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, quantitative measurements the International System of Units (SI). They will be introduced to the importance of measurements as the basis for drawing inferences.

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

1. Measure length, mass, volume, temperature and other conditions
2. Calculates measurements and converts answers within/between metric and customary units.
3. Uses appropriate units and significant digits when taking measurements.

Ecosystem(s): Any, Indoor/Outdoor

Equipment:

- 100 meter Tape Measure
- Ruler with (cm)
- Stopwatch
- Graduated Cylinder
- Spring scale
- Beam Balance
- Measuring rod
- Thermometer
- Sling Psychrometer
- Calculator

Background:

- Vocabulary: observation, measurement, precision, accuracy, estimation, physical properties, matter
- Reference Material: Glencoe 7th Grade Florida Science Skill Handbook pages 576-584
  Accuracy and precision: http://www.fordhamprep.org/gcurran/sho/sho/lessons/lesson22.htm
- Post activity: Have students chart or graph the heights of the students in the classroom.
- Equipment Training: No pre-requisite equipment training required.

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. In groups of 4-6 students, rotate through the five pre-established measurement stations:
3. 1) Height of student: Use a straight board to get an accurate measurement. Have student record their own height and the average of their group's height, then the average height of the class.
4. 2) Volume in cubic cm of a box (LWH=V); Volume of pennies in mL, by displacement
5. 3) Weight and mass of pennies. Weight is measured with a spring scale; Mass is measured with a balance. *use the same number of pennies as in station 2, so that density can be determined later.
6. 4) Abiotic factors. (outdoors) Measure Air temperature with a thermometer and humidity with a sling psychrometer.
7. 5) Distance and Time. (outdoors) Distance to a pre determined spot with the 100 meter tape. Time, with stopwatch, how long it takes for a team member to get to the spot (s)
8. 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:	

Student Hypothesis and Rationale

If a cubic centimeter (cm3) is equal to a milliliter (ml) than when I measure the object's volume it will be (the same or different) in cm3 and ml because…_____

_____.

Field Observations/Measurements/Data

	Station 1		Station 2		Station 3	
Parameter	Distance (m)	Time (s)	Volume (cm3)	Volume (ml)	Weight (kg)	Mass (g)
Group 1			_____X _____X _____ = _____			
Group 2			_____X _____X _____ = _____			
Group3			_____X _____X _____ = _____			
Average			_____X _____X _____ = _____			

Field Measurements Student Assessment Questions

1. Which parameter or condition had the greatest variation between the groups' measurements? Why do you think this is?

2. What was the volume of the pennies according to your group's measurement? What was the average volume of the pennies? Calculate the density of pennies.

Your group:
Average:
Density (m/V = D):

3. Was your hypothesis supported by your data? Whether your hypothesis is supported or not, what can you infer from your observations, measurements, and results?

4. Was your time when measuring distance significantly different than the other groups? Did you get there faster or slower? What was your average speed? (speed = distance/ time)

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.

Field Measurements Portfolio Journal Prompt

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

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

1mL = 1 g = 1 cm^3