MAKERPORTFOLIO

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Hi! My name is Ayesha Qadri and I am a current high school science teacher. I completed my apprentice teaching semester at Austin High School in Spring 2018 where I taught two regular chemistry classes. My certification area is Composite Science 7-12, which includes biology, chemistry, physics, and earth sciences. I have completed the certification requirements through the UTeach program at UT Austin! I graduated with a Bachelor of Science and Arts in Biology in May 2018. To learn more about my student teaching experience, you can visit my student teacher website.

I am proud to say that I currently teach AP/IB Environmental Science this upcoming 2020-2021 school year at Lamar High!! Go Vikings!!

I plan on adding my future maker lessons to this website! Stay tuned!

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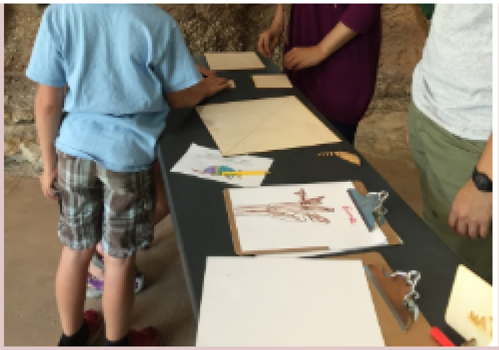

MORE ABOUT ME & MAKING!

I was born and raised in Chicago, Illinois and grew up in a tight-knit community. When I turned 8, my family and I moved to Texas. Growing up, I have always wanted to become a teacher and got some classroom experience as a PALS mentor in high school.

After deciding to pursue a career in education, I decided to join the UTeach program at UT Austin. After interning with Mathhappens as part of the UTeach internship program for a year, I realized my passion for making and creativity in the

rogram and as a result,

MAKING IS A LASTING JOURNEY

I plan on using this site to share the making I do during my personal time and making that goes on in my classrooms!

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I am excited to say that I have fulfilled the UTeach Maker program requirements and am officially a UTeach Maker Teaching fellow!

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Making is practicing and building upon your knowledge by taking your curiosity a step further and reinforcing it into something tangible. Making is what humans can do best, and that is the legacy we leave behind.

Summer Reading Book Club

In summer 2017, both old and continuing makers participated in a book club reading *Meaningful Making*, a resource to learn about issues prevalent in maker education, projects put on by teachers and makers around the world, and insight into makerspaces and fab labs. Reading this book really made me think about what making meant to me. I did a lot of making before this, but if I was asked to define making, I would not be able to give a response. However, after reading *Meaningful* *...ng*, I was not only able to define what making meant to me, but also understood the issues of

Week 4 Prompts:

1. **In looking at the various projects, what ideas do you have for they types of learning activities you might ask students to engage in during your own Maker lesson?**

1. One thing I took away from these articles is that the making aspect of these lessons is so challenging that students think it is hard, but also fun. I liked how in the article "Exploring Circuits: Make Stuff Light Up and Move," the teachers wanted the students to brainstorm first and then materials were provided, similar to normal classroom instructions. However, I think it would be cool if I was to ask students to make anything they would like to make. After that, I would give them a set of materials to choose from and with that, students would have to adjust their ideas to accommodate for the materials provided and to make it science themed. I think this allows for the students' imagination to never end!

2. Select one of the projects to explore in depth and consider ways that it might plug into the content standards for your discipline. This might include state standard such as the TEKS (Links to an external site.)Links to an external site, or national standards such as NGSS (Links to an external site.)Links to an external site. and standards ...ite.)Links to an external site.

(5) Scientific processes. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:

(D) evaluate the impact of scientific research on society and the environment;

(E) evaluate models according to their limitations in representing biological objects or events; and

(F) research and describe the history of biology and contributions of scientists.

Week 6 Prompts:

1. This is our last week so let's open it up. What did you think about this final section or the book as a whole? What were your big take aways? How did this material connect to your own life/interests?

1. This book was a great introduction for people like me who did not know much about making and what tools were out there/are used for making. This final section opened it up to how teachers who had access to makerspaces and had their students do a making lesson were able to solve problems, start from scratch, make something for themselves, their classroom, and/or schools. Museums also have implemented makerspaces and began to offer the public more than just the exhibits. From this, some of my big take aways are that making can be anything, you just have to think of something you want to make and figure out how it can be done. Second, there are plenty of resources, such as books, videos, real people that can provide help and offer ideas to help you with your maker project. Third, making always involves something that you are passionate about, something that you and other can benefit from, and something that can always be adjusted to be better than what it already is! This is how it has connected with other interests; it's a work in progress.

real world equipped with the necessary tools needed to succeed. The maker education movement emphasizes design thinking and media literacy and focuses on students taking control of their time in the classroom through inquiry based learning. Students deal with real-world problems and engage in project-based activities not as an end product, but as the vehicle for learning. Students are given the opportunity to work in groups, establish roles within those groups, become comfortable with multi-disciplinary problems, learn and master different technologies, and convey their knowledge to their community. This allows students more agency and the opportunity to impress the teacher with their talents and strengths. I believe if teachers are able to incorporate maker ideas and practices within the classroom, they are preparing their students to go out in the world and be confident in what they can do to bring about changes that are necessary in society. Maker education is not an alternative way of teaching; I believe it is the way we as educators should educate. It is difficult, but one of the most important aspects of maker education is the idea of collaboration. If educators work together to help students become active learners, then teaching students in a constructive manner becomes much easier.

EQUITY, DIVERSITY, & ACCESS IN MAKING

It would be grand if every student had access to a makerspace, wouldn't it? However, we all know that unfortunately this is far from the truth. In maker education, students of all backgrounds do not have equal access to the tools necessary to make. For an example, the maker lesson I implemented in my chemistry class had students design a soap dish for the soap bar they had made.

http://sde.ok.gov/sde/equity-plan

experience with these challenges really made me think about the disparity and inequality facing making in the classroom.

Personal Definition of Making:

To me, making means transforming an idea or a thought into reality by producing it and using it to benefit those around you.

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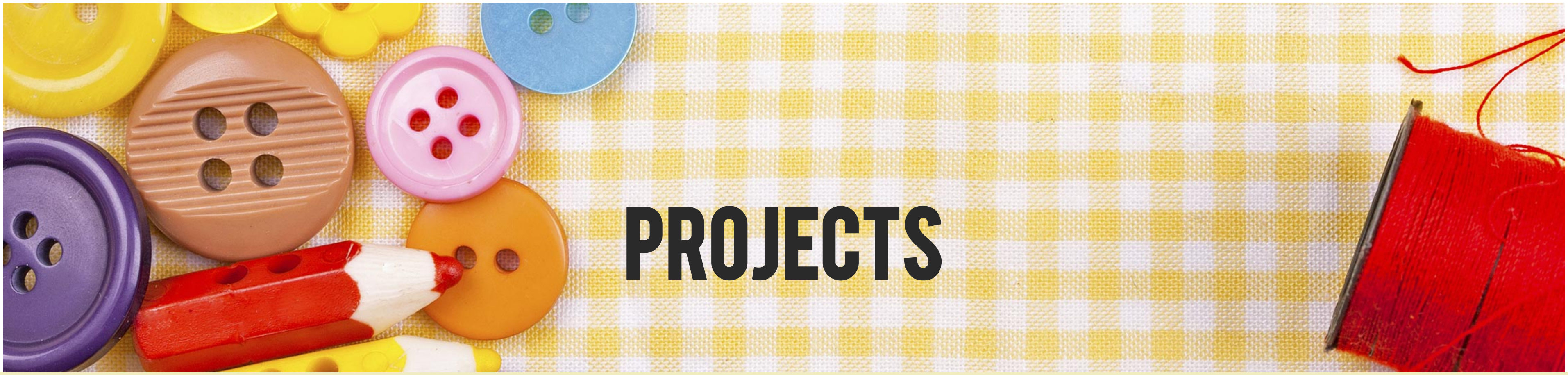
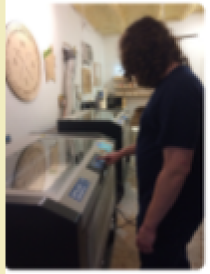
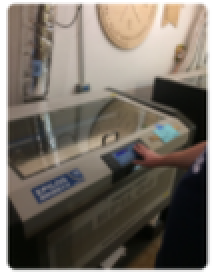
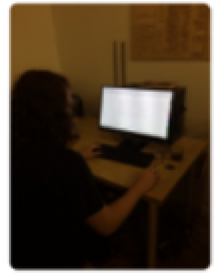


"Vulnerability is the birthplace of innovation, creativity, and change." -Brene Brown

LASERCUTTING







I think I have had the coolest internship ever with the UTeach program!! I interned with MathHappens, a non-profit organization co-founded by Lauren Siegel and her husband, Phil Siegel, for a year.

During this year, I learned how to use a laser cutter and then laser cut many math-based projects, some that I have shared and discussed here! MakeATX, a laser cutting place, was where I cut all the projects. MathHappens had a membership with the owners of the makerspace, which fortunately eliminated any issues of access. Each laser cutting project had its own challenges, the most prevalent one being unable to get the proper size of the design cut and setting the raster and vector speeds correctly the first time. Using this high-power tool has taught me to how to be creative when designing different math tools, accurate at setting the speeds for efficient cutting, patient with the software being used (Corel Draw) and most importantly, understanding that I am not going to get it right the first time. This helped me realize the importance and effectiveness of iterations and re-designing prototypes, something I had to do for every single one of my projects!

There are many issues of equity and access when it comes to laser cutting. MakeATX was the only location where the other interns and I went to cut out our projects! If we were to use another tool to produce our projects, there would have to be a few adjustments and modifications to do so.

was super cool and let us do so! I got to choose the type of cut I wanted on my gem, which made the gem more personal to me. However, if I was to facet another gem, it would be the pear cut on a sapphire gem. The problems I would run into would be getting the materials and equipment for this project, which are very expensive.

Initiation

Completion

The design process included following a set of directions to facet each part of the gem such as the table, crown, girdle, and pavilion. To begin, I was given a quartz gem dopped onto a dop stick with a coating of shellac. I followed the instructions to facet the gem and started faceting the crown main facets. For each cut, it was important to ensure that the index on the faceting machine and the protractor were correct and the facets were of equal size. Four different laps were used during the project. To make the cuts on the gem, a medium lap was used. This basically shaped the gem based on the size and angle I needed. A fine and extra fine lap were used to slightly re-cut parts of the gem, such as the table, and to remove any scratches from the medium lap. Water from the faceting machine is used to help this process. The last task for each part of the gem was to polish it. The polishing lap containing cerium oxide
motionless lap. Polishing the gem was the most difficult part of the project and required a lot
e procedures I followed for the project are below!

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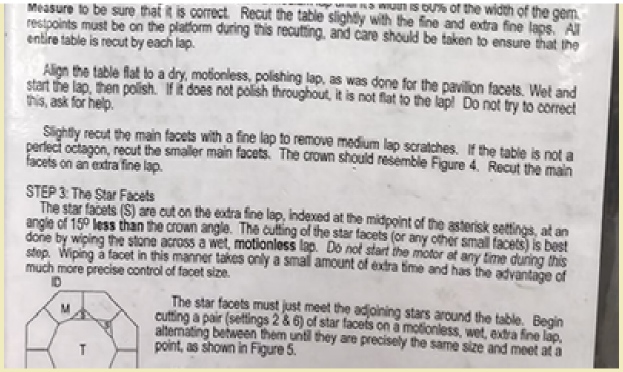
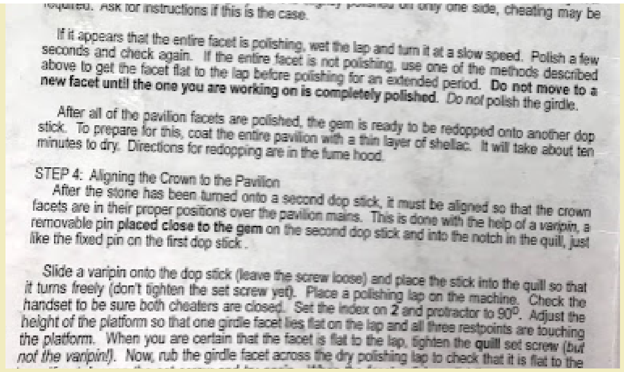

Measure to be sure that it is correct. Recut the table slightly with the fine and extra fine laps. All restpoints must be on the platform during this recutting, and care should be taken to ensure that the entire table is recut by each lap.

Align the table flat to a dry, motionless, polishing lap, as was done for the pavilion facets. Wet and start the lap, then polish. If it does not polish throughout, it is not flat to the lap! Do not try to correct this, ask for help.

Slightly recut the main facets with a fine lap to remove medium lap scratches. If the table is not a perfect octagon, recut the smaller main facets. The crown should resemble Figure 4. Recut the main facets on an extra fine lap.

STEP 3: The Star Facets
The star facets (S) are cut on the extra fine lap, indexed at the midpoint of the asterisk settings, at an angle of 15º **less than** the crown angle. The cutting of the star facets (or any other small facets) is best done by wiping the stone across a wet, **motionless** lap. *Do not start the motor at any time during this step.* Wiping a facet in this manner takes only a small amount of extra time and has the advantage of much more precise control of facet size.

The star facets must just meet the adjoining stars around the table. Begin cutting a pair (settings 2 & 6) of star facets on a motionless, wet, extra fine lap, alternating between them until they are precisely the same size and meet at a point, as shown in Figure 5.

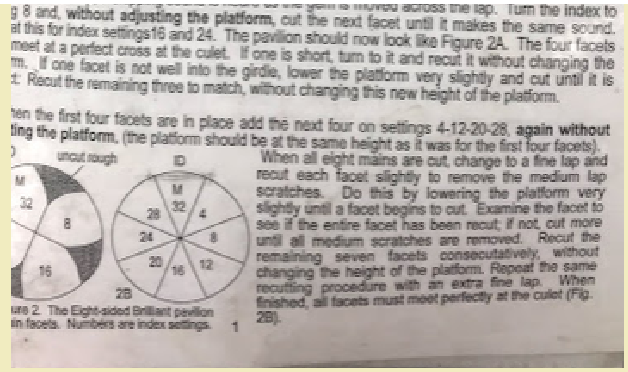

required. Ask for instructions if this is the case.

If it appears that the entire facet is polishing, wet the lap and turn it at a slow speed. Polish a few seconds and check again. If the entire facet is not polishing, use one of the methods described above to get the facet flat to the lap before polishing for an extended period. **Do not move to a new facet until the one you are working on is completely polished.** *Do not* polish the girdle.

After all of the pavilion facets are polished, the gem is ready to be redopped onto another dop stick. To prepare for this, coat the entire pavilion with a thin layer of shellac. It will take about ten minutes to dry. Directions for redopping are in the fume hood.

STEP 4: Aligning the Crown to the Pavilion
After the stone has been turned onto a second dop stick, it must be aligned so that the crown facets are in their proper positions over the pavilion mains. This is done with the help of a varipin, a removable pin **placed close to the gem** on the second dop stick and into the notch in the quill, just like the fixed pin on the first dop stick.

Slide a varipin onto the dop stick (leave the screw loose) and place the stick into the quill so that *it turns freely* (don't tighten the set screw yet). Place a polishing lap on the machine. Check the handset to be sure both cheaters are closed. Set the index on **2** and protractor to 90º. Adjust the *height of the platform* so that one girdle facet lies flat on the lap and all three restpoints are touching *the platform*. When you are certain that the facet is flat to the lap, tighten the **quill** set screw (*but not the varipin!*). Now, rub the girdle facet across the dry polishing lap to check that it is flat to the


8 and, **without adjusting the platform**, cut the next facet until it makes the same sound. ... this for index settings 16 and 24. The pavilion should now look like Figure 2A. The four facets meet at a perfect cross at the culet. If one is short, turn to it and recut it without changing the ... If one facet is not well into the girdle, lower the platform very slightly and cut until it is ... Recut the remaining three to match, without changing this new height of the platform.

...hen the first four facets are in place add the next four on settings 4-12-20-28, **again without** ...ting the platform, (the platform should be at the same height as it was for the first four facets).

When all eight mains are cut, change to a fine lap and recut each facet slightly to remove the medium lap scratches. Do this by lowering the platform very slightly until a facet begins to cut. Examine the facet to see if the entire facet has been recut; if not, cut more until all medium scratches are removed. Recut the remaining seven facets consecutatively, without changing the height of the platform. Repeat the same recutting procedure with an extra fine lap. When finished, all facets must meet perfectly at the culet (Fig. 2B).

...ure 2. The Eight-sided Brilliant pavilion ...in facets. Numbers are index settings. 1

MATHHAPPENS PROJECTS!

The following slideshow shows pictures of some of my work and work of other interns, Lauren, and I all collaborated on to produce. All the math objects were laser cut at MakeATX, except for the stereographic projection!

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MATHHAPPENS BLOG

Feel free to visit MathHappens' blog, a documentation of all the work the non-profit organization accomplishes every month! To see more of what former (including myself) and current interns have accomplished with Lauren Siegel, press the button above:)

MAKER PORTFOLIO

MAKERS...AND MORE MAKERS!!!

THE MAKER COMMUNITY

Having a maker community has helped me in many ways. I have learned so much from my maker mentor, Lauren Siegel, my maker peers, and my UTeach professors involved with making. The maker community has helped me define what making is and motivate me to explore different technologies that I would normally not do. Sharing ideas with others and learning from their designs has really helped me think deeper into how unique making is for each person. Moreover, being a part of the maker cohort with other UTeach makers, attending cohort meetings, learning about makerspacers and what they have to offer, and participating in design

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During my first year with the UTeach maker program, I was interning for a non-profit organization co-founded by my maker mentor, Lauren Siegel. Lauren was working with a high school math teacher in the Austin area to design a math field trip about math related to Alice in Wonderland, which was successfully implemented at the Harry Ransom Center! Two of the teacher's students wanted to come and make a giant sized coin and paper. Lewis Carroll was known to amuse people with his famous coin trick challenge. I met up with the two seniors at MakeATX, a lasercutting workshop, and showed them how to use the laser cutting machine and helped them design their giant-sized coin and paper. Some issues with the design was that the dimensions were off and the coin and paper had to be the correct dimensions in order for the trick to work! After converting units and modifying the design a couple of times, the high schoolers were able to get a giant-sized coin and paper for the coin trick! This was a great way to teach and support high school students in a small maker project with big lessons!

HELIUM BALLOON DESIGN CHALLENGE

This helium balloon airship design challenge took place at the Ann Richard's Makerspace. My maker mentor, Lauren Siegel, peer Payton Crawley, and I were trying to design an airship with tape, helium-filled balloons, string, and toy pieces such as quadcopters. The hardest part was getting the proper buoyancy and balance so that our airship would actually move through the air and stay in the air when propelled to do so. Although our airship design resulted in a product that only last three seconds in the air, I learned a lot from this challenging experience! Doing this challenge in a group brought about more ideas, such as when Lauren decided to use a stereographic projection to ensure our design had a balance. We also got to see other groups and their designs, which included one group that used remote controllers and toy mouse!

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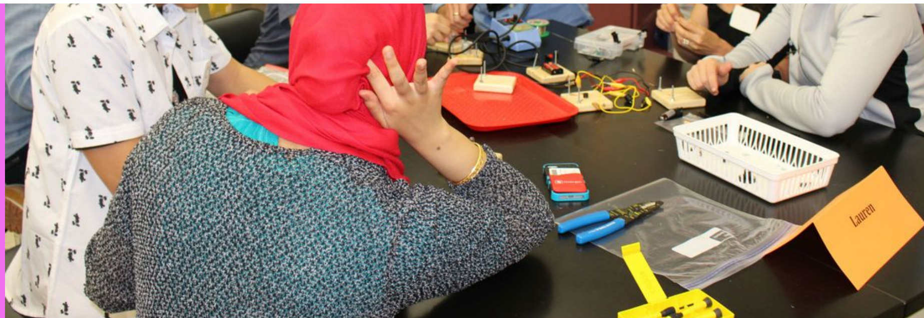
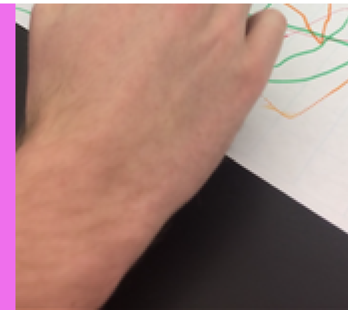


Learning how to solder with my maker group!



Callum and I at a cohort meeting watching our markers go crazy!

MAKING AN INCHWORM USING MICRO BITS

At our last cohort meeting of the semester, makers were challenged to learn how to use micro bits and then design a functioning inchworm. This was a challenge for me, especially because I was not comfortable using the technology. However, after the two hours went by and I brainstormed ideas with my group members and tried things out, we had a semi-functioning inchworm! Our design including using two micro bits, cardboard, and lots of tape!

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UTEACH STEM CONFERENCE 2017

I had the cool opportunity to participate in the UTeach summer conference with MathHappens. We shared two highly successful projects with others, the Austin Nature and Science Center calipers and golden ratio exhibit established by MathHappens and the La Belle field trip (which was a huge success) at the Bob Bullock Museum. We all had lots of fun talking to teachers from around the country and sharing some of our work and reflections of it with those who were passionate about making! Our visitors really liked how MathHappens was able to create a math field trip focusing on nautical mathematics for an exhibit at a history museum.


— Shepard Fairey —

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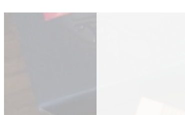
LA BELLE FIELD TRIP



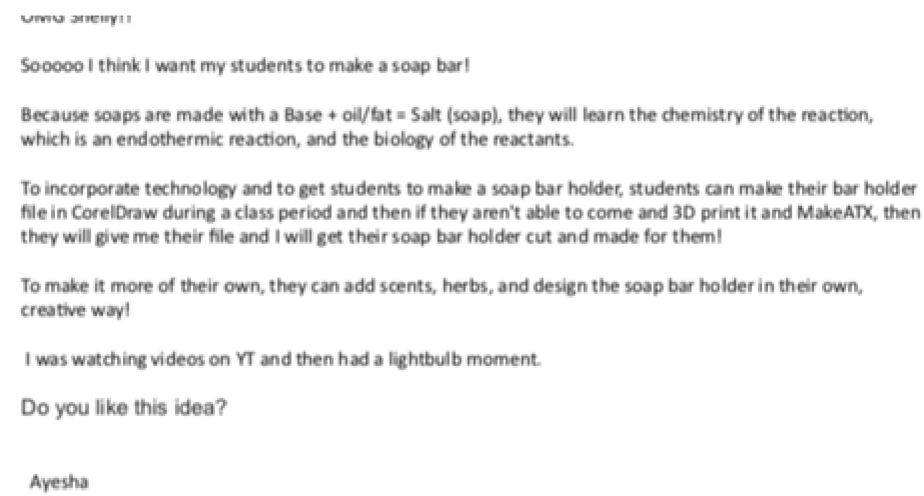
Overview. This La Belle field trip was held in May 2017 at the Bob Bullock Museum. The field trip created for 75 7th graders focused on the navigation tools used the era of the La Belle that were created by mathematicians. This field trip was without doubt a team effort. Each intern during this semester was assigned a project to complete for the field trip. Lauren challenged us to "create activities that would display and explain the navigation instruments

Nocturnal. My share of this field trip was to help design the nocturnal, an instrument used to determine time based on the relative positions of two stars, the big and little dipper. There were many designs, some more confusing than others. It was not until my fourth try that I was able to get the nocturnal we ended up using for the field trip (displayed in the students' hand). Students were challenged to interpret the many markings on the parts of the nocturnal. They had to relate the nocturnal to a display showing the motion of the dippers around the north star (nocturnal is attached to it on the board) and to then connect that to the rotating dials.

Reflection. It I was told that I would be part of a team that put on a math field trip my freshmen year, I would probably laugh for a good five minutes. This is because I did not know about making. The best part of it is that you can learn how to do all these cool things if you are passionate about what you want to do, have the resources, and have others to bounce around ideas. I had to research a lot and read excerpts from math books I never thought I would ever read, but that was another outcome of working on this field trip that really stuck with me. I really appreciated being a part of making this field trip happen and had a blast showing kids how the nocturnal worked!! It was SO FUN!

MAKER LESSON: LET'S MAKE SOME SOAP!

lesson was an introduction to making that came with two critical components: students making a bar of soap and designing a soap dish. The maker project took five days to complete. Day one was the introduction to what making is and maker education. I talked to students about my maker journey and asked students to share things they have made or are making in a class. For day two, students made their first round of soap bars using olive oil. After realizing that olive oil does not harden as fast as needed, day three had students learn from day two and make their second soap bar, this time using coconut oil. Students had the opportunity to add scents, color, and use a mold to make their soap bar personal to them. On day four, students used an online software editor, Method Draw, to modify templates of soap dishes and to create their own design if they were ambitious and determined. At the end of the day, students reflected on what they learned so far in the project and prepared to present and talk about their soap bar and holder for next class. On day five, students participated in a gallery walk in which they presented to other classmates and members of the UTeach community, including a University facilitator, some of the UTeach professors, a former UTeach graduate and maker, and my maker mentor. This allowed students to realize the importance of their hard work, share it with their classmates and members of the larger community, and reflect on it. Students then turned in a foldable documenting


OMG Shelly!!

Sooooo I think I want my students to make a soap bar!

Because soaps are made with a Base + oil/fat = Salt (soap), they will learn the chemistry of the reaction, which is an endothermic reaction, and the biology of the reactants.

To incorporate technology and to get students to make a soap bar holder, students can make their bar holder file in CorelDraw during a class period and then if they aren't able to come and 3D print it and MakeATX, then they will give me their file and I will get their soap bar holder cut and made for them!

To make it more of their own, they can add scents, herbs, and design the soap bar holder in their own, creative way!

I was watching videos on YT and then had a lightbulb moment.

Do you like this idea?

Ayesha

they learned and how it can be used to help them with other projects/ideas in

sitting in a study room on campus watching cool chemistry experiments when another video on the side about saponification popped up and caught my eyes. I then clicked on it and watched a couple more after I realized that I totally wanted my students to make soap. Moreover, in order for students to have something to hold their soap, I wanted students to design their own soap dish. I then contacted Shelly Rodriguez and Jason Harron, Uteach Maker program coordinators and spoke with them about my scattered ideas. Shelly, Jason, and I then met one morning at Kerbey Lane during which I communicated my ideas, got feedback on my ideas for my soap lesson, and had a rough, multi-day overview of my project. I was debating whether or not the project would be four or five days. I initially wanted each student to laser cut their soap dish. The school I student taught at did not have a laser cutting machine. Because of limited access to materials and equity issues, I decided I would cut 42 students' soap dish design on my own and bring it back to the school. Realizing that this would be infeasible due to time constraints, I gave my students the option that if they were very interested, they can come to UT and laser cut their soap dish design. Also, after incorporating a day for the gallery walk where students presented their work and shared their project with others, the project was planned to take five days.

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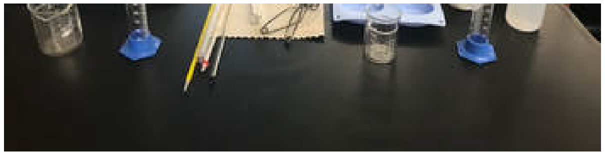

Prep: Preparing all the lab stations to make sure each student has each equipment needed.

Prep: Heating up the coconut oil for students.

Students' first soap bar using olive oil (notice that some of them did not harden).

This students' second soap bar included three different colors and the Macintosh apple scent!

A students' work using one of the molds provided!

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I ordered different colors for students to add to their soap and make it personal. Colorants were ordered from Brambleberry.com. Students also used eco glitter ordered from the website. Students were so happy to play with glitter and mix it into their soap.

The most popular fragrance oil was the Macintosh Apple scent from Brambleberry.com

A students' soap bar made of olive oil that solidified! The soap was taken out of the mold after a week.

Reflection

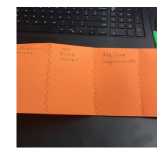
This project was my first maker lesson project I ever implemented and I think for a first, it went well. Students were interested from day one when asked my their personal making experiences in their life or in the other classes. Students then made soap for two whole class periods and learned from day of soap making that olive oil was not such a good oil to use for making soap. For day three and the second round of soap making, every students except two chose to make their second soap using coconut oil. The realized that coconut oil compared to olive oil thickens faster, which will minimize the time it will take to heat their oil and lye-water solution, which means a faster soap making process as a whole. Students then liked the ideas that I wanted for them to make the soap more personal to them and enjoyed the variety of colors and fragrance [illegible] ough the room stinked for a week, it did for a good reason. Students then had the

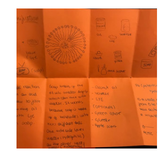
Revisions

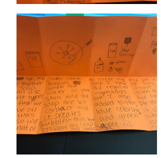
Making the soap dish design with the software was very structured and was a bit less creative. If students were give more time to work with the software, I would not have had students use the templates.Using the templates helped students give a background of the software and the designs that could be made, which destroys the personal aspect of it as well as the creativity. However, students were able to modify the design, add images and colors, which helped make it more meaningful to them. Of course there were also other areas where I could and would improve on for next time. For future implementations, I would have students bring something in that they made and share it with the class on day one of the project when we talked about making. I would also do this project after we discussed acids and bases. Many students were confused over the difference between the two, which became evident during their presentations. The soap making aspect of the project went well, but I would change it to where students had to use more than one oil the second round and determine the difference in their soap properties after both days of soap making. Students would still be given the opportunity to use the same additives and maybe even be able to bring some of their own additives if they wished! For the gallery walk, I would invite other science teachers to come and have a look around at my students' work. This would allow teachers to talk to students they don't have as students and for students to share their project with another science teacher, someone they may have or have had or heard a lot of cool things about in the past!

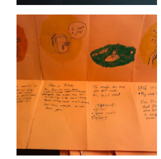
All the lesson materials I used and created can be viewed and downloaded at the button below!

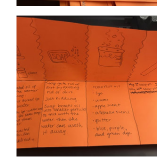
experience, and their research on pH! Students presented this information to me in a foldable in which students had to draw what each flap represented in the inside and write about it on the bottom flap. I got to see what my students learned, what they did not quite understand (very high pH and very low pH are both dangerous), and the artistic abilities of my students! I noticed a lot of doodling and art on my students' former assignments. To make this project more meaningful to those students, I had every students draw me what each flap meant. I also walked around during the gallery walk and talked to some students about their soap project. I learned a lot about what to modify for future implementations and more about my students!



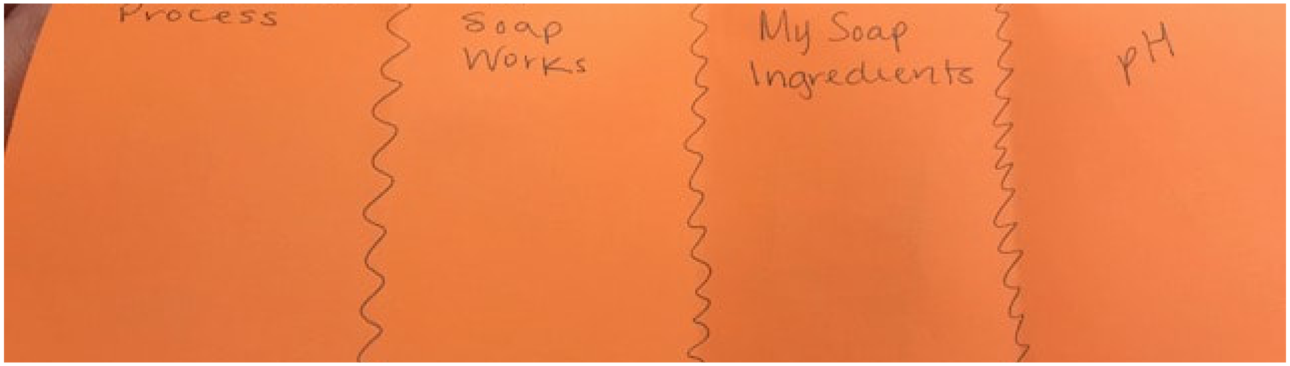






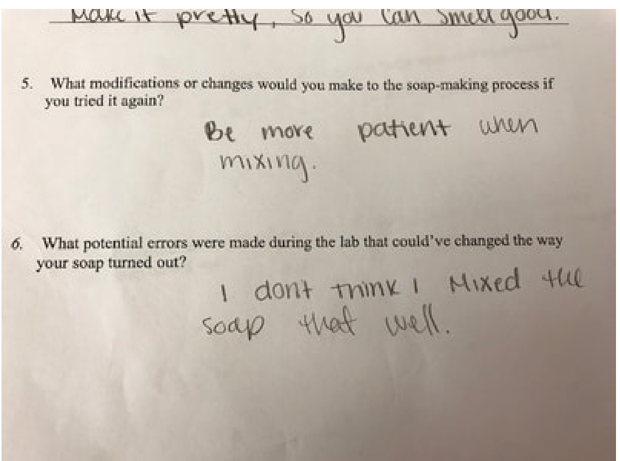


MAKER PORTFOLIO



STUDENT REFLECTIONS

Students were asked to reflect on they first soap bar to better their second bar of soap they would be making the next day. Students also had to reflect on their soap dish design and talk about the challenges that came with designing that.

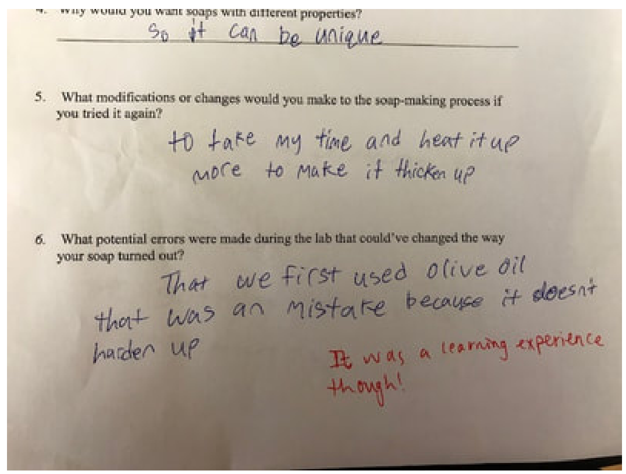

Make it pretty, so you can smell good.

5. What modifications or changes would you make to the soap-making process if you tried it again?

Be more patient when mixing.

6. What potential errors were made during the lab that could've changed the way your soap turned out?

I don't think I mixed the soap that well.


4. Why would you want soaps with different properties?

So it can be unique

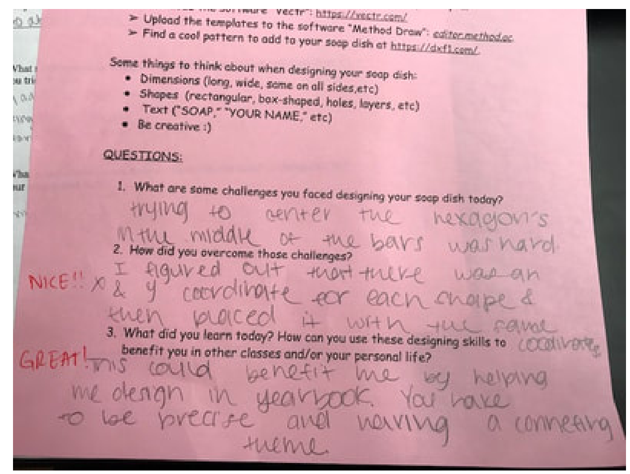
5. What modifications or changes would you make to the soap-making process if you tried it again?

to take my time and heat it up more to make it thicken up

6. What potential errors were made during the lab that could've changed the way your soap turned out?

That we first used olive oil that was an mistake because it doesn't harden up

It was a learning experience though!


➢ Upload the templates to the software "Method Draw": editor.method.ac
➢ Find a cool pattern to add to your soap dish at https://dxf1.com/

Some things to think about when designing your soap dish:
- Dimensions (long, wide, same on all sides, etc)
- Shapes (rectangular, box-shaped, holes, layers, etc)
- Text ("SOAP," "YOUR NAME," etc)
- Be creative :)

QUESTIONS:

1. What are some challenges you faced designing your soap dish today?

trying to center the hexagon's in the middle of the bars was hard

2. How did you overcome those challenges?

NICE!! I figured out that there was an x & y coordinate for each shape & then placed it with the same coordinate

3. What did you learn today? How can you use these designing skills to benefit you in other classes and/or your personal life?

GREAT! This could benefit me by helping me design in yearbook. You have to be precise and having a connecting theme.

Invent to Learn
Meaningful Making

Name: ____ Period: ______________

Making Your Own Soap-Part 1

Introduction

The process of making soap is called *saponification* and is one of the earliest examples of using organic chemistry to produce a man-made product. Saponification involves the reaction of natural fats and oils, called *triglycerides* (see figure 1), with sodium hydroxide (NaOH).

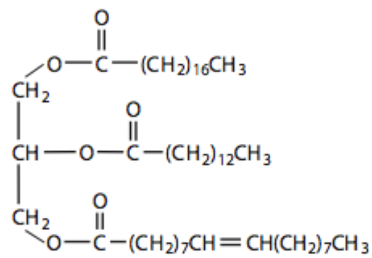
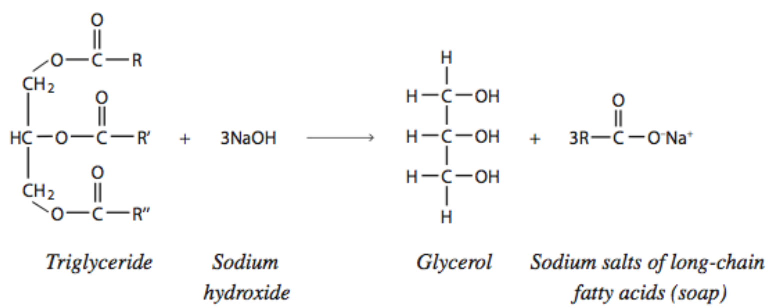


Figure 1. Structure of a Triglyceride

The products of a saponification reaction are sodium or potassium salts of fatty acids and glycerol (Equation 1).



Equation 1

All soap molecules have two basic features in common. One end of the molecule is usually a long, nonpolar hydrocarbon chain, resembling a "tail." The hydrocarbon tail is said to be *hydrophobic* (water-fearing) because it tends to repel or exclude water and will not dissolve in water. The other end of the molecule is a small ionic or polar group that is *hydrophilic* (water-loving). The hydrophilic group will tend to be surrounded by water molecules and will dissolve in water. These two competing structural features give soaps the unique properties that allow it to clean dirt and grease and protect us from germs and diseases.

When dissolved in water, soaps molecules spontaneously self-associate to form spherical aggregates called *micelles* (see Figure 2).

Name: ____ Period: ______________

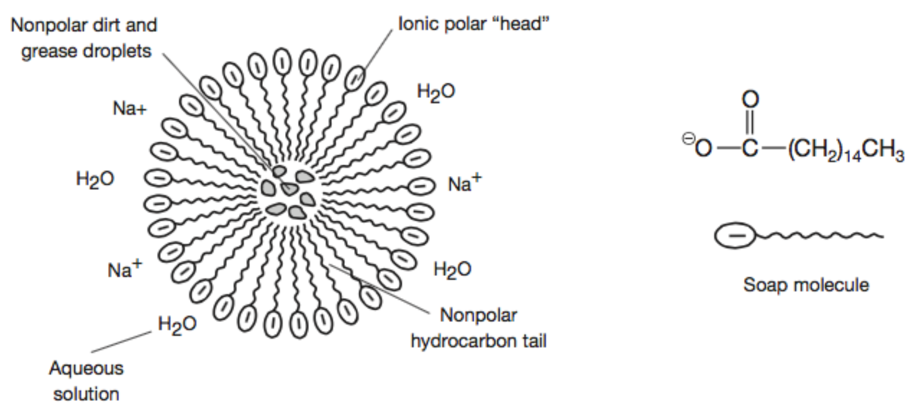


Figure 2. Structure and Properties of a Micelle

The nonpolar hydrocarbon tails in the soap molecules spontaneously arrange themselves toward the interior of the micelle, giving it a hydrophobic core that repels and thus excludes water. The ionic head groups are arranged on the outside surface of the micelle and are surrounded by water molecules. <u>The ability of soap molecules to form micelles explains how and why soaps work.</u>

Dirt and grease are nonpolar, hydrophobic substances that are not soluble in water. If water alone were used for washing or cleaning, the hydrophobic dirt and grease molecules would not dissolve in the water. In soapy water, however, dirt and grease molecules become trapped or suspended within the hydrophobic core of a micelle. The soap thus disperses or breaks up the dirt particles and dissolves them in the water. The dirt-containing micelles are water-soluble and are rinsed away in the wash. This is also how we rid our bodies of harmful germs to lead to infections and diseases.

*Note: we are not killing the germs, we are simply washing them off our bodies.

Materials

Olive Oil
Lye (NaOH)
Water, distilled
Balance, 0.1g precision
Beakers, 50-mL and 250-mL
Hot Plate
pH paper
Pipet, disposable
Spatula, metal
Stirring rod
Weighing dishes, 2
Thermometer

Safety Precautions

Sodium hydroxide solution causes severe skin burns and eye damage.
Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron.
Notify the instructor and clean up all spills immediately.
Avoid contact of all chemicals with eyes and skin.

Name: ____ Period: ______________

Do not taste or ingest any material in the lab and do not remove any remaining items used in the lab. Wash hands thoroughly with soap and water before leaving the laboratory.

Preparation of Soap

1. Working individually at your lab station , measure out about 11.24 mL of DI water in the smaller of the two beaker. Use the graduated cylinder.

2. Zero out the weighing dish on the balance again. Wearing gloves, measure 3.65 grams of lye (NaOH) into a weighing dish.

3. Proceed to the FUME HOOD. Carefully add the lye to the smaller beaker under the fume hood. DO NOT do it the other way around.

4. Stir while you add the lye into the water and continue stirring for about 5 minutes. Once the solution is clear, you may proceed to the next step. MAKE SURE the solution is clear before moving to step 5.

5. Bring back the small beaker to your lab station. Add 29.57 mL of olive oil into the bigger beaker. Use your graduated cylinder to measure.

6. Place the beaker on a hot plate **at the lowest setting (40** °C). Heat the olive oil in the beaker until the temperature ranges from 40–45 °C. Get your thermometer in the beaker.

7. Carefully remove the beaker from the hot plate **using beaker tong**s when the temperature reaches 40–45 °C. ***Note:*** Do not allow temperature to exceed 45 °C, monitor the temperature frequently with a thermometer. If necessary, remove the beaker periodically from the hot plate to cool, and continue stirring.

8. When both beakers are about the same temperature (no more than 45°C), add the lye-water solution to the larger beaker.

8. Continue stirring until the soap mixture gets thick—the product is ready to be heated again at **a low setting**. Use a glass dish to place on top of your big beaker to contain the heat.

9. When the soap that drips back into the beaker from the stirring rod traces a path (leaves a mark) on the surface of the soap, the soap is ready to pour.

10. Carefully pour the thickened soap solution from the beaker into one of the molds. Gently tap the mold on the table to evenly distribute the soap in the dish.

11. Allow the soap in the molds to dry until next class day. Initial the mold.

Name: ____ Period: _______________

Conclusion Questions

**Turn this part of the lab in to be graded!*

1. What does your soap look like? List 3 properties (color, appearance, texture):
   a) ____
   b) ____
   c) ____

2. What are the different kinds of soaps that you have used in your life? List two.
   a) _______________________ b)___________________________

3. What are some items you can add to your soap to change its properties?

   ____

4. Why would you want soaps with different properties?

   ____

5. What modifications or changes would you make to the soap-making process if you tried it again?

6. What potential errors were made during the lab that could've changed the way your soap turned out?

Let's Make Soap – A Single Point Rubric

The goal of this project is to use chemical principles to create an original product that is functional and allows you to express your creativity. The rubric highlights important project elements and focuses on the process of 'making' soap as well as science content. You can use this rubric to guide and reflect on your work.

Concerns *Areas that Need Work*	**Criteria**	**Highlights** *Areas Going Over and Above*
	Personal Relevance You create an original product and can describe its connection to your outside values or interests	
	Iterative Design and Fabrication You provide evidence of the evolution of the creation including brainstorming notes, drawings, and/or prototypes	
	Collaboration and Community You collaborate and connect with others to get design ideas, solicit feedback, or make improvements	
	Sharing Work Products are presented publicly and you are able to clearly share ideas about your process and product with others	
	Maker Mindset Habits of a maker mindset including persistence, reflection, and adaptability are demonstrated throughout the project	
	Content Connection You are able to: • Describe the pH scale, including the relationship between H+ and OH- ions, and • Discuss its application to the soap making process	
	Content Connection You are able to: • Describe the basics of the saponification process • Identify polar and non-polar regions of soap molecules and • Explain how this structure enables soap to function	
	Content Connection You are able to: • Discuss how the transfer of energy takes place in soap making process, including both heat transfer and chemical	

	energy used in the bonding process	

Introduction to Making!!

“Without the opportunity to learn through the hands of making, the world remains abstract, and distant, and the passions for learning will not be engaged” - Critical Making, UC Berkeley

Watching Making in Action

Maker Faire Austin 2017

Video:
https://www.youtube.com/watch?v=DF3rLZP-3Ng

What is Making??

"Making is an iterative process of tinkering and problem solving that draws on a DIY mindset. Making is collaborative and allows for self-expression through the creation of a personally meaningful artifact that is shared with a larger community." - *UTeach Maker Advisory Group, 2016*

UTeach

UTeach Maker

CHANGING EDUCATION, ONE MAKER AT A TIME

What does Making mean to you?

1. Write down a sentence, words, or phrases that come into your mind when you hear the word making.
2. Have you done any making in your life? If so, what did you make?
3. Share your thoughts with your partner.
4. Be ready to share with the class as well.

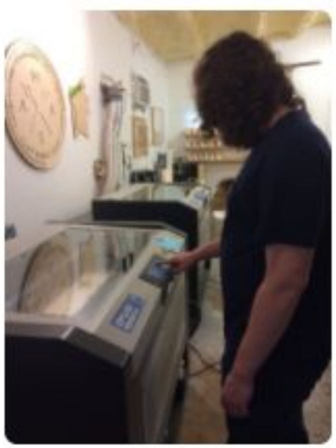
My Maker Journey

MATHHAPPENS

- Non-profit organization
- Dedicated to increasing math literacy in the community and beyond!
- Laser cutting
- Math Field Trips

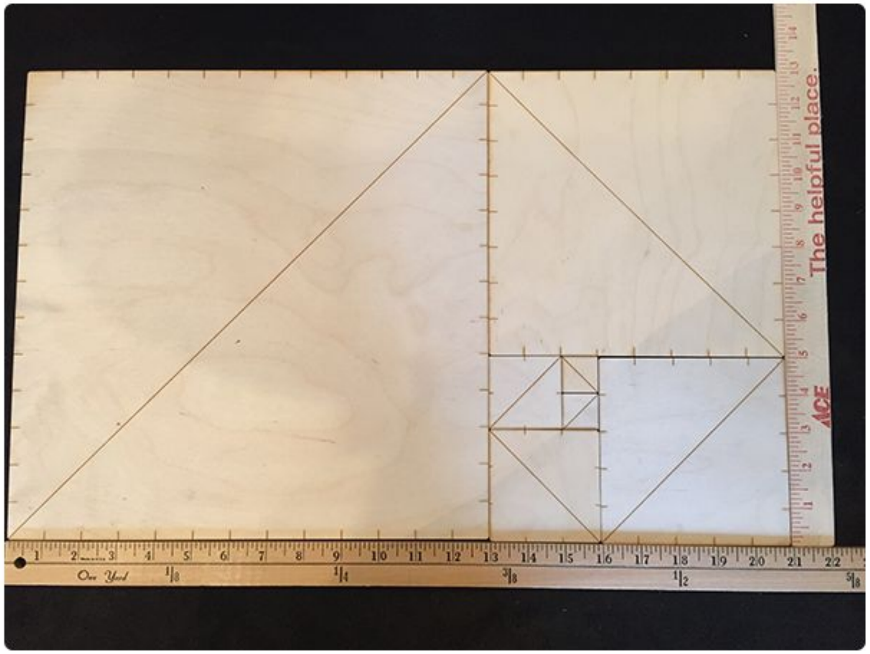
Laser Cutting!!






https://www.youtube.com/watch?v=07eSudYY6hc

Fibonacci numbers which approach phi, the Golden Ratio which is an irrational number: 1/2 + sqrt(5)/2.



Austin Nature & Science Center

Summer 2016

- Calipers
- Fibonacci






Cool things I got to do!

Faceting a Quartz Gem!

What Making Means to Me...

“Making is practicing and building upon your knowledge by taking your curiosity a step further and reinforcing it into something tangible. Making is what humans can do best, and that is the legacy we leave behind. To me, making means transforming an idea or a thought into reality by producing it and using it to benefit those around you.”

Introduction to Saponification

What is soap?

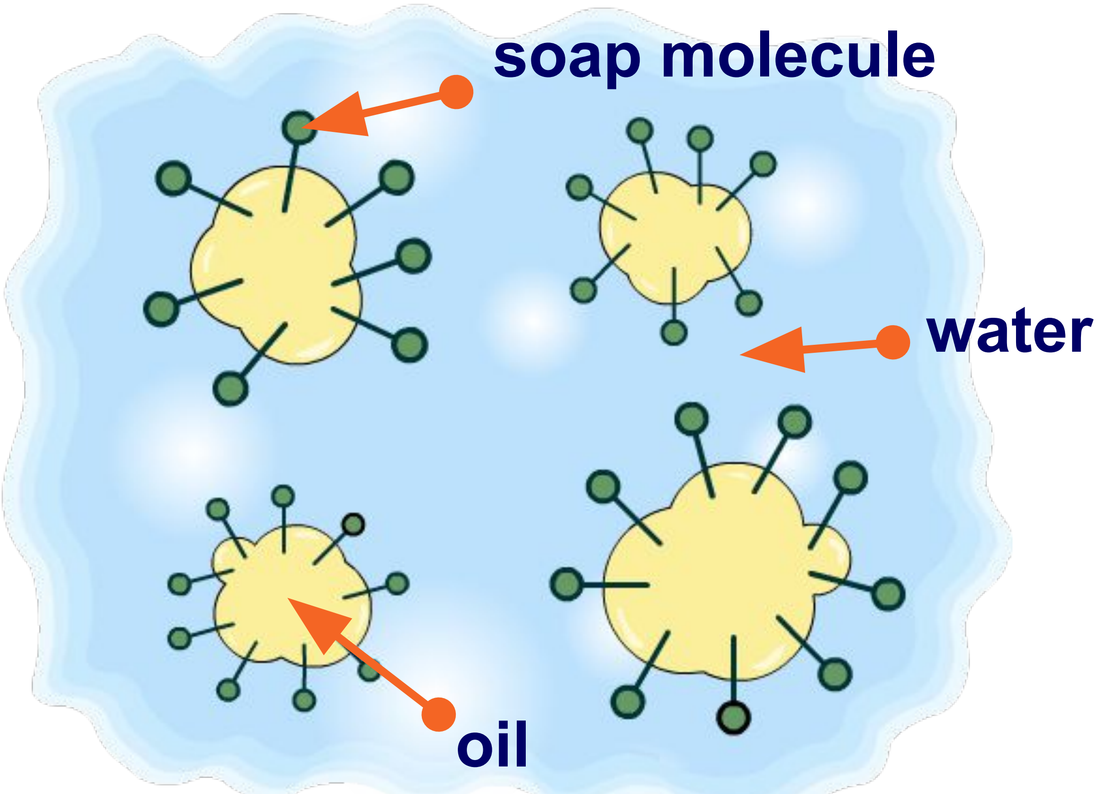
If oil is added to water, the two liquids do not mix.

Because of this, grease stains can be difficult to remove during washing.

Soaps are compounds which act as **emulsifiers**.

This means that they help the oil to mix with the water.

Detergents, Bile salts, also emulsify fats.



Google Search: Christopher Whitehead, Saponification PowerPoint.

SAPONIFICATION

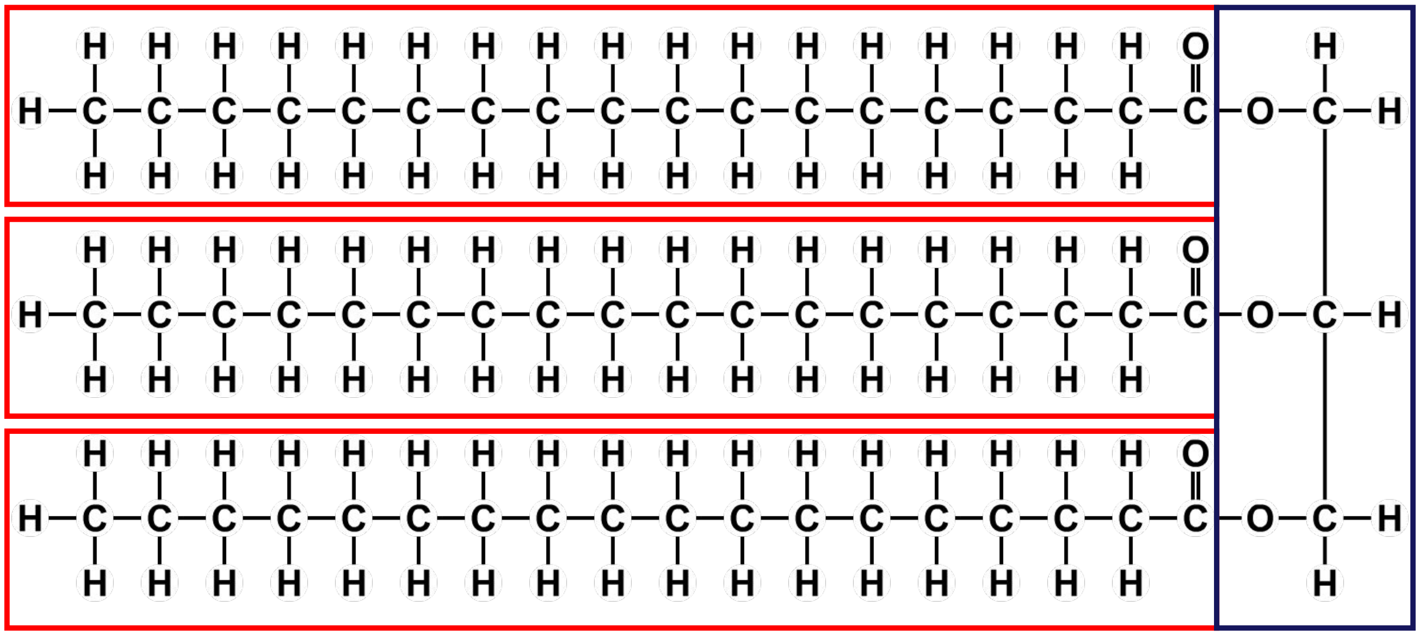
+

=

acid	base	salt
(oil)	(lye)	(soap)

How are soaps made?

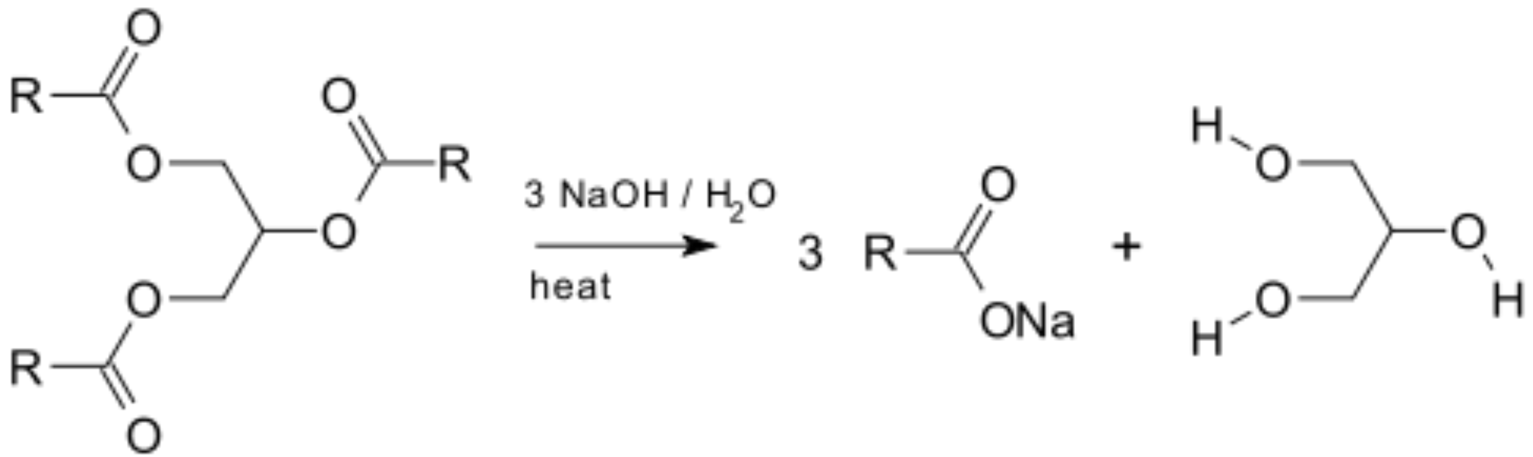
Soaps are usually made from vegetable fats and oils. These consist of **3 fatty acid chains, held together by a glycerol molecule**.



The reaction used to make soap from fats and oils is called **saponification**.

Google Search: Christopher Whitehead, Saponification PowerPoint.

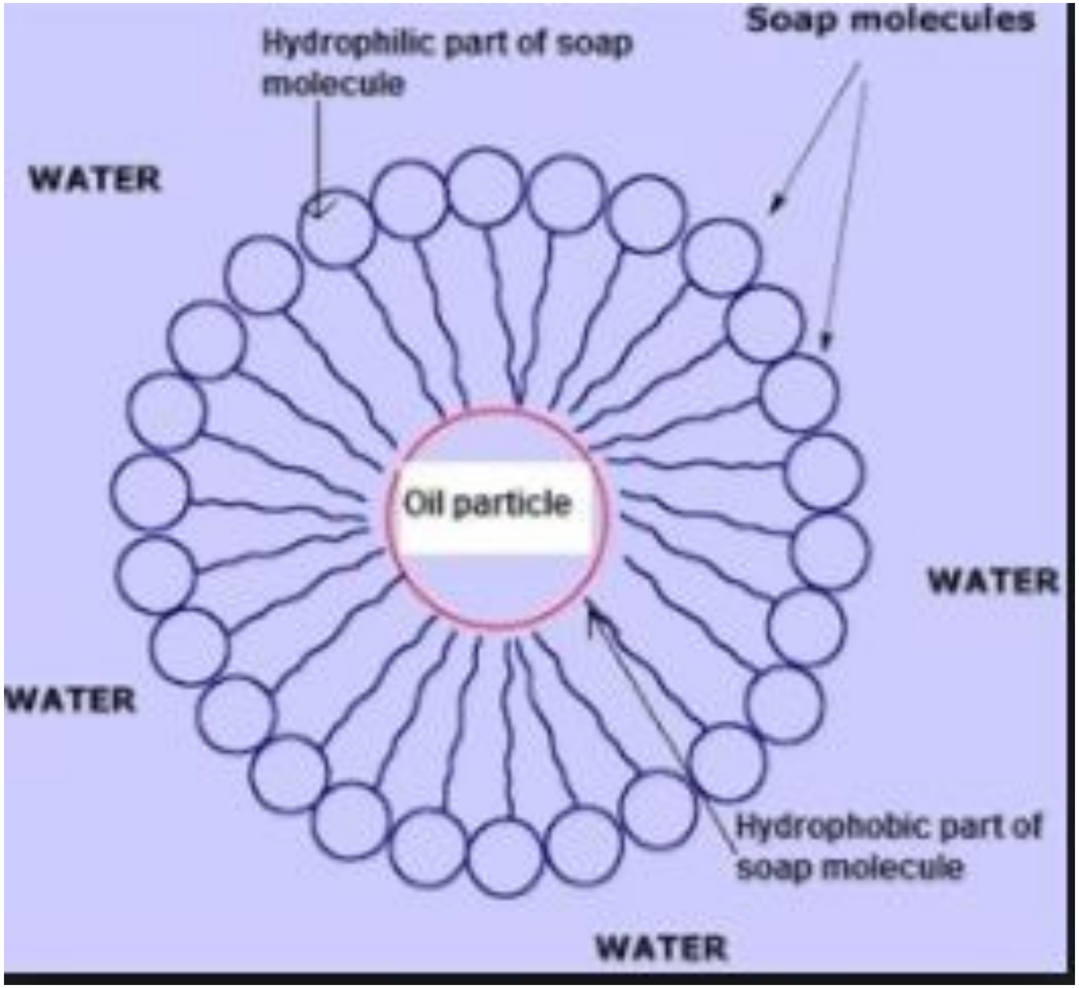
Saponification Reaction



Heat accelerates the reaction speed.

http://en.wikipedia.org/wiki/Saponification

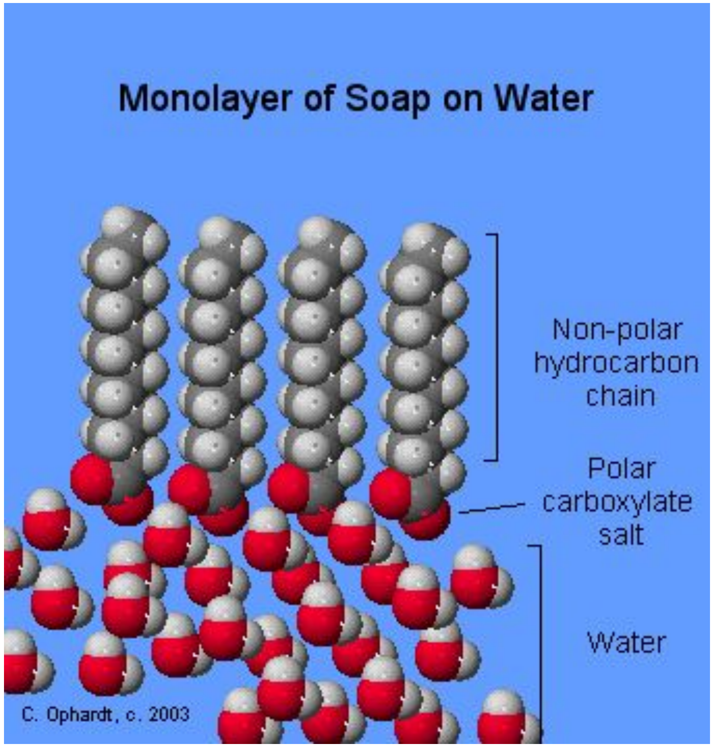
How does Soap Work?



http://www.planet-science.com/categories/under-11s/chemistry-chaos/2011/06/soap---how-does-it-get-things-clean.aspx

Modifications

- Potassium salts – yields softer lather
- Air bubbles added to molten soap – low density (floats)
- Long fatty acid derived soaps are harder and more insoluble in water
- Short fatty acid derived soaps irritate the skin and smell unpleasant!
- **GET CREATIVE!**

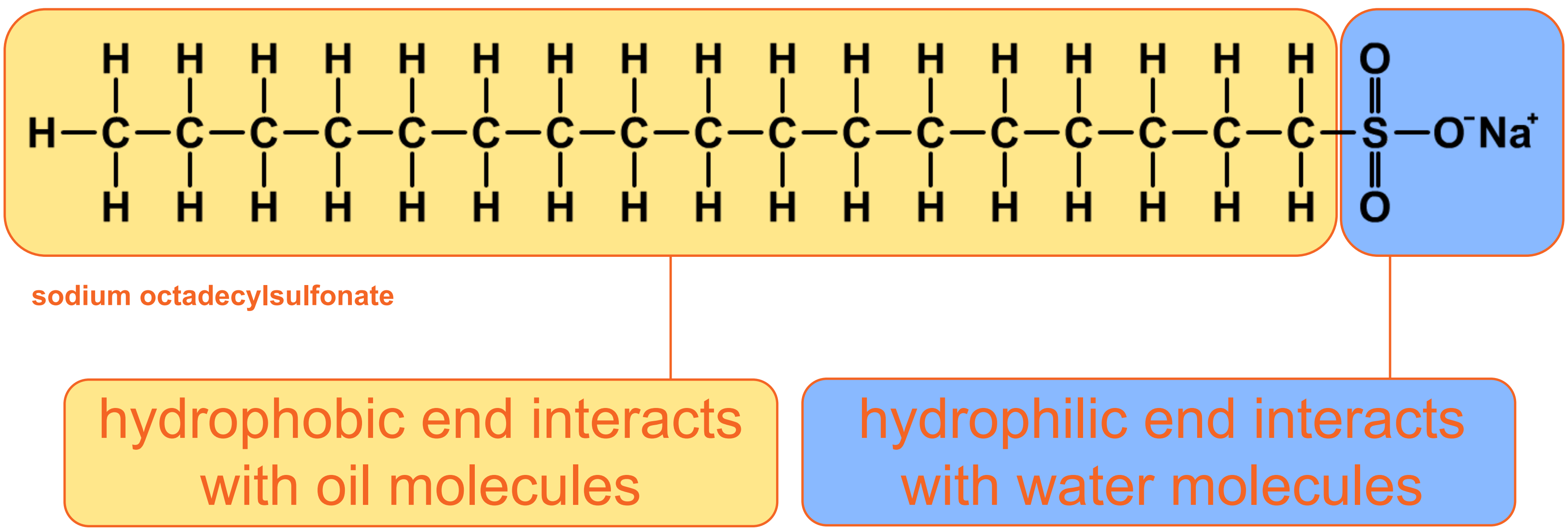


http://www.elmhurst.edu/~chm/vchembook/554soap.html

More Mods: Soapless Detergents

Soapless detergents can be made from crude oil, rather than vegetable oils or animal fats.

Soapless detergents are still made of long, hydrophobic carbon chains, but the hydrophilic end of the molecule is a sulfonate:



sodium octadecylsulfonate

Soaps vs. soapless detergents

What are the advantages and disadvantages of soapless detergents over soaps?

- Soaps form a scum with hard water, meaning that it is more difficult to produce a lather. Soapless detergents react with the substances in hard water to form soluble compounds, and so do not form a scum.
- Soapless detergents can be made from the by-products of the oil refining process, so can be cheaper to produce than soaps.
- Some soapless detergents are not biodegradable. This means that they stay in the water system causing froth in rivers and streams.

Google Search: Christopher Whitehead, Saponification PowerPoint.

Next Time...

- Making our soap
  - Coconut oil
  - Olive oil
  - Sunflower oil
  - Vegetable oil
  - Fragrance oils
  - Color!!

Period:

Fill this out as you move around the classroom and discuss the soap project with a classmate. You must fill out the following 3 questions for each classmate you talk to. Check the project rubric to determine how many classmates you need to visit to get the score you would like on the project. A minimum of 3 classmates is required.

Classmate’s Name:

1. What are some challenges or obstacles your classmate came across during this project?

2. What is unique about your classmate’s soap bar and soap dish design? Any similarities with your bar and soap dish design?

3. What are some things your classmate learned from this project? How has it helped him/her?

Designing your Customized Soap Dish :)

Instructions: Congratulations on making your soap bar!! The goal of today's activity is to design a soap dish that is capable of holding your soap. If interested, you will have the opportunity to laser cut your soap dish out of acrylic!

- ➢ You will be working with soap dish templates. Modify the template and add or remove parts of it to make the soap dish unique to you.
- ➢ Download the templates from BLEND.
- ➢ Upload the templates to the software "Method Draw": *editor.method.ac*.
- ➢ Find a cool pattern to add to your soap dish at https://dxf1.com/.

Some things to think about when designing your soap dish:

- Dimensions (long, wide, same on all sides,etc)
- Shapes (rectangular, box-shaped, holes, layers, etc)
- Text ("SOAP," "YOUR NAME," etc)
- Be creative :)

QUESTIONS:

1. What are some challenges you faced designing your soap dish today?

2. How did you overcome those challenges?

3. What did you learn today? How can you use these designing skills to benefit you in other classes and/or your personal life?

5E Lesson Plan Template

Grade Level and Subject: 10^{th} grade GL Chemistry	**Name of Teacher:** Ayesha Qadri
Length of Lesson: 5 block schedule class periods- Day 1: Introduction to making (90 mins) Day 2: Soap Making (90 mins) Day 3: Second Soap Bar (90 mins) Day 4: Designing Soap Dish (90 mins) Day 5: Gallery walk (90 mins)	**Title of Lesson**: Let's Make Some Soap

Main Idea of the Lesson:

This main idea of the lesson was to introduce students to making and encourage them to take on a five-day maker lesson in their chemistry classroom. This lesson strongly connects with the concept of producing a tangible product in a chemistry class using skills such as observations, trial-and-error, peer feedback, and basic knowledge of the saponification process, and acids and bases.

State or National Standards for Lesson:

Texas Essential Knowledge and Skills (TEKS)

Chemistry (c) 2. (E) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting equipment and technology, including graphing calculators, computers and probes, sufficient scientific glassware such as beakers, Erlenmeyer flasks, pipettes, graduated cylinders, volumetric flasks, safety goggles, and burettes, electronic balances, and an adequate supply of consumable chemicals; (G) define acids and bases…

Next Generation Science Standards (NGSS)

HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.

Common Core State Standards

ELA/Literacy

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

Mathematics

MP.2 Reason abstractly and quantitatively.

MP.4 Model with mathematics.

HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

Objective/s- **Write objective/s in SWBAT form…**	**Evaluation** **In the space below, write at least one question to match the objective you listed or describe what you will look at to be sure that students can do this.**
The SWBAT: • Apply the saponification equation in lab and create soap from hypothetical procedures • Explain the process of saponification • Describe the pH scale, including the relationship between H+ and OH- ions and application to the soap making process • Identify a product for each pH on the pH scale • Identify polar and non-polar regions of soap molecules and explain how this structure enables soap to function • Measure pH of soap and determine soap's safe use • Discuss how the transfer of energy takes place in the soap making process, including both heat transfer and chemical energy used in the bonding process • Produce a second bar of soap after day one feedback • Design a soap dish using an online software • Present and share outcomes and products through a gallery walk	What is the general equation of saponification? What acid was used for your soap project? Base? Compare and contrast polar and non-polar regions of soap molecules. What was the pH of your soap? Is your soap safe to use? What process did you use to make your soap? What types of energy transfer occurred during the process? What additives did you add? Why? How can you use the designing aspect of this lesson in other classes? Personal life?

Engagement: **Estimated Time: 90 mins**

Description of Activity:
The teacher introduces the concept of *making*, identifies herself as a maker, and asks students to share examples of their own past creations. The teacher then provides students with basic information about the saponification process and its application in soap making. The students explore properties of the materials and tools they will be using. Students are presented with a rubric to guide their work. This rubric emphasizes the process of making as well as relevant science content.

What the teacher does:	**What the student does:**	**Possible questions to ask students – *think like a student and consider possible student responses***
The teacher introduces what making is to students and plays a video of a local Maker Faire. https://vimeo.com/111461414 The teacher mentions some history about making and the growing importance of it in education. The teacher asks students about their making history after sharing her journey in making. Classroom Management Tip: The teacher walks around as students think-pair-share about their own making experiences. The teacher introduces saponification by showing a short video at https://www.youtube.com/watch?v=wTuRmwSkuzQ and gets students to understand the reactants and products of the chemical reaction. This video also compares and contrasts polar and non-polar regions of soap molecules with visual and auditory explanations.	Students watch and learn making and try to relate to it. Students share thought with each other and ask questions about the maker movement to the class. Students take note of the chemical reaction of soap and what ingredients they will be using to make soap while watching the soap making video. Students begin to think of their soap recipe.	Have you heard of the maker movement? Share your thoughts/ideas with your partner. Are there any classes/activities/hobbies you are a part of that involve making? What did you like about the making experience you had? How did it challenge you and what did you learn from that? Discuss the polar and non-polar regions of soap molecules and explain how this structure enables soap to function. What is the general equation of saponification? What basic ingredients are needed to make soap? How will you make your soap?

The teacher encourages students to make their own soap recipe for next class. The teacher reminds students of the project overview and the rubric students will be graded with at the end.		

Maker Elements:
Maker Mindset: Habits of a maker mindset including persistence, reflection, and adaptability are demonstrated throughout the project

Resources:
Maker Faire Video https://vimeo.com/111461414
Soap Making Introduction https://www.youtube.com/watch?v=wTuRmwSkuzQ
Let’s Make Soap Grading rubric

Exploration: **Estimated Time: 90 mins**

Overview of Activity:

Students select from a variety of materials to fabricate and personalize their soap using a variety of bases, oils, molds, and fragrances. Students are allowed to work collaboratively. The teacher encourages safe practices while using laboratory tools. Students are encouraged to seek feedback from others throughout the making process. Students engage in multiple iterations of soap making to refine their process and product. Students use a foldable to document observations from each round and write reflections.

What the teacher does:	What the student does:	Possible questions to ask students – *think like a student and consider possible student responses*
Classroom Management Tip: The teacher prepares the lab in advance and assures each student has all the necessary materials (does take time). The teacher reviews the ingredients, lab safety, and possible errors students can make in lab. The teacher is hands off for most of the lesson and walks around to make sure students are following safe lab practices and properly handling all lab equipment. The teacher provides a hypothetical soap recipe and students follow it if they wish or follow their own soap recipe. (see sample recipe in resources) Classroom Management Tip: The teacher rarely answers questions and encourages students to use the “three before me” rule to promote peer interaction.	The students review lab safety and wear safety gear for the lab. The students work individually to make their soap. Students reason quantitatively about the ratios of chemicals being used in the provided soap recipe and make adjustments for their own creations. With teacher oversight, the students carefully add the lye to the water and not the other way around. This is done under a ventilated fume hood. The students are patient, as some parts of soap making can become frustrating. Students are documenting each step of the making process and writing reflections in their foldable.	What equipment will you use to measure your ingredients? Why is it important to add the lye to water and not vice versa? What is the importance of the ventilated fume hood? How will you make sure you soap hardens enough to be poured in the mold? Do you think your soap bar will harden? Why or why not? What other recipes could you have followed to make your soap? How does this lab relate to other labs you have done? What will you change for next lab, if anything? Why? Note: Students will ask many questions, but because the lab involves flames and strong bases, the teacher should

The teacher handles the lye, NaOH, and monitors the handling of the lye and the fume hood for safe practice. Classroom Management Tip: The teacher watches class time and paces the students during the lab. Classroom Management Tip: The teacher allows for at least 10 minutes of clean up time and makes sure each lab bench and all equipment are clean for next class. *This is important to ensure the pH is unaffected for the second round of soap making as remains in equipment are more difficult to remove (oils).*	The students ask each other questions when confused and push forward. The students use the hot process and add the lye water to the beaker with the correct volume of oil needed. The students take ownership of the lab and add additives such color, glitter, and fragrance in the proportions they believe are correct. The student stirs as appropriate and wait to see a trail from the stirring rod. Students also answer the concluding questions while waiting to see a trail in their beaker. Once the student sees the trail, the soap is ready to be poured in the mold. The student pours the soap in the mold and initials it. After students initial their mold, students begin to clean up their equipment and lab bench. Students finish recording observations, making processes and reflections on their foldables.	refrain from answering them and focus on ensuring all students are safe. Ask students to use the “three before me” rule and enforce it. Get students to think and reflect on their lab experience and how they can learn from it for their second attempt at soap making!

Connections to NGSS:
In the creation of the bars of soap, students reason quantitatively about the ratios of chemicals being used in their soap recipe and describe changes in the outcome after they modify their recipe.

Maker Elements:
Personal Relevance-You create an original product and can describe its connection to your outside values or interests
Iterative Design and Fabrication-You provide evidence of the evolution of the creation including brainstorming notes, drawings, and/or prototypes
Maker Mindset-Habits of a maker mindset including persistence, reflection, and adaptability are demonstrated throughout the project

Resources:
Molds, additives (fragrances, glitter, color), lye, oils,
Equipment (1 of each for each student): graduated cylinder, spatula, thermometer, small and big beaker, weighing boat, tongs, hot plate
At each lab station: Bunsen burner, beaker brushes, vinegar, and DI water
Making Your Own Soap handout

Sample Soap Recipe
Coconut Oil-6 oz.=170 g
Olive Oil-26 oz.=737 g
Water-10 oz.=283 g
Lye-4.4 oz=124 g

Safety Considerations:
Students must be careful when working with the hot plate and Bunsen burner, as burns can result from a lack of caution. Because a lot of glass is around, students should be careful not to break beakers by stirring too hard or leaving beaker on the hot plate for too long. Students MUST add the lye to the water and not the other way around; this will help avoid serious issues. The ventilator must be on and students must do this step under the fume hood to avoid inhaling any fumes. All broken glass must go in the glass disposal. Safety is of utter importance and students are told of the lab safety techniques and consequences for failing to follow directions.

Explanation: **Estimated Time: 90 mins** **Overview of Activity:** Students have made their soap bar and there will be mixed responses from students regarding the successes and coming improvements. Students collaboratively discuss the pH scale and its implications for their own processes of creating soap. Customized designs and soap recipes, including temperature settings and concentrations, are included in the conversations and initial results are shared. Students provide constructive feedback to each other and continue to refine their recipes. This stresses the importance of iteration in making and develops the habit of reflection and revision.		
What the teacher does:	**What the student does:**	**Possible questions to ask students – *think like a student and consider possible student responses***
The teacher prepares student for the lab and mentions common errors and how to avoid them. The teacher reminds students of the pH scale and asks students to recall prior knowledge of the pH of acids and bases. The teacher encourages students to share their ideas regarding safe pH levels of soap and if soap should fall into the category of acid or base. Classroom Management Tip: The teacher calls on students randomly using name sticks to ensure equitable participation throughout the discussion. The teacher encourages students to recall the engagement video and the discussion of H+ and OH- ions in the soap making process. The teacher takes a few minutes to offer hints and tips to a successful soap bar after watching students the previous day. She encourages	The students review lab safety and wear safety gear for the lab. After a first attempt, students modify their soap recipe to decrease hardening time, adjust the pH, and customize their fragrance and color. Students engage in iterative design while creating their soap, switching from olive oil to coconut oil after encountering the unanticipated effect of slow hardening time. Students measure the pH of their soap bar using pH strips and evaluate if it is safe to use. The students carefully add the lye to the water and not the other way around. This is done under a ventilated fume hood.	How have you modified your approach to making your second soap bar? Why is it important to add the lye to water and not vice versa? What is the importance of the ventilated fume hood? Describe the pH scale, including the relationship between H+ and OH- ions and application to the soap making process. What is the pH of soap? What other products have similar pH? What is the pH of your first soap? What can you infer from that regarding the quality of your soap? How can you quicken the hardening process? What types of energy transfer are taking place during the soap making reaction?

students to think about how using a different type of oil would affect the hardening time. The teacher also prompts the students to think about the energy transfers that are taking place during the soap making process. She reviews endothermic and exothermic reactions and encourages students to recall both processes. Classroom Management Tip: The teacher is hands off for most of the lesson and walk around to make sure students are following safe lab practices and properly handling all lab equipment. Classroom Management Tip: During the lab work, the teacher rarely answers questions and encourages students to use the “three before me” rule to promote peer interaction. The teacher handles the lye, NaOH, and monitors the handling of the lye and the fume hood for safe practice. Classroom Management Tip: The teacher watches class time and paces the students during the lab. She provides visual and verbal time cues throughout the lab activity. Once the lab work is mostly complete, the teacher fosters a group discussion where students are sharing results, comparing temperature settings and concentrations of chemicals used, answering questions posed by	The students ask each other questions and provide suggestions for improvement of individual designs. Student groups discuss how changing temperature or differing concentrations of various soap ingredients affect the chemical reactions involved in soap making and how these changes impact their final product. The students use the hot process and add the lye water to the beaker with the correct volume of oil needed. Students discuss how the transfer of energy takes place throughout the hot process. The students take ownership of the lab and add additives such color, glitter, and fragrance in the proportions they believe are correct. Student groups discuss the effect of temperature on the chemical bonds between oil, lye, fragrance, food coloring, and glitter used to make their bars of soap. Students discuss the types of heat transfer occurring throughout the bonding process.	Are endothermic or exothermic reactions occurring during the soap making process? If you were to make soap again, what would you change and why?

the teacher, and providing constructive feedback to their peers. Classroom Management Tip: The teacher allows for at least 10 minutes of clean up time at the end of class and makes sure each lab bench and all equipment are clean for next class.	The student stirs as appropriate and wait to see a trail from the stirring rod. Students also answer the concluding questions while waiting to see a trail in their beaker. Once the student sees the trail, the soap is ready to be poured in the mold. The student pours the soap in the mold and initials it. After students initial their mold, students begin to clean up their equipment and lab bench. Students complete the concluding questions and turn them in after lab.	

Connections to NGSS:

After a first attempt, students modify their soap recipe to decrease hardening time, adjust the pH, and customize their fragrance and color.

Students engage in iterative design while creating their soap, switching from olive oil to coconut oil after encountering the unanticipated effect of slow hardening time.

Student groups discuss how changing temperature or differing concentrations of various soap ingredients affect the chemical reactions involved in soap making and how these changes impact their final product.

Student groups discuss the effect of temperature on the chemical bonds between oil, lye, fragrance, food coloring, and glitter used to make their bars of soap.

Students compare the results of their soap making with other groups and discuss how differing concentrations of chemicals impact the color, fragrance, hardness, and pH of their final product.

Students discuss how the transfer of energy takes place throughout the soap making process, including both heat transfer and chemical energy used in the bonding process.

Maker Elements:

Personal Relevance-You create an original product and can describe its connection to your outside values or interests

Iterative Design and Fabrication-You provide evidence of the evolution of the creation including brainstorming notes, drawings, and/or prototypes

Collaboration and Community-You collaborate and connect with others to get design ideas, solicit feedback, or make improvements
Sharing Work-Products are presented publicly and you are able to clearly share ideas about your process and product with others
Maker Mindset-Habits of a maker mindset including persistence, reflection, and adaptability are demonstrated throughout the project

Resources:
Molds, additives (fragrances, glitter, color), lye, oils,
Equipment (1 of each for each student): graduated cylinder, spatula, thermometer, small and big beaker, weighing boat, tongs, hot plate
At each lab station: Bunsen burner, beaker brushes, vinegar, and DI water
Making Your Own Soap handout

Safety Considerations:
Students must be careful when working with the hot plate and Bunsen burner, as burns can result from a lack of caution. Because a lot of glass is around, students should be careful not to break beakers by stirring too hard or leaving beaker on the hot plate for too long. Students MUST add the lye to the water and not the other way around; this will help avoid serious issues. The ventilator must be on and students must do this step under the fume hood to avoid inhaling any fumes. All broken glass must go in the glass disposal. Safety is of utter importance and students are told of the lab safety techniques and consequences for failing to follow directions.

Elaboration: **Estimated Time: 90 mins**

Overview of Activity:
Students are introduced to the use of graphic editor software and laser cutters for making self-designed soap dishes. Graphic editor software is used to make precise measurements for laser cutting customized soap dishes. These designs are based on personal preference and utility, with each design being unique to the individual. Students are given the option to show their designs on the computer or meet the teacher outside of school to laser cut their dish.

What the teacher does:	**What the student does:**	**Possible questions to ask students – *think like a student and consider possible student responses***
The teacher introduces the objective of a customized, personal soap dish and passes around three laser cut soap dish designs for students to see. The teacher briefly shows how to use the graphic editor software, Method Draw. The teacher lists a few points to think of when designing the soap dish and encourages peer interaction to generate ideas. The teacher encourages students to go above and beyond with their design and challenges students to think of the design in a 3D form, the layout of the design, measurements, etc. The teacher walks around and guides students with their design. If laser cutting resources are available, the teacher provides times for students to come in	Students fire up their laptops and visit the graphic editor software. Students play with “Method Draw” and begin to put a soap dish together. Students create a design for a soap dish using graphic design software and explain both the structural and aesthetic choices of the design. Students are aware of important points such as measurements, shape of soap dish, etc. Students use their creativity to make the soap dish unique and personal to them. Students interact with one another and help each other learn how to use the software and offer tips to fix errors and minimize frustrations. They use the teacher as a last resort.	How can you make the soap dish unique to you? What are some challenges you faced designing your soap dish today? What was the easy part? Hard part? How did you overcome those challenges? What did you learn today? How can you use these designing skills to benefit you in other classes and/or your personal life?

after school to assist with the laser cutting process to complete their soap dish designs. The teacher provides the big picture of the maker lesson and helps student think of the big takeaways, what they learned, how they made their soap and soap dish, and the skills from this lesson they learned that can be used in other classes and everyday life.	Students complete the “Designing Your Customized Soap Dish” handout and turn it in. Students try their best to complete their soap dish design or at least have a general layout of it to present during the gallery walk. Students begin to prepare for their presentations and use the questions, feedback, and points of revision mentioned to prepare for the lab.	

Connections to NGSS:
Students create a design for a soap dish using graphic design software and explain both the structural and aesthetic choices of the design.
Students create digital models of their soap dish using graphic design software and share these designs as part of their class presentation

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Collaboration and Community-You collaborate and connect with others to get design ideas, solicit feedback, or make improvements

Resources:
Computers
Method Draw software (free)
http://editor.method.ac/
Designing Your Customized Soap Dish handout

Safety Considerations:
For those students who choose to come in after school to participate in the laser cutting activity to complete their soap dish, proper laser cutter safety must be reviewed and implemented. The teacher operating the laser cutter will be trained for use and students will be able to assist while wearing the proper eye safety.

Evaluation: **Estimated Time: 90 mins**

Description of Activity:
Formative evaluation occurs through the use of a rubric that was provided for students at the start of the lesson. The teacher uses this rubric to make notes on student progress at each stage of the 5E learning cycle. Students also use this rubric to self-evaluate and reflect on their work throughout the project. Additionally, students conduct presentations showcasing their soap and dish designs. The presentations include an explanation of their personalized making process as well as a discussion of the chemistry content. The audience is comprised of people from a variety of sectors within the community. After presentations, the teacher revisits the rubric and uses it to provide a summative evaluation for each student.

What the teacher does:	What the student does:	Possible questions to ask students – ***think like a student and consider possible student responses***
The teacher sets up the room for the gallery walk and gives five minutes for students to prepare their presentations and their talking points. The teacher invites member of the community, other teachers, makers to the class as the audience to the student presenters. As students begin presenting and community members start asking questions, the teacher walks around and checks on students to check their understanding. The teacher offers encouragement to nervous students and assurance to everyone. The teacher acknowledges the hard work students have put into the project and remind them of that during the presentations.	Students prepare to talk about their soap and soap dish. They reflect on what making is, what it means to them, and how it came out during this project. Students walk around and listen to their peers present and complete a slip for each peer they hear present when time is called to switch. Students turn in their slips and work on their project foldable for the remainder of the class.	Questions to be included on the half slips of paper for gallery walk: How has this project helped shape your idea of making? What were the challenges of this project? How did you overcome them? What was the most fun part of the project? What was the most frustrating part of the project? What are some changes you would make if you did this project again? How and why?

The teacher also asks questions and makes sure students are going around and filling out the slips of questions. When half of the class has presented, the teacher tells students to switch. Those that were presenting now go around and ask their classmates the questions on the slip and students who were asking questions now presented their lesson products. At the end, the teacher tells students to turn in their slips all stapled together for a grade as part of the project rubric. The teacher reminds students of the project rubric and gives students time to work on the project foldable. (Project foldable can be due as decided by the teacher).		What skills did you develop during this lesson? How can these skills be used in the future either in your everyday life or in your classes and extracurriculars? Would you embark on another maker lesson again? Why or why not? What do you hope to gain from it?

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Collaboration and Community-You collaborate and connect with others to get design ideas, solicit feedback, or make improvements
Sharing Work-Products are presented publicly and you are able to clearly share ideas about your process and product with others

Resources:
Gallery walk slips, Soap dish design, and Soap bars (If available: Laser Cutter with trained operator, appropriate eye safety and materials for cutting soap dish)