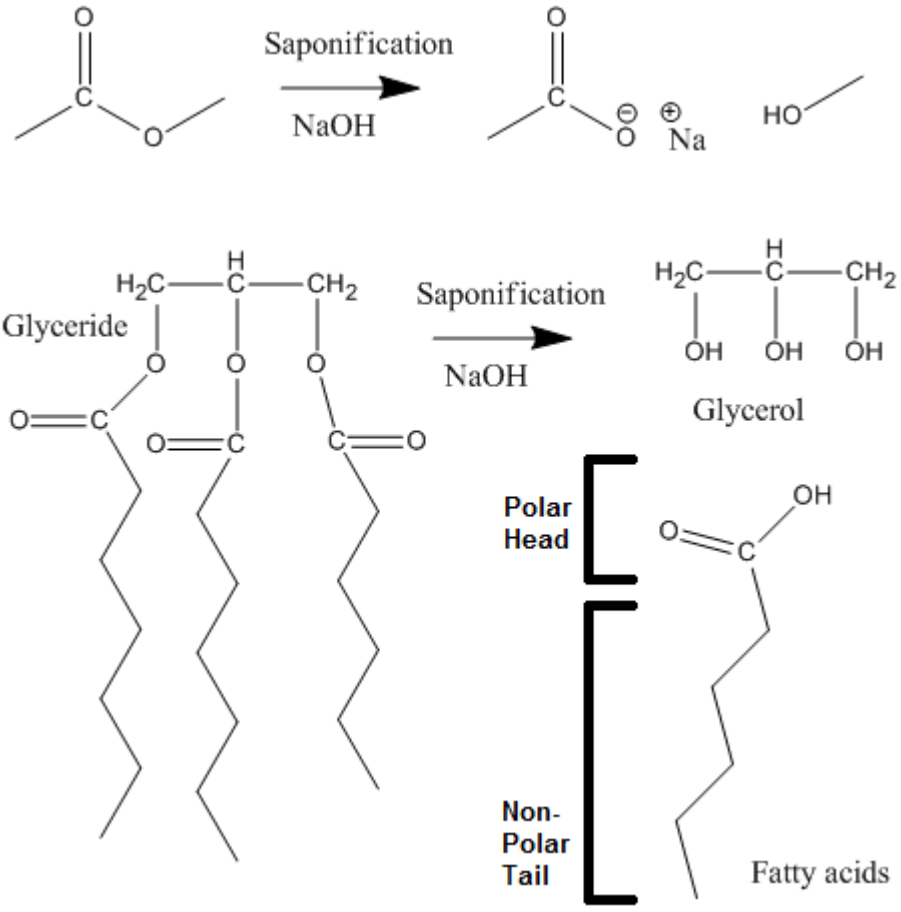
Name:_____
Date:_____ Block:_____

Saponification Lab

Saturated Fats vs Unsaturated Fats

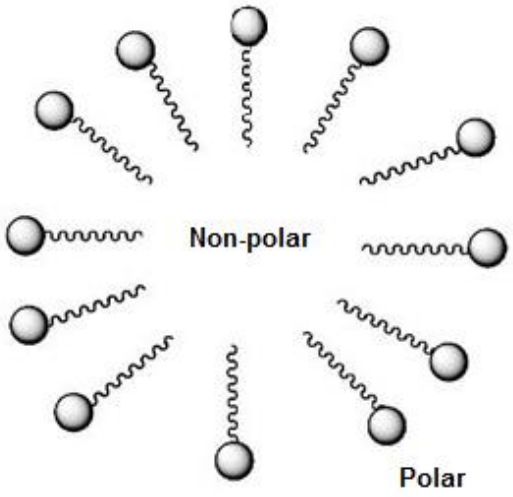
Introduction:

The process of making soap can be done many ways but mainly involves mixing a hydroxide with triglycerides (lipids). This results in a hydrolysis of the fatty acid ester linkage which produce glycerol and a fatty acid salt which we call soap.

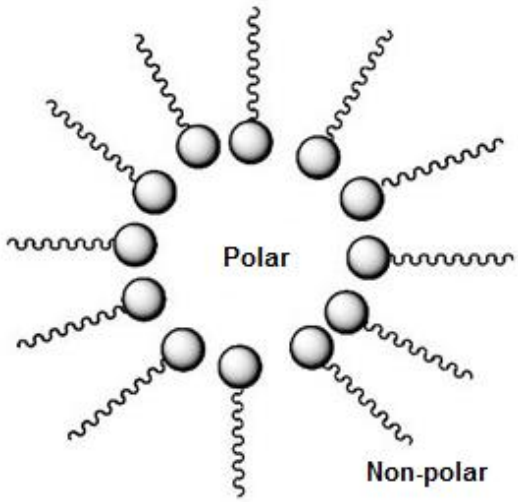


These fatty acids in small numbers form micelles which produce the suds that clean our skin because of the polar head and non-polar tail.

Name:_____
Date:_____ Block:_____



(a)



(b)

However, certain types of fats contribute specific properties in soap making. For example, most Saturated Fats are considered unhealthy and are solid at room temperature giving it a good structure but not a good lather. Unsaturated fats tend to produce a good amount of suds but can be too oily and make soft bars of soap that fall apart.

Objective:

Make a bar of soap that produces suds (micelles) and has a good structure (not soft).

Pre-Lab:

Use the following charts to plan your combination of oils and fats that you would like to use to make your soap. You can make a bar of soap that is made of just fat (or oil) if you wish, just be sure to adjust your ratios accordingly.

Example: Let's say you want to make a 50g bar of soap made from lard with an excess fat of 5%. Intersecting the Lard row with the 5% column, you find the number 0.132. Multiply the 50g by 0.132 which will give you 6.6g of NaOH you will need to measure out. To figure out how much water to dissolve the NaOH in, multiply 50g by 0.38 which will be 19g of water.

Name:_____
Date:_____ Block:_____

Saturated Fats

Animal Fat	0%	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Goat	0.138	0.137	0.136	0.136	0.133	0.131	0.130	0.129	0.127	0.126	0.125
Lanolin	0.075	0.074	0.073	0.073	0.072	0.071	0.070	0.070	0.069	0.068	0.067
Lard	**0.139**	**0.137**	**0.136**	**0.135**	**0.133**	**0.132**	**0.130**	**0.129**	**0.128**	**0.126**	**0.125**
Mutton	0.138	0.137	0.136	0.134	0.133	0.131	0.130	0.129	0.127	0.126	0.125
Tallow	0.140	0.139	0.138	0.136	0.135	0.133	0.132	0.131	0.129	0.128	0.126

Unsaturated Fats

Vegetable Fat	0%	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Canola Oil	0.137	0.136	0.134	0.133	0.131	0.130	0.129	0.127	0.126	0.125	0.123
Caster Oil	0.129	0.127	0.126	0.125	0.123	0.122	0.121	0.120	0.118	0.117	0.116
Coconut	0.184	0.182	0.180	0.178	0.177	0.175	0.173	0.171	0.169	0.167	0.166
Corn Oil	0.136	0.134	0.133	0.131	0.130	0.129	0.127	0.126	0.125	0.123	0.122
Cottonseed	0.138	0.137	0.136	0.134	0.133	0.131	0.130	0.129	0.127	0.126	0.125
Olive Oil	**0.136**	**0.134**	**0.133**	**0.131**	**0.130**	**0.129**	**0.127**	**0.126**	**0.125**	**0.123**	**0.122**
Palm Oil	0.142	0.141	0.139	0.138	0.136	0.135	0.133	0.132	0.131	0.129	0.128
Peanut Oil	0.136	0.134	0.133	0.131	0.130	0.129	0.127	0.126	0.125	0.123	0.122
Safflower	0.136	0.134	0.133	0.131	0.130	0.129	0.127	0.126	0.125	0.123	0.122
Soybean	0.136	0.134	0.133	0.131	0.130	0.129	0.127	0.126	0.125	0.123	0.122
Sunflower	0.137	0.135	0.134	0.132	0.131	0.130	0.128	0.127	0.126	0.124	0.123

Note: It is highly recommended to use 5% and greater for beginners to ensure there is not any excess NaOH in the soap. We want to keep the skin on the body;)

Data:

	Saturated		Unsaturated		Total
a) Pick your ratio of fats:	_____	+	_____	=	50g
b) Pick your % of excess fat:	_____		_____		
c) Chart value:	_____		_____		
d) NaOH needed [Multiply (a) by (c)]:	_____ g		_____g	=	_____g
e) Water needed: [Multiply TOTAL mass from (a) by 0.38]			_____g		

Procedure:

1. Set up a ring stand and Bunsen burner.
2. Measure out the amount of water needed and place into a 400mL beaker.

Name:_____
Date:_____ Block:_____

3. Measure out the total number of grams of NaOH and place into the same 400mL beaker. (WARNING: Solid NaOH is highly basic. Use caution and wear gloves. Watch out for the residue it leaves.)
4. Stir solution until all NaOH is dissolved. (WARNING: As solid NaOH dissolves it releases energy which can heat up the solution.)
5. Measure out your ratio of oils and place into a separate 400mL beaker.
6. Begin heating the beaker with the oil solution in it. Keep it within the range of 37°C to 43°C (100°F to 110°F).
7. Once the oil is within the targeted range, add the dissolved NaOH solution to the oil and begin stirring! (If NaOH has become room temperature, carefully heat the solution back to 37°C.)
8. Take turns stirring and heating. Both must be done simultaneously for 30 minutes for saponification to properly occur. (WARNING: Do not leave Bunsen burner under the stand while heating. The oil will heat up really fast so remove from heat before it reaches 37°C.)
9. After 30 minutes, the soap should be thick. Let it cool to below 37°C before stirring in 3 to 5 drops of desired scented oils.
10. Pour into molds and wait 2 to 4 weeks to cure.

Post-Lab

11. After soap has cured, test it out by washing your hands. If you are worried that the soap did not properly cure then you may wear gloves as you test it out.

Questions:

1. Did you use more saturated, unsaturated fat or equal amounts?

2. Did your soap properly cure? (How tough is it? How does it compare to a store bought bar of soap?)

3. Did your soap lather up properly? (Was it too greasy? How does it compare to a store bought bar of soap?)

4. If you could do this lab again, what new ratio would you try out to improve your bar of soap? Would you use something other than Lard and Olive Oil? Explain.