

Series No. 02: Lipid Structure

Exercise n° 1

1. Write the semi-developed chemical formula of the following fatty acids:
 $C_{10} : 0$; $C_{14} : 1\Delta^9$; $C_{18} : 3\Delta^{9, 12, 15}$.
2. Give the common name (origin) of these 03 fatty acids.
3. What is the difference between these 03 fatty acids?
4. Represent these 03 chemical formulas using the second nomenclature (ω).

Exercise n°2

Given the following fatty acids: $C_{16}:0$; $C_{18}:0$; $C_{18}:1(\omega 9)$; $C_{18}:2(\omega 6)$; $C_{20}:1(\omega 6)$ With the following melting points: $-43.5^{\circ}C$; $-5^{\circ}C$; $13^{\circ}C$; $63^{\circ}C$; $70^{\circ}C$.

1. Give the names of these different fatty acids. Can our cells synthesize all of them?
2. Match the fatty acids with their melting points.

Exercise n°3

Classify the following fatty acids: Stearic acid; Linoleic acid; Linolenic acid; **Oleic acid**; **Lignoceric acid**; **Palmitoleic acid**; **Arachidonic acid**; **Butyric acid**.

- a- In ascending order of iodine number (given atomic weight of iodine = 127)
- b- In ascending order of melting points

Exercise n°4

A fatty acid containing one double bond is oxidized by potassium permanganate when heated. Analysis of the products shows two compounds: an acid: $C_9H_{18}O_2$ and a diacid: $C_9H_{16}O_4$.
- Find the formula of the initial fatty acid. Give its name? (common name or systematic name)

Exercise n°5

An oil is formed of a homogeneous saturated triglyceride with a saponification index equal to 535.
- What is the triglyceride present in the oil? MW of $KOH=56$.

Exercise n°6

Given the following triacylglycerol: α -linoleyl; β -palmityl; α -butyl glycerol.

1. Write its formula
2. Write its saponification reaction with KOH
3. Calculate its theoretical saponification index, given that $K=39$.

Exercise n°7

A sample of 1.766 g of a triglyceride is hydrolyzed by 12 ml of 0.5 N potassium hydroxide and fixes 6.10^{-3} moles of iodine.

- Determine:

- a) The molecular weight of the lipid.
- b) The number of double bonds
- c) The average length of fatty acid chains.
- d) The semi-developed formula, in the case where each fatty acid has one double bond.

Exercise n°8

A lipid X is hydrolyzed by pancreatic lipase. After the first step of hydrolysis, two compounds A and B are obtained. Compound B shows no reaction with I₂; after treatment of B with methanol, a compound with formula C₁₇H₃₄O₂ is obtained. What is the developed formula of B?

Compound A undergoes a second step of enzymatic hydrolysis, yielding compounds C and D.

Compound D fixes one molecule of I₂ and its oxidation gives the following two compounds:

- CH₃-(CH₂)₇-COOH and HOOC-(CH₂)₇-COOH
- Give the formula of D.

The hydrolysis of compound C gives:

- A trialcohol with formula C₃H₈O₃
- A compound E with formula C₁₈H₃₅O₂K under KOH action.
- Give the formula of E and that of the entire lipid.

Exercise n°9

Give the names of products obtained by mild hydrolysis of the following lipids with diluted NaOH.

- a- 1-stéryl-2,3- dipalmityl-glycérol
- b- 1-palmityl-2-oléyl-phosphatidylcholine

Exercise n°10

The hydrolysis of a triglyceride by phospholipase A1 gives a diglyceride and palmitic acid. When phospholipase A2 acts on it, a diglyceride and oleic acid are obtained. Saponification followed by chromatography allows us to identify glycerol and 3 different fatty acids: palmitic, oleic, and stearic acids.

Write the semi-developed formula of the triglyceride in question.

Data: Palmitic acid C₁₆:0; Oleic acid C₁₈:1 Δ⁹; Stearic acid C₁₈:0

Exercise n°11

Given a complex lipid X. After hydrolysis with pancreatic lipase, two compounds A and B and a complex C are obtained.

- A does not react with iodine and forms an ester with formula CH₃-(CH₂)₂-CO-O-C₂-H₅ with ethanol.
- Compound C consists of a galactosyl linked at C1 to a trialcohol with formula C₃H₈O₃.
- Compound B reacts with 2 molecules of iodine and has 18C on its side chain.
- Give the formula of X and calculate its iodine number.