School. STRONG TOWER ACADEMY, IKORODU

Date 3rd May, 2020

Class SS2

Subject Chemistry

Subject Teacher. MR OYERINDE

Topic Alkanoic Acids

Instructional Objectives: At the end of the lesson, students should be able to:

(a) define alkanoic acids;

(b) establish the nomenclature of the alkanoic acids;

(c) draw the structures of some simple carboxylic acids;

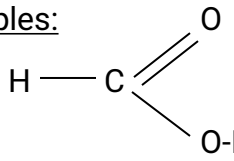
(d) identify the sources of carboxylic acids.

Content

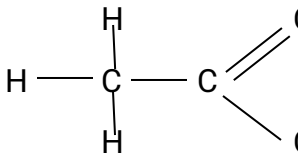
ALKANOIC ACIDS or CARBOXYLIC ACIDS.

They have the general molecular formula $C_{(n-1)}H_{2(n-1)}$ +1COOH and functional group –COOH (carboxylic group). The acids are named after alkenes based on the number of carbon atoms but each name ends with –oic acid.

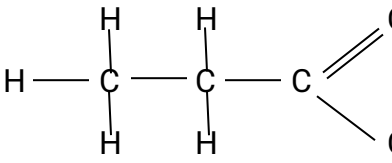
Examples:



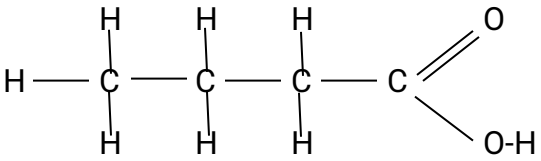
Methanoic acid



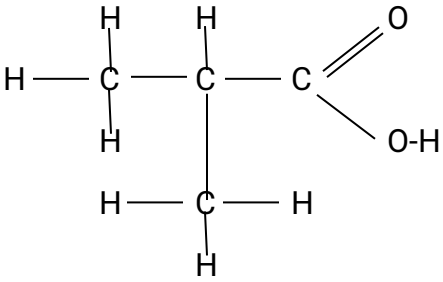
Ethanoic acid



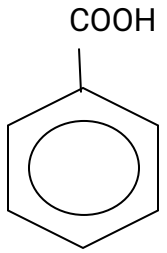
Propanoic acid



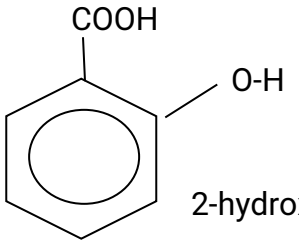
Butanoic acid



2-methylpropanoic acid

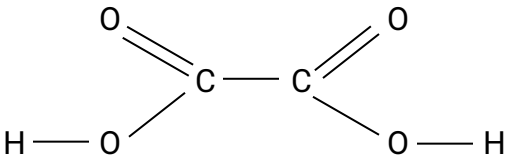


Benzoic acid

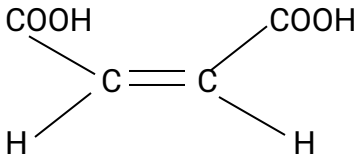


2-hydroxylbenzoic acid or salicylic acid

Some organic acid have more than one carboxylic group. e.g



Ethane-dioic acid



Cis-butene-dioic acid

<u>Sources of organic acids</u>

Acid	Source

Methanoic acid	Stinging nettles and anti stings
Ethanoic acid	Vinegar
Ascorbic acid	Citrus fruits
Lactic acid	Milk
Palmitic acid	Palm oil
Oleic acid	Peanut and olive oil
Stearic acid	Animal fat
Linoleic acid	Vegetable oil
Citric acid	Lemons and oranges

Evaluation Teacher asks students the following questions:

(a) Define carboxylic acids

(b) Draw the structures of (i) ethanoic acid (ii) 2-chloropropanoic acid

Conclusion: Teacher gives a concise note to students, marks same.

Date 4th May, 2029

Class SS2

Subject Chemistry

Topic Alkanoic Acids

SUBJECT TEACHER MR OYERINDE

Duration 80 minutes

Period 3rd and 4th

Instructional Objectives: At the end of the lesson, students should be able to:

(a) explain the preparation of ethanoic acid;

(b) state the properties of ethanoic acid;

(c) mention the uses of ethanoic acid.

Content

Preparations of ethanoic acid

(a) Oxidation by atmospheric oxygen: when ethanol is exposed to the atmosphere, it is oxidised by atmospheric oxygen to form ethanoic acid.

$CH_3CH_2OH + O_2 \longrightarrow CH_3COOH + H_2O$

Ethanol ethanoic acid

(b) Laboratory preparation of ethanoic acid: ethanol can be oxidised by using oxidising agent such as acidified $KMnO_4$ or acidified $K_2Cr_2O_7$ to form ethanoic acid.

$$C_2H_5OH_{(l)} \xrightarrow{\text{acidified } KMnO_4} CH_3COOH_{(l)} + H_2O_{(l)}$$

Ethanol ethanoic acid

Physical properties of ethanoic acid

1. Ethanoic acid is a colourless liquid with a pungent smell. Below room temperature, it solidifies into slates, hence it is called glacial acetic acid. Methanoic acid is also a colourless liquid at room temperature. All other acids are in solid form at room temperature and they are called fatty acids because they are found mostly in fats and oils.

2. Ethanoic acid melts at 16.6^{o}C and boils at 118^{o}C. All alkanoic acids have high boiling and melting points because of the presence of hydrogen bond.

3. Ethanoic acid is soluble in water. All organic acids are weak acids, they ionise partially in water. A dynamic equilibrium is set up when they ionise in water. The solution contains excess H^+ ions over OH^- ions, so the solution is weakly acidic.

Ethanoic acid + water $\rightleftharpoons$ ethanoate ions + hydrogen ions

$CH_3COOH_{(aq)} + H_2O_{(l)} \rightleftharpoons CH_3COO^-_{(aq)} + H^+_{(aq)}$

4. Solubility and acidity of alkanoic acids decrease with increase in the number of carbon atoms.

Chemical properties of ethanoic acid Organic acids undergo all the reactions that

inorganic acids undergo.

1. Neutralisation reaction: organic acids will neutralise bases to form salts and water. e.g. ethanoic acid will neutralise sodium hydroxide to form sodium ethanoate and water.

   $CH_3COOH_{(aq)} + NaOH_{(aq)} \longrightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$

2. Reaction with electropositive metals. e.g. metals such as Na, K, Ca etc react with ethanoic acid to liberate hydrogen gas.

   $2CH_3COOH_{(aq)} + 2Na_{(s)} \longrightarrow 2CH_3COONa_{(aq)} + H_{2(g)}$

3. Reaction with carbonates and hydrogen carbonates: ethanoic acid reacts with carbonates and hydrogen carbonates to liberate carbon(IV)oxide.

   $2CH_3COOH_{(aq)} + Na_2CO_{3(s)} \longrightarrow 2CH_3COONa_{(aq)} + H_2O_{(l)} + CO_{2(g)}$

4. Ethanoic acid will turn blue litmus paper to red.

5. Esterification: ethanoic acid will react in equimolar amount with ethanol to produce ethylethanoate which is an ester.

   $$C_2H_5OH_{(l)} + CH_3COOH_{(aq)} \underset{\text{heat}}{\overset{\text{Conc } H_2SO_4}{\rightleftharpoons}} CH_3COOC_2H_{5\,(l)} + H_2O_{(l)}$$

   Ethanol ethanoic acid ethylethanoate

<u>Uses of ethanoic acid</u>

1. It is used as organic solvent.
2. Ethanoic as is used in form of vinegar in food and drink industries as preservatives and flavourings.
3. It is used in coagulating rubber latex.
4. It is used in making ethylethanoate that is used in perfumery.
5. It is used in making ethenyl ethanoate (vinyl acetate) that is used in making vinyl resins.
6. Cellulose ethanoate or acetate is used for packaging, used in vanishes, in filter tips of cigarettes, synthetic fibres such as rayon and artificial silk.
7. It is used in making acetyl salicylic acid i.e. aspirin

Evaluation Teacher asks students the following questions:

(a) Describe one method of preparing ethanoic acid in the laboratory

(b) (i) Write an equation showing the reaction of ethanoic acid with ethanol (ii) What name is given to the reaction in (i)?

(c) State three uses of ethanoic acid

Conclusion: Teacher gives a concise note to students, marks same.

Assignment: (i) What are *esters?* Explain the chemical properties of esters.