Altamonte Springs
SCIENCE INCUBATOR

Name: _____
Date: _____

Real Time Experience: Interpreting Titration Data in Charts & Tables

Middle School Earth Science | Fall Module 1 | Altamonte Springs Environmental Lab

NGSSS Big Idea: Big Idea 1—The Practice of Science

Benchmark Code & Description:

SC.6.N.1.1, SC.7.N.1.1, SC.8.N.1.1—Define a problem from your curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

NGSSS Big Idea: Big Idea 2—The Characteristics of Scientific Knowledge

Benchmark Code & Description:

SC.6.N.2.3—Recognize that scientists who make contributions to scientific knowledge come from all kinds of backgrounds and possess varied talents, interests and goals.

LEARNING GOAL/OBJECTIVE

Students will learn how laboratory staff analyze drinking water and surface water samples to determine water quality.

PREREQUISITES

Review:

- Applicable Textbook Sections
- Titration Procedure: How to Test Hardness in Water Samples
- Vocabulary List
- Laboratory Safety (see Support Materials)

VOCABULARY

See vocabulary sheet.

HANDS-ON ACTIVITY

Task(s):

Students will perform a titration experiment to determine the hardness of a drinking water sample.

Provided Materials:

- Clipboard
- Titration procedure
- Lab coat and safety goggles

Career Options: Chemist (BS Degree), Scientist (BS Degree), Microbiologist (BS Degree)

Lesson Steps:

1. Students will be provided lab coats and safety goggles to wear.
2. As students are suiting up, a brief presentation will be playing.
3. Students will break into pairs for titration lab.
4. Staff will discuss responsibilities, job description and educational requirements of laboratory personnel.
5. Students will be provided a clipboard and the titration procedure.
6. Student teams will perform titration procedure and record data.
7. Students will discuss results and relate to water quality (i.e., impacts on environment).

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Titration Procedure: How to Test the HARDNESS of Water Samples

Introduction: Minerals like calcium and magnesium determine the "hardness" of water. The term "hard water" comes from the fact that these minerals in the water prevent soap from removing dirt making it "hard" to clean things. Water hardness is tested by titration.

Procedure: Analyze water for hardness.

1. Measure 50 mL of water into a flask.
2. Add 2.0 mL of the Buffer Solution.
3. Add 4 drops of Color Indicator Solution. The water will turn RED.
4. Record the initial volume of Titrant in the burette.
5. Slowly open the burette to add the Titrant.
6. Continue adding the Titrant drop by drop until the color of the water changes from red to purple to blue.
7. When the blue color is reached, the titration is completed. This is called End Point of the reaction. Read and record the final volume of Titrant in the burette.
8. How much Titrant did you use?

	Final Volume	**(from Step 7)**		mL
-	Initial Volume	**(from Step 4)**	-	mL
=	Titrant Used			mL

Place an "X" above the Volume of Titrant that you used.

X								
Titrant	3	4	5	6	7	8	9	10
Result	60	80	100	120	140	160	180	200

What does my result mean?

EPA Hardness Chart

Hardness (mg/L)	Classification
<75	Soft
75-150	Moderately Hard
150-300	Hard
>300	Very Hard

Affect on Environment

Hardness (mg/L)	Affect on Life
<45	Fish don't reproduce
45-200	Game fish live
200-500	Rough fish live
>500	Fish don't reproduce

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Environmental Laboratory—Titration Vocabulary

Burette—a glass column that has graduations to mark the volume of liquid dispensed. It is used for titrations.

Compound—a chemical substance formed when two or more elements combine.

Concentration—the amount of a substance per defined space. It usually is expressed in terms of mass per unit volume.

Endpoint—in titration procedures it is the point at which the chemical reaction has completed and is usually detected by a color change.

Graduated Cylinder—a vertical glass column that has graduations that measure a certain volume of liquid.

Hardness—water hardness is the measurement of the minerals present in the water specially these of calcium and magnesium.

Meniscus—the curved upper surface of a still liquid in a tube, concave if the liquid wets the walls of the container, convex if it does not, caused by surface tension.

Minerals—inorganic compounds that naturally exist in nature.

pH Meter—an electric device that uses electrodes to determine the pH of a sample.

Potable Water—water pure enough to be consumed or used with low risk of immediate or long term harm. This is another term for drinking water.

Stirrer—a mechanical device that rotates a magnet to stir liquids.

Titrant—in titration procedures it is the solution added to another solution to complete a chemical reaction. Usually contained in a buret.

Titration—a chemical procedure used to determine the presence and the amount of a substance in a solution.