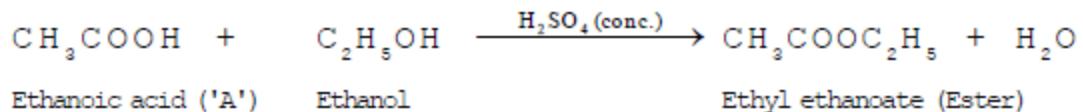


Carbon & Its compounds

PREVIOUS YEARS' BOARD QUESTIONS:

Q1. An organic compound 'A' has molecular formula $C_2H_4O_2$ and is acidic in nature. On heating with alcohol and conc. sulphuric acid, vapours with pleasant or fruity smell are given out. What is this chemical compound 'A' and what is the chemical equation involved in the reaction? (CBSE All India 1999)

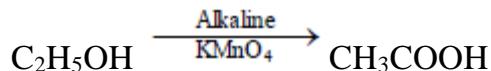
Ans. The compound 'A' with molecular formula $C_2H_4O_2$ is ethanoic acid (acetic acid). Upon heating with ethanol (ethyl alcohol) and concentrated sulphuric acid, ethyl ethanoate (ethyl acetate) is formed as the product. It is an ester with pleasant or fruity smell. The reaction is known as esterification reaction.



Q2. An organic compound 'A' is a constituent of antifreeze and has the molecular formula C_2H_6O . Upon reaction with alkaline $KMnO_4$, the compound 'A' is oxidised to another compound 'B' with formula $C_2H_4O_2$. Identify the compounds 'A' and 'B'. Write the chemical equation for the reaction which leads to the formation of 'B'. (CBSE All India 2000 Comptt.)

Ans. The compound 'A' is ethanol and with alkaline $KMnO_4$, it is oxidised to ethanoic acid 'B'.

The chemical equation for the reaction is:



Ethanol (A) Ethanoic acid (B)

Q3. Name the functional groups present in the following compounds:

- (i) $\text{CH}_3\text{—CH}_2\text{—CH}_2\text{—OH}$
- (ii) $\text{CH}_3\text{—CH}_2\text{—CH}_2\text{—COOH}$
- (iii) $\text{CH}_3\text{—CH}_2\text{—CHO}$ (iv) $\text{CH}_3\text{—CO—CH}_2\text{—CH}_3$

Ans. (i) —OH (ol) (ii) —COON (oic acid) (iii) —CHO (al) (iv) —CO— (one)

Q4. Write the formulae of the compounds and name the functional groups present in each of them

- (i) Ethanoic acid
- (ii) Propanone
- (iii) Nitromethane (C.B.S.E. Delhi 2005)

Ans. (i) Ethanoic acid: CH_3COOH (oic acid)

(ii) Propanone: CH_3COCH_3 (one)

(iii) Nitromethane: CH_3NO_2 (nitro)

Q5. Name the enzyme which converts:

- (i) milk into curd (yogurt)
- (ii) cane sugar into glucose and fructose
- (iii) glucose into ethanol. (C.B.S.E. Foreign 2005)

Ans. (i) Lactase converts milk into curd

(ii) Invertase converts cane sugar (sucrose) into glucose and fructose

(iii) Zymase converts glucose into ethanol.

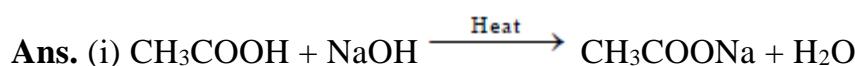
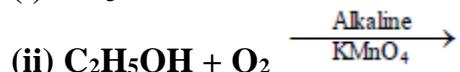
Q6. (i) Name the gas evolved during fermentation process. (C.B.S.E. Delhi 2006)

(ii) List the two products formed when enzyme invertase acts on sugar present in molasses.

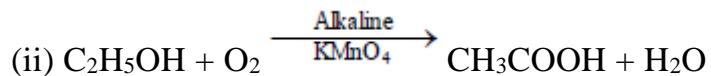
Ans. (i) CO_2 gas is evolved accompanied by brisk effervescence.

(ii) Glucose and fructose are the products when enzyme invertase acts on sucrose ($\text{C}_12\text{H}_{22}\text{O}_{11}$) present in molasses.

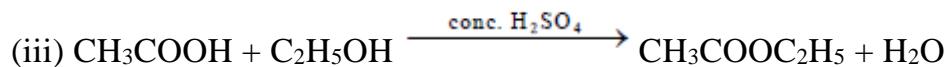
Q7. Complete the following equations and write the names of the products formed. (C.B.S.E. Delhi 2007)



Ethanoic acid Sod. Ethanoate



Ethanol Ethanoic acid



Ethanoic acid Ethanol Ethyl ethanoate

Q8. Name the organic compound present in vinegar. Write a chemical equation which represents the commercial method for the preparation of this compound from methanol. (C.B.S.E. All India 2007)

Ans. The organic compound present in vinegar is ethanoic acid also called acetic acid. For its commercial preparation.

Q9. (a) Why does carbon form compounds by covalent bonding?

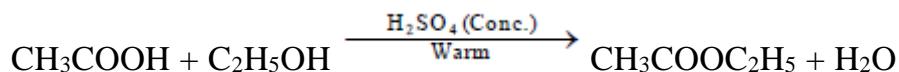
(b) An organic acid 'X' is a liquid which often freezes during winter time in cold countries. It has the molecular formula $\text{C}_2\text{H}_4\text{O}_2$. On warming with ethanol in the presence of a few drops of sulphuric acid, a compound 'Y' with sweet smell is formed.

(i) Identify X and 'Y'.

(ii) Write chemical equation for the reaction involved. (C.B.S.E. Delhi 2008)

Ans. (a) Carbon forms a large number of organic compounds due to the self-linking property known as catenation.

(b) The available information suggests that the organic acid X with molecular formula $\text{C}_2\text{H}_4\text{O}_2$ is ethanoic acid (CH_3COOH). It reacts with ethanol in the presence of a few drops of sulphuric acid on warming to give ethyl ethanoate ester with a pleasant smell.



$(\text{C}_2\text{H}_4\text{O}_2)$ Warm Ethyl ethanoate (Y)

Ethanoic acid (X)

Q10. Why do covalent compounds have low melting and boiling points? (C.B.S.E. All India 2008)

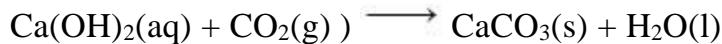
Ans. In covalent compounds, the atoms are linked by covalent bonds formed by electron sharing. Since no ions are present in these, the attractive forces are quite weak. As a result, the covalent compounds have low melting and boiling points.

Q11. (i) How are carboxylic acids different from mineral acids from Ionisation point of view?

(ii) Describe an activity to find how ethanoic acid reacts with sodium carbonate. Name the gas evolved. How can it be tested?

Ans. (i) Carboxylic acids (organic acids) are less ionised in solution as compared to mineral acids (HCl, HNO₃, H₂SO₄ etc.) Due to this reason, these are weaker acids than the mineral acids.

(ii) Take a small volume of ethanoic acid in a tube. Add a few drops of sodium carbonate (Na₂CO₃) solution prepared in water to the tube. A colourless gas with brisk effervescence will evolve. When the gas is passed through lime water, it will become milky.



Lime water (Milky)

Q12. (a) What is a functional group in a carbon compound? Identify the functional group present in CH₃COOH and C₂H₅OH.

(b) State the principle on which the cleansing action of soap is based. (C.B.S.E. Foreign 2008)

Ans. (a) Functional group may be defined as an atom or group of atoms upon which the properties of a particular organic compound are based. Different families differ in the functional groups.

Functional group in CH₃COOH: (—COOH)

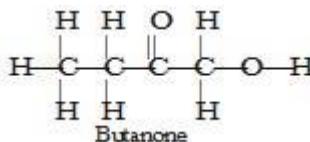
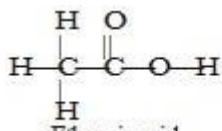
Functional group in C₂H₅OH: (—OH)

(b) The cleansing action of soap is based on its tendency to act as a bridge between water and oil drops containing dirt particles. As a result, oil and water get mixed. They form a stable emulsion also called micelle. This helps in removing oil drops containing dirt particles from clothes. The clothes become clean.

Q13. (a) Draw the structure of the following compounds

(i) Ethanoic acid (ii) Butanone.

(b) Why is conversion of ethanol to ethanoic acid considered an oxidation reaction? (C.B.S.E. Foreign 2008)



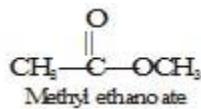
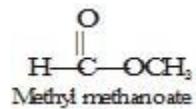
Ans. (a)

(b) When ethanol (C_2H_5OH) changes with ethanoic acid (CH_3COOH)

- There is a decrease in the number of hydrogen atoms by two.
- There is an increase in the number of oxygen atoms by one. Therefore, the conversion represents an oxidation reaction.

Q14. (a) What are esters? How are they formed? (b) Write two uses of esters?

Ans. (a) Esters are the group of organic compounds which contain the function group ($COOR$) called ester group. The value of R may change as $-CH_3$, $-C_2H_5$, $-C_3H_7$ etc. A few example of esters are:



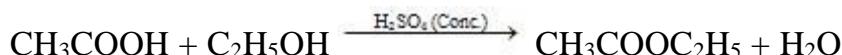
Esters are formed as a result of chemical reaction called esterification.

Uses of esters

- (i) Esters have pleasant smell. These are used as flavoring agents and also in perfumes.
- (ii) Esters of glycerol known as triglycerides are used in the manufacture of soaps. This reaction is called saponification reaction.

Q15. Distinguish between esterification and saponification reactions of organic compounds. (C.B.S.E. All India 2008)

Ans. (a) In the esterification reaction an acid reacts with alcohol in the presence of conc. H_2SO_4 to form an ester with a pleasant or fruity smell. For example,



Ethanoic acid Ethanol Ethyl ethanoate (ester)

Saponification is quite different from esterification because in this case an ester reacts with an alkali (NaOH or KOH) to form salt of acid and alcohol. For example,



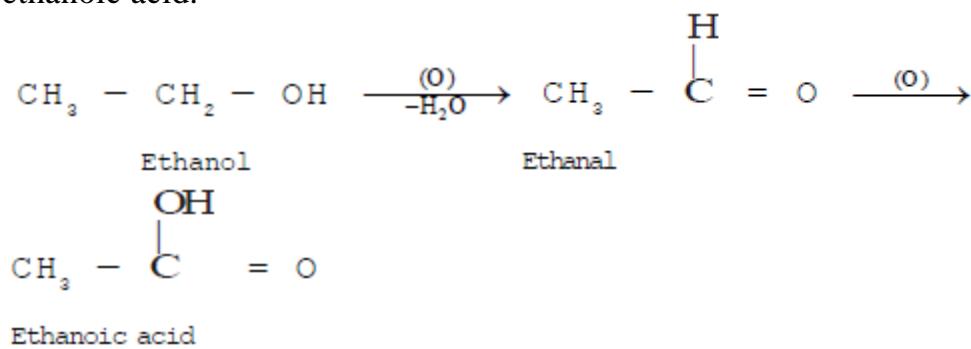
Ethyl ethanoate Soda ethanoate Ethanol

- Q16. (a) In organic compounds, which part largely determines the physical and chemical properties.**
(b) Write chemical equation to represent the reaction of ethanol with acidified solution of potassium dicromate.

Ans. (a) In organic compounds, it is the functional group which largely determines the physical and chemical properties of compounds. Actually, an organic compound is made up of two parts.

These are alkyl group and the functional group. Whereas the alkyl group remains the same (size may change) but the functional groups change. These are responsible for the characteristics of the compounds. For example, the properties of alkanols (OH is the functional group) are different from those of alkanoic acid (COON is the functional group). For more details, consult text part.

(b) Acidified solution of potassium dichromate ($\text{K}_2\text{O}_2\text{O}_7$) forms chromic acid (H_2CrO_4). It releases oxygen to bring about the oxidation of ethanol first to ethanal and then to ethanoic acid.



Ethanol Ethanal Ethanoic acid

Q17. Give reason for the following:

- (a) Air holes of the gas burners have to be adjusted when heated vessels get blackened by the flame.
(b) Use of synthetic detergents causes pollution problems.

Ans. (a) In case the vessel where cooking is done gets blackened from outside, this means that combustion is incomplete.

As a result, the carbon particles in the form of soot get deposited and the vessel becomes black from outside. In order to check this, oxygen or air supply must be increased. This can be done only by adjusting the air holes of the gas burner.

(b) The pollution problems caused by the synthetic detergents is due to their non-biogradable nature. These are actually long chain organic compounds which do not break or decompose in water. Naturally, this will result in pollution problems. Some of the detergents are even of toxic nature and will make water unfit for drinking.