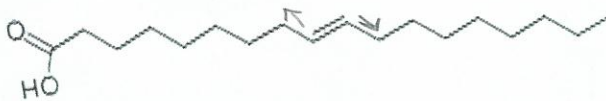


- Lipids are soluble in nonpolar / polar solvents.
- The nonpolar / polar portion of a lipid allows for the formation of structures such as micelles and cell membranes.
- The nonpolar / polar portion of a lipid contributes to the water insolubility.
- Many lipids contain one or more fatty acids. What is a fatty acid? Give three facts about them.
 - fatty acid is a long chain carboxylic acid
 - found in plants and animals
 - insoluble in water
 - can be free or part of a larger molecule
- Fatty acids can either be saturated or unsaturated. From the picture below, determine whether it is *saturated*, *cis-unsaturated*, or *trans-unsaturated*.

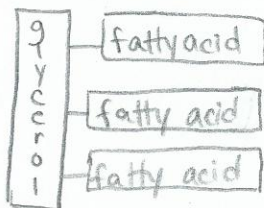


unsaturated - b/c it has a double bond

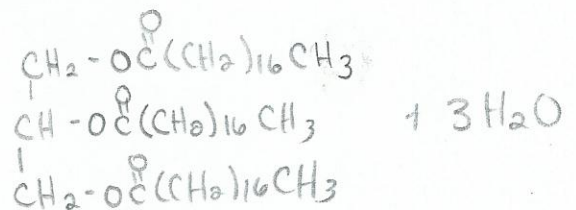
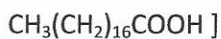
trans - b/c chain goes in different directions from the double bond

- Describe the melting points in the pairs below:
 - Between a 12 carbon saturated fatty acid and a 16 carbon saturated fatty acid
16 carbon will have higher m.p. b/c m.p. increases w/ chain length
 - Between a 12 carbon unsaturated fatty acid and a 12 carbon saturated fatty acid
12 carbon unsaturated will have lower m.p. b/c m.p. decreases w/ unsaturation
- Waxes, oils, and fats all contain an ester linkage or linkages. What is an ester?

$$R-\overset{\text{O}}{\parallel}{C}-O-R'$$
- Waxes are esters of a fatty acid and a long chain alcohol
- What is the difference between fats and oils?
 fats - solid at room temp
 oils - liquid at room temp.
- Fats and oils are triacylglycerols or triglycerides. Draw a triacylglycerol cartoon.



- Draw an example of the formation of a triglyceride: glycerol + steric acid. [steric acid is



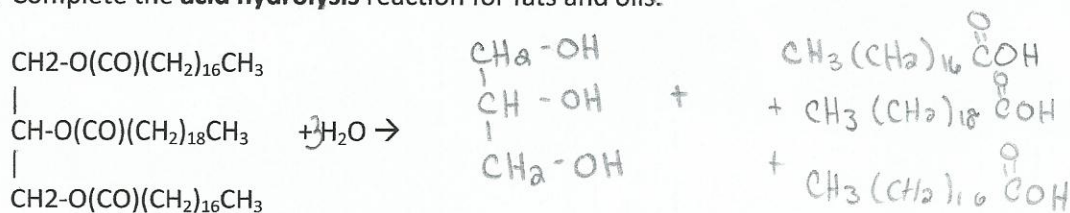
12. Describe Omega-3 fatty acids. What does the name refer to, what are their significance, and where are they found?

Omega-3 means there is a double bond 3 carbons from the end of the chain. They are used to lower cholesterol, reduce heart disease and improve joint function. Found in fish oils and some plants.

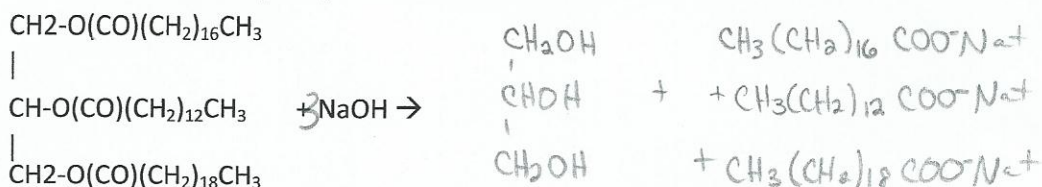
13. Describe the **hydrogenation** of unsaturated fats and oils.

-unsaturated fats and oils have double bonds, so when they are hydrogenated, H's are added to the double bond
-trans fats produced by hydrogenation

14. Complete the **acid hydrolysis** reaction for fats and oils.



15. Complete the **base hydrolysis** reaction for fats and oils.



16. Describe **soaps**. How are they formed? How were they originally formed? How do they work?

Soaps are long chain fatty acid salts. They are formed from the reaction of a fatty acid with a base (NaOH, KOH). Originally formed by mixing wood ashes with animal fats. Soaps form micelles: nonpolar region on inside and polar region on the outside. Hard soaps: Na⁺, soft soaps: K⁺

17. transesterification is the replacement of the alcohol portion of an ester with a different alkyl group. Give an example showing this. What is a real life example of this reaction?



example is biodiesel, which is made by the transesterification of fats or oils with methanol.