VI) Results:

During the first procedure I was able to synthesize .733 g of margarine. In my second procedure when I tried to cool the product down, nothing solidified even after I put it in the ice for quite a while. But the margarine I made was absolutely paper white and I was pretty proud of it.

VII) In this lab I was able to use a Palladium on Carbon catalyst to partially hydrogenate olive oil which then produced margarine as a result. When I was aspirating my product the first time, I had a problem of flashing. I think it was because I got some extra water in there. I'm not sure where I got it but I think the H_2O boiling off caused the flashing. The second product didn't solidify at all so I'm not sure if I did anything wrong. I don't think I did because it's the cyclohexene that makes the olive oil into margarine, not cyclohexane. Another thing from this lab is I suggested putting a piece of filter paper on top of the hirsch funnel to prevent the Pd-on-C from blackening the hirsch disk. It worked great! the time I did it, there was no blackness on the disk at all. The second time there was a little but very little at that. I loved this lab. It probably has been my favorite so far.

VIII)

Questions: 1) Cyclohexene donates hydrogen to the olive oil and as a result turns into benzene.

2) Well this explains my question in the results, but, it is because while cyclohexene readily donates hydrogens to olive oil, the cyclohexane does not. This is also why it becomes solid at room temperature, there is more molecules packed in a small space.

VII. Results

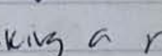
In this experiment, I began with .80g of olive oil and was able to end with 1.05g of margarine after the addition of cyclohexene. Because I ended with more than the .80g I started with, I am guessing that I did not possibly get the water or cyclohexene out completely, resulting ~~x~~ in more. 131.25% recovery

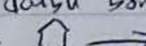
In the second round of this experiment I used cyclohexane instead of cyclohexene. Using .808g of olive oil, I was able to synthesize .92g of liquid product. Once again, it is very possible that I didn't evaporate water or get the cyclohexane completely out.

The two products obtained from this experiment were quite different. Round 1 was thick + looked like margarine or Crisco. Round 2's product was a gray liquid + remained in a liquid state even after cooling, unlike Round 1. 113.86% recovery

VIII. Conclusion

In this lab we compared cyclohexene and cyclohexane. After the experiment it was very visible that when added to olive oil, the two substances create two very different products.

When  was used, the product of the experiment was solid + white, this reaction is  + $2H_2$. Cyclohexene is a proton donor. - therefore making a new product (the Crisco looking stuff).

When  was used, the product was grey liquid.  has no double bonds so it can't donate any hydrogens. The reaction is . The product is basically identical to the initial reactant.

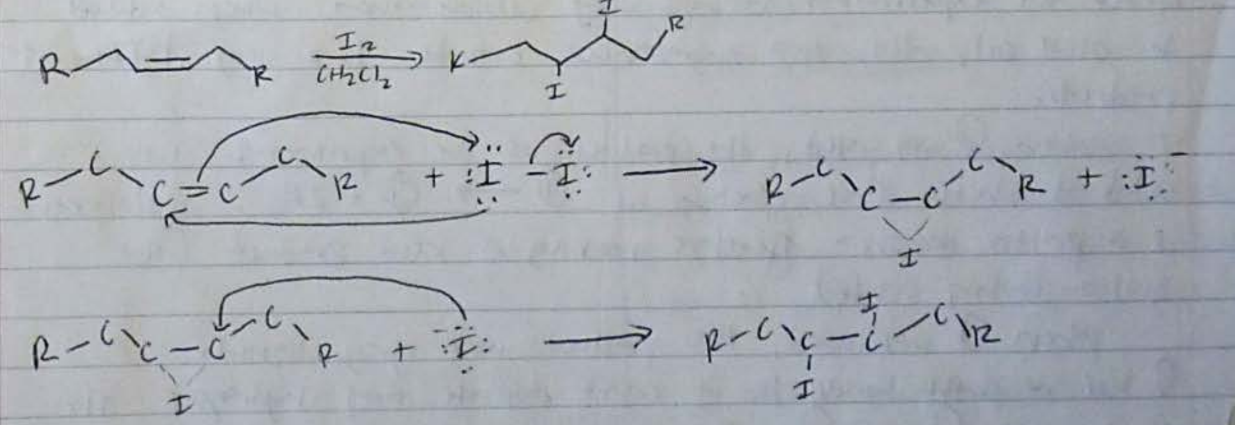
This lab amazed me to say the least! It is insane how the difference in a double bond or not can create a solid product or a liquid one.

Creating the margarine product made me feel quite accomplished. I understood the lab & the molecular & chemical reactions / processes that were occuring. I felt very accomplished in this lab and enjoyed it a lot!

IX. Questions

1) The role of cyclohexene in this lab was to act as an hydrogen donor. The double bond in cyclohexene allows this to happen. Cyclohexene was converted into benzene.

2) The final products from part A and B differ because in part A cyclohexene was used and in part B cyclohexane was used. Cyclohexene has a double bond so its able to donate hydrogens. However, cyclohexane has no double bonds so it can't donate H^+ very easily. In part A, a H transfer took place & in part B it did not take place

3) 

VIII Conclusions

Ⓐ I also enjoy doing the macroscales of products, though the setting up procedure takes some time actually seeing the experiment and transfering product is really interesting.

Ⓑ This step is interesting to see the difference between cyclohexane to cyclohexene. Even though there was not much of a difference seen yet there is an anticipation of what is coming and where a huge difference, if any will be seen.

Ⓒ The purification steps are always interesting because you are taking out substances that don't make a pure product to get a close to pure product. Here there was a difference between the cyclohexene mixed solution, which began as a yellowish clear color liquid and after the product was cooled it was a solid grey/white color, as apposed to cyclohexane, which began as a black/clear colored liquid and after being cooled it stayed a black clear colored liquid.

All in all this lab was very interesting to see the difference between two solvents and being able to make margarine from olive oil.

VII Results

Cyclohexene - 32.610 g side arm flask with solid product
- 31.806g side arm flask with boiling stone
.804g product - Solid

Cyclohexane - 33.261g side arm flask with liquid product
- 31.803g side arm flask with boiling stone
1.458g product - liquid

Qualitatively, these two products differed in the sense that the first, made with cyclohexene, was solid (margarine) and had a yellow color. The second product, made with cyclohexane, was liquid, and did not solidify when vaccuumed. It remained a clear, colorless liquid while the other product solidified to make margarine

VIII Conclusion

From this experiment it can be concluded that two seemingly insignificant hydrogens can make a very large difference in chemistry. For this experiment, using cyclohexene (C₆H₁₀) renders a useful, daily used substance through a certain procedure. Using cyclohexane and the same procedure, a completely different product was rendered.

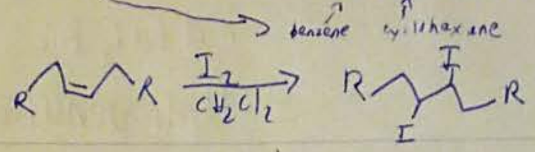
This experiment was a great example of catalytic hydrogenation and lets us see the reaction that we understand the mechanism for. Using palladium on carbon as a catalyst has essentially the same effect as pumping the reaction full of hydrogen, but the catalyst is used as a much more manageable way to carry out the experiments.

Cyclohexane does not have a double bond so it did not want to give up hydrogens.

① role of cyclohexene, into what molecule is cyclohexene transformed?

② why do the final products from Parts A & B differ? → benzene, cyclohexane

③ reaction mechanism

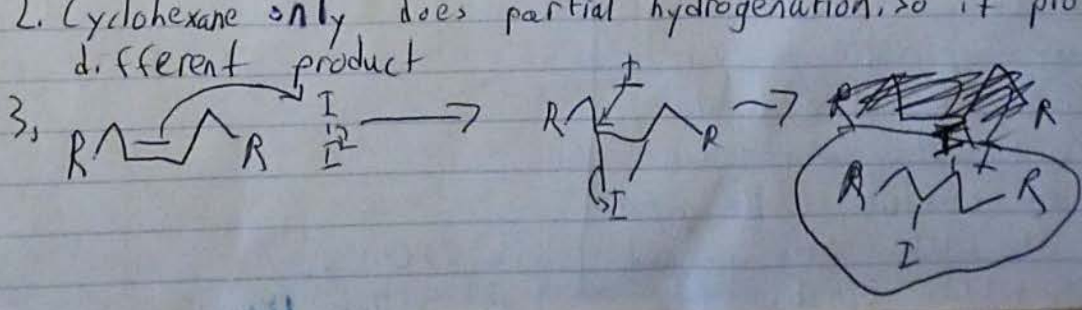


4. Rinse the reaction tub, filter with a few drops of hexane, and evaporate to dryness.	
5. Heat the filter flasks under vacuum.	dark brown crystals light yellow
6. Cool on ice.	37.937 g. 37.045 g.

Results: When using cyclohexene, I started out with ~~0.804~~ 3.356 g. of ~~olive oil~~. After hydrogenation and purification, I ended with 1.157 g. solution of glycerol tristearate. When using cyclohexane, I began with 3.446 g. I ended with 0.265 g.

Conclusion: In this lab I was able to understand that cyclohexene is a better hydrogen donor than cyclohexane. I was also able to understand why this is.

Questions:

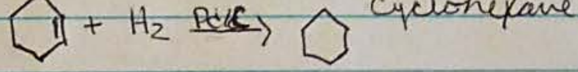
1. In this experiment cyclohexene acts as a hydrogen donor. Cyclohexene is transformed into cyclohexyne.
2. Cyclohexane only does partial hydrogenation. So it produces a different product
3. 

Conclusion: I found this experiment to be fun & exciting. It was long but interesting lab. I was able to make my product even though I ran into problems with my filter many times. I learned a lot & gained knowledge about margin.

Results: I lost some product after my filter was not working correctly but still was able to get a small amount of product from each my solid & liquid product. I got .75g of solid product and .56g liquid product.

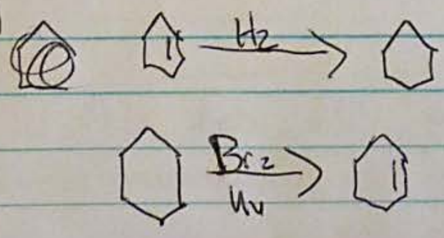
Questions:

1) H_2 absorbs to a catalyst and the binding of hydrogen to alkene weakens H-H bond.

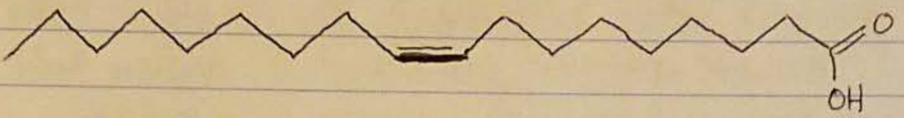


2) One we added heat and one we cooled

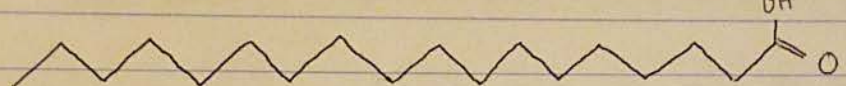
3)



Results:



FW: 282.52g



FW: 284.54g

$$.84\,g \cdot \frac{1\,mol}{282.52\,g} \cdot \frac{1\,mol}{1\,mol} \cdot \frac{284.54\,g}{1\,mol} = .846\,g$$

The recovered mass of margarine was .792 grams.
The theoretical mass was .846 g, so the percent recovery was 89.0%.

The recovered mass of olive oil was .620 grams.
Ther theoretical mass was .84 g, so the percent recovery was 73.8%.

Conclusion:

The synthesis of margarine occured by hydrogenating olive oil. The double bond formed a single bond when two hydrogen atoms were added. We used a catalyst of palladium and a hydrogen donor of cyclohexene which became benzene after the hydrogens were displaced. This reaction was repeated with cyclohexane as a replacement for cyclohexene, but the product was olive oil because the hydrogens didn't attach to the palladium catalyst as cyclohexene could. The product from the reaction from cyclohexenes was a solid (more packing ability) compared to the second product which had no change and therefore was still a liquid. My results showed a suprisingly high percent of recovered mass. This maybe because this was a simple straightforward lab and not many transfers or estimations (or underestimations) of reactants occured.

VI. Results

This lab went smoothly, the two resulting products were produced w/ relative ease once a few bumps were straitened out with the filter leaving a Grey Goo of margarine (due to discoloration from Carbon Pd) and a clear viscous liquid that resembled the viscosity of the original Olive oil.

1st Part: Grey Goo

Olive/TW = 33.37g
BSt = .025g
33.395g

Final product = 34.05g
− 33.395g
.66g Margarine

$(.66/.8) \times 100 = 82.5\%$

2nd Part:

Olive/TW = 33.88g
BSt = .056g
33.94g

Final Product = 34.02g
−33.94g
.08g

$(.08/.8) \times 100 = 10\%$

VII. Conclusion:

The lab itself was fairly easy, having to do it twice made it better to understand & easier to do the second time.

It was cool to use the products

☺

that the blue group mainly made in the previous lab to assist in the transformation of the olive oil into margarine. I was successful in the lab having a 82.5% yield of margarine from the original olive oil but encountered a few errors along the way. Having to redo new filter paper for my filter, either the seal was not correct or it was my error but with each try of the parts of the experiment I had to filter the Carbon Pd from the solutions 3 times each. Still this gave me a Grey Goo like margarine that didn't resemble the normal white or even yellow of the other classmates which was frustrating. However I enjoy lab time & I enjoy learning from the mistakes made leaving me eager to get better next week.

VIII Questions.

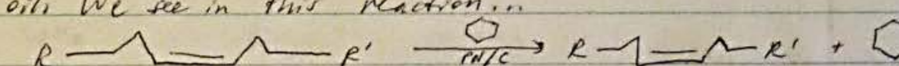
1) Cyclohexene allows olive oil to lose its double bond and cyclohexene turns into a benzene ring

VII) Results:

For Part A, which used cyclohexene, I got a product of .611 g. It did turn to a solid when I evaporated and cooled it which is what was supposed to happen. For Part B, which used cyclohexane, I got .539 g of product but it never solidified. We did not have to calculate a percent yield for this experiment, but just looking at my numbers my retention of product from reactants was far better than it has been. A was just over 75% and B was just under 70%. Part A still had a very yellow color.

VIII) Conclusion:

Part A was the successful hydrogenation of olive oil using cyclohexene. Part B was unsuccessful because the cyclohexane failed to hydrogenate the olive oil. We see in this reaction...



that no hydrogenation occurs. The cyclohexane that goes into the reaction comes out as a product. The hydrogens that are supposed to hydrogenate the oil simply rehydrogenate the cyclohexanes. Cyclohexene, however, gives up two hydrogens and forms the stable molecule benzene in this reaction. Considering this makes it clear why Part A resulted in a solid and Part B remained a liquid. My Part A was more yellow than it was supposed to be. My reflux did not give me as pure a product as I would have liked. I had a little trouble with the reflux in Part A. It got too hot and the bubbler started popping up into the condenser. I don't know if that would have caused it but it required attention.

IV.

IX) Questions:

1) Cyclohexene attaches to the Pd/C and dehydrates allowing the olive oil to be hydrogenated. It forms the stable molecule benzene and readily gives up the hydrogens in this experiment. This reaction is energetically favorable for cyclohexene so as I showed above gives the desired product unlike cyclohexane.

2) The final products of part A and B differ because in part A you form a solid with a melting point above 50°C. This occurs because cyclohexene gives up hydrogens to turn an unsaturated molecule into a saturated one. Part B

Mason Koeritz

VII In part A of the experiment, I reacted the olive oil with cyclohexene and the Pd on Carbon catalyst. The end product was a solid, grey mass that behaved like I would expect margarine would. I was able to obtain 0.802g of olive oil margarine from 0.835g olive oil. Part B of the experiment used cyclohexane instead of cyclohexene. The end product was a grey liquid that behaved much like the starting olive oil product, probably because it still was plain olive oil with the Pd on Carbon catalyst mixed in.

VIII After this experiment, I have a better understanding of how hydrogenation is done. The Cyclohexene acted as a hydrogen donor, forming two moles of H_2 and benzene. The palladium on carbon acted as a catalyst to make the reaction proceed. Since I want to go into food science, it is really interesting to know how margarine is made, although ours was mostly trans fats.

IX. ① What is the role of cyclohexene in this experiment? Into what molecule is cyclohexene ultimately transformed?
- Cyclohexene acts as a hydrogen donor. Two more double bonds are formed, converting cyclohexene into a benzene ring. In the process, cyclohexene releases 4 of its hydrogen atoms, which are transferred to the olive oil, hydrogenating it.

Results: In the first part of this experiment we used cyclohexene to hydrogenate olive oil. I believe my experiment was a success as I managed to recover .801g of what was a greyish oily solid, otherwise known as margerine. This was the expected result for this part of the experiment. In the second part of the experiment we attempted to hydrogenate olive oil with cyclohexane. As expected, the final product was .646g of a greyish viscous liquid. It was unable to solidify like in part 1 because cyclohexane is unable to donate a hydrogen like cyclohexene.

Conclusion: In this experiment, olive oil was put through the process of hydrogenation to form what is essentially margerine. The experiment was a success all round as the expected & desired results were achieved. In part one, an oily solid was synthesized due to the chemical properties of cyclohexene, it is very easy for cyclohexene to donate hydrogens to form benzene. These hydrogens then hydrogenated the olive oil and changed it to something completely different; the magic of organic chemistry. The same cannot be said for part two of the experiment. When hydrogenation was attempted.

using cyclohexane insted of cyklohexene, the results were drastically different. No panic though, this was expected; this is good! Due to the chemical properties of cyclohexane, the likelyhood of it donating hydrogens to form benzene is very low. As a result of this, minimal changes occour with the olive oil, it remains in a similar state in the product as it did in the reactant, although slightly more viscous. All in all, what was expected & desired was successfully achieved!

Questions:

#1 The role of cyclohexene is to donate hydrogens to essentially hydrogenate the olive oil & form two more double bonds to transform into benzene.

#2. Product 1 was able to be solidified to margerine unlike product 2 which was not. This was due to cyclohexene being better (more freely) at donating hydrogens for hydrogenation than cyclohexane. The reaction, under the same conditions has very different products.

#3 NEXT PAGE →