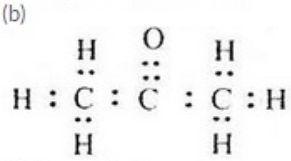
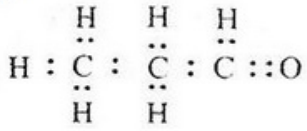
Solution 56

(a) Propanone (or Acetone)
(b)



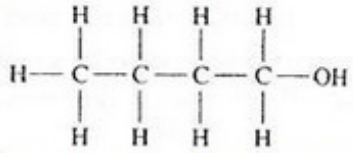
(c) Propanal
(d)



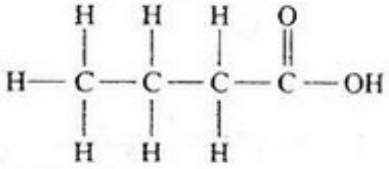
(e) Methanal (or Formaldehyde) is used in preserving biological specimens.

Solution 57
(a) X is coal; Y is wax; Z is natural gas
(b) (i) Y (wax)
(ii) X (coal)
(iii) Z (natural gas)
Solution 58

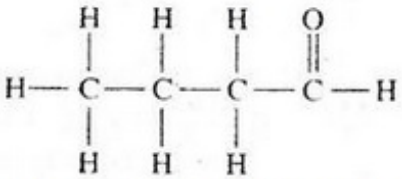
(a) B; Butanol, C_4H_9OH



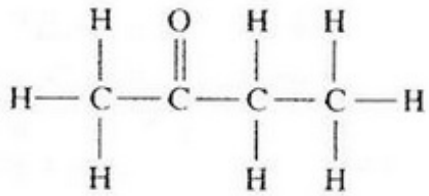
(b) A; Butanoic acid, C_3H_7COOH



(c) C_4H_8O
Aldehyde : Butanal, C_3H_7CHO



Ketone: Butanone, $CH_3COCH_2CH_3$



Solution 59
(a) Liquid X is ethanoic acid; it belongs to homologous series of carboxylic acids. Methanoic acid is another member of this homologous series.
(b) Liquid Y is Propanone; it belongs to homologous series of

ketones. Butanone is another member of this homologous series.
(c) Propanal; it belongs to homologous series of aldehydes.
(d) Liquid Z is ethanol; it belongs to homologous series of alcohols. Methanol is another member of this homologous series.
Solution 60
(a) Chloropropane, CH_3-CH_2-CH_2-Cl
(b) Propanol, CH_3-CH_2-CH_2-OH
(c) Butanal, CH_3-CH_2-CH_2-CHO
(d) Butanoic acid, CH_3-CH_2-CH_2-COOH
(e) Propanone, CH_3-CO-CH_3

Solution 1
Carbon dioxide (CO_2) gas is evolved in the reaction. When passed through lime water, it turns lime water milky.
Solution 2
CH_3COOH will give brick effervescence. Being acid, it reacts with sodium hydrogencarbonate to produce carbon dioxide gas.
Solution 3
Carboxylic acid group, -COOH gives brisk effervescence with $NaHCO_3$
Solution 4
Ethene is formed when ethanol is heated with conc. H_2SO_4 at 170^oC. This reaction is called dehydration.
Solution 5
Ethyne (acetylene) burn with a sooty flame because ethyne is an unsaturated hydrocarbon and the percentage of carbon in these hydrocarbons is comparatively higher which does not get oxidised completely in oxygen of air.
Solution 6
Ethane is formed when hydrogen is added to ethene.
Solution 7
Ethene decolourises bromine water because ethene is an alkene. And all alkenes and alkynes are unsaturated compounds which decolourise bromine water. On the other hand, ethane being an alkane is a saturated compound which does not decolourise bromine water.
Solution 8
Nickel or palladium can be used as catalyst in the hydrogenation of unsaturated compounds.
Solution 9
Disadvantages of incomplete combustion:
(i) It leads to the formation of soot which is nothing but unburnt carbon which pollutes the atmosphere, blackens cooking utensils.
(ii) It leads to the formation of an extremely poisonous gas called carbon monoxide.
Solution 10

When Sodium reacts with ethanol (ethyl alcohol), hydrogen gas is evolved.

$$2C_2H_5OH + 2Na \rightarrow 2C_2H_5O^-Na^+ + H_2$$

Solution 11

Ethanol reacts with sodium metal to form sodium ethoxide and hydrogen gas. This reaction is used as a test for ethanol. When a small piece of sodium metal is put into ethanol in a dry test tube, rapid effervescence is produced due to evolution of hydrogen gas.

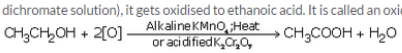
$$2C_2H_5OH + 2Na \rightarrow 2C_2H_5O^-Na^+ + H_2$$

Solution 12
Ethanol is used as an additive in petrol.
Solution 13
(i) Vegetable oil (like castor oil, cottonseed oil or soyabean oil)
(ii) Sodium hydroxide (caustic soda)
(iii) Sodium chloride (common salt)
Solution 14
No, we would not be able to check the hardness of water by using a detergent because a detergent forms lather easily even with hard water.
Solution 15

Litmus test: Some blue litmus solution is added to the organic compound (to be tested). If the blue litmus solution turns red, it shows that the organic compound is acidic in nature and hence it is a carboxylic acid.

Solution 16

Oxidation means controlled combustion. When ethanol is heated with alkaline potassium permanganate solution (or acidified potassium dichromate solution), it gets oxidised to ethanoic acid. It is called an oxidation reaction because oxygen is added to it during this conversion.



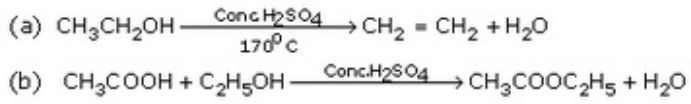
Solution 17

Alkanes burn in air to produce a lot of heat due to which they are known to be excellent fuels.

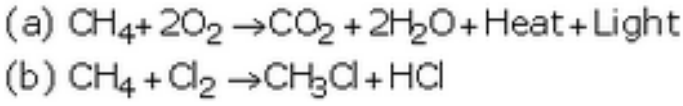
Solution 18

Sodium hydrogencarbonate can be used to distinguish between ethanol and ethanoic acid.

Solution-19



Solution 20



Solution 21

(a) Combustion

(b) Soap

(c) Detergent

(d) Ethanoic acid

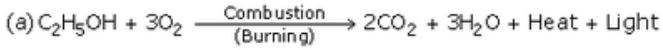
Solution 22

CH_4, C_3H_8 and C_5H_{12}; all these are saturated hydrocarbons (Alkanes) and hence will give substitution reactions.

Solution 23

C_2H_4 and C_3H_4 will give addition reactions because these are unsaturated hydrocarbons (Alkene and Alkyne) and unsaturated hydrocarbons give addition reactions.

Solution 24



(b) Since, ethanol burns with a clear flame giving a lot of heat, therefore, it is used as a fuel.

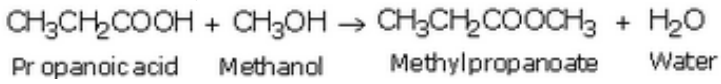
(c) Uses of ethanol:

(i) It is used in the manufacture of paints, varnishes, lacquers, medicines, perfumes, dyes, soaps and synthetic rubber.

(ii) It is used as a solvent. Many organic compounds which are insoluble in water are soluble in ethyl alcohol.

Solution 25

(a) Propanoic acid will react with the alcohol in the presence of concentrated sulphuric acid to form esters.



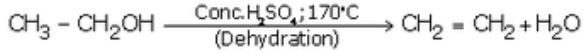
(b) Red litmus paper turns blue in soap solution and no change occurs on blue litmus paper because soap is basic in nature.

(c) Denatured alcohol is ethyl alcohol which has been made unfit for drinking purposes by adding small amounts of poisonous substances like methanol, pyridine, copper sulphate etc. This is done to prevent the misuse of industrial alcohol for drinking purposes or black marketing (as it is supplied duty free for industrial purposes by the government).

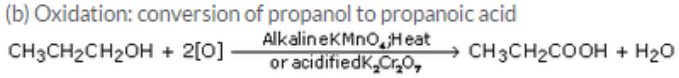
Solution 26

(a) Sodium metal test: Add a small piece of sodium metal to the organic liquid (to be tested), taken in a dry test tube. If bubbles (or effervescence) of hydrogen gas are produced, it indicates that the given organic liquid is an alcohol.
(b) Harmful effects of drinking alcohol:
(i) Alcohol slows down the activity of the nervous system and brain due to which the judgement of a person is impaired and his reaction becomes slow.
(ii) Heavy drinking of alcohol on a particular occasion leads to staggered movement, slurred speech and vomiting.
(c) Unlike ethanol, drinking methanol, even in a small quantity can be fatal leading to permanent blindness and even death. Methanol damages the optic nerve causing permanent blindness in a person. This happens because methanol is oxidised to methanal in the liver of a person. This methanal reacts rapidly with the components of the cell causing coagulation of their protoplasm. Due to this, the cells stop functioning normally.
Solution 27

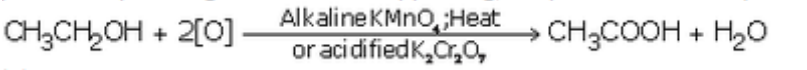
(a) Dehydration: conversion of ethanol into ethene



(b) Oxidation: conversion of propanol to propanoic acid



Solution 28
(a) Air holes of a gas burner have to be adjusted b ecause blackening of vessels show that the air holes of the gas stove are getting blocked and hence the fuel is not burning completely (due to insufficient supply of oxygen).
(b) Some of the detergents (synthetic) are not bio-degradable, that is they cannot be decomposed by micro organisms like bacteria and hence cause water pollution.
Solution 29
(a) On adding 5% alkaline potassium permanganate solution drop by drop to some warm ethanol, we would observe that the purple color of potassium permanganate starts disappearing; the product formed by this process; ethanoic acid can turn blue litmus red.



(b) A carboxylic acid reacts with sodium hydrogencarbonate to give brisk effervescence of carbon dioxide gas but an alcohol does not react with sodium hydrogencarbonate.
Solution 30
Alkenes can be hydrogenated.
The addition of hydrogen to an unsaturated hydrocarbon to obtain a saturated hydrocarbon is called hydrogenation.
Example: Ethene reacts with hydrogen in the presence of finely divided nickel as catalyst to form ethane.
Liquid vegetable oils are hydrogenated into vegetable ghee (solid fat).

Solution 31
(a) Hydrogen gas is evolved when ethanol reacts with sodium.
(b) Esters are formed when a carboxylic acid reacts with an alcohol in the presence of conc. H_2SO_4.
(c) Dilute ethanoic acid turns universal indicator paper to orange, showing that its pH is about 4 which tell us that ethanoic acid is a weak acid. On the other hand, dilute hydrochloric acid turns universal indicator paper to red, showing that its pH is about 1. This shows us that hydrochloric acid is a strong acid.
Solution 32
(a) CH_3COOH is a c arboxylic acid.

(b) Ethanol, CH_3CH_2OH should be oxidised to prepare CH_3COOH.
(c) Liquid state
(d) Soaps are biodegradable whereas detergents are non-biodegradable.

Solution 33

(a) When ethanol reacts with ethanoic acid in the presence of a little of concentrated sulphuric acid, a sweet smelling ester called ethyl ethanoate is formed.

$$CH_3COOH + C_2H_5OH \xrightarrow{Conc.H_2SO_4} CH_3COOC_2H_5 + H_2O$$

(b) When ethanol is heated with concentrated sulphuric acid at 170°C, it gets dehydrated to form ethene.

$$CH_3 - CH_2OH \xrightarrow[(Dehydration)]{Conc.H_2SO_4;170°C} CH_2 = CH_2 + H_2O$$

Solution 34

(a) When ethanol is oxidised with alkaline potassium permanganate (or acidified potassium dichromate), it gets oxidised to form ethanoic acid.
(b) CH_3COOH and HCOOH can turn blue litmus solution red. These are organic acids.

Solution 35

(a) Soap can be prepared in the laboratory as follows:
1. Take about 20 ml of castor oil (cottonseed oil, linseed oil or soya bean oil) in a beaker.
2. Add 30 ml of 20% sodium hydroxide solution to it.
3. Heat the mixture with constant stirring till a paste of soap is formed.
4. Then add 5 to 10 grams of common salt (sodium chloride).
5. Stir the mixture well and allow it to cool. On cooling the solution, solid soap separates out.
6. When the soap sets, it can be cut into pieces called 'soap bars'.
(b) Common salt is added to the mixture to make the soap come out of solution. Though most of the soap separates out on its own but some of it remains in solution. Common salt is added to precipitate out all the soap from the aqueous solution.
(c) When soap is used for washing clothes with hard water, a large amount of soap in water is reacting with the calcium and magnesium ions of hard water to form an insoluble precipitate called scum, before it can be used for the real purpose of washing.

Solution 36

(a) Carbon dioxide and water vapour are formed when methane burns in air.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + Heat + Light$$

(b) Ethanoic acid reacts with sodium carbonate to form sodium ethanoate and carbon dioxide.

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

(c) Add bromine water to a little of cooking oil and butter taken in separate test tubes:
(i) Cooking oil decolourises bromine water (showing that it is an unsaturated compound).
(ii) Butter does not decolourise bromine water (showing that it is a saturated compound).

Solution 37

(a) Substitution reaction of methane with chlorine: Methane reacts with chlorine in the presence of sunlight to form chloromethane and hydrogen chloride.

$$CH_4 + Cl_2 \xrightarrow{Sunlight} CH_3Cl + HCl$$

(b) An oxidising agent is one which oxidises other substances by providing oxygen or removing hydrogen. Alkaline potassium permanganate and acidified potassium dichromate can be used as oxidising agents.
(c) Reaction with alcohols: Ethanoic acid reacts with alcohols in the presence of a little of conc. sulphuric acid to form esters.

$$CH_3COOH + C_2H_5OH \xrightarrow{Conc.H_2SO_4} CH_3COOC_2H_5 + H_2O$$

Solution 38

(a) (i) Single bond: Methane, CH_4. They are quite unreactive hence they undergo substitution reaction with chlorine in presence of sunlight.
(ii) Double bond: Ethene, CH_2=CH_2. They undergo addition reaction in the presence of a catalyst like nickel or palladium.
(b) A detergent is the sodium salt of long chain benzene sulphonic acid which has cleansing properties in water. Ex: Sodium n-dodecyl benzene sulphonate.
(c) Detergents are better cleansing agents than soaps because they do not form insoluble calcium and magnesium salts with hard water, and hence can be used for washing even with hard water.

Solution 39

(a) Ethanoic acid reacts with sodium hydrogencarbonate to evolve brisk effervescence of carbon dioxide gas.

$$CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + CO_2 + H_2O$$

(b) Carbon and its compounds used as fuels because they burn in air releasing a lot of heat energy.
(c) Detergent is better for washing clothes with hard water. They are better cleansing agents than soaps because they do not form insoluble calcium and magnesium salts with hard water, and hence can be used for washing even with hard water.

Solution 40

(a) The reaction in which one (or more) hydrogen atoms of a hydrocarbon are replaced by some other atoms (like chlorine), is called a substitution reaction.
Example: Substitution reaction of methane with chlorine:-
Methane reacts with chlorine in the presence of sunlight to form chloromethane and hydrogen chloride.

$$CH_4 + Cl_2 \xrightarrow{\text{Sunlight}} CH_3Cl + HCl$$

(b) Soap is made by heating animal fat or vegetable oil with concentrated sodium hydroxide solution.

$$\text{Fat or oil} + \text{Sodium hydroxide} \xrightarrow{\text{Heat}} \text{Soap} + \text{Glycerol}$$

Solution 41

(a) Ethanoic acid is obtained from ethanol by the means of oxidation reaction. When ethanol is heated with alkaline potassium permanganate solution (or acidified potassium dichromate solution), it gets oxidised to ethanoic acid. It is called an oxidation reaction because oxygen is added to it during this conversion.

$$CH_3CH_2OH + 2[O] \xrightarrow[\text{or acidified } K_2Cr_2O_7]{\text{Alkaline } KMnO_4;\text{Heat}} CH_3COOH + H_2O$$

(b) Litmus test: Some blue litmus solution is added to the organic compound (to be tested). If the blue litmus solution turns red, it shows that the organic compound is acidic in nature and hence it is a carboxylic acid (ethanoic acid). Ethanol has no effect on any litmus solution.
(c) When soap is used for washing clothes with hard water, a large amount of soap in water reacts with the calcium and magnesium ions of hard water to form an insoluble precipitate called scum. This makes the cleaning of clothes difficult.

Solution 42

(a) Methane reacts with chlorine in the presence of sunlight to form chloromethane and hydrogen chloride. This reaction is called substitution reaction.

$$CH_4 + Cl_2 \xrightarrow{\text{Sunlight}} CH_3Cl + HCl$$

(b) The addition of hydrogen to an unsaturated hydrocarbon to obtain a saturated hydrocarbon is called hydrogenation.
Application: Vegetable oils are hydrogenated to form vegetable ghee (or vanasapati ghee).
(c)

Soaps	Detergents
(i)Soaps are biodegradable. (ii)Soaps have relatively weak cleansing action.	(i) Detergents are not biodegradable. (ii) Detergents have a strong cleansing action.

Solution 43

(a) Ethanoic acid reacts with sodium hydroxide to form a salt called sodium ethanoate and water.

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$$

(b) On hydrogenation, the liquid vegetable oils change into solid fat (vanasapati ghee). Nickel or palladium can be used as the catalyst.
(c) Advantage: Detergents can be used even with hard water and have stronger cleaning action.
Disadvantage: Detergents are not biodegradable and hence cause water pollution.

Solution 44

(a) Ethanoic acid, CH_3COOH gives brisk effervescence with sodium hydrogencarbonate.
(b) A mixture of ethyne and air is not used for welding because burning of ethyne in air produces a sooty flame (due to incomplete combustion) which is not hot enough to melt metals for welding.
(c) Addition reactions are a characteristic of unsaturated hydrocarbons.

Solution 45

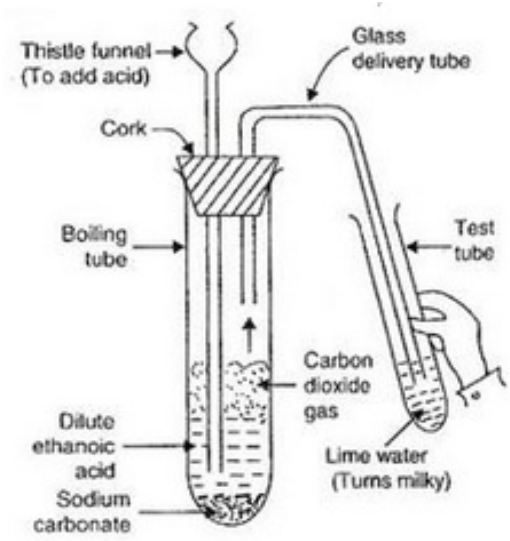
(a) The reaction in which an unsaturated hydrocarbon combines with another substance to give a single product is called an addition reaction.
Example: Ethene reacts with hydrogen when heated in the presence of nickel catalyst to form ethane:

$$CH_2 = CH_2 + H_2 \xrightarrow[\text{Heat}]{\text{Ni Catalyst}} CH_3 - CH_3$$

(b) Hydrogen is added to groundnut oil when it is to be converted to vanaspati ghee.
(c) Vegetable oil is better because it has unsaturated fatty acids which are good for our health.

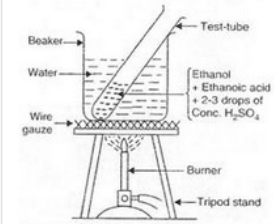
Solution 46

(a)Salt X is sodium ethanoate, CH_3COONa; Gas Y is carbon dioxide, CO_2
Activity: Take a boiling tube and put about 0.5 g of sodium carbonate in it. Add 2 ml of dilute ethanoic acid to the boiling tube (through a thistle funnel). We will observe that brisk effervescence of carbon dioxide gas is produced. Let us pass this gas through lime water taken in a test tube. We will find that lime water turns milky. Only carbon dioxide gas can turn lime water milky. So, this experiment proves that when ethanoic acid reacts with sodium carbonate, then carbon dioxide gas is evolved.



$$CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + CO_2 \uparrow + H_2O$$

(b) (i) Dilute ethanoic acid (in the form of vinegar) is used as a food preservative in the preparation of pickles and sauces.
(ii) It is used in the manufacture of acetone and esters used in perfumes.
(a) Activity:
(i) Take 1 ml of pure ethanol (absolute alcohol) in a test-tube and add 1 ml of glacial ethanoic acid to it. Then add 2 or 3 drops of concentrated sulphuric acid to the mixture.
(ii) Warm the test-tube containing above reaction mixture in hot water bath (a beaker containing hot water) for about 5 minutes.
(iii) Pour the contents of the test-tube in about 50 ml of water taken in another beaker and smell it.
(iv) A sweet smell is obtained indicating the formation of an ester.
Reaction:
(c) Uses of esters:
(i) Esters are used in making artificial flavours and essences. These are used in cold drinks, ice-creams, sweets and perfumes.
(ii) Esters are used as solvents for oils, fats, gums, resins, cellulose, paints, varnishes, etc.

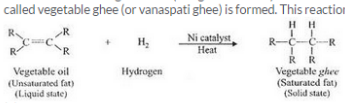


(iii) Pour the contents of the test-tube in about 50 ml of water taken in another beaker and smell it.
(iv) A sweet smell is obtained indicating the formation of an ester.
Reaction:

$$\underset{\text{Ethanoic acid (Acetic acid)}}{CH_3COOH} + \underset{\text{Ethanol (Ethyl alcohol)}}{C_2H_5OH} \xrightarrow{\text{Conc. } H_2SO_4} \underset{\text{Ethyl ethanoate (Ethyl acetate – ester)}}{CH_3COOC_2H_5} + \underset{\text{Water}}{H_2O}$$

Solution 48

(a) Catalytic hydrogenation is usually used in conversion of vegetable oils to fats.
Hydrogenation of oils: Vegetable oils are unsaturated fats having double bonds between some of their carbon atoms and can undergo addition reactions. When a vegetable oil (like groundnut oil) is heated with hydrogen in the presence of finely divided nickel as catalyst, then a saturated fat called vegetable ghee (or vanaspati ghee) is formed. This reaction is called hydrogenation of oils and it can be represented as follows:



(b) The process of making soap by the hydrolysis of fats and oils with alkalis is called saponification.

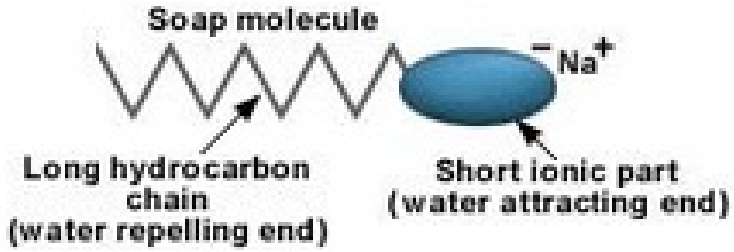
$$\underset{\text{(An ester)}}{\text{Fat or Oil}} + \underset{\text{(An alkali)}}{\text{Sodium hydroxide}} \xrightarrow{\text{Heat}} \underset{\text{(Sodium salt of fatty acid)}}{\text{Soap}} + \underset{\text{(An alcohol)}}{\text{Glycerol}}$$

(c) Soap are sodium or potassium salts of long-chain carboxylic acids. When soap is added to the water, the hydrophilic end (acid end) will align along the surface of water and the hydrophobic tail (carbon chain) remains out of water.
When a soap is dissolved in water, it forms a colloidal suspension in water in which the soap molecules cluster together to form spherical aggregates called micelles. In a soap micelle, soap molecules are arranged radially with hydrocarbon ends directed towards the centre and ionic ends directed outwards.
No, micelle will not be formed in other solvents such as ethanol because hydrocarbon chains of soap molecules are soluble in organic solvents like ethanol.

Solution 49

(a) A soap is the sodium salt (or potassium salt) of a long chain carboxylic acid (fatty acid) which has cleansing properties in water.

Example: Sodium stearate, $C_{17}H_{35}COO^-Na^+$

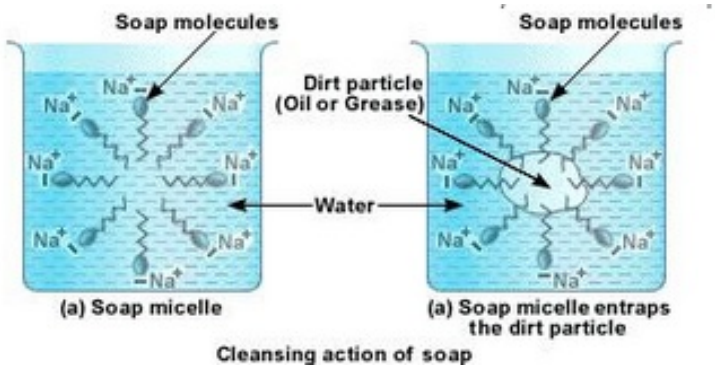


Representation of a soap molecule.

(b) A soap molecule has two parts: the long chain organic part and the ionic part containing the $-COO^-Na^+$ group. It has to be remembered that this is not an ion, the atoms are all covalently bonded, the electrical charges show how the charges get polarized in the group. A soap molecule has a tadpole like structure shown below:

(c) Cleaning action of soap has been explained with the help of the image below:

Soaps are molecules in which the two ends have differing properties, one is hydrophilic, that is it dissolves in water, while the other end is hydrophobic, that is it dissolves in hydrocarbons. When soap is at the surface of water, the hydrophobic 'tail' of soap will not be soluble in water and the soap will align along the surface of water with the ionic end in water and the hydrocarbon 'tail' protruding out of water.



Cleansing action of soap

Inside water, these molecules have a unique orientation that keeps the hydrocarbon portion inside the water. This is achieved by forming clusters of molecules in which the hydrophobic tails are in the interior of the cluster and the ionic ends are on the surface of the cluster. This formation is called a micelle. When a dirty cloth is put in water containing dissolved soap, then soap in the form of a micelle is able to clean. The hydrocarbon ends of the soap attach to the oily dirt particles and entrap them at the centre of the micelle. the ionic ends in the micelles remain attached to water. When the dirty cloth is agitated in soap solution, the oily dirt particles entrapped by soap micelles get dispersed in water and the cloth gets cleaned.

********** END **********