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**Title:** Let's get sterile and learn to problem solve!!!!

**Key Questions:** (Unit on safety and scientific method)

1. How well do we wash our hands and why is it important to keep science labs sterile?
2. How do we use pipettes properly?
3. Which, if any, bodies of water in Escambia County test positive for coliform and/or E.Coli?
4. Why were the steps to uncovering the water quality lab important and beneficial to follow?

**Science Subject:** Physical Science

**Grade/Ability Level:** 9<sup>th</sup> grade/Regular

**Overall time estimate:** 8 days for the unit.

**Learning Styles:** Visual, auditory, kinesthetic, and synthesis

**Science NGSSS:**

SC.912N.1.1 Define a problem based on a specific body of knowledge...

SC.912.N.1.2 Describe and explain what characterizes science and its methods

SC.912N.1.3 Recognize that the strength or usefulness of a scientific claim is evaluated...

SC.912N3.4 Explain that a scientific theory is the culmination of many scientific investigations...

SC.912N.3.4 Recognize that theories do not become laws nor do laws become theories...

SC.912N3.5 Describe the function of models...

SC.912N.4.1 Explain how scientific knowledge and reasoning provide an empirically based...

SC.912N.4.2 Weight the merits of alternative strategies for solving a specific societal....

**Abstract:** I will integrate three labs in with the scientific method unit. It will instill relevant information about sterility and safety, use of science equipment, and the scientific method through the three following labs: 1. hand-washing, 2. learning to use pipettes, and a lab utilizing the scientific method to get real world data on the water that is around them in Escambia County. They will gain practice in science safety, (hand washing/sterility), using pipettes, writing out a hypothesis, carrying out an actual lab and making meaning out of the real life data collected, in addition to providing an overall conclusion that ties their hypothesis in with the actual lab results.

**Rationale:** I am going to do something completely different this year. Rather than

using the textbook as the main resource, my unit plan will become the main resource for science safety and the scientific method with pathogens as the theme for that content. The text will be only a supplement. I believe that in the urban area my school is in, that the waters in Escambia county are very important to the students. Therefore, I feel that if they can attach meaning to the lab then the lab and its' procedure will be much more meaningful.

In addition, my classes are regular ed students. Hands-on approach should involve them and make it knowledge that will stick with them. Science, in and of itself, is about a natural curiosity about the world around them so “getting in the trenches” so to speak will make it a lasting experience.

**Data Collection techniques/assessments:**

- Unit pretest/posttest
- Lab outcome (worksheets) on pipettes
- Water Quality lab/worksheet

**ICORE Summer Institute elements specifically included (UF connection):**

- Pipette use/lab
- Water quality lecture with Dr. Max Teplinski and UF labs on water quality

**\*\*Literature cited:**

1. [learnweb.harvard.edu/ent/gallery/pop4/pop4\\_lesson7.pdf](http://learnweb.harvard.edu/ent/gallery/pop4/pop4_lesson7.pdf)
2. [www.sjwmd.com/education/lessonplans/whatarewe.html](http://www.sjwmd.com/education/lessonplans/whatarewe.html)
3. Pipetting by Design, ICORE 2012
4. Water Quality module (Dr. Max Teplinski) UF-CPET ICORE 2012.

**Lesson Plan:**

- Discussion of safety in a science classroom to include proper hand-washing with a GloGerm activity.
- Will show a range of science equipment and their uses and do a lab learning to use pipettes.
- Will introduce pathogens and our bodies of water.

Discussion as a class ~

- What is fecal coliform?
- Can they cause disease?
- How do they get in the water?
- Recall normal values for drinking/swimming/boating.
- What is the importance of sterile equipment and procedure in the lab?

**Vocabulary:**

- Science
- Control
- Hypothesis

- Scientific method
- Data
- Pollution/Contaminate
- Bacteria
- Toxic
- Filtration
- Groundwater
- Run-off
- E.coli
- Coliform

## **LABS:**

### **(1) Hand-washing importance**

(Put glo-germ on stuffed animal and desks prior to lab.)

Use a black light to “show” all the germs on the desks. Have students wash their hands. Use the black light to show “germs” before washing and after. Then have them be seated (where there will no doubt touch the desks again) and touch a stuffed animal that has been predisposed to “Glo germ”. Do the UV light again. This will show the “contamination” again to their hands. We will discuss how and where we pick up germs and how this can be unhealthy. This will lead into a discussion on how important hand-washing is to sterility in a lab and why this is important to be sterile in a science lab.

### **(2) Pipette lab -- (rainbow pipette)**

#### **STUDENT INSTRUCTIONS:**

Use the 200  $\mu$ l and the 20  $\mu$ l pipettes

1. Pipette 219  $\mu$ l of the blue solution into a blank 1.5 ml tube.
2. Carefully and slowly add 210  $\mu$ l of the green solution on top of the blue solution, making sure to not mix the blue with the green.
3. Add 435  $\mu$ l of the yellow solution on top of the green solution – don’t mix with the blue and green.
4. Pipette 300  $\mu$ l of the orange solution on top of the yellow – don’t mix.
5. Add 336  $\mu$ l of the red solution on top of the orange – don’t mix.

Did you reach the top line of the tube?

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### (3) Water Quality Lab

Students will be in groups of 4 and will follow procedure on the handout. Each group should test a tap water sample and a local body of water sample. I will have water samples from the creek beside Tate High, my pond, Escambia river and Bayou Texar.) Turn in one data collections sheet per group.

**GROUP NAMES:**

- |          |          |
|----------|----------|
| 1. _____ | 3. _____ |
| 2. _____ | 4. _____ |

**HYPOTHESIS:** \_\_\_\_\_  
\_\_\_\_\_

## PROCEDURE

1. The coliform tubes are capped and about one-half full of purple liquid. Before removing the cap, write the date, time, and source of the water sample on the tube itself. (Either use tape or a permanent marking, pen.)

2. Remove the cap from one of the coliform testing tubes. Fill the tube with your tap water sample via pipette to about 1 cm from the top. (The tube has a small shoulder at that level.) Place the cap back on the tube. Then use the pipette and place a water sample from the body of water on the petri dish and cover.

3. Leave the tube and petri dish in a safe, warm place for 48 hours.

*NOTE: Cool temperatures will not change the results of the test; temperatures of less than 20 °C (68 °F), however, may slow down the color change if coliform is present.*

After 48 hours, examine the tube and the petri dish and record the results on the *Data Recording Form*.

**Purple = No coliform bacteria present**

**Yellow = Coliform bacteria in the water sample**

The Petri dish will show colonies.

7. Add several drops of chlorine bleach to the tube to kill the bacteria. Flush the contents of the tube down the drain and discard the tube. **DO NOT dispose of the sample without first disinfecting it.**

## DRAW SAMPLES:

Tube:

Petri Dish:

**CONCLUSION:** \_\_\_\_\_  
\_\_\_\_\_

## \*\*Literature cited:

5. [learnweb.harvard.edu/ent/gallery/pop4/pop4\\_lesson7.pdf](http://learnweb.harvard.edu/ent/gallery/pop4/pop4_lesson7.pdf)
6. [www.sjwmd.com/education/lessonplans/whatarewe.html](http://www.sjwmd.com/education/lessonplans/whatarewe.html)
7. lesson/lab module with pipettes, ICORE 2012
8. Water Quality module (Dr. Max Tepliski) UF-CPET ICORE 2012.

## **EQUIPMENT/SUPPLIES NEEDED**

<b>Item #</b>	<b>Vendor/Source</b>	<b>Cost</b>	<b>Total</b>
652595	Carolina Biologicals	\$66.75 x 3	\$200.25
154681	Carolina Biologicals	\$18.55 x 2	37.10
<b>Total</b>			<b>237.35</b>

\*\*Additional costs will be covered by my school account with monies left over from last year.

### **BACKGROUND INFO FOR WATER QUALITY LAB:**

#### **TOTAL COLIFORM BACTERIA**

##### **Brief Summary**

A simple presumptive test that indicates the presence of total coliform bacteria in a water sample. After 48 hours of incubation at room temperature, a lactose broth solution changes colors from purple to yellow if coliform is present.

##### **Background**

Coliform is a group of generally nonpathogenic bacteria that live throughout the environment. One type of coliform, fecal coliform, lives in the intestinal tract of warm blooded animals and helps digest foods. It is not harmful in and of itself, but it serves as an *indicator* and are easy to find whenever sewage is present. If you find coliform bacteria in water, you can be sure that other bacteria, viruses or parasites are also present.

Some of these might cause diseases. Testing for particular pathogens in water is usually difficult and time consuming. Coliform bacteria, however, are fairly easy to test for, and they usually occur with other pathogens. That is why people who monitor water quality use this group as an indicator. In water with high total coliform counts, about 10% of the coliform will be fecal coliform. This kit uses a simple presumptive test for the presence of total coliform bacteria. The test uses a lactose broth that changes color from purple to yellow in the presence of coliform bacteria. Since it is a presumptive test, it is impossible to calculate the quantity of coliform in the water but this test does not require special equipment or incubation.

## **WATER-BORNE DISEASES ARE STILL WORLDWIDE KILLERS**

According to the World Health Organization, throughout the world, 4.3 million people, mostly children, die every year from diarrhea caused by water-borne bacteria! That is more than the population of Norway. Other water-borne diseases, such as typhoid, cause seven million deaths and seven billion illnesses each year. Proper water treatment and disinfection of sewage prevent large-scale epidemics.

### *Sources of Coliform*

\* Combined sewage systems carry both sanitary wastes - from toilets, washers and sinks - and storm runoff.

During rains, sewer pipes are too small to handle the combined flow, so part of it is diverted into a river, bay or harbor. This storm overflow contains untreated or inadequately treated sewage.

- Agricultural and rural runoff carries wastes from birds and animals. -

- Improperly working septic tanks and cesspools can allow untreated wastewater to seep into the groundwater.

### **Interpreting Results**

Positive results indicate the presence of total coliform bacteria from warm-blooded animals and various soil organisms. People should not drink that water! Total coliform counts are usually about 10 times higher than fecal coliform. Thus, if you find total coliform bacteria, your sample probably contains fecal coliform and other disease-carrying pathogens. You cannot tell whether fecal coliform bacteria came from human sewage or animal waste without performing other laboratory tests.

### **Extension Activities**

I. Rinse your hands in clean water (water not contaminated with coliform), then test that wash water. Were you carrying coliform on your hands? The results might be a strong, argument in favor of regular hand washing.