

Lab Framework

Text: Cord Applied Mathematics

Unit number and title: Unit 12 Using Scientific Notation

Short Description: Learning to use significant digits by various types of measurement

Developed by: Timothy D. Stave

Contact Information: tstave@bethelsd.org

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Lab Title

How accurate can you measure? Understanding significant digits.

LAB PLAN

TEACHER: Teacher Prep/ Lesson Plan

- **Lab Objective**

Students will understand why and how we use significant digits when measuring.

- **Statement of pre-requisite skills needed** (i.e., vocabulary, measurement techniques, formulas, etc.)

Vocabulary – Significant Digit, Graduated Cylinder, Triple Beam Balance, Bathroom Scale with metric units

Skills –

- Measuring via graduated cylinder, measuring stick and triple beam balance
- Labeling with correct metric measurements
- Writing numbers in scientific notation
- Converting metric units.

- **Vocabulary**

Significant Digit
Graduated Cylinder
Meniscus

- **Materials List**

Per Class

Power point to review how to measure
3 triple beam balances
1 bathroom scale
Something to weigh

Per group of students

3 graduated cylinders... one with marks to 10^{th} of a mL, one with markings to mL, one with markings to the dL

3 laminated rulers.... One with marks to the mm, one to the cm, and one to the dm

A pencil to measuring

An eraser for measuring

A small glass full of water and pipets

- **State Standards addressed**

Math: A1.2.A Know the relationship between real numbers and the number line, and compare and order real numbers with and without the number line.

A1.2.B Recognize the multiple uses of variables, determine all possible values of variables that satisfy prescribed conditions, and evaluate algebraic expressions that involve variables.

A1.8.A Analyze a problem situation and represent it mathematically.

A1.8.B Select and apply strategies to solve problems.

A1.8.C Evaluate a solution for reasonableness, verify its accuracy, and interpret the solution in the context of the original problem.

A1.8.D Generalize a solution strategy for a single problem to a class of related problems, and apply a strategy for a class of related problems to solve specific problems.

Reading: Component 3.2 Read to perform a task.

3.2.2 Apply understanding of complex information, including functional documents, to perform a task.

Writing: EALR 2: The student writes in a variety of forms for different audiences and purposes

EALR 3: The student writes clearly and effectively.

- **Leadership Skills**

Students will practice working with partners and also present their findings to class as a whole.

- **SCAN Skills/Workplace Skills**

Interpersonal

A. Participates as a Member of a Team—contributes to group effort

F. Works with Diversity—works well with men and women from diverse backgrounds

Information: Acquires and uses information

A. Acquires and Evaluates Information

Technology: Works with a variety of technologies

A. Selects Technology—chooses procedures, tools or equipment including computers and related technologies

- **Set-up information**

Create a power point for the warm up (or find one on the net), that covers measuring with graduated cylinders, rulers and triple beam balances. The power point should also describe how to measure to accurate significant digits.

Set up supplies, student handouts and groups ahead of time.

- **Lab organization**(-Grouping/leadership opportunities/cooperative learning expectations; -**Timeline required**)

5-10 minutes: Warm up, The teacher shows pictures of items being measured with rulers, a graduated cylinder and a triple beam balanced and are asked to write the measurements. Go over warm up

11-20 minutes: Go over method of measuring and significant digits with students. The teacher can either use a power point, document camera or demonstrations / white board.

5 minutes: Explain lab to students and start them working.

20-40 minutes: Students will work on the lab. They will do the following steps.

- As a class, measure an object with the scale and the triple beam balance. Students write down significant digits for each.
- Measure the pencil with the three different rulers, writing down the answer with the correct number of significant figures.
- Measure the eraser with the three different rules, writing down the answer with the correct number of significant figures.
- Fill water in the smallest graduated cylinder to about the halfway point. Write down the measurement with the correct number of significant digits.
- Dump the water into the other two graduated cylinders and write down the measurements using the correct number of significant digits
- Students then compare answers to other groups

10 minutes: Review findings with students, ask them to correct their results. Ask group members to share results to class. Ask students why it is important for scientists and researchers to keep track of significant digits.

- **Teacher Assessment of student learning** (scoring guide, rubric)

Students will turn in their results. Students will present their topic in groups

Grading

50% - Completeness of Lab

25% - Correctness of Mathematics

25% - Presentation to other groups / class

- **Summary of learning** (to be finished after student completes lab)

-discuss real world application of learning from lab

-opportunity for students to share/present learning

- What are significant digits? What do they measure?

- How can you tell how accurate the tools someone used were by looking

at their data?

- Why might it be important to keep track of significant digits?

- **Optional activities**

Significant digit / scientific notation work sheets

- **Career Applications**

Health, Financial, Construction, Science, Mechanical, etc.

<https://wa-appliedmath.org/>

LAB TITLE: How accurate can you measure? Understanding significant digits

STUDENT INSTRUCTIONS:

- **Statement of problem addressed by lab**
How do you communicate the accuracy of the tools you use to a reader?
- **Grouping instructions and roles**
You will be grouped in partners.
Roles: Partner 1: Measurer
Partner 2: Materials Handler, Presenter
- **Procedures** – steps to follow/instructions
 1. As a class we will measure objects with a bathroom scale and a triple beam balance. Write down the mass of each object using both tools using the correct number of significant digits.
 2. Measure the pencil with the three different rulers, writing down the answer with the correct number of significant figures.
 3. Measure the eraser with the three different rules, writing down the answer with the correct number of significant figures.
 4. Fill water in the smallest graduated cylinder to about the halfway point. Write down the measurement with the correct number of significant digits.
 5. Dump the water into the other two graduated cylinders and write down the measurements using the correct number of significant digits
 6. Answer the additional questions
 7. Compare your answers to other groups

- **Outcome instructions**

Object	Measuring tool	Measurement

Questions:

1. What are significant digits? What are they used for?
2. How can you tell how accurate the tools someone used were by looking at their data?
3. Why might it be important to keep track of significant digits?

Assessment instructions (peer-teacher)

	Self Assessment	Teacher's Assessment
<p>1. How complete was your worksheet?</p> <p>a. (0-25) missing two or more sections.</p> <p>b. (25-40) missing one section.</p> <p>c. (40-45) missing no sections</p> <p>d. (46-50) above and beyond requirements</p>		
<p>2. How accurate were your mathematics?</p> <p>a. (0-10) Calculation incorrect, little explanation.</p> <p>b. (11-15) Calculation correct, little explanation.</p> <p>c. (16-20) Calculation correct, some explanation</p> <p>d. (21-25) Calculation correct, complete explanation</p> <p>e.</p>		
<p>3. Presentation</p> <p>a. (0-10) Hasty presentation</p> <p>b. (11-20) Presentation describes the process of using significant digits</p> <p>c. (21-25) Presentation describes the process of using significant digits and applications</p>		
Total Score (out of 100)		