

TUTORIAL SESSION- LIPIDS (BIOCHEMISTRY)

Exercise No. 1:

One mole of a **polyunsaturated fatty acid** is oxidized by potassium permanganate (KMnO_4). This oxidation yields one mole of **caproic acid** (a C6 monoacid), three moles of **malonic acid** (a C3 diacid), and one mole of **glutaric acid** (a C5 diacid).

- 1- Write its **semi-developed structure** and provide its **name**.
- 2- Specify the **ω -series** to which it belongs.
- 3- Calculate its **saponification value** and **iodine value**.

Exercise No. 2:

The **saponification** of **3 g** of a **homogeneous triglyceride** requires **566.27 mg** of **KOH**. KMnO_4 has **no** effect on the **fatty acids** constituting this triglyceride.

- 1- Calculate the **saponification value** and the **molar mass** of the triglyceride.
- 2- Provide the **name** and **fully developed structural formula** of the triglyceride.

Exercise No. 3:

A **triglyceride** has a **saponification value** of **196** and an **iodine value** of **59**. Chromatographic analysis of this lipid reveals the presence of **palmitic acid** and **oleic acid**.

- Propose one possible **structure** of this triglyceride.

Exercise No. 4:

Analysis of a **lecithin** shows that it contains **one fatty acid** with **4 carbon** atoms and another **unsaturated fatty acid**. The **diglyceride** has a **saponification value (SV) = 281.40** and an **iodine value (IV) = 63.81** ($\text{KOH} = 56$; $\text{I}_2 = 127$).

- 1- Provide the **structure** and **nomenclature** of this lecithin.
- 2- Indicate its **classification**.
- 3- State whether it is a **storage lipid** or a **structural lipid**.
- 4- Give two **essential properties** of this lecithin.
- 5- Give the **names** of the final products obtained after the action of **phospholipase D**.

Table 1: Classification of Saturated Fatty Acids by Chain Length

Relative Chain Length	nC	Systematic Name	Common Name	Main Sources
Short-chain	4	n-butanoic	Butyric	Butter
	6	n-hexanoic	Caproic	goat milk
	8	n-octanoic	Caprylic	
	10	n-decanoic	Capric	
Medium-chain	12	n-dodecanoic	lauric (laurel)	animal and plant fats
	14	n-tetradecanoic	myristic (nutmeg)	
	16	n-hexadecanoic	palmitic (palm)	
	18	n-octadecanoic	stearic (tallow)	
Long-chain	20	n-eicosanoic	Arachidic	Seeds
	22	n-docosanoic	Behenic	
	24	n-tetracosanoic	Lignoceric	
	26	n-hexacosanoic	Cerotic	plant waxes
	28	n-octacosanoic	Montanic	Bacteria
	30	n-triacontanoic	Melissic	Insects
	32	n-dotriacontanoic	Laceroic	

Table 2: Major Unsaturated Fatty Acids

nC	Systematic Name	Common Name	Symbol	Series	Main Sources
16	cis-9-hexadecenoic acid	palmitoleic	C16: 1 (9)	ω 7	very widespread
18	cis-9-octadecenoic acid	oleic	C18: 1 (9)	ω 9	very widespread
	cis-11-octadecenoic acid	vaccenic	C18: 1 (11)	ω 7	Bacteria
	cis,cis-9,12-octadecadienoic acid	linoleic	C18: 2 (9,12)	ω 6	Seeds
	all-cis-9,12,15-octadecatrienoic acid	linolenic	C18: 3 (9,12,15)	ω 3	Seeds
20	all-cis-5,8,11,14-icosatetraenoic acid	arachidonic	C20: 4 (5,8,11,14)	ω 6	Animals
	all-cis-5,8,11,14,17-icosapentaenoic acid (EPA)	EPA*	C20:5(5,8,11,14,17)	ω 3	fish oils
24	cis-15-tetracosenoic acid	nervonic	C24: 1 (15)	ω 9	Brain