE Test Paper-03

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1. Match the following with the correct response: **(1)**

(1) Ionic bond	(A) NH_3
(2) Polar covalent bond	(B) C_{60}
(3) Non-polar bond	(C) N_2
(4) Fullerene	(D) NaCl

   a. 1-D, 2-A, 3-C, 4-B
   b. 1-C, 2-B, 3-D, 4-A
   c. 1-B, 2-D, 3-A, 4-C
   d. 1-A, 2-C, 3-B, 4-D

2. Match the following with the correct response: **(1)**

(1) Bond which holds cations and anions	(A) Ionic
(2) Self linking property of carbon	(B) Pyridine
(3) Denatured alcohol	(C) Catenation
(4) Synthetic detergents	(D) Non-biodegradable

   a. 1-D, 2-A, 3-C, 4-B
   b. 1-B, 2-D, 3-A, 4-C
   c. 1-C, 2-B, 3-D, 4-A
   d. 1-A, 2-C, 3-B, 4-D

3. Diamond is not a good conductor of electricity because**: (1)**

   a. It is not soluble in water.
   b. It is very hard.
   c. It has no free electrons to conduct electric current.
   d. Its structure is very compact.

4. Hydrocarbon with molecular formula C_4H_{10} has**: (1)**

    a. 10 covalent bonds
    b. 7 covalent bonds
    c. 13 covalent bonds
    d. 6 covalent bonds

5. Substance 'X' is formed by the reaction of carboxylic acid and alcohol. It is used in making ice creams, cold drinks, perfumes and in flavoring agent. Name 'X'. **(1)**

    a. Aldehyde
    b. Alkyne
    c. Ester
    d. Ketone

6. Name the organic acid present in red ants. **(1)**

7. Would you be able to check if water is hard using a detergent? **(1)**

8. What is the common name of ethanoic acid? How ethanoic acid is different from vinegar? Give the use of vinegar in our daily life. **(1)**

9. What are constituents of an antifreeze? **(1)**

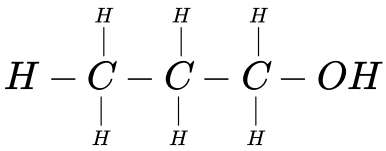
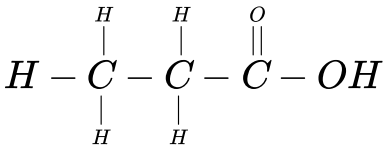
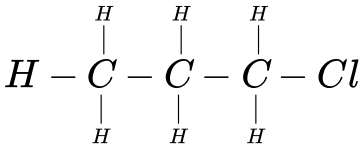
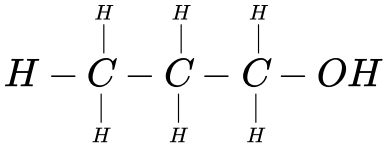
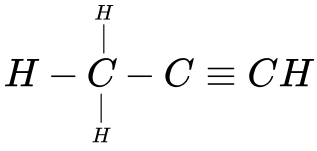
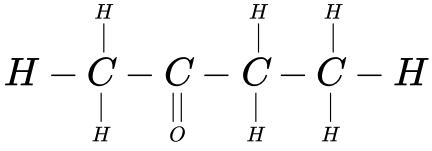
10. Explain giving chemical equation, how are esters prepared? Specify any one property and one use of esters. **(3)**

11. Write the name and chemical formula of the simplest organic acid. **(3)**

12. Why is the conversion of ethanol to ethanoic acid an oxidation reaction? **(3)**

13. Give names of the following**: (3)**
    (a) An aldehyde derived from ethane
    (b) Ketone derived from butane
    (c) Compound obtained by the oxidation of ethanol by chromic anhydride

14. Name the following compounds. **(5)**

1. 
2. 
3. 
4. 
5. 
6. 

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

    i. Identify the compound A.
    ii. Write the chemical equation for its reaction with ethanol to form compound B.
    iii. How can we get compound A form B?
    iv. Name the process and write corresponding chemical equuation.
    v. Which gas is produced when compound A reacts with washing soda? Write the chemical equation. **(5)**

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Answers

1. a. 1-D, 2-A, 3-C, 4-B

   Explanation: NaCl has ionic bonds between the sodium ion and the chlorine ion. Ammonia has polar covalent bonds between nitrogen atom and hydrogen atoms. Nitrogen molecule has non-polar covalent bonds between the two nitrogen atoms since the two atoms are alike. C_{60} is a member of fullerenes (Allotropes of carbon). Buckminsterfullerene contains a cluster of 60 carbon atoms joined together to form spherical molecules.

2. d. 1-A, 2-C, 3-B, 4-D

   Explanation: Ionic bonds are formed between cations and anions. Catenation is the linkage of atoms of the same element into longer chains. Catenation occurs most readily in carbon. Pyridine is added to alcohol to make it unsuitable for drinking. Most of the synthetic detergents are non-biodegradable. They cannot be decomposed by micro-organisms like the bacteria.

3. c. It has no free electrons to conduct electric current.

   Explanation: Diamond is not a good conductor of electricity because it has no free electrons in its structure (like graphite) to conduct electric current.

4. c. 13 covalent bonds

   Explanation: Butane C_4H_{10} has 3 C-C covalent bonds and 10 C-H covalent bonds. Thus, it has 13 covalent bonds.

5. c. Ester

   Explanation: Substance X is an ester. The reaction in which a carboxylic acid combines with an alcohol to form an ester is called esterification. Some volatile esters with characteristic odours are used in synthetic flavours, perfumes, and cosmetics. Certain volatile esters are used as solvents for lacquers, paints, and varnishes; large quantities of ethyl acetate and butyl acetate are commercially

produced for this purpose.

6. The acid produced by ants is called formic acid.
7. No, we can't check whether the water is hard or soft using a detergent.
8. Ethanoic acid (CH_3COOH) is commonly known as acetic acid. The dilute solution of acetic acid in water (6-8%) is known as vinegar. The vinegar is used for preserving food sausage, pickles, etc.
9. Ethylene glycol or ethanol is used as an antifreeze.
10. Ethyl ethanoate which is a ester of ethanoic acid and ethanol.

$$\underset{Ethanoic\ acid}{CH_3COOH} + \underset{Ethanol}{CH_2CH_3OH} \xrightarrow{Conc.\ H_2\ SO_4} \underset{Ethyl\ ethanoate}{CH_3COOCH_2CH_3} + H_2O$$

The process is called esterification.

Esters have pleasent fruity smell which is used in prepration of perfumes.

11. Formic acid is the simplest organic acid.

IUPAC name: Methanoic acid, $H - \overset{\overset{O}{\|}}{C} - OH$

12. During the conversion of ethanol to ethanoic acid 1 oxygen atom is added to the ethanol to convert ethanoic acid. Addition of oxygen is nothing but oxidation. Hence, the conversion of ethanol to ethanoic acid called an oxidation reaction.

$$\underset{\text{Ethanol}}{CH_3 - CH_2 - OH} + 2(O) \xrightarrow{\text{Alk } KMnO_4} \underset{\text{Ethanoic acid}}{CH_3 - \overset{\overset{O}{\|}}{C} - O - H} + H_2O$$

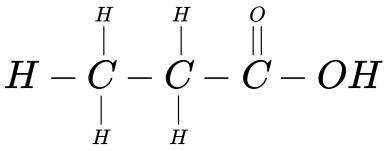
13.

(a) An aldehyde derived from ethane	(a) Ethanal (CH_3CHO)
(b) Ketone derived from butane	(b) Butanone ($CH_3COCH_2CH_3$)
(c) Compound obtained by the oxidation of ethanol by chromic anhydride	(c) Ethanal (CH_3CHO)

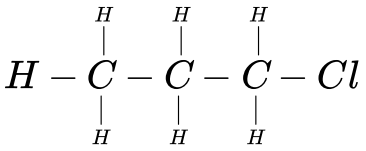
14. According to the question, Given compounds are

i. $H - \overset{\overset{H}{|}}{\underset{\underset{H}{|}}{C}} - \overset{\overset{H}{|}}{\underset{\underset{H}{|}}{C}} - \overset{\overset{H}{|}}{\underset{\underset{H}{|}}{C}} - OH$

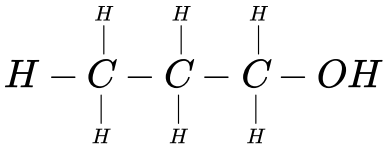
Propan-1-ol or Propanol

ii. 

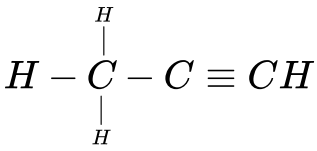
Propanoic acid

iii. 

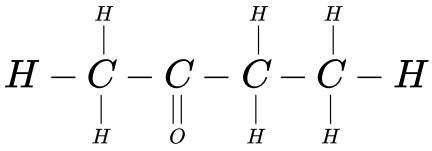
Chloropropane

iv. 

Propanal

v. 

Prop-1-yne or Propyne

vi. 

Butan-2-one

15. i. A is ethanoic acid (CH_3COOH). Commonly, known as acetic acid. Its 5 % solution in water is used to prepare vinegar, which is used as preservatives for pickles.

ii. $\underset{(A)}{CH_3COOH} + \underset{Ethanol}{C_2H_5OH} \xrightarrow{Conc.H_2\ SO_4} \underset{(B)}{CH_3COOC_2H_5} + H_2O$

iii. Compound A (ethanoic acid) can be obtained from compound B (ethyl ethanoate) by the action of a base.

iv. Saponification.

$$CH_3COOC_2H_5 \xrightarrow{NaOH} \underset{Ethanol}{C_2H_5OH} + CH_3COONa$$

v. CO_2 gas is produced. This reaction is same as reaction of acid with metal carbonate.

$$CH_3COOH + \underset{Washing\ soda}{Na_2CO_3} \rightarrow 2CH_3COONa + H_2O + CO_2 \uparrow$$