

Finley Elementary Design Challenges- Washington STEM Grant

SE LASER - STC Kit the STEM Design Challenge developed for : 3rd Grade Chemical Tests
STEM Design Challenge Project Title: <u>Neutral Nancy's Nursery</u>
Created by: Lorianne Donovan and Robin Ward
STEM Design Challenge Project Placement and Pacing Placement: After Lesson 15 "Testing Household Liquids with Red Cabbage Juice" Pacing: 1 day about 60-90 minutes or can be divided into 2 days with Day 2 being the letter writing.
Overview: Students will determine the most neutral water source using red cabbage juice as an indicator. Objectives: <ul style="list-style-type: none">• Students apply the red cabbage juice test to 3 unknown water samples to determine the most neutral sample.• Students use the pH indicator strip to identify acidity of 3 water samples (provided)• Students share test results and write a recommendation letter stating the most neutral sample.
STEM Design Challenge Problem: Students will read a memo from "Neutral Nancy's Nursery" which is a new plant nursery in your area. Nancy wants to sell healthy, thriving plants to the people of your community. Nancy has already purchased land that has good quality soil, but she is now concerned about a water source. She has a well, but the water has been too acidic due to wildlife falling in the well at night. Nancy needs a constant high quality, neutral water source. The students' job will then be to test samples of water that three companies have sent to the school. They will test the three samples to find the most neutral water source for her plants. Students will record their test results on a data table, using an Acid Base pH indicator strip to determine the most neutral (least acidic) water for Nancy to use. After all results of the class groups have been shared and recorded on a class data chart, each group will complete a Recommendation Letter (form provided-optional) to be sent to Neutral Nancy's Nursery.
Materials List: <ul style="list-style-type: none">• Cabbage juice(See recipe in resource section)• 30 Water droppers (3 per group)• 30 Small plastic liquid medicine dosage cups (3 per group)• 1 – 16oz Water bottle (plain)(nothing added)• 1 – 16oz Water bottle (with 25 drops of liquid dish soap)

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- 1 – 16oz Water bottle (with 25 drops of lemon juice)
- Detergent (Lemon scent liquid dish soap such as DAWN)
- Lemon juice
- Water bottle labels (print out and attached to bottles)
- Copy of Memo for each student
- Copy of Data Table for each group
- 1 test mat for each group
- 1 **COLOR** pH strip for each group
- Copy of Recommendation Letter for each student (2 choices included for adaptations)

Preparation:

1. Groups of 3-4 are best for this lesson.
2. Prepare the water bottles with label (provided in the lesson). Cut and tape the label around the 16 oz. water bottles.
3. Add 25 drops of liquid dish soap into 1 bottle labeled “Otter Water”. Next add 25 drops of lemon juice in 1 bottle labeled “Penguin Arctic Chill”. Leave the last bottle labeled “Flamingo Springs” plain.
4. Cut and laminate test mats for each group. These fit in the trays provided in the Chemical Test kit.
5. Print Acid Base pH indicator strip in **COLOR** cut apart. Use one strip for each group. Suggestion: These can be laminated for future use.
6. Provide each student with the official memorandum page from the Design Challenge.



Procedure:

1. Student and teacher read the Memo from Neutral Nancy’s Nursery together.
2. Guide students through creating and writing a procedure to test water samples or post procedure provided if students are not familiar with writing scientific procedures yet.

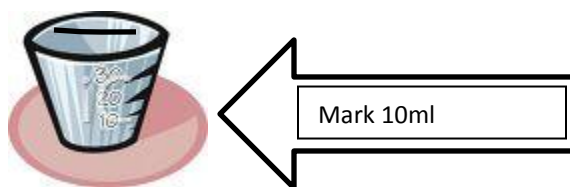
Procedure

1. Gather materials from science table.
2. Set up tray and mat with empty labeled dosage cups.
3. Teacher will pour 10 ml water sample from each water company in a dosage cup and place on the mat in the correct box.
4. Put 6 drops of cabbage juice in the water sample cup.
5. Observe any color changes and compare to pH chart
6. Record on data table if the water changes color indicating
A=Acid B=Base N=Neutral
7. Repeat steps #4-6 for the other 2 water samples.

3. Step back and allow the students to completion the investigation.
4. Let students know they will need to record results on Data Table after about 20 minutes of allowing students to test all three waters.
5. When groups have completed testing and filled in the Data Table, share the results of each group with the class. Record class total for Data Chart. Then complete recommendation letter (included) to be sent back to Neutral Nancy.



OPTIONAL: You may consider marking 10ml on the medicine dosage cups and label FS= Flamingo Springs PAC = Penguin Arctic Chill and OW for Otter Water. Use a permanent black marker so as not to confuse or hint and any color variations in the pH level.



Resources:

Red Cabbage Recipe

1 head of red or purple cabbage

1 16oz bottle of water

- Put both in the blender or food processor
- Blend until pulpy
- Drain with colander. Use bowl to collect juice
- Discard pulp and return juice to water bottle for storage
- Store juice in refrigerator until needed (up to 1 month)



Evidence:

- Group Data Table
- Class Data Chart
- Letter of Recommendation

Official Memorandum

To: Student Chemists

From: Neutral Nancy's Nursery

Subject: Help in finding a water source



Nancy is starting a new plant nursery in your area. She wants to sell healthy, thriving plants to the people of your community. She has already purchased land that has good quality soil. She is now concerned about a water source. She has a well, but the water has been too acidic due to wildlife falling in at night. (Skunks, mice, raccoon, etc...) Nancy needs a constant high quality, neutral water source.

Three companies have sent samples of their water. She has asked you to test the 3 samples to find the most neutral water source for her plants.






Data Table Group Name _____	
Flamingo Springs 	
Penguin Arctic Chill 	
Otter Water 	
Mark each sample as A =Acid B =Base N =Neutral	

1 copy of this data table for each group

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Class Data Chart:

Mark each sample as **A**=Acid **B**=Base **N**=Neutral

	<u>Group</u>	<u>Group</u>	<u>Group</u>	<u>Group</u>	<u>Group</u>
Flamingo Springs 					
Penguin Arctic Chill 					
Otter Water 					

Dear Neutral Nancy,

After testing the water from three different water companies, we have chosen _____ . When we added red cabbage juice, the water color turned _____ indicating a neutral pH. Therefore, the data shows you should select _____ as the company that best fits your water needs.

Sincerely yours,

Student Chemist

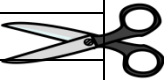




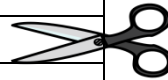
Sincerely Yours,

Student Chemist

Otter Water






Penguin Arctic Chill






Flamingo Springs






(Water bottle labels: Cut apart and tape on each 16 oz water bottle.)

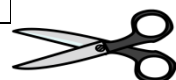
Acid	Neutral	Base
		






Acid	Neutral	Base
		






Acid	Neutral	Base
		



Acid	Neutral	Base
		



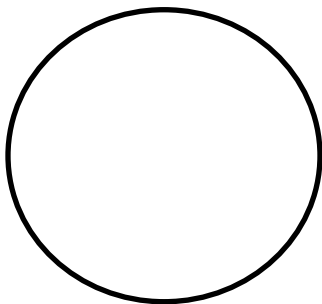
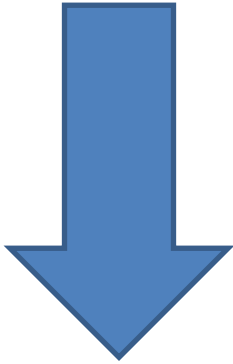
Acid	Neutral	Base
		

Ph indicator strips: Print in color, cut a part. 1 strip will be used for each team or group

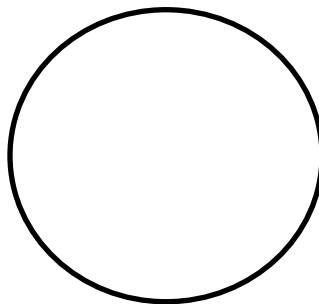
Test Mat: Cut and Laminate, 1 for each group or team

The test mat will fit in the trays provided in the Chemical Test Kit.

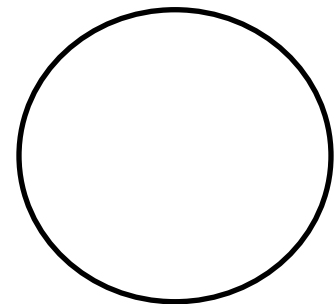
Place the graduated medicine dosage cups samples in the circles.



Flamingo
Springs



Penguin Arctic Chill



Otter Water

