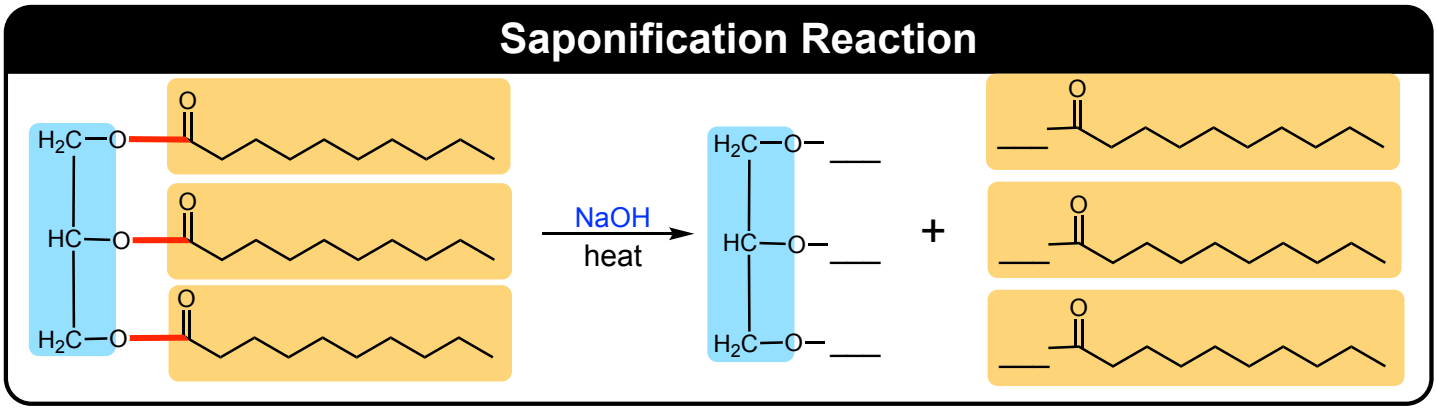
CONCEPT: TRIACYLGLYCEROL REACTIONS: HYDROLYSIS

Saponification

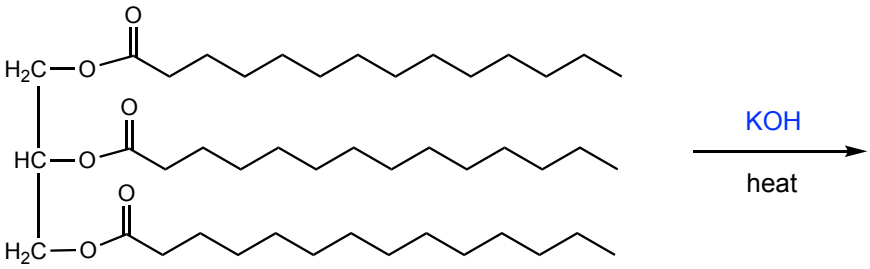
- Under this reaction the _____ ion cleaves the ester bond to create _____ of the fatty acids and _____.



- The salts of the fatty acids are used in the creation of soaps.
  - □ When NaOH used = _____ soap created.
  - □ When KOH used = _____ soap created.

EXAMPLE: Draw the starting triacylglycerol used when its complete basic hydrolysis created 2 laurate salts, 1 palmitate salt, and a glycerol molecule.

PRACTICE: The salt of a fatty acid has its ending of "ic acid" changed to "ate". Based on this information provide the name of the salt created from the following saponification reaction.



a) Potassium Laurate

b) Sodium Oleate

c) Potassium Myristate

d) Potassium Lactate

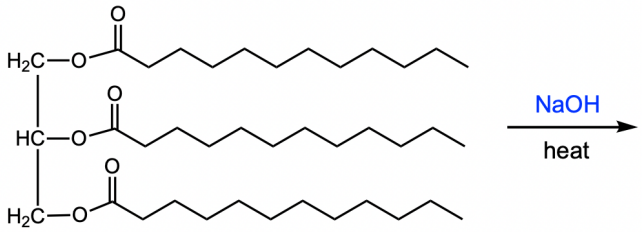
CONCEPT: TRIACYLGLYCEROL REACTIONS: HYDROLYSIS

Base-Catalyzed Hydrolysis Mechanism

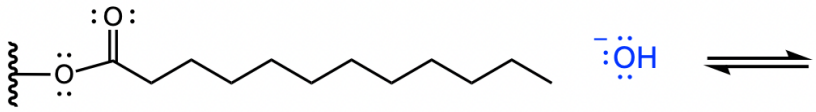
- The base-catalyzed hydrolysis of a triacylglycerol follows a nucleophilic acyl substitution mechanism.

Step 1	Step 2	Step 3
Nucleophilic Attack	Leaving Group	Proton Transfer

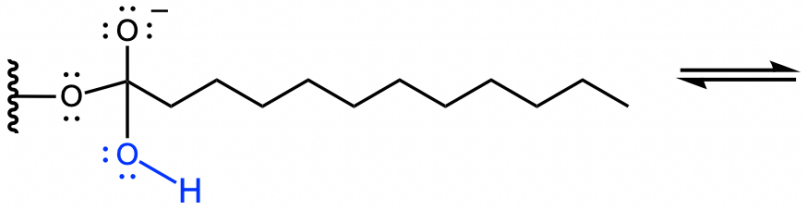
EXAMPLE: Provide the mechanism for the base-catalyzed hydrolysis for one of the fatty acid chains in the following triglyceride.



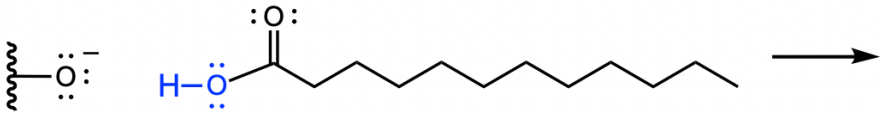
STEP 1: Use the hydroxide ion as a _____ to attack the carbonyl carbon.



STEP 2: Recreate the pi bond of the carbonyl group to _____ _____ the alkoxyl group of the ester.



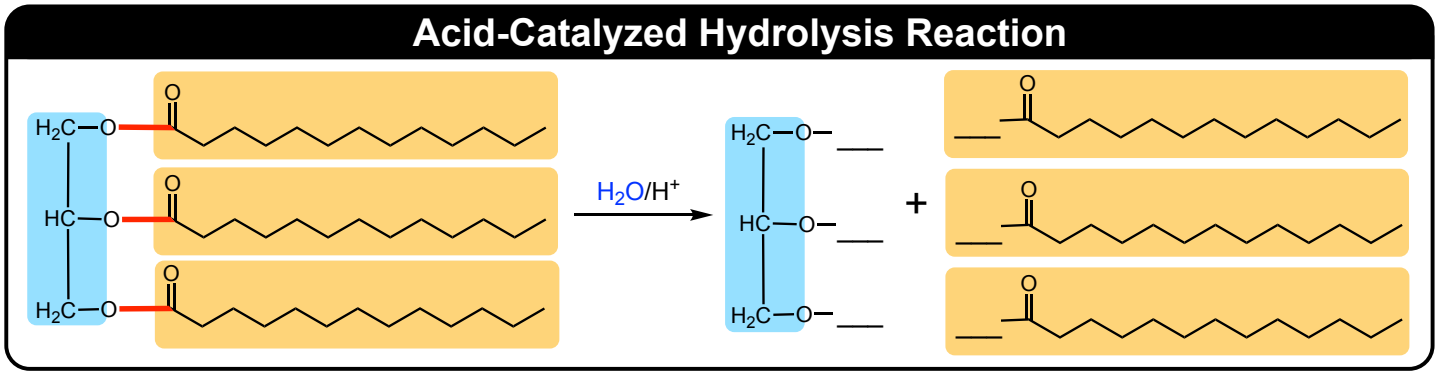
STEP 3: Use the newly formed carboxylic acid to _____ the alkoxide ion.



CONCEPT: TRIACYLGLYCEROL REACTIONS: HYDROLYSIS

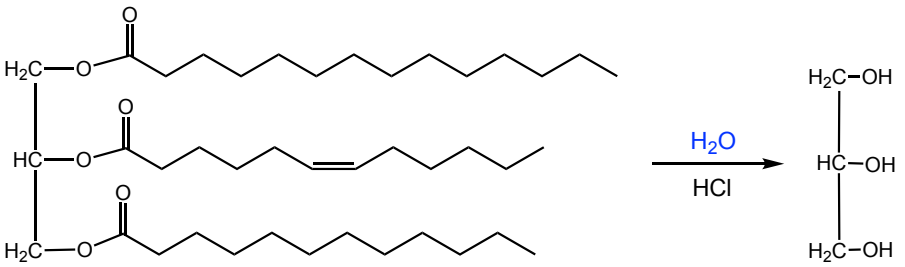
Acid-Catalyzed Hydrolysis

- Under this type of reaction, ester bond is hydrolyzed to create a _____ and ___ fatty acids.
  - □ Occurs stepwise in the presence of a strong acid (_____ or _____).

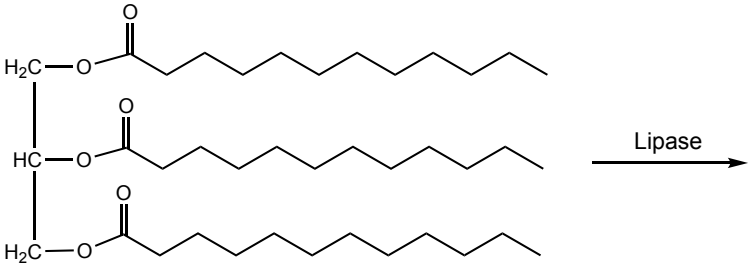


- **Enzymatic Hydrolysis:** a similar reaction done under milder conditions that instead uses the digestive enzyme _____.

EXAMPLE: Draw the fatty acid products for the following reaction.



PRACTICE: Provide the common name of the fatty acids produced from the acid-catalyzed hydrolysis of the following triacylglycerol.



a) Palmitoleic acid b) Lauric acid c) Palmitic acid d) Myristic acid

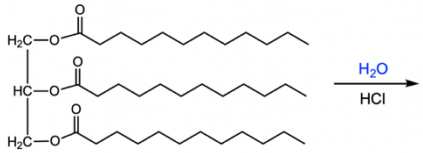
CONCEPT: TRIACYLGLYCEROL REACTIONS: HYDROLYSIS

Acid-Catalyzed Hydrolysis Mechanism

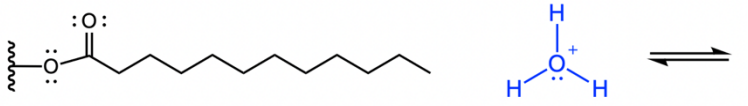
- The acid-catalyzed hydrolysis of a triacylglycerol follows a nucleophilic acyl substitution mechanism.

Step 1	Step 2	Step 3	Step 4	Step 5
Proton Transfer	Nucleophilic Attack	Proton Transfer	Leaving Group	Proton Transfer

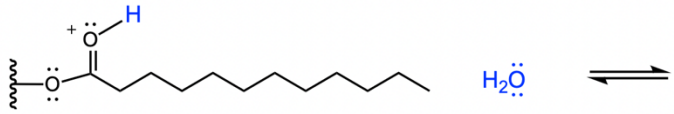
EXAMPLE: Provide the mechanism for the acid-catalyzed hydrolysis for the top fatty acid chain of the following triglyceride.



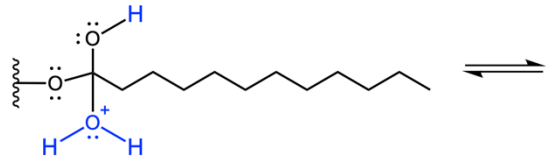
STEP 1: Protonate the carbonyl oxygen with a _____ _____.



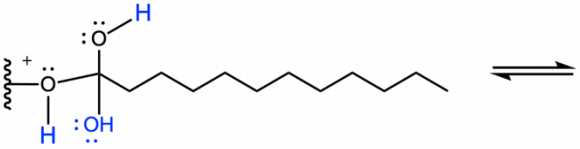
STEP 2: Use the newly created water molecule to attack the carbonyl carbon.



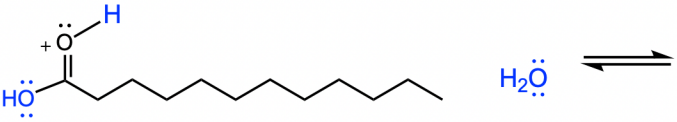
STEP 3: Perform a proton transfer between attached water molecule and alkoxyl oxygen.



STEP 4: Create a double bond between hydroxyl group oxygen and attached carbon then kick out alkoxyl leaving group.

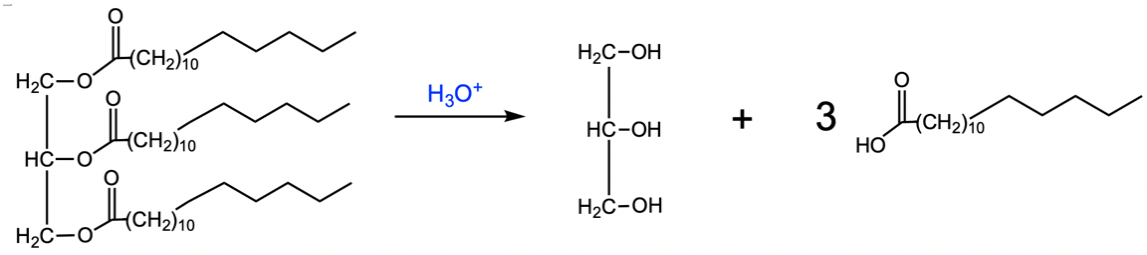


STEP 5: Deprotonate the double bonded hydroxyl group oxygen with a water molecule.



CONCEPT: TRIACYLGLYCEROL REACTIONS: HYDROLYSIS

PRACTICE: Propose a possible mechanism for the following reaction.



PRACTICE: An optically inactive triacylglycerol molecule undergoes base-catalyzed hydrolysis to produce 1 glycerol molecule, 1 mole of laurate and 2 moles of myristate. Determine the structure of the triacylglycerol molecule.