

TITLE OF LESSON

Physical Science Unit 1 Lesson 3 – Significant Digits and Scientific Notation  
*Nature of Matter: How do tribes standardize their lives?*

---

TIME ESTIMATE FOR THIS LESSON

One class period

---

ALIGNMENT WITH STANDARDS

California – Sciences  
Introduction Necessary To:  
significant digits; Investigation and Experimentation 1e

---

MATERIALS

*Hydrogen* – Reading from *The Periodic Table* by Primo Levi (not provided by ESubjects)  
**Significant Digit/Scientific Notation** – Student Page  
**Significant Digit/Scientific Notation Key** – Teacher Page  
**Addition, Subtraction, Multiplication, Division Lecture** – Teacher Page  
pen or pencil  
calculator (optional)

---

LESSON OBJECTIVES

- To introduce significant digits
  - To learn how to apply significant digits to math problems
  - To introduce scientific notation
  - To learn how to apply scientific notation to math problems
  - To identify lab safety techniques within a short story
- 

FOCUS AND MOTIVATE STUDENTS

- 1) Dialectical Journal 1 – Have students get into groups and get out their dialectical journals. Tell them to read each other's entries and decide which entry they feel is the most important. Then the group will present the entry to the class and tell the class why they feel it is important.
  - 2) Homework Check - Collect all homework.
  - 3) **Agenda** – Have students copy the agenda you have posted.
  - 4) Short Story – Hand out copies of the story “Hydrogen” from the book *The Periodic Table* by Primo Levi, or pass out copies of the book itself. Ask students to get into groups of four and **read** the short story **out loud**. Tell them they have 10 min. Ask them to identify what they think would be considered good or bad lab safety techniques and why. They should write down the items. If they do not finish the story, they must do so tonight along with their list.
- 

ACTIVITIES – INDIVIDUAL AND GROUP

1. Notetaking – Remind students that they should take notes during class since being a good scientist requires that one has documentation proving that the work has been completed. Have them take out a sheet of paper and title it Significant Digits and Scientific Notation.
2. Vocabulary – Write the words SIGNIFICANT DIGITS on the board.

3. Class Definition – Ask students to define each word. Write their ideas on the board. They may answer that SIGNIFICANT means important, and DIGITS are numbers or fingers or toes. If they answer the latter, ask them which would most likely be used in a scientific way. They should answer numbers. Remind them that in this case digits or numbers relates to a scientific term. This is one way that we can determine if we are looking at a scientific definition or a general definition. Then ask students, “Does anyone know anything about significant digits? How many digits should your answer have? Is it always the same? Does it really matter? Why is it important that measurements in labs be accurate?”

–Answers should include:

*Different answers*

*depends on the **precision** of your measurement tool*

*No, depends on the **precision** of the measurement and the math involved*

*Yes, we want to be **accurate** in science with our values.*

*In order for results to be meaningful, the data must be taken accurately. There is a difference between 10g and 10.0g; 10.0g is much more accurate.*

4. Graphic Organizer – Make a chart on the board. Discuss rules.

Rules for Determining Significant Digits	
Rule	Example
<p><i>The following are always significant:</i></p> <ul style="list-style-type: none"> <li>◆ all nonzero digits</li> <li>◆ all zeros between nonzero digits</li> <li>◆ zeros to the right of a nonzero digit and to the left of a decimal</li> <li>◆ zeros to the right of a nonzero digit and to the right of a decimal</li> </ul>	<p>456 has 3sig digs 70009 has 5 sig digs 10. has 2 sig digs 25.00 has 4 sig digs</p>
<p><i>The following are never significant:</i></p> <ul style="list-style-type: none"> <li>◆ zeros to the left of decimal in values less than one</li> <li>◆ zeros to the right of decimal and to the left of the first nonzero digit</li> </ul>	<p>0.876 has 3 sig digs 0.098 has 2 sig digs</p>
<p><i>Exceptions:</i></p> <ul style="list-style-type: none"> <li>◆ exact conversion factors are understood to have unlimited sig digs</li> <li>◆ counting numbers are understood to have unlimited sig digs</li> </ul>	<p>100cm/1m –unlimited 30 days - unlimited</p>

5. Individual Work – Hand out copies of the **Significant Digit and Scientific Notation** worksheet. Have students individually try the first few problems on the worksheet (problems 1-5). Tell them to write down the rule that applies to each question. Randomly, ask students to give their answers and which rules they used to come up with their answer. Go over any difficulties they may be having.
6. Review and Discuss – Now introduce students to the rules when mathematics is applied.

Rules for Determining Significant Digits when Applying Mathematics	
Rules	Example
<p><i>Addition and subtraction:</i> The answer must be rounded to contain the same number of digits to the right of the decimal as there are in the measurement with the smallest number of digits to the right of the decimal.</p>	<p>2.71m + 0.0004m =2.7104m =2.71m</p>
<p><i>Multiplication and division:</i> The answer must be rounded to contain the same number of digits as there are in the measurement with the smallest number of digits.</p>	<p>5.6g x 2.345g =13.132g =13g</p>

7. Individual Work – Have students individually try the first few problems on the worksheet (problems 6-10).
8. Review and Discuss – Now introduce students to the concept of applying mathematics to numbers written in scientific notation, which you reviewed yesterday in class. Put the chart on the board and fill in as you go through the explanations.

<b>Rules for Applying Mathematics to Scientific Notation</b>	
<b>Rules</b>	<b>Example</b>
<i>Applying Scientific Notation:</i> Use scientific notation to eliminate all place holding zeros	2400m → 2.4 x 10 <sup>3</sup> m 0.0005g → 5 x 10 <sup>-4</sup> g
<i>Addition and subtraction:</i> All values must have the same exponent before they can be added or subtracted. The result is the sum or difference with the same exponent of 10.	4.5 x 10 <sup>6</sup> + 2.3 x 10 <sup>5</sup> =45 x 10 <sup>5</sup> + 2.3 x 10 <sup>5</sup> =47.3 x 10 <sup>5</sup> =4.7 x 10 <sup>6</sup>
<i>Multiplication:</i> The first factors of the number are multiplied and the exponents of 10 are added.	(4.5 x 10 <sup>6</sup> )(2.3 x 10 <sup>5</sup> ) =(4.5 x 2.3) x 10 <sup>6+5</sup> =10.35 x 10 <sup>11</sup> =1.0 x 10 <sup>12</sup>
<i>Division:</i> The first factors of the number are divided and the exponents of 10 are subtracted.	(4.5 x 10 <sup>6</sup> )/(2.3 x 10 <sup>5</sup> ) =(4.5 / 2.3) x 10 <sup>6-5</sup> =1.95652 x 10 <sup>1</sup> =20.

Ask students how to convert the following number into scientific notation: 504900 = 5.049 x 10<sup>5</sup>  
Then using the **Addition, Subtraction, Multiplication, and Division Lecture** (Teacher Page) explain to students the information on that sheet in relation to the chart above.

- Group Work – Have students break into lab groups and work on the rest of the **Significant Digit and Scientific Notation** worksheet. Students should be challenged to complete as many significant digit and scientific notation problems as possible. Walk around the room checking on students' progress. Reward correct problem solving technique and answers with sticker/stamp. Help students who are struggling. Remember ALL WORK MUST BE SHOWN. Students will finish worksheet for homework.
- Homework Review – Collect finished assignments and class notes. Go over the homework assignments.

#### HOMEWORK

- Finish **Significant Digit /Scientific and Scientific Notation** worksheet
- Finish reading the story "Hydrogen"
- List good or bad lab safety practices from the story

#### GROUP ROLES

None

#### DOCUMENTATION FOR PORTFOLIO

None