

# Lipids

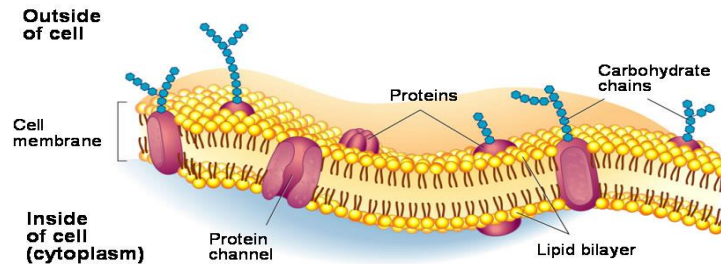
# Lipids are....

It can be defined as **nonpolar** organic compound insoluble in polar solvent , but **soluble in organic solvents** such as benzene ,ether, chloroform.

## Biological role of lipids:

Lipids are found naturally in all living organisms.

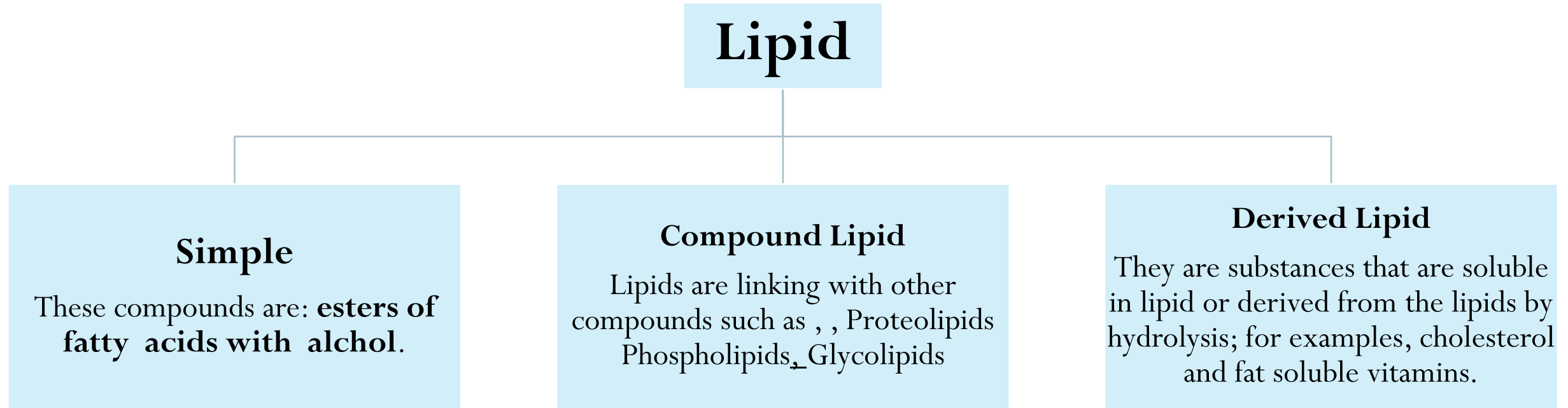
1)It presents in cell membranes,



2) An essential **source of energy** in the body. It give more energy than carbohydrate and proteins.

# Classification of Lipids

lipids can be divided according to their chemical composition to:

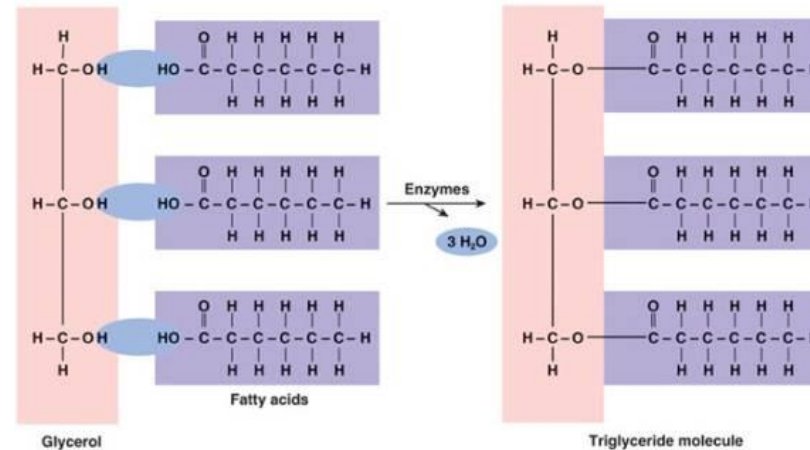


# I) Simple lipids

These compounds are: **esters of fatty acids with alcohol.**

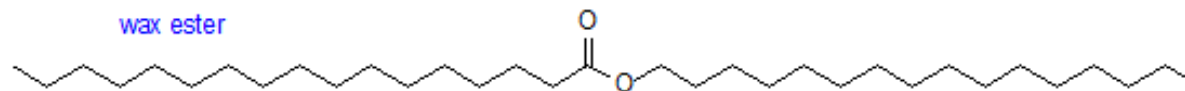
## a) Neutral lipids

Esters of fatty acids with alcohol(glycerol) e.g.: **Triacylglyceride.**



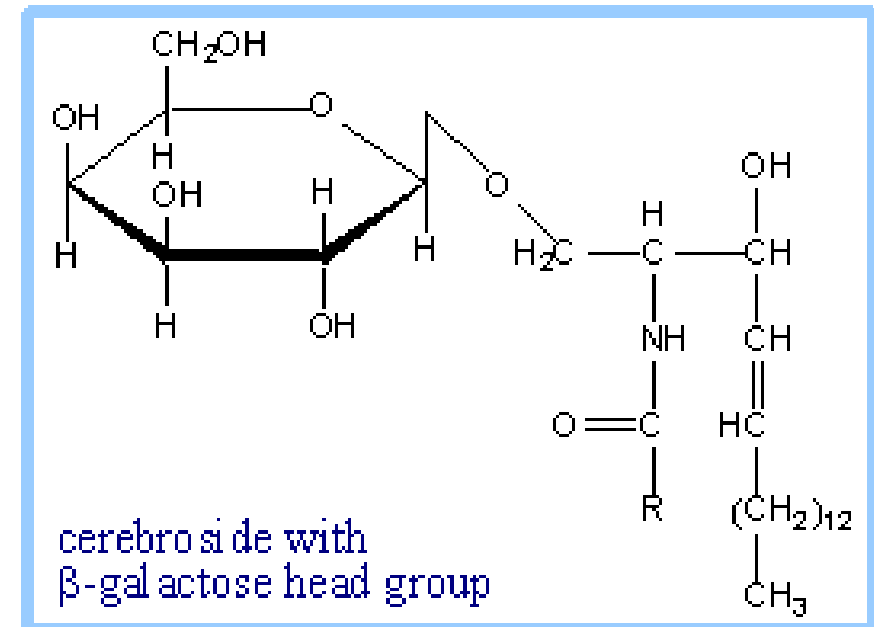
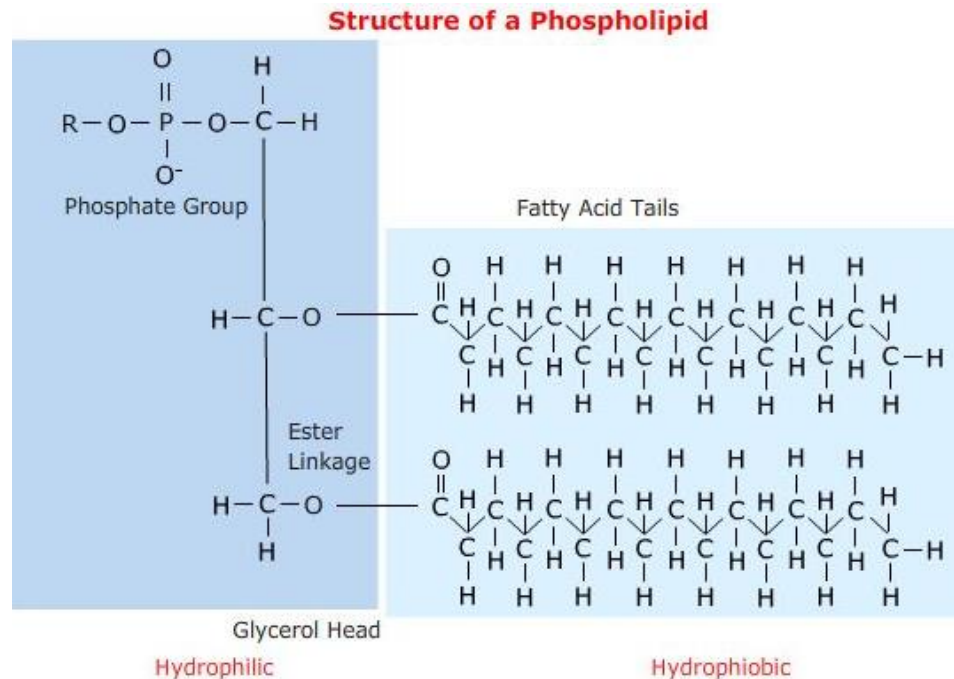
## b) Waxes:

Esters of fatty acids with mono hydroxyle alcohol and higher than glycerol (high molecular weight)  
e.g.: Beeswax



## II) Compound (conjugated) lipids.

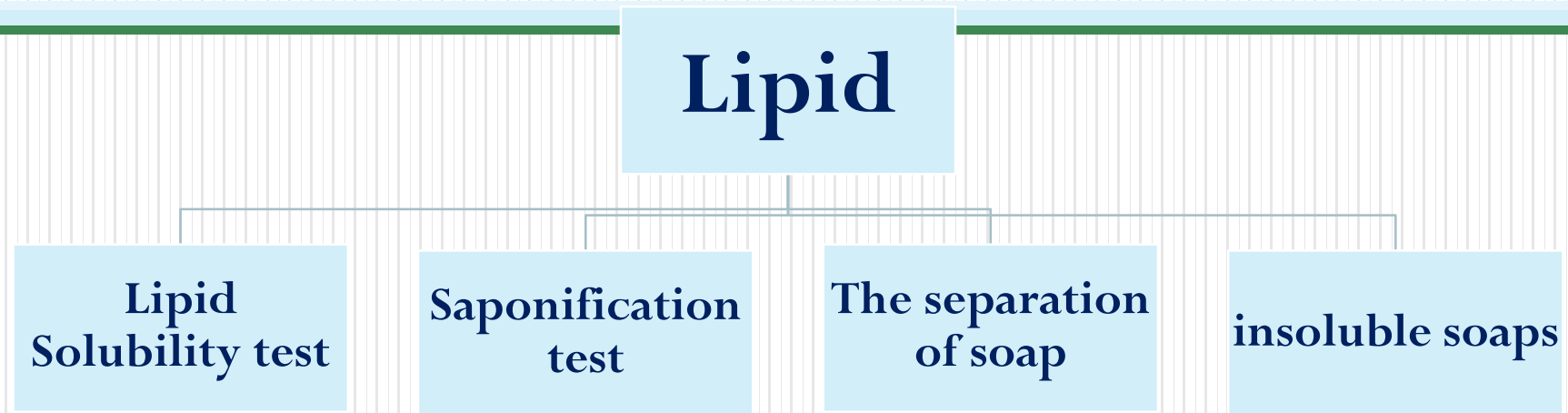
Lipids are linking with other compounds such as , , Proteolipids  
Phospholipids, Glycolipids



### III) Derived lipids .

They are substances that are soluble in lipid or derived from the lipids by hydrolysis; for examples, cholesterol and fat soluble vitamins.

# Qualitative tests of lipids:



# Experiment 1: Solubility test

- Fats are not dissolved in water due to their nature, non-polar (hydrophobic), but it is soluble in organic solvents such as chloroform, benzene, and boiling alcohol.



Different lipids have different ability to dissolve in different organic solvent. This property enable us to separate a mixture of fat from each other for example,

- Phosphatidelipid can not dissolve in acetone;
- Cerebroside and sphingomyline can not dissolve in the ether.



# Material and Method:

## Material

- Olive oil .
- Solvents: diluted acid - dilute alkaline - ethanol - ether - chloroform – acetone
- Water bath, Test tubes

## Method:

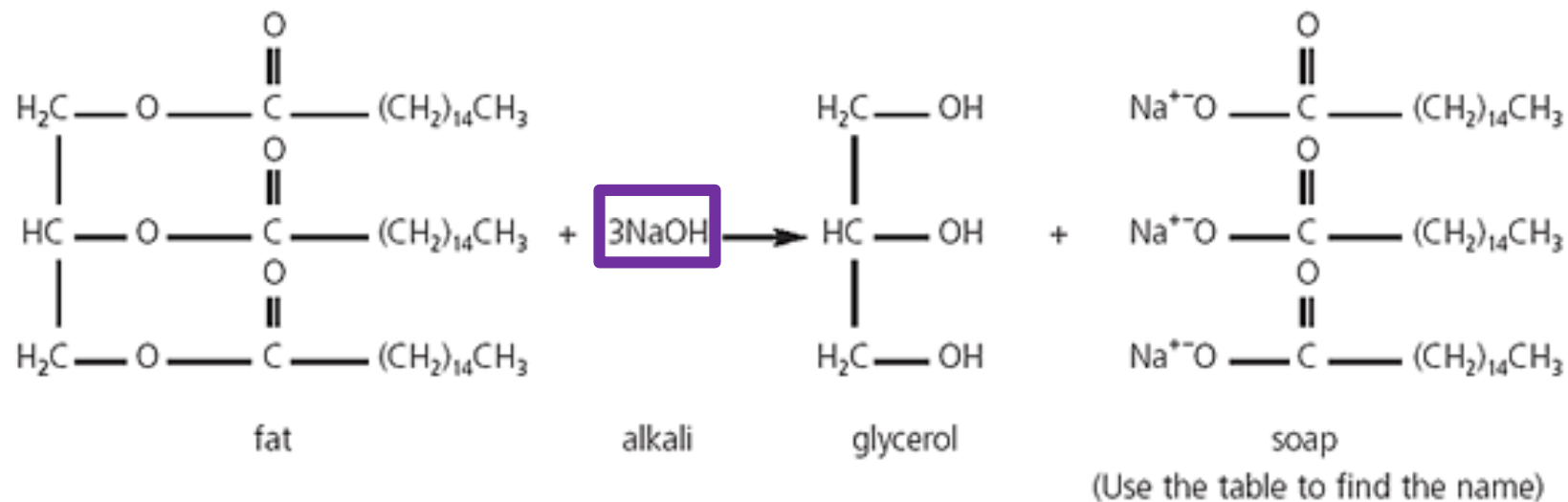
- Place 0.5ml of oil in 6 test tubes clean, dry containing 4ml of different solvents (**acetone, chloroform and ether and ethanol, cold ethanol and hot water**), **(Becarful!!!!)**
- Shake the tubes thoroughly, then leave the solution for about one minute,
- Note if it separated into two layers , the oil are not dissolve; but if one layer homogeneous transparent formed , oil be dissolved in the solvent

## Results:

[illegible]

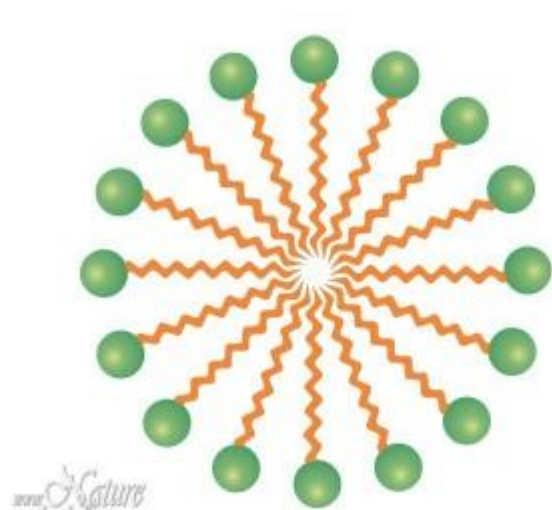
# Experiment 2: Saponification test:

- TAG can be hydrolyzed into their component fatty acids and alcohols.
- This reaction can also be carried out in the laboratory by a process called **saponification** where the hydrolysis is carried out in the presence of a strong base (such as NaOH or KOH).

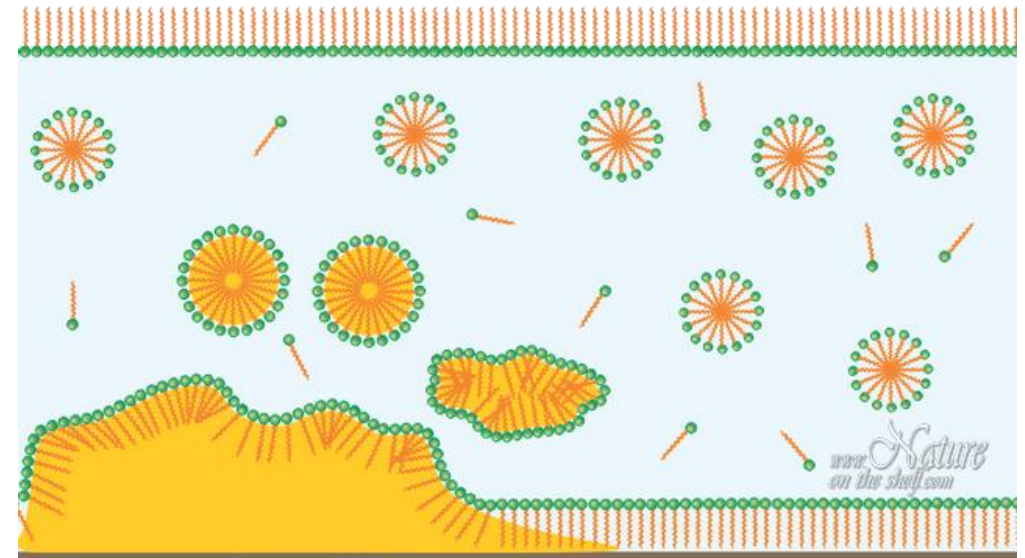
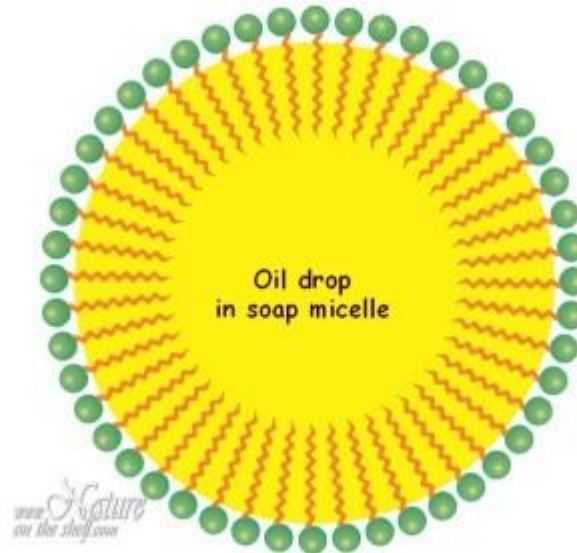


Soap can be defined as **mineral salts of fatty acids**. The soap is soluble in **water** but insoluble in **ether**. Soap works on emulsification of oils and fats in the water as it works to reduce the attraction surface of the solution

When soap molecules are dissolved in water, the water-repelling hydrophobic tails cluster together while hydrophilic heads surround them arranging themselves in a spherical form toward water molecules.



soap molecules dissolved in water



## Material and Method:

### **Materials:**

- Olive oil.
  - KOH solution in alcohol (20% KOH)
  - a water bath (boiling)

## Method:

- Place 2 ml of oil in a large test tube (or flask).
- Add 4 ml of alcoholic potassium hydroxide).
- Boil the solution for 3 minutes. After this period, make sure it is perfectly saponification process, by taking a drop of the solution and mix with the water if oil separated indicates that the non-completion of the saponification. In this case, continued to boil until all the alcohol evaporates.
- Take the remaining solid material (soap) and add about 30 ml of water and keep it for the following tests.
- Shake the solution after it cools and noted to be thick foam.

# Experiment 3: Testing the separation of soap from the solution by salting out

**Principle:** To get the soap out of solution by salting out by the addition of solid sodium chloride to the solution until saturation; separated soap in the form of insoluble and floats above the surface.

The NaCl solution provides  $\text{Na}^+$  and  $\text{Cl}^-$  ions that bind to the polar water molecules, and help separate the water from the soap. This process is called salting out the soap.

## **Materials:**

- Soap (which was prepared in the previous experiment)
- Solid sodium chloride NaCl
- A small beaker.

## **Method:**

Place about 10 ml of soap in the beaker, then add small amounts of sodium chloride in batches, stirring until saturated solution.

## Experiment 4: Test formation insoluble fatty acids salt (insoluble soaps):

Working calcium, magnesium, lead or iron ions to the deposition of soap and make it **insoluble** in water.

The soap would no longer be attracted to water molecules and could no longer emulsify oil and dirt.

Hard water contains metal cations, such as  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$ , that react with the charged ends of the soaps to form insoluble salts. The insoluble salts that  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  form with soap anions cause **white precipitate** from **calcium stearate or oleate**).





## **Materials:**

- Soap (which was prepared in the previous experiment)
- Calcium chloride( $\text{CaCl}_2$ ) 5%
- Magnesium chloride or sulfate 5%
- Test tubes.

## **Method:**

- 1 - Add about 4 ml of distilled water to 2 ml of soap in two test tubes
- 2 - Add to the first tube a few drops of calcium chloride, to second tube  $\text{MgCl}$

Result:

Tube	Observation	Conclusion
CaCl <sub>2</sub>		
MgCl <sub>2</sub>		