

**Welcome!**

**Weaving Chemistry into the  
Fabric of Life**

**Laura J. Cummings  
Indianapolis**

# Weaving Chemistry into the “Fabric of Life”

Agenda:

1. Introduce myself
2. Poll to tell me something about you
3. Background info about where I teach
4. Share the projects
5. Hopefully this generated ideas in you; I want to hear your ideas

# About me:

Laura Cummings

B.A. Chemistry DePauw University

M.S. Biochemistry University of Wisconsin Madison

M.A.T. University of Indianapolis

Woodrow Wilson Cohort #1

10<sup>th</sup> year teaching high school

Department Chair, Science



# About you:

Poll:

1. What do you teach?
2. What grade of student do you teach?
3. How long have you been teaching?

# Background Information:

## Indianapolis Classical Schools

### Herron High School

930 students

36% Free and Reduced Lunch

54% White, 25% Black, 11% Hispanic,  
8% Multiracial, 1% Asian



## Riverside High School

320 students

64% Free and Reduced Lunch

58% Black, 20% White, 13% Hispanic,  
6% Multiracial, 1% Asian



# Background Information

How Indianapolis Classical Schools set up E-Learning:

Monday – Thursday

45 minute asynchronous lessons

Shared lessons via Haiku

Daily office hours for one hour a day on Zoom

# Example of Haiku:

PreAP Chemistry

Pages Calendar Messages Activities ▾

- Online Learning May 2020
- Online Learning April 2020
- Online Learning March 2020
- Weekly Schedule Fall 2019
- Weekly Schedule Spring 2020

## Online Learning May 2020

Submit Daily Attendance Here

**Daily Attendance:** Click this link to submit daily attendance (only need to do once per day):  
[tinyurl.com/ICSeLearning](http://tinyurl.com/ICSeLearning)

**Submitting Late Assignments?** Please fill out this **LATE FORM** so we know to look for them. They will be entered by the next Sunday evening.

### Wednesday May 20 2020

Welcome to our last day of classes!

We can't believe we're already done. As always, use your Herron High School email, and this is due by midnight on May 20, 2020.

This should take about 45 minutes or so to complete!

Today we're learning one last equation --  $PV=nRT$  -- and watching a couple of cool gas law demos.

1. Grab a piece of paper and a writing utensil and take careful notes on this video by Ms. Gardner: [Ideal Gas Law](#).
2. Continue to take notes as you watch Mr. Fritch's video [Floating Water](#).
3. Here's one last demo video from Mrs. Cummings that pulls acid-base chemistry together with gas laws. [Video Can you pour a gas?](#) Continue to take notes and answer the questions at the end!
4. Submit your notes here: [Submit notes for May 20, 2020](#).
5. Watch a one minute goodbye video from your instructor.

#### Virtual Office Hours

**Mr. Fritch's office hour:**  
bfritch@herronhighschool.org  
9 am - 10 am every day  
[Click this link to get to Mr. Fritch's office hour](#)

Dial-in: (US) +1 929-252-0981 PIN: 947 782 733#

**Mrs. Cummings's office hour:**  
lcummings@herronhighschool.org  
noon - 1:00 every day  
To join the video meeting, [click this link](#).  
Otherwise, to join by phone, dial +1 515-518-0056 and enter this PIN: 471 485 041#

# Background Information

How we worked with students who did not have online access:

Delivered laptops

Delivered hot spots

Accepted any assignment late

Assigned one on one coaches



“Good teachers join self, subject, and students in the fabric of life.”

--Parker Palmer

How can I get my students off-screen and engaged in the ‘fabric of life’?”?

# Guidelines for creating lessons that weave the content into the “Fabric of Life”:

Think differently than you do in the classroom. Don't simply take worksheets and move them online. Think “How can I leverage the GOOD points about online learning?”

1. Start with the state standards
2. Write “SWBATS’ (“Students Will Be Able To...”)
3. Use the most limited home situation as a guide to what is available in students' homes
4. Narrow the focus of the lesson to one or two concepts.
5. Create associations between the content and what is in the home
6. Carefully think about what the students must know before they can start the project
7. Make instructions concise; use bulleted checklists that make grading clear
8. Provide models of assignments

# Major categories

## 1. Scavenger Hunts

Acid Scavenger Hunt

Pressure Scavenger Hunt

## 2. “Hands on” activities in the home

Cleaning with Acids and Bases

Baking with Acids and Bases

# Acid Scavenger Hunt

Purpose:

To help students see which acids are in their homes and how common acids are.

# Acid Scavenger Hunt

DIRECTIONS: Wet hair, lather and rinse thoroughly. Avoid contact with eyes.

**INGREDIENTS:** Water, Sodium Lauryl Sulfate, Cocamidopropyl Betaine, Sodium Laureth Sulfate, Ammonium Chloride, Fragrance, Methylchloroisothiazolinone, Methylisothiazolinone, Tetrasodium EDTA, Citric Acid, Sodium Chloride, Polysorbate 20, Panthenol (Vitamin B5), Tocopheryl Acetate (Vitamin E), Ascorbic Acid (Vitamin C), Niacinamide (Vitamin B3), Biotin (Vitamin H), Rosmarinus Officinalis (Rosemary) Leaf Oil, Prunus Amygdalus Dulcis (Sweet Almond) Oil, Anthemis Nobilis Flower Oil, Helianthus Annuus (Sunflower) Seed Oil, Mangifera Indica (Mango) Seed Oil, Yellow 6 (CI 15985).

**INGREDIENTS:** SUGAR, DEXTROSE, GELATIN, CONTAINS 2% OR LESS OF FUMARIC ACID, SODIUM CITRATE, SALT, ARTIFICIAL FLAVOR, RED 40, BLUE 1.

DISTRIBUTED BY THE KROGER CO.  
CINCINNATI, OHIO 45202

**CAUTION AND DISPOSAL:** Store in original container out of reach of children and pets. Do not reuse empty container. Recycle empty bottle in trash collection or recycle.

**PRECAUTIONARY STATEMENTS**  
**CAUTION: EYE AND SKIN IRRITANT. MAY BE HARMFUL IF SWALLOWED.** Contains water, sulfamic acid, oxalic acid, methyl ether, and alkyl ethoxylate. Due to irritating nature, do not ingest or breathe vapors. Use only with adequate ventilation. Avoid contact with eyes. For sensitive skin or prolonged use, wear household vinyl or rubber gloves. Wash thoroughly with soap and water after handling. Do not mix with chlorine-type bleaches or other household chemicals. To do so may release hazardous gases. **KEEP OUT OF REACH OF CHILDREN.**

**REUSE EMPTY BOTTLE:** Use in well ventilated area. In case of irritation, wash with cool water for 15 minutes. Call physician if irritation continues. If swallowed, do not drink a glass of water followed with milk. Call a physician immediately. Contains Water, Lactic Acid CAS# 79-33-4, Gluconic Acid CAS #526-95-4, Lauramine Oxide CA Dipropylene Glycol n-Butyl Ether CAS #29911-28-2, Blue 1 CAS #3844-45-9, Yellow 5 CA  
**PELIGRO: MANTENGA FUERA DEL ALCANCE DE NIÑOS. DA INGIERE. IRRITANTE DE LOS OJOS. EL VAPOR PUEDE SER PERJUDICIAL.**

**Ingredients:** Enriched flour (wheat flour, niacin, reduced iron, vitamin B<sub>1</sub> [thiamin mononitrate], vitamin B<sub>2</sub> [riboflavin], follic acid, corn syrup, high fructose corn syrup, dextrose, soybean and palm oil (with TBHQ for freshness), sugar, bleached wheat flour.

Contains 2% or less of wheat starch, salt, dried

**INGREDIENTS:** VINE-RIPENED TOMATOES, TOMATO JUICE, LESS THAN 2% OF: SALT, DRIED ONION, DRIED GARLIC, SOYBEAN OIL, SPICES, CALCIUM CHLORIDE\*, NATURAL FLAVOR, OLIVE OIL, CITRIC ACID\*

\*NATURALLY DERIVED

DISTRIBUTED BY  
**RED GOLD, LLC**

ingredient: distilled vinegar, red pepper, salt.

Bottled by McIlhenny Company  
 Avery Island, Louisiana 70513

Shake Well

www.TABASCO.com

# Acid Scavenger Hunt

Advance preparation is important

Students should know:

- Our operational definition of an acid

- How to identify an acid

- What is an organic acid?

- What is a carboxylic acid?

- Which hydrogen is the acidic hydrogen in a carboxylic acid?

- How to read an ingredients list (model in video)

# How to Assign it:

## Acid Scavenger Hunt Instructions

How many acids are in your home? What is the most common acid in your home?

Look at as many ingredient labels as you can in your kitchen, bathroom, cleaning closet, etc. Use your phone to take a photo of any label that includes an acid (remember that vinegar is acetic acid).

Make a collage of your labels. You can either use PAINT on your computer or use any free collage-making software.

Curious what this might look like? Here's a model collage of "sweeteners": [Model](#) (this is obviously limited to food since the topic is sweeteners, but you get the idea.) Your collage will be about acids.

Here's how points will be assigned:

	Item	Number of Points
<b>Collage:</b>	At least 7 labels that each include an acid	7
	At least four <i>different</i> acids	4
	At least one example from food	1
	At least one example from a household cleanser	1
	At least one example from a hair and body care product (shampoo, make up, etc.)	1
	<a href="#">Submit Collage Here</a>	
<b>List of Acids:</b>	Tell us the names of the acids you found! Add them to this Google Form: <a href="#">Submit Names of Household Acids here.</a>	7
	<b>Total number of points</b>	21

Hyperlinks are not live. Email me if you'd like a full version.





Students filled in a Google Form with the acids they found:

### [List of Household Acids](#)

Put in chat box: what was the most common acid that they found?

How many different acids did 96 students find?

We rearranged the list to get:

### [Rearranged List of Household Acids](#)

# Follow Up Assignment

Choose an acid and make a poster about it.

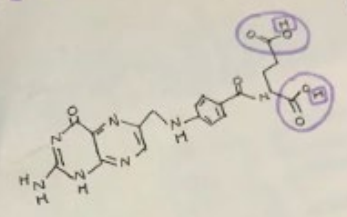
**FOLIC acid**

**FORMULA**  
 $C_{19}H_{19}N_7O_6$

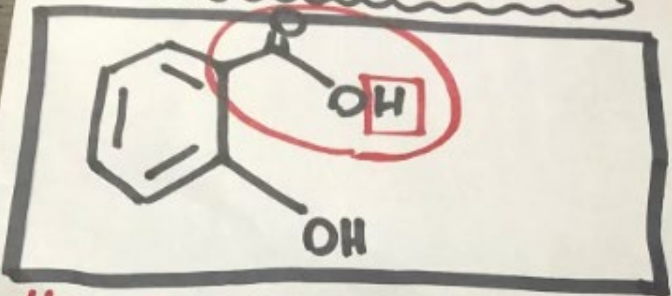
**MOLAR MASS**  
441.4 g/mol

**FOUND IN...**  
leafy greens (ex: spinach)  
nuts  
beans

**SOURCES**  
National Center for Biotechnology Information, PubChem Database. Folic acid, CID=135342652, <https://pubchem.ncbi.nlm.nih.gov/compound/Folic-acid> (accessed on Apr. 14, 2020)  
"Folic Acid." ChemSpider, Royal Society of Chemistry, [www.chemspider.com/Chemical-Structure.5215.html](http://www.chemspider.com/Chemical-Structure.5215.html)  
Wikipedia entry on Folic acid accessed Apr. 14, 2020



Salicylic Acid  
 $C_7H_6O_3$  or  $HOC_6H_4COOH$



Molar Mass: 138.121 g/mol

Found in: Acne Medicine, Anti-inflammatory Ointment, Anti-Bacterial Ointment

Sources:

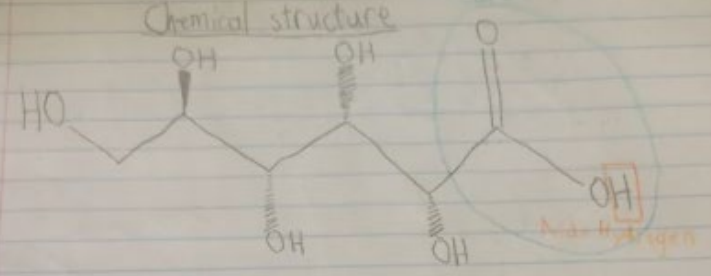
- Pub Chem. web. NLM. NIH. Gov - salicylic acid
- ChemSpider - Salicylic Acid
- Wikipedia - Salicylic acid Formula

## Gluconic Acid

Molecular Formula  $C_6H_{12}O_7$   
 Note the similarity to glucose - gluconic acid can be formed from oxidation of glucose.

Average molar mass about 196.12 g/mol

Chemical structure



Most methods of manufacturing gluconic acid involve oxidizing glucose in some way - for example, by electrolytic oxidn. It occurs naturally in fruits, honey, and wine. It forms several salts that have various uses; for example, calcium gluconate is used to treat burns and necrosis.

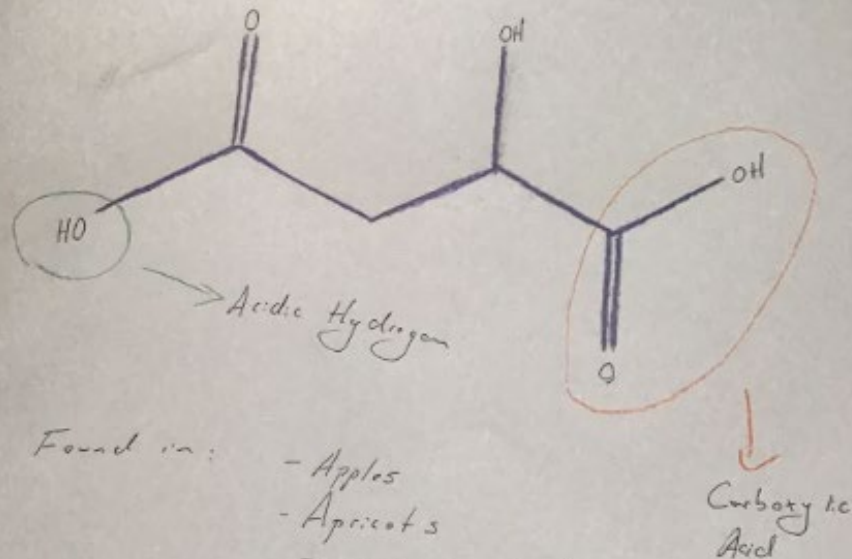
Sources:

- Pub Chem entry on Gluconic acid (compound) accessed 14 Apr 2020
- Wikipedia article on Gluconic acid accessed 14 Apr 2020
- ChemSpider entry on D-Gluconic acid accessed 14 Apr 2020

# Malic Acid

Chemical Formula:  $C_4H_6O_5$

Molar Mass: 134.0874 g/mol



Found in:

- Apples
- Apricots
- Skincare products

Sources:

- The European Bioinformatics Institute
- Wikipedia.org
- National Library of Medicine
- Sciencedirect.com

**Rubric for Poster Organic Acid**

Name: \_\_\_\_\_

**Scroll all the way down to see a Model Poster!**

<b>Title</b> <ul style="list-style-type: none"><li>There is a clear title to the poster.</li></ul>	1 pt	
<b>Chemical Formula</b> <ul style="list-style-type: none"><li>The correct chemical formula is clearly labeled and stated</li></ul>	1 pt	
<b>Chemical Structure</b> <ul style="list-style-type: none"><li>The correct chemical structure is drawn <b>BY HAND</b> (you may NOT copy and paste it) neatly and clearly labeled.</li><li>The carboxylic acid is circled <b>in a different color of ink</b></li><li>The acidic hydrogen is boxed <b>in a different color of ink</b>.</li></ul>	3 pts	
<b>Molar Mass</b> <ul style="list-style-type: none"><li>The molar mass, with units, is clearly labeled and stated</li></ul>	1 pt	
<b>Where is it found?</b> <ul style="list-style-type: none"><li>A detailed description of where this organic acid is found is included.</li></ul>	2 pts	
<b>Sources.</b> <ul style="list-style-type: none"><li>There should be at least three sources; one can be Wikipedia.</li><li>Sources must be reliable. Excellent places to start include <b>Chemspider</b> (by the Royal Society of Chemistry), Wikipedia, and sources referenced within Wikipedia.</li></ul>	1 pt	
<b>Neatness, Grammar and Spelling</b> <ul style="list-style-type: none"><li>Use good grammar and spelling. One point will be removed for every 3 grammatical or spelling errors.</li><li>The poster should be neat and organized.</li></ul>	1 pt	
<b>Total</b>	10 practice points	

*Scroll down to see a model (example) poster! Use it as an example of what your poster should look like!*

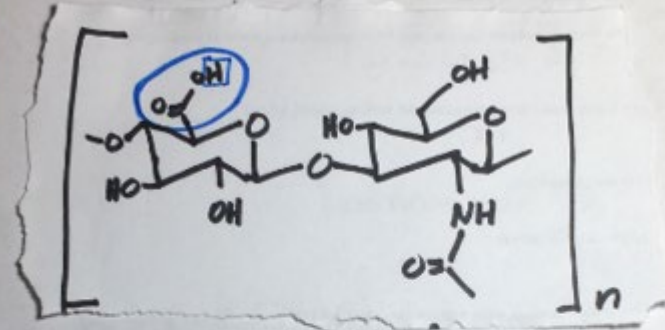
This is my model poster.

I purposely chose not to fight the battle of MLA format for citations. I merely asked that they list their sources, and that the sources be credible.

## HYALURONIC ACID

CHEMICAL FORMULA:  $(C_{14}H_{21}NO_{11})_n$

CHEMICAL STRUCTURE:



MOLAR MASS: about 7,000,000 g/mole  
(THIS IS A MASSIVE MOLECULE!)

WHERE IS IT FOUND? A TYPICAL 154 lb human has roughly 15 g of hyaluronic acid in the body. It is found between cells, and has been described as "goo". It's a major component of skin; uvb light affects it. Helps keep skin hydrated.

SOURCES:

1. Wikipedia entry on hyaluronic acid  
accessed 4.12.2020
2. Chemspider (Royal Society of Chemistry)  
entry on hyaluronic acid  
accessed 4.12.2020
3. "What is hyaluronic acid?" Harper's Bazaar  
March 31 2020

# Scavenger Hunt Units of Pressure

Important:

Students must have been introduced to the various units of pressure before doing this activity

Purpose:

- Students will see what units of pressure are surrounding them in real life – almost never atm, which is what we talk about most of the time in Chemistry!
- Students will connect the operational definition of pressure with what they see in their own homes.

# Scavenger Hunt Units of Pressure

## Scavenger Hunt Units of Pressure

The purpose of this is for you to see what units of pressure are surrounding you in your real life and to connect the operational definition of pressure with what you see in your own home.

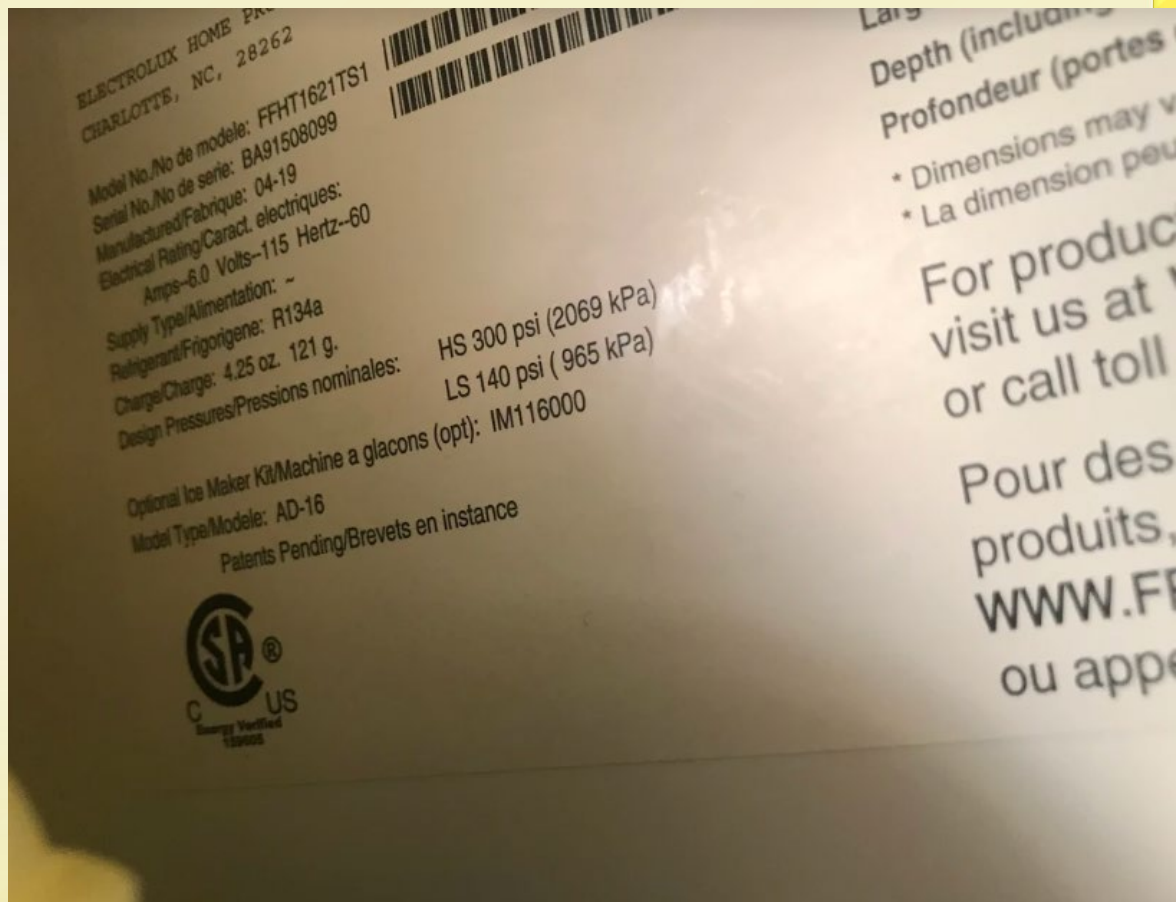
1. Find at least **two** items that have contents under pressure and take photos of them. Consider car or bike tires, spray cans, shaving cream cans, etc. At least one of them must show the units of pressure. (HINT: car tires have pressures listed on the side of the tire. So do bike tires).
2. Look up today's atmospheric pressure. What units of pressure are being used?
3. Go to [Submit Scavenger Hunt Pressure](#) and submit everything.

Here's how we will grade you:

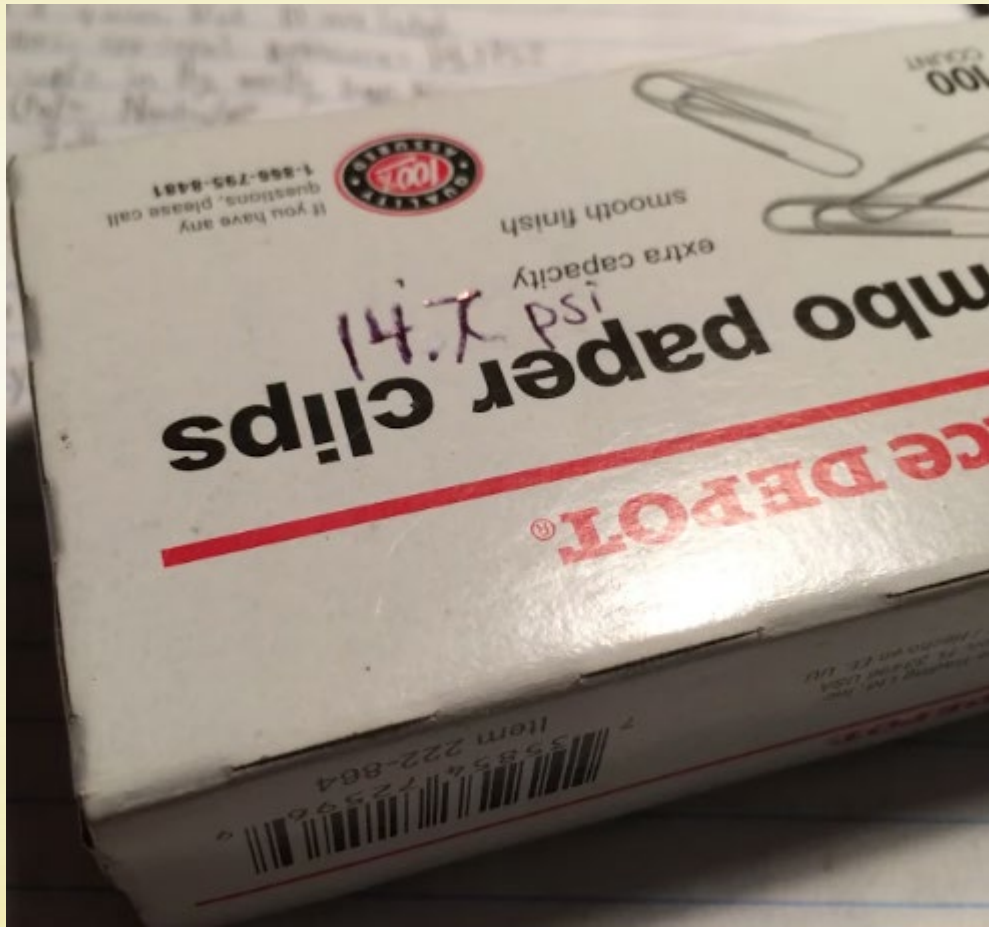
Item	Number of Points
At least 2 photos of items under pressure	2
One of the photos must show units of pressure	1
Look up today's atmospheric pressure. What units is it in?	1
Remind yourself of the Operational Definition of Pressure. Do NOT Google it; use the official Operational Definition we are using. It's best if you have it memorized!	1
<b>Total number of points</b>	<b>5</b>

Hyperlinks are not live; please email me if you'd like a full version









**Use the “annotate” function  
and write additional ideas  
for scavenger hunts**

# Hands On Activities

1. Cleaning with Acids and Bases
2. Baking with Acids and Bases

# Cleaning with Acids and Bases



**Before**



**After**

**Cleaning Agent:** Baking soda

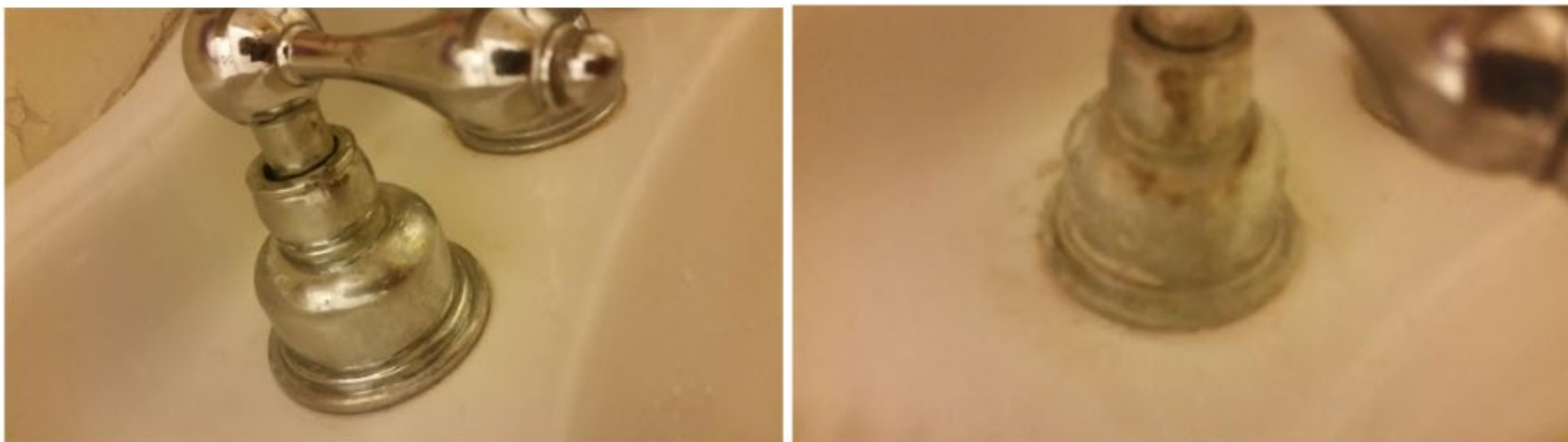
**Properties Used:** Physical, used as an abrasive

**Chemical Formula:**  $\text{NaHCO}_3$

**Acid, Base, Neither:** Base

**Safety Considerations:** Avoid contact with eyes, otherwise it is very safe

# Cleaning with Acids and Bases



Cleaning agent Vinegar

On a side note I am heavily surprised at how well this worked, been trying to get that off for years, who knew all it would take is a hammer, vinegar, water, and paper towels

Formula  $\text{CH}_3\text{COOH}$

This is an acid

Avoid Eye and Cut contact

Properties Aqueous, liquid

# Cleaning with Acids and Bases

The Chemistry of Cleaning: Vinegar





# How we assigned it

We did this near the end of the acid/base unit.

I framed it as “the assignment that could one day save you \$500”

Students watched a video in which we explored:

1. what makes water ‘hard’
2. the chemical formula of acetic acid (vinegar)
3. the chemical reaction that occurs when acetic acid is mixed with hard water deposits
4. how to clean with vinegar
5. the chemical formula of baking soda
6. cleaning with baking soda is largely a physical process
7. how to clean with baking soda

(If you want the PowerPoint that we used, please email me)

## The Chemistry of Cleaning

## Scroll down for a Model Poster

Item	Number of Points	Points Earned	Comments
<b>Photograph of dirty item</b> <ul style="list-style-type: none"> <li>Item might be a faucet, a sink, a glass, tile, a bathtub, an outdoor faucet, etc.</li> </ul>	2		
<b>Cleaning Agent:</b> Choose either: <ul style="list-style-type: none"> <li>Baking soda</li> <li>Vinegar</li> <li>If you don't have either baking soda or vinegar in your home, email your teacher to find out good alternatives</li> </ul>	1		
<b>Properties used:</b> <ul style="list-style-type: none"> <li>Are you cleaning the item using physical properties or chemical properties?</li> <li>Watch the introductory video for more info</li> </ul>	1		
<b>Chemical Formula:</b> <ul style="list-style-type: none"> <li>What is the chemical formula of the cleansing agent you are using?</li> <li>Watch the introductory video for more info</li> </ul>	1		
<b>Acid, Base or Neither?</b> <ul style="list-style-type: none"> <li>Is the agent an acid or a base or neither??</li> </ul>	1		
<b>Photograph of the clean item</b>	2		
<b>Safety Considerations</b> <ul style="list-style-type: none"> <li>What safety considerations should you have in mind when using this?</li> </ul>	1		
<b>TOTAL:</b>	9 points		

# Baking with Acids and Bases

## SWBATS:

- (Review from earlier in year): Predict the products of an acid-base reaction
- Recite that an acid + base yields water and a salt and sometimes a gas
- Recite the difference between baking soda and baking powder
- A carbonate decomposes to form  $\text{CO}_2$  which helps make cakes, muffins, and cookies rise.

### **Baking with Acids and Bases**

*Bake a quick bread, muffin, or cookie that uses baking powder, baking soda, or a combination.*

*Places to find recipes:*

- 1. Cookbooks in your home*
- 2. Your parents/grandparents/other family members*
- 3. Google "quick bread" or "muffin" or "cookie"*
- 4. Email us; we can suggest a recipe*
- 5. Got an idea other than quick breads, muffins or cookies? Email us to get approval!*

*Use safe techniques in the kitchen.*

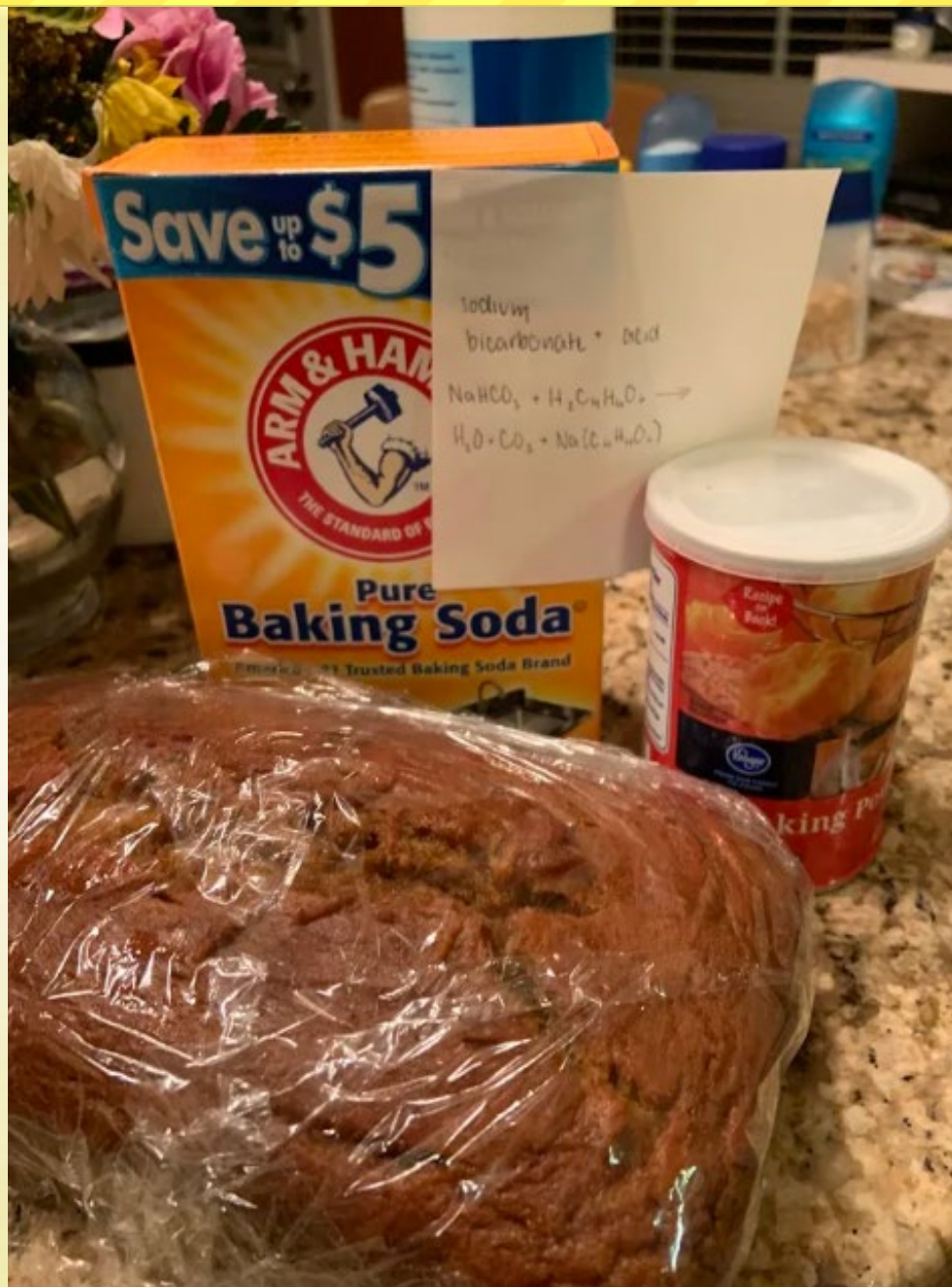
*Make sure an adult knows that you are baking.*

*Submit a photo or have some fun and make a PowerPoint or other kind of report. The submitted project should include:*



You and your final cookie/muffin/bread together in a photo	1 pt for you being in the photo 4 pts for the cookie/muffin/quick bread	
The photo includes a card with the chemical reaction handwritten that occurred in the bread, cookie, or muffin very clearly written (see Video "Mixing Acids and Bases" for one version of the reaction)	2 pts for correct chemical reaction 1 pt reaction is handwritten and clearly visible	
A picture of the recipe showing the baking soda or baking powder	2 pts for the recipe	
Total	10 points	

# Baking with Acids and Bases



Wacky cake (SINGLY)

1 C. SUGAR 1 1/2 C. FLOUR  
1/2 t. SALT 1 t. soda 3 T. Cocoa  
1/4 c 2 T oil 1 T VINEGAR 1 t vanilla  
1 C. COLD WATER

8x8 PAN

30-40 MINUTES

regular muffins 15-18 mini muffins 10

300 + 0.4 = 100.4 = 100.4



Chemical reaction: rose in the oven  
the CO<sub>2</sub> made the cupcakes rise

12:36  
Messages  
celebratingweets.com

Course: Dessert Cuisine: Dessert  
Prep Time: 10 minutes  
Cook Time: 15 minutes  
Total Time: 25 minutes  
Servings: 5 Calories: 318kcal  
Author: Allison - Celebrating Sweet

**Ingredients**

- Cupcakes:**
- 1/2 cup all purpose flour
  - 1/2 teaspoon baking powder
  - 1/8 teaspoon salt
  - 1 large egg
  - 1/4 cup granulated sugar
  - 2 teaspoons pure vanilla extract
  - 4 tablespoons unsalted butter melted and slightly cooled
  - 1/4 cup milk preferably whole or 2% milk

**Vanilla Frosting:**



Have a second option in case they don't have supplies to bake.

Our alternative: Students answered questions about this video by Bon Appetit





**One last random idea:  
Use real websites to gather  
information relevant to  
current events**

<https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2-covid-19>

# Guidelines for creating lessons that weave the content into the “Fabric of Life”:

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5. Create associations between the content and what is in the home
6. Carefully think about what the students must know before they can start the project
7. Make instructions concise; use bulleted checklists that make grading clear
8. Provide models of assignments

# Something to think about:

Have students do “I wonders” or generate questions at the beginning of the project

I am hopeful that you have been creatively coming up with your own ideas and extensions.

Let's share!

My email: [ljcumming721@gmail.com](mailto:ljcumming721@gmail.com)