Field Measurements Teacher's Guide

Subject: Integrated Science (Life; Earth-Space; Physical)

Topic: This field lab introduces students to the methods, skills, and tools associated with making common environmental field measurements including the following: Length, Mass. Liquid Volume, Temperature, Light, Humidity, Wind Speed

Summary: Students will learn how to take field measurements in a systematic and consistent manner in order to maximize precision and accuracy. Students will be introduced to the concepts of qualitative observations and quantitative measurements. They will be introduced to the importance of these as the basis for drawing inferences. The lab will allow students to make measurements inside a cave and compare them with measurements outside.

Objective(s): After completing the field lab, students will be able to:

1. Measure length, mass, volume, temperature and other conditions
2. Describe the tools used for these measurements including their strengths and limitations
3. Describe the difference between accuracy and precision
4. Carry out simple conversions of common units

Ecosystem(s): Karst Ecosystems

Equipment:

- Tape Measure (metric)
- Graduated Cylinder
- Thermometer (digital)
- Triple Beam Balance
- Spring scale
- Measuring Rod
- Calculators
- Env. Multi-meter (optional)

Background:

- Vocabulary: observation, measurement, inference, precision, accuracy, estimation, physical properties or matter
- Reference Material: Glencoe 7th Grade Florida Science Science Skill Handbook pages 576-584
- Equipment Training: none

Procedure (Engage; Explore; Explain)

1. Engage the students by asking a specific question that gets to the heart of the activity: Why is it important to make accurate measurements? Use the students' answers to ascertain what they already know, clarify any misconceptions, and then ask them to formulate their own hypothesis relating to their own expectations of the outcome of the lab.
2. Separate the students into 3 groups to rotate through the stations (small groups can remain as one)
3. Complete the measurements at each of the stations:
    a. Temperature (solid, liquid, gas)
    b. Volume (solid and liquid)
    c. Mass and Weight
4. After completing the lab, allow the students to answer the discussion questions as a group and explain their answers relating them to the concepts, processes and skills associated with the activity. Students should record their answers individually. At this time, facilitators can introduce/explain the specific concepts and explanations in a formal manner.

Sunshine State Standards:

Science: SC.A.1.3.1; SC.H.1.3.1; SC.H.1.3.4; **Language Arts**: LA.C.1.3.1; **Social Studies**: SS. B.2.3.9
Mathematics: MA.A.1.3.1; MA.A.3.3.3; MA.B.1.3.2,3; MA.B.2.3.1-2; MA.B.3.3.1; MA.B.4.3.1; MA.E.1.3.1

Field Measurements Student Data Sheet

General Information

Full Name:		Date:	
School (teacher):		Time:	
Latitude:		Longitude:	

Student Hypothesis and Rationale

If I take the average of multiple measurement I am (circle one: more or less) likely to have an accurate answer than if I just take just one single measurement because . . . _____

_____.

Field Observations/Measurements/Data

	Station 1: Temperature			**Station 2: Volume of a regular shaped solid (m3)** (Note: make measurements to the nearest cm)	**Station 3: Volume by displacement**	**Station 3: Mass & Weight**	
	Soil (℃)	Air (℃)	Water (℃)	Volume (m3) (length x width x height = volume)	Volume (ml)	Mass (g)	Weight (Kg)
Group 1				_____ x _____ x _____ = _____			
Group 2				_____ x _____ x _____ = _____			
Group 3				_____ x _____ x _____ = _____			
Average				_____ x _____ x _____ = _____			

Field Measurements Student Assessment Questions

1. Which object (solid, liquid or gas) had the highest temperature? Lowest?

Highest:

Lowest:

2. What was the volume of the gift shop based on one person's measurements? What was the volume based on the average of the three groups?

One person:

Average:

3. Based on the calculations for the volume of the gift shop, was your hypothesis supported?
Note: the instructors will provide the actual volume for you to compare your results with.

Actual Volume Based on Instructor's Measurements:

4. What types of objects are better suited to determining liquid volume by displacement than by using the L x W x H formula?

5. We measured the volume of water in milliliters and one milliliter of water represents 1 cubic centimeter. If we put a small stone into 50 milliliters of water, and the water level rose to 57 milliliters, what would the volume (in cubic centimeters) of the stone be?

6. Think about what you learned in this lab; has it generated any new questions? Write a new question about something you want to learn more about.

Portfolio Journal Prompt

Measurements help us to be specific about our observations and to generate quantitative data that can be compared with other measurements. Think about how often you use measurements in your daily life and describe how many measurements you make in the course of a day? Before you begin writing, think about the common types of measurements (time, distance, volume, weight, temperature, etc.).

Field Measurements Conversion Reference Sheet

Common System International (SI) Prefixes

Prefix	Symbol	Meaning	Meaning
kilo-	k	1,000	thousand
hecto-	h	100	hundred
deka-	da	10	ten
deci-	d	0.1	tenth
centi-	c	0.01	hundredth
milli-	m	0.001	thousandth

Unit System Equivalents

Type of Measurement	Equivalent
Length	1 in = 2.54 cm
Mass and weight*	1 lb = 0.45 kg
Volume	1 gal = 3.78 L
Area	1 yd^2 = 0.83 m^2
Temperature	℃ = (℉ – 32)/1.8

*Weight is measured in standard Earth gravity.

1 milliliter = 1 gram = 1 cubic centimeter