

Lipids

Qualitative test of lipids

Lipids

- **Lipids** are **esters** of long chain **fatty acids** and alcohols.
- They are waxy or oily substance present in all living organism.
- They are **non-polar** (hydrophobic) compounds, **soluble in organic solvents** (chloroform, benzene, ether etc.).
- **Some of Lipids function:**
 - Has structural functional in the cell.
 - It's an essential source of energy in the body
 - (**It give more energy than carbohydrates and proteins**)

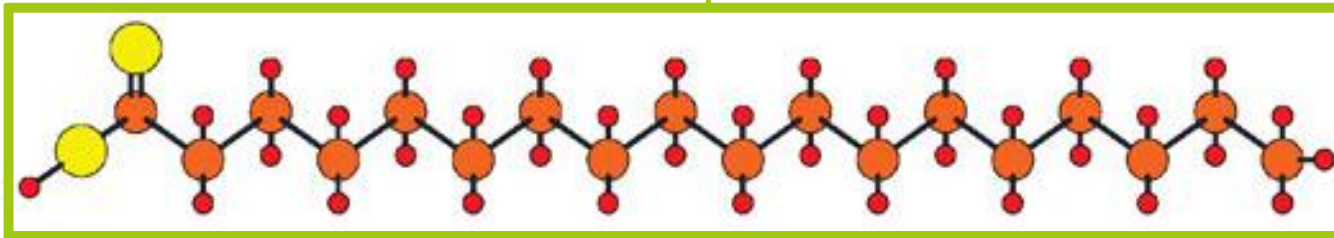
Fatty Acids

- ▣ The building blocks of lipids are (**Fatty Acids**)

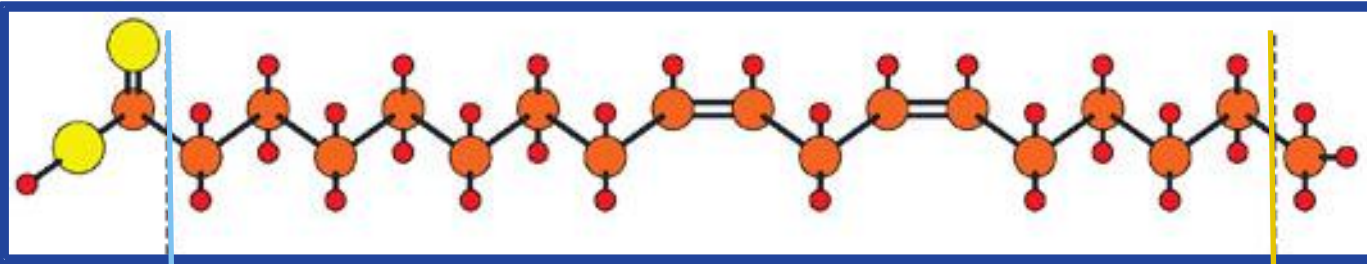
- ▣ **Fatty Acids:**
 - General formula [**CH₃ (CH₂)_n COOH**]
 - Have a long hydrocarbon chain with a terminal carboxylic group.

- ▣ **Fatty acids divided into:**
 1. Saturated fatty acids.
 2. Unsaturated fatty acids [**Contain double bonds**]

Saturated Fatty Acid



General formula of a saturated fatty acid (stearic acid, C18:0)



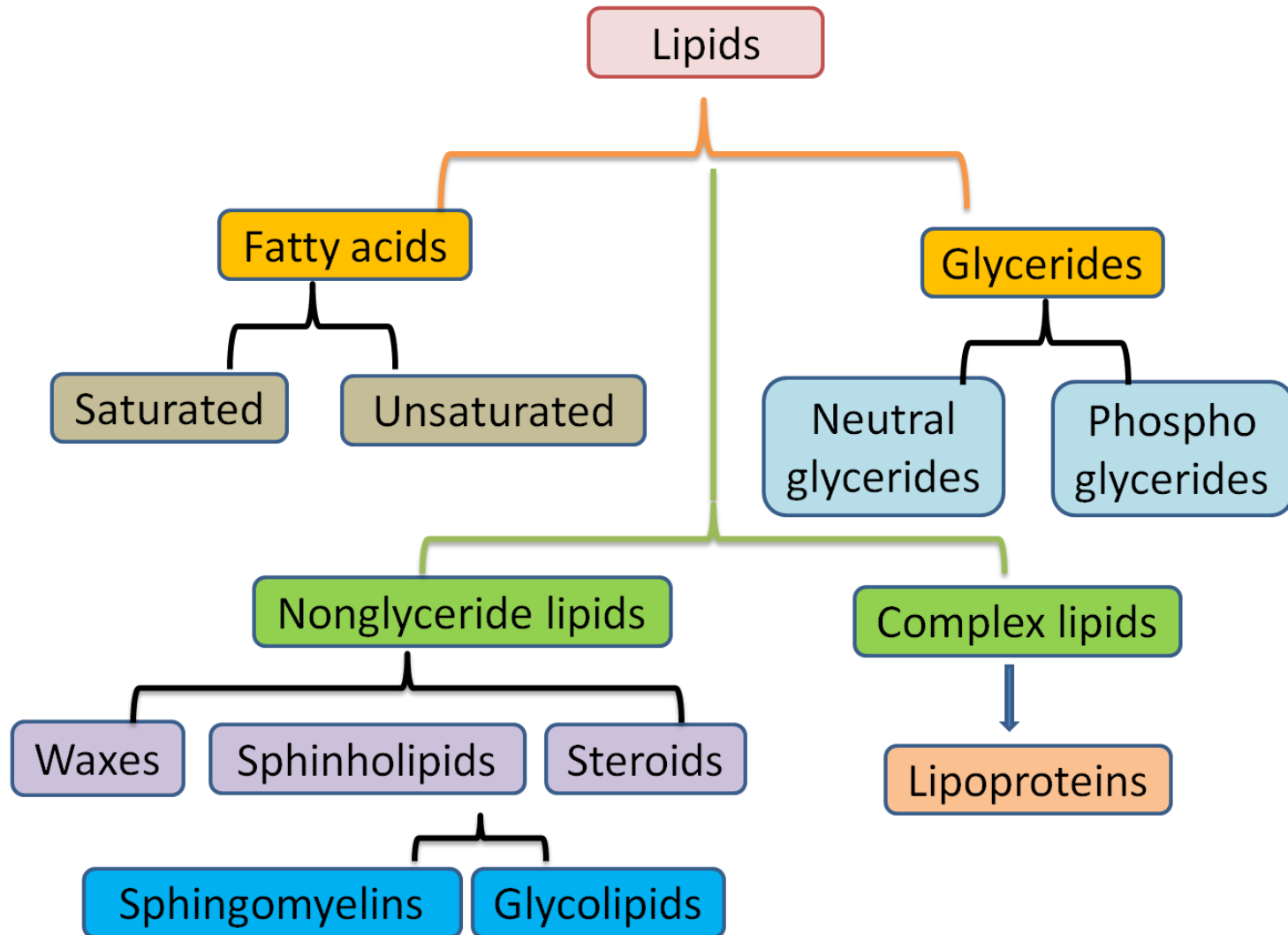
General formula of a polyunsaturated fatty acid (linoleic acid, C18:2)

Carboxylic end

unsaturated Fatty Acid

Methylic end

Lipids Classification



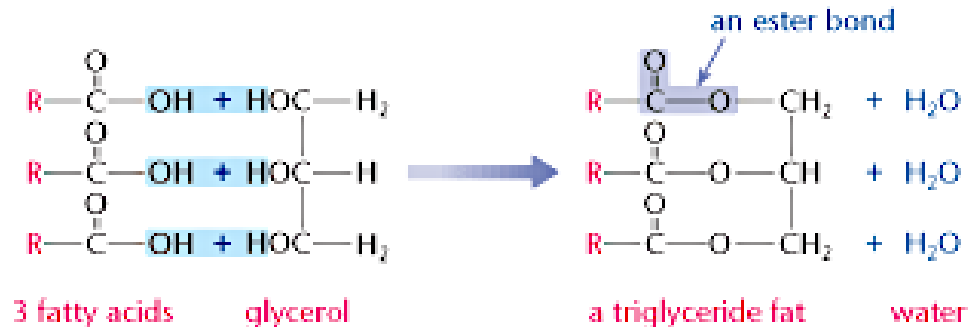
Lipids Classification

■ Fat can divided to their chemical composition to:

1. Simple lipids
2. Conjugated lipids
3. Derived lipids

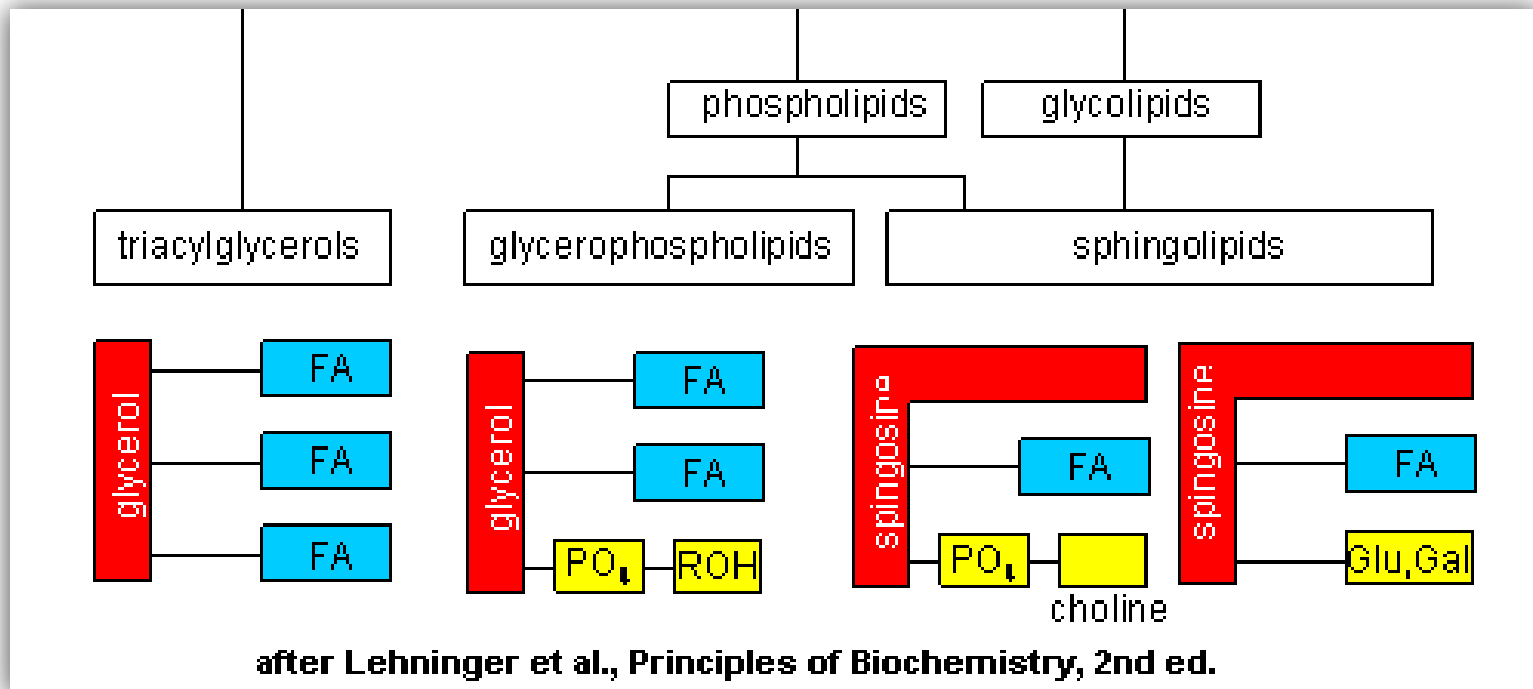
1. Simple Lipids

- Triglycerides is the simplest and most common fat
- Triglycerides are esters of [**fatty acids** + **glycerol**].
- It's found in fats and oils.
- It's the form in which lipids are stored in the cell.



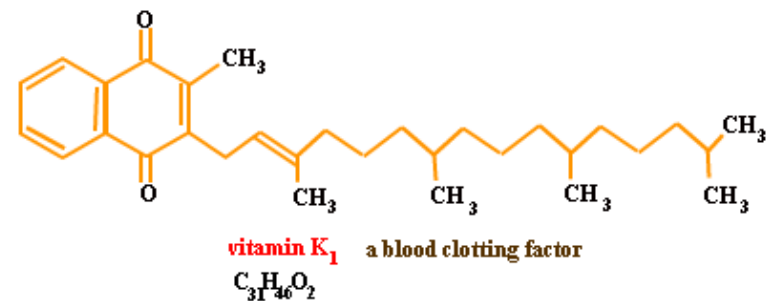
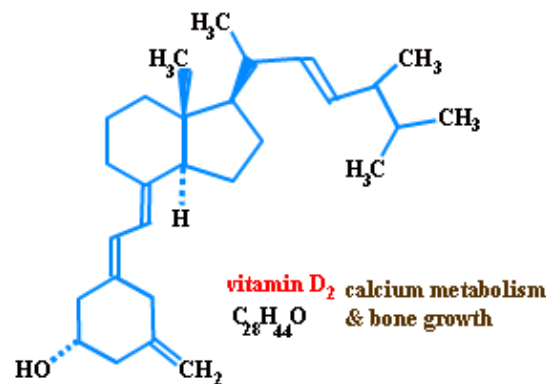
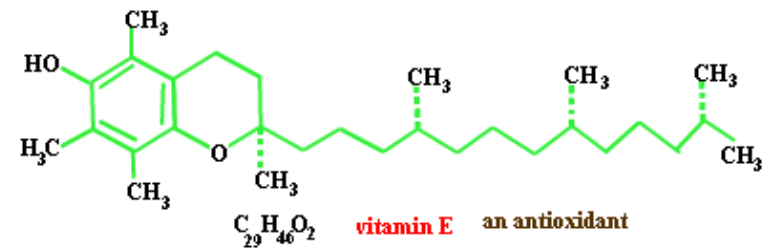
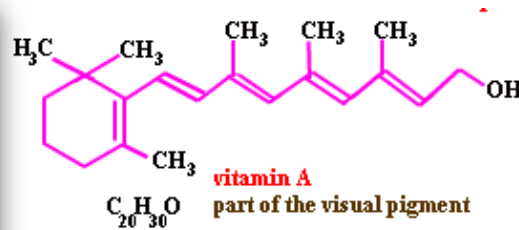
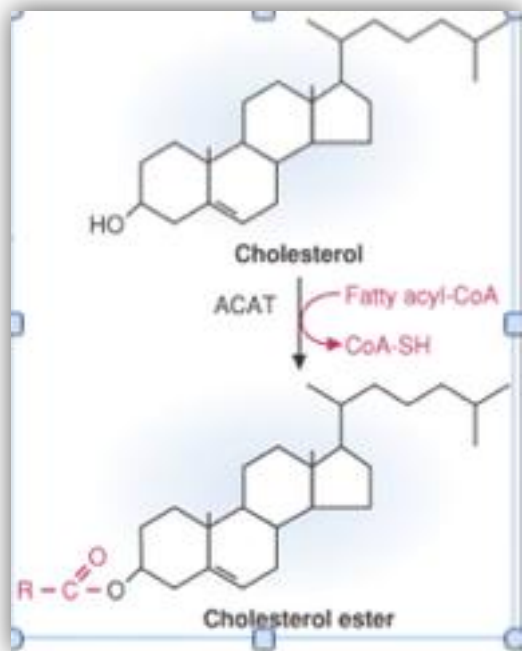
2. Compound “Conjugated” Lipids

- Lipids are linking with other compounds, such as:
 - Phospholipids,
 - Glycolipids.



3. Derived Lipids

- They are substance that are soluble in lipids or, derived from the lipids groups by hydrolysis, for example:
 - Cholesterol,
 - Fat soluble vitamins.



Qualitative tests of lipids

1. Solubility test.
2. Saponification test.
3. Testing the separation of soap from the solution by salting out.
4. Test formation insoluble fatty acids salt (insoluble soaps).

1st Experiment

Solubility test

▣ Objective:

- ▣ to test the solubility of oils in different solvent.

▣ Principle:

- ▣ 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 ability to dissolve in different organic solvent.**

This property enable us to separate a mixture of fat from each other

- ▣ **for example:** undissolve phosphatide lipid in acetone; undissolve of cerebroside, as well as sphingomyline in the ether.

1st Experiment

Solubility test

□ Materials:

- 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**),
- 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.

1st Experiment

Solubility test

Tube	Solvent	Degree of solubility
1		
2		
3		
4		
5		
6		

2nd Experiment

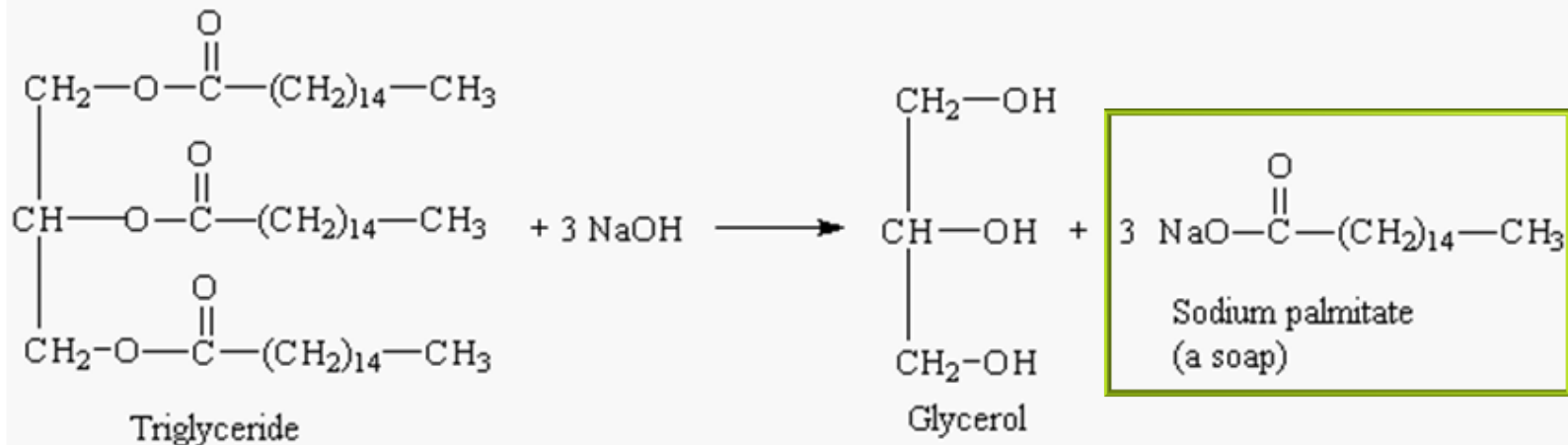
Saponification test

Objective:

- to form the soap.

Principle:

- Saponification is a process of **hydrolysis of oils or fat** with alkaline and **result** in **glycerol** and **salts of fatty acids** (soap)
- can be used the process of saponification in the separation of saponifiable materials from unsaponified (which are soluble in lipid).
- The process of saponification as follows :



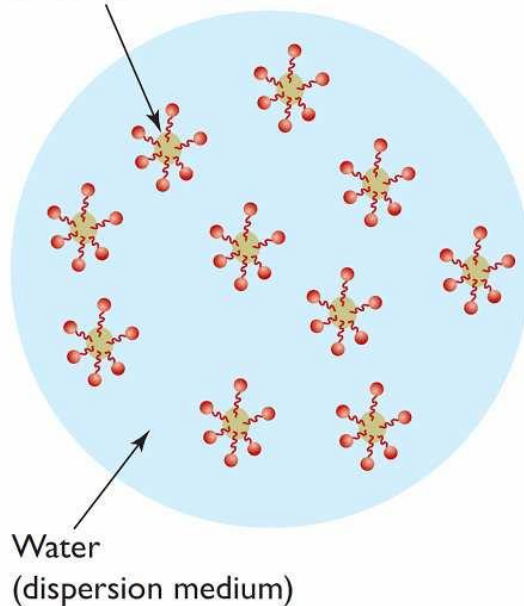
2nd Experiment

Saponification test

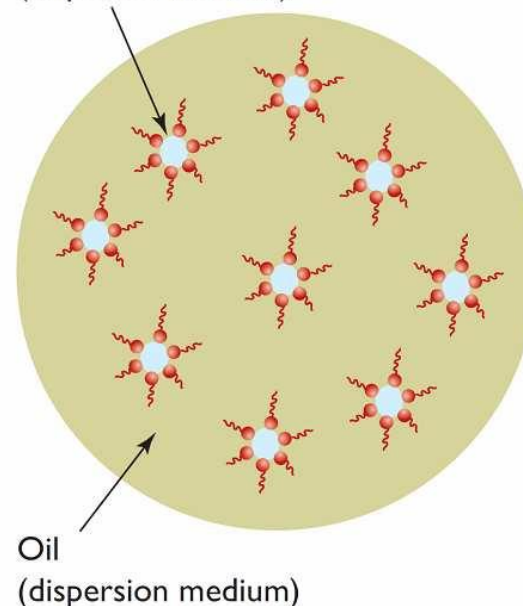
□ Principle:

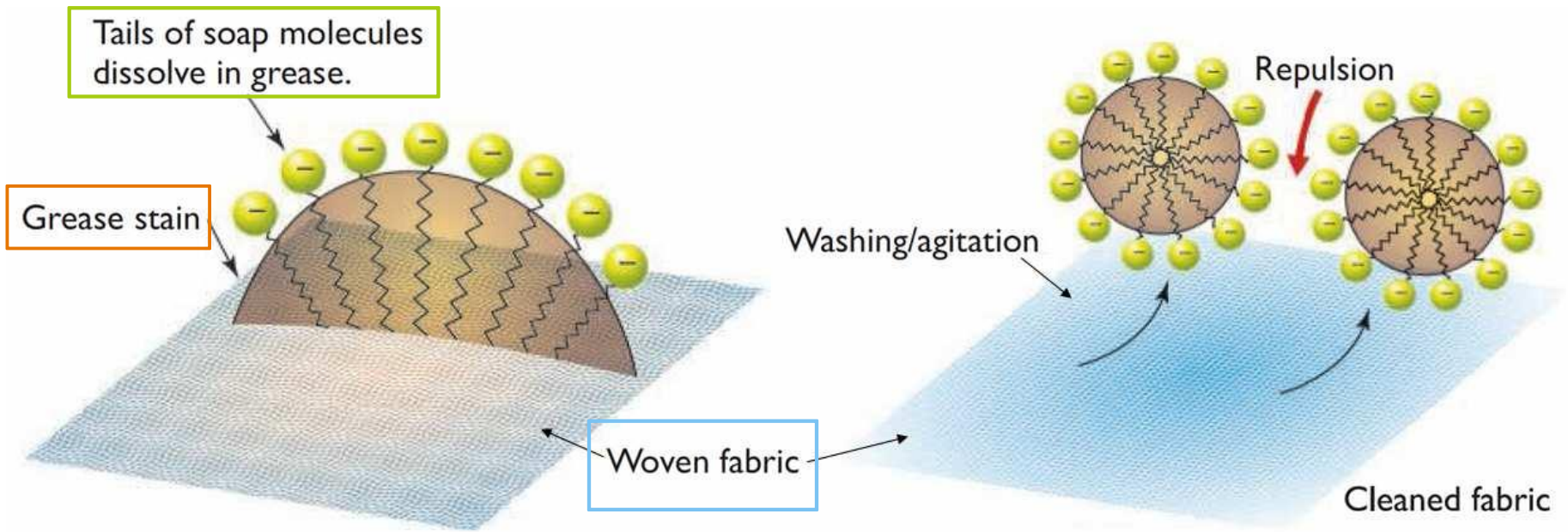
- Soap can be defined as **mineral salts of fatty acids**.
- The soap is soluble in water but insoluble in ether.
- Soap works on **emulsification** of oils and fats in the water as it works to reduce the attraction surface of the solution.

(a) Oil droplets
(dispersed medium)



(b) Water droplets
(dispersed medium)





2nd Experiment

Saponification test

▣ 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.

3rd Experiment

Testing the effect of NaCl on Saponification solution

□ Objective:

- To investigate the effect of NaCl on soap solubility.

□ Principle:

- To get the soap out of solution by salting out,
- when added solid sodium chloride (NaCl) to the solution until saturation; separated soap in the form of insoluble and floats above the surface.

3rd Experiment

Testing the effect of NaCl on Saponification solution

▣ 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.

4th Experiment

Test formation insoluble fatty acids salt (insoluble soaps)

□ Objective:

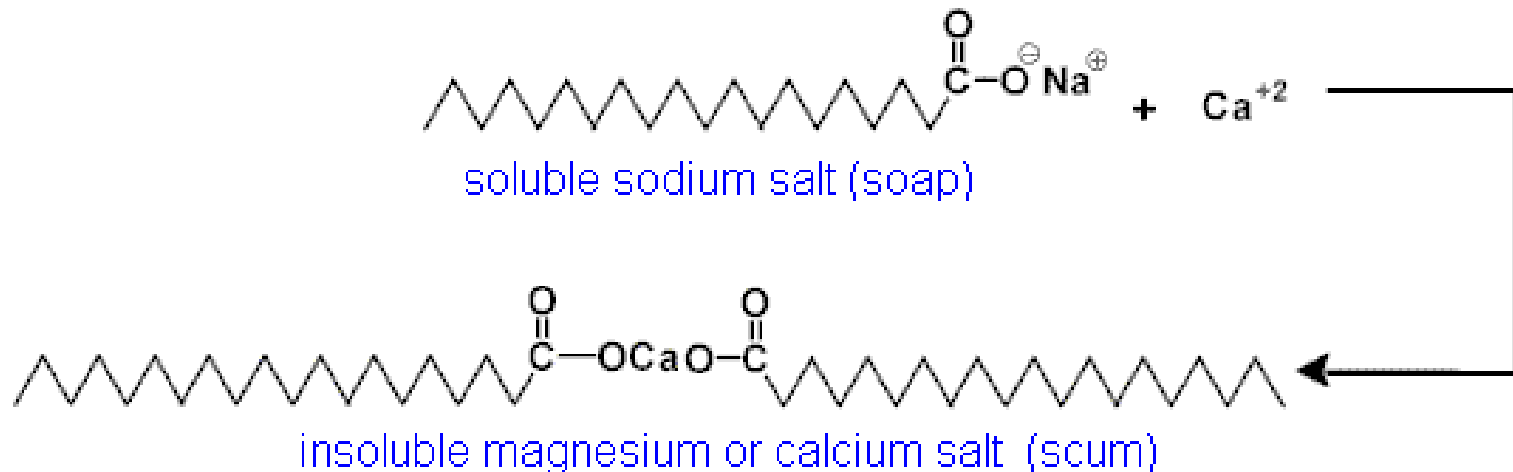
- To investigate the effect of different cations on soap solubility.

□ Principle:

- ✓ Working calcium, magnesium, lead or iron ions to the deposition of soap and make it **insoluble in water**, where solve these ions replace the sodium or potassium ions are present in soap.
- ✓ Due to the hard water to contain significant quantities of Ca^{2+} , Mg^{2+} and some Fe^{3+} are **difficult to foam**.
- ✓ (Potassium soap + calcium sulfate) \rightarrow (calcium soap + potassium sulfate).
- ✓ (Consisting of a white precipitate from **calcium stearate or oleate**).

4th Experiment

Test formation insoluble fatty acids salt (insoluble soaps)



4th Experiment

Test formation insoluble fatty acids salt (insoluble soaps)

□ Materials:

- Soap (which was prepared in the previous experiment).
- Calcium chloride (CaCl_2) 5%.
- Magnesium chloride or sulfate 5%.
- Lead acetate.
- Test tubes.

□ Method:

- Add about 4 ml of distilled water to 2 ml of soap in three test tubes,
- Add to **the first tube** a few drops of calcium chloride,
- to **second tube** MgCl,
- and to **third tube** lead acetate.

4th Experiment

Test formation insoluble fatty acids salt (insoluble soaps)

Tube	Observation	Conclusion
CaCl ₂		
MgCl ₂		

.. Now ..

‘ Wear your gloves and lab coat
And Act Like a biochemist ’

Thank You