

WHAT IS A LIPID?

OBJECTIVE

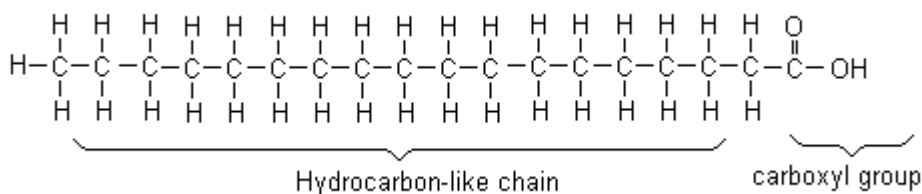
The objective of this worksheet is to understand the structure and function of lipids

PART A: Understanding Lipids

Lipids are more commonly known as fats and include triglycerides, phospholipids, and waxes. Lipids get a bad rap, but they are very important for all living things. We are made up of trillions of cells, and lipids form the membranes of all of our cells. Without these membranes, cells couldn't exist! So why do lipids have a bad reputation? Because we store up too many of them when we eat a poor diet and don't exercise regularly. In addition to this, lipids can build up in our blood vessels and cause cardiovascular disease. However, other problems can appear if we don't store enough lipids in our bodies. For example, hormones are made from lipids. Our bodies do not function correctly without the proper amounts of hormones. Therefore, we need to eat lipids!

Lipids are actually similar to carbohydrates. With some exceptions, both lipids and carbohydrates are composed of only 3 elements: carbon, hydrogen, and oxygen. However, there are far less oxygen in lipids than there are in carbohydrates. In addition, both lipids and carbohydrates can be broken down for energy.

Another key component to lipids is **fatty acids**. A fatty acid is recognizable by its long hydrocarbon (made of hydrogen and carbon) chain and its carboxyl group.



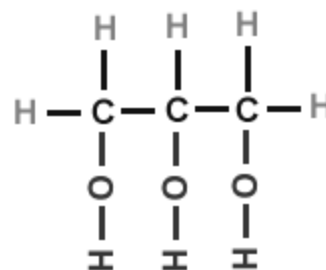
Triglycerides

Triglycerides are composed of three fatty acids and one glycerol.

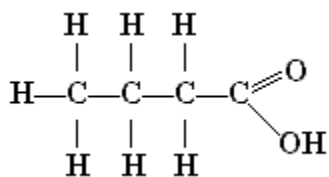
Tri = 3 fatty acids

Glyceride = glycerol

Glycerol is an alcohol that contains three hydroxide (-OH) groups.

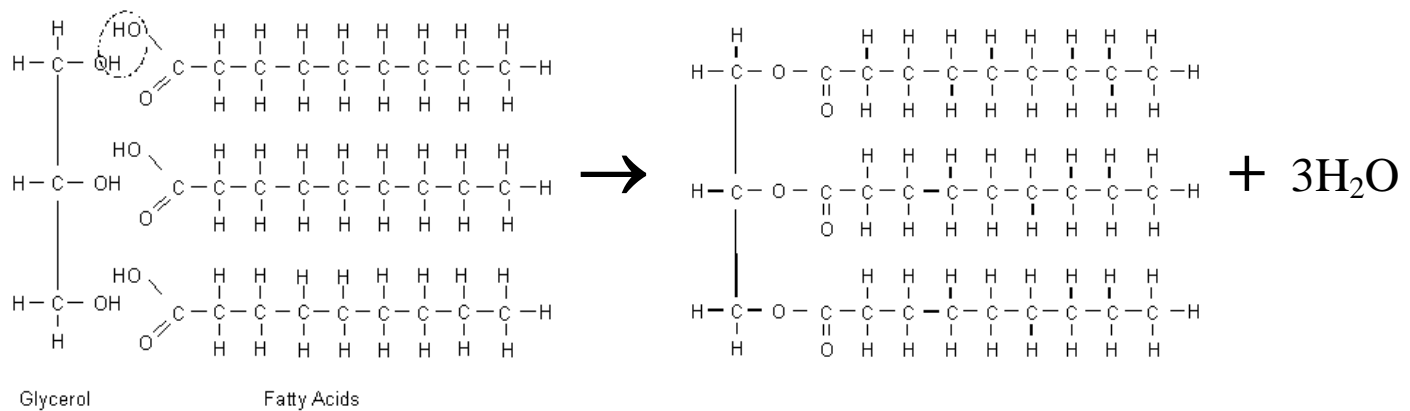


Fatty Acids contain a hydrocarbon chain and a carboxyl (-COOH) group



In order to join Glycerol to the three fatty acids we simply remove three molecules of water by dehydration synthesis.

To do this we remove the “H” from each hydroxyl group on Glycerol and an “OH” from each carboxyl group on the fatty acids. This will form 3 water molecules.

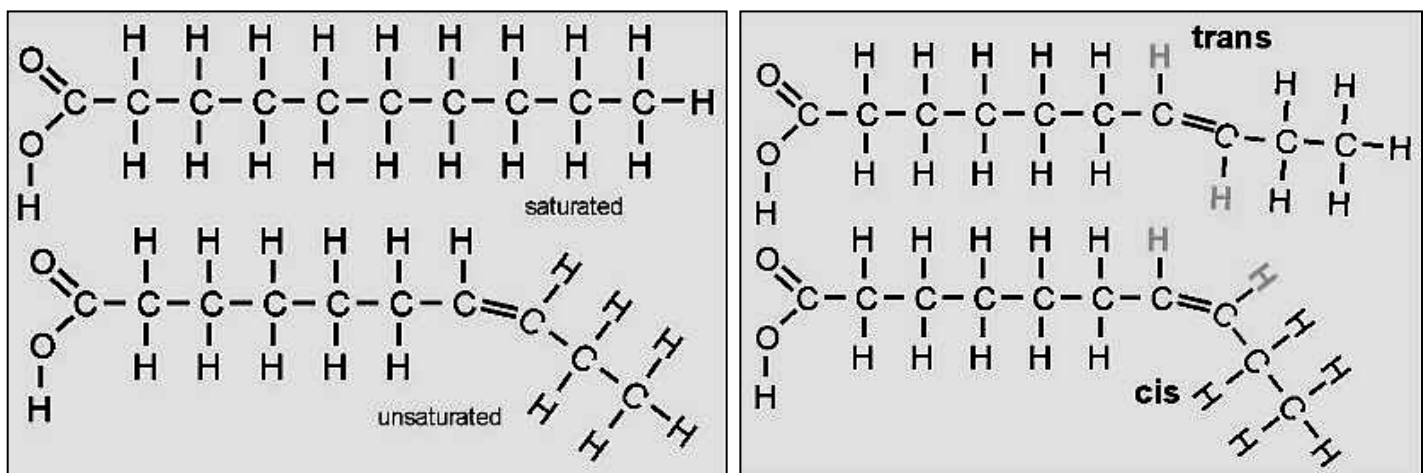


Saturated vs. Unsaturated

Saturated – Fatty Acids that contain the maximum number of hydrogen atoms, and therefore no carbon to carbon double bonds

Unsaturated – Fatty Acids that contain less than the maximum number of hydrogen atoms in one or more of its fatty acid chains because some of its carbon atoms are double-bonded to each other.

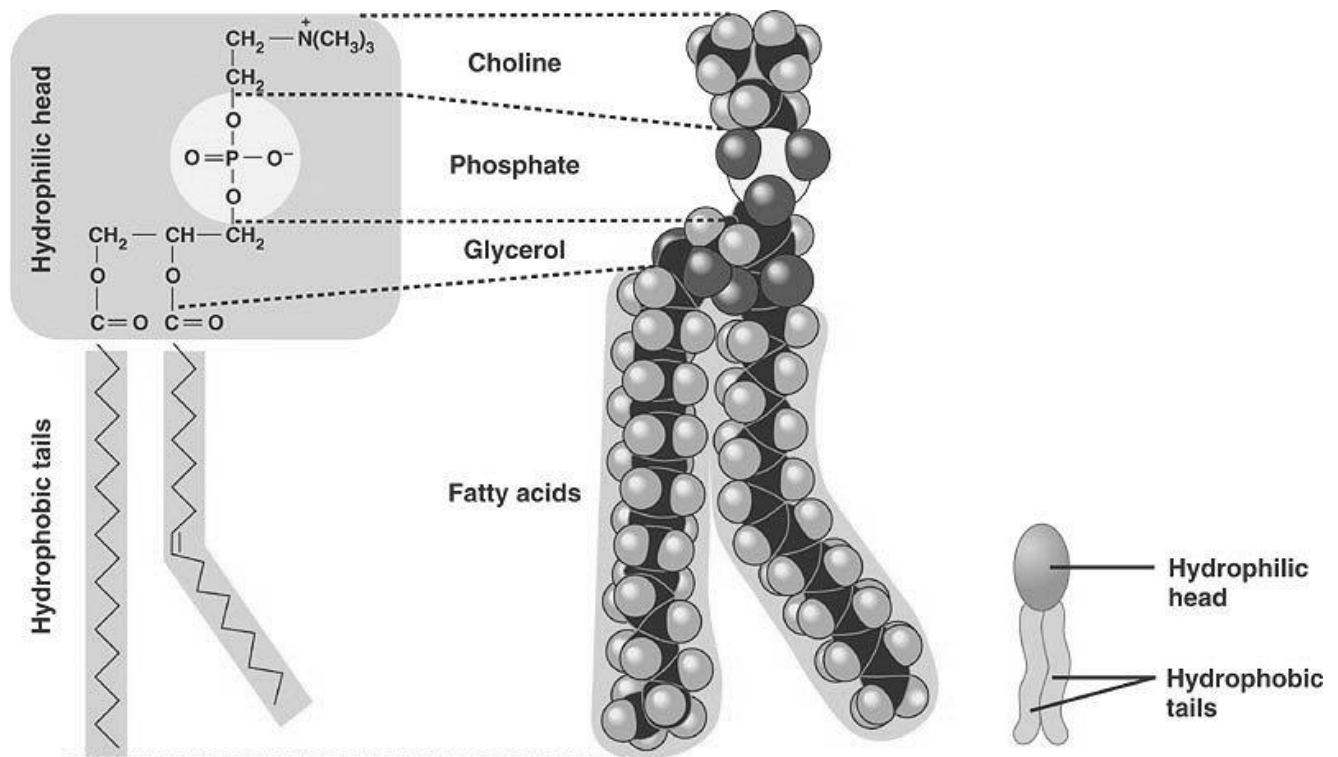
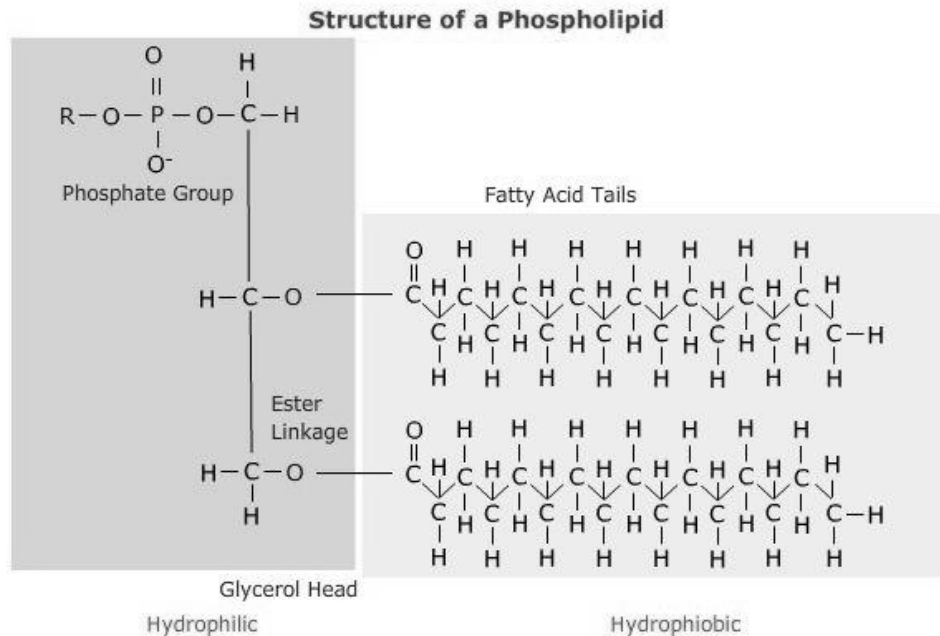
- * **Trans Unsaturated Fatty Acids** – Carbons are missing on opposite sides of the carbon chain
- * **Cis Unsaturated Fatty Acids** – Carbons are missing on the same side of the carbon chain



Phospholipids

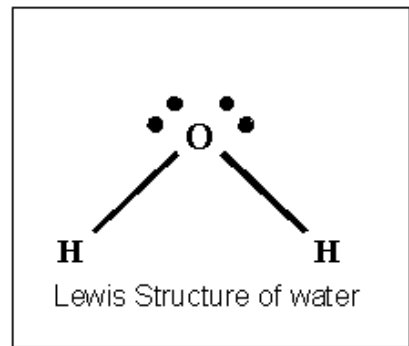
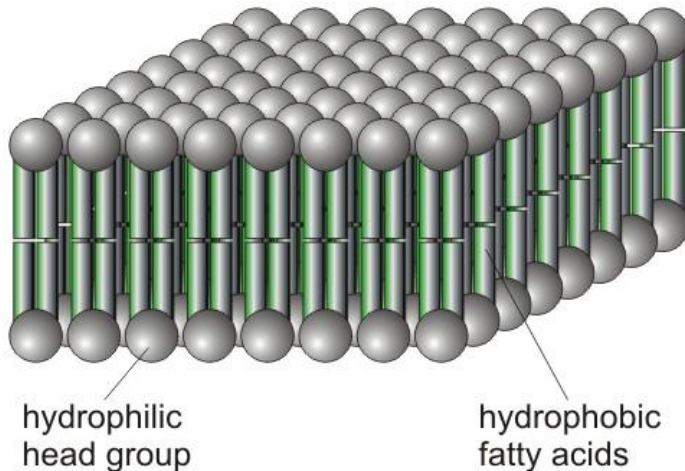
Phospholipids are very important molecules that compose the cell membrane of a cell

Phospholipids are very similar to triglycerides, except Phospholipids contain Glycerol, two Fatty Acids, and one Phosphate Group. (the Phosphate Group replaces one of the fatty acids)

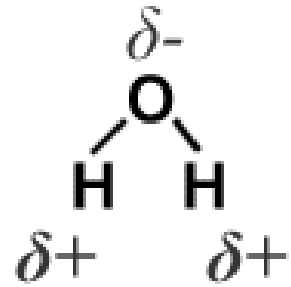


Phospholipids contain a polar head (the phosphate group) and a non-polar tail (the two fatty acids). This allows phospholipids to form a phospholipid bi-layer (Two layers of phospholipids) when placed in water. (Remember, water is Polar!).

Phospholipid bilayer



Hydrophobic – “water fearing”
Hydrophilic – “water loving”

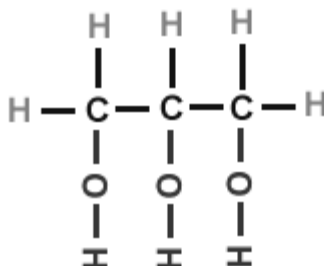


PART B: Applying your knowledge of lipids

Lipids include triglycerides (fats), phospholipids, and waxes. One of the key parts that make up a lipid is an **alcohol**. An alcohol is recognizable by its hydroxyl (-OH) groups.

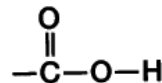
1. Use the chemical models to build a model of the alcohol called glycerol. Use the key below. When you have finished, have your teacher sign his/her name. _____

key	
carbon	black
hydrogen	white
oxygen	blue
bond	white tube



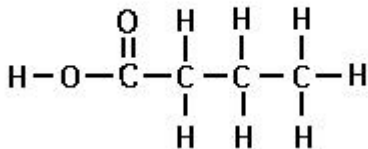
2. Draw a box around each OH group.
3. The molecular formula for glycerol is C ___ H ___ O ___.

Another key component of lipids is a **fatty acid**.
A fatty acid is recognizable by its carboxyl group.

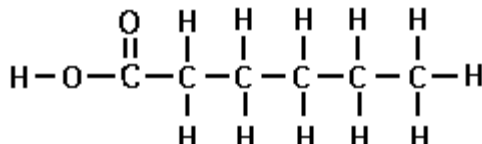


1. Use the chemical models to build a model of each of the fatty acids shown below. When you have finished, have your teacher sign his/her name. _____

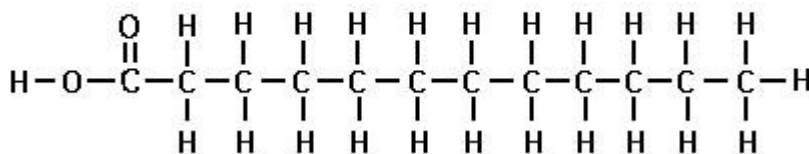
butyric acid



caproic acid



lauric acid

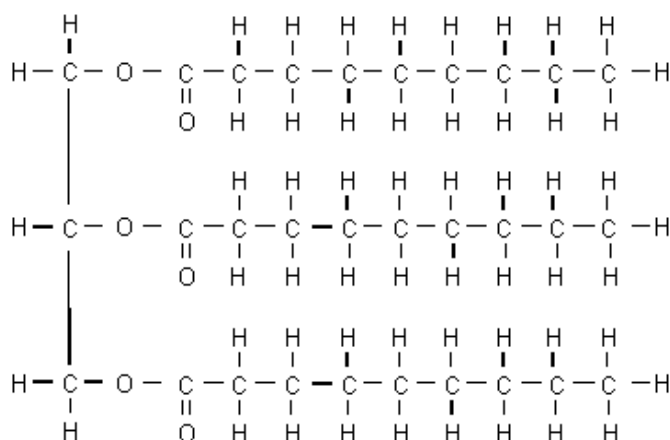


2. Draw a box around the carboxyl group on each fatty acid.
3. The molecular formula for butyric acid is C ___ H ___ O ___.
4. The molecular formula for caproic acid is C ___ H ___ O ___.
5. The molecular formula for lauric acid is C ___ H ___ O ___.

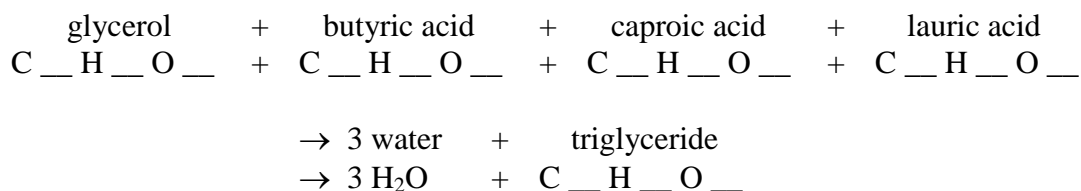
One of the lipids, **triglyceride**, is composed of glycerol and three fatty acids.
In order to make a triglyceride, you will have to modify each of the component parts.

1. There are three OH groups on the glycerol model. Pull the H off each OH group.
2. Each fatty acid has a carboxyl group. Pull the OH group off the carboxyl group of each acid.
3. In removing the 3 Hs and the 3 OHs, you have created how many H₂O molecules? _____
4. You should now be able to create a triglyceride. Join the glycerol and 3 fatty acids.
Use the diagram below to help build your model of a triglyceride.
Note: the diagram will not be identical to your model.

When you have finished, have your teacher sign his/her name. _____



5. Write the molecular formula for triglyceride by completing the following equation:



6. What process was used to join glycerol to the three fatty acids? _____
7. The more carbon – hydrogen bonds in a molecule, the more energy the molecule can hold.

Do you think lipids, like triglycerides, are efficient energy carriers? _____

Explain your answer: _____
