NAME: _____ **PERIOD:** _____ **DATE:** _____

LAB PARTNERS: _____ **LAB #3**

Math in Earth Science

CLAIM: Math skills are needed to find rate of change, percent deviation and gradient in studying Earth Science

SEP's: Throughout this lab, the following SEP's (Science Engineering Practices) will be touched upon:

1. Asking questions and defining problems
2. Developing and using models
3. Analyzing and interpreting data
4. Using mathematics and computational thinking

PHENOMENON:

1. Steep slopes while skiing
   https://www.youtube.com/watch?v=Llg2oBONZ3Q
2. White Water Rafting (to talk about rate of change with real life example)
   https://www.youtube.com/watch?v=QeaWIgOt-yU

INTRODUCTION

Throughout your study of Earth Science, you will use equipment to help you observe and measure earth materials in the laboratory. You will also be called upon to demonstrate some simple math skills. Not only must you be able to calculate problems such as percent deviation and rate of change, but you must also be able to correctly divide using a calculator, round to the nearest tenth, and use scientific notation. In this lab you will practice these math skills.

OBJECTIVE

During this investigation you will be able to:

1. Round to the nearest tenth
2. Converting in and out of scientific notion
3. Subtract time
4. Calculate percent deviation and rate of change
5. Determine rate of change from a graph

MATERIALS

Calculator
Ruler
Earth Science Reference Tables

PART 1: Simple Math Skills (Rounding, Division and Scientific Notation)

ROUNDING

When performing calculations, answers frequently come out uneven, with many decimal places. In this course, unless otherwise directed, you are expected to round off all answers to the nearest **tenth** (one place after the decimal point).

For example:

97.268 would be rounded to 97.3 139.42 would be rounded to 139.4

Round off the following numbers to the nearest tenth.

1) 10.76 _____

2) 1369.07 _____

3) 0.134 _____

4) 1.544 _____

5) 0.09 _____

6) 10.02 _____

DIVISION

Solve the following division problems, rounding off all answers to the nearest **tenth.**

7) 75 $\overline{)105}$ _____

8) 36 / 7 _____

9) 13.2 ÷ 6 _____

10) $\frac{20}{65}$ _____

11) $\frac{10000}{77000}$ _____

SCIENTIFIC NOTATION

Values that are used in scientific notation can be very large. One way to make these numbers more manageable for calculations is to use scientific notation. For example, the distance from the sun to the nearest star, Proxima Centauri, is about 40 trillion kilometers. The number 40 trillion equals 40,000,000,000,000. This number expressed in scientific notation is 4.0×10^{13}. Another example is when the size of a pebble is measured it is found to be 25 ten-thousands of a meter across. This number equals 0.0025. When expressed in scientific notation it is written 2.5×10^{-3}. Express the following numbers in scientific notation.

12) 3,700 _____

13) 87,000,000 _____

14) 120 _____

15) 0.250 _____

16) 0.03 _____

17) 0.000,000,1 _____

Express the following numbers as they should be written.

18) 3.3×10^{8} _____

19) 4.9×10^{10} _____

20) 1.0×10^{3} _____

21) 5.8×10^{-5} _____

22) 1.7×10^{-2} _____

23) 1.0×10^{-8} _____

RATE OF CHANGE

Procedure A

1. **Wind up your animal until you cannot turn it anymore**
2. **Still holding the wind-up handle, place the animal at the starting line (DO NOT LET GO OF THE ANIMAL YET)**
3. **Using your timer, make sure it starts at zero (0)**
4. **At the same time, let go of your animal and start your timer**
5. **When the animal stopped moving, stop your timer and record the time**
6. **Using a ruler, measure the distance between the starting line and where your animal stopped. Record this distance in your data table**
7. **Repeat steps 1-6 for two more trials**

Data Table 1: Animal _____

	Trail 1	Trail 2	Trail 3
Distance (cm)			
Time (seconds or minutes)			

Calculate

Calculate the rate change for each trail. To calculate rate of change, use the formula:

Trail 1	Trail 2	Trail 3

Procedure B

1. **Grab another wind-up toy to compare with Procedure A**
2. **Wind up your animal until you cannot turn it anymore**
3. **Still holding the wind-up handle, place the animal at the starting line (DO NOT LET GO OF THE ANIMAL YET)**
4. **Using your timer, make sure it starts at zero (0)**
5. **At the same time, let go of your animal and start your timer**
6. **When the animal stopped moving, stop your timer and record the time**
7. **Using a ruler, measure the distance between the starting line and where your animal stopped. Record this distance in your data table**
8. **Repeat steps 1-6 for two more trials**

Data Table 2: Animal _____

	Trail 1	Trail 2	Trail 3
Distance (cm)			
Time (seconds or minutes)			

Calculate

Calculate the rate change for each trail. To calculate rate of change, use the formula:

Trail 1	Trail 2	Trail 3

Use the Rate of Change model to answer the following questions

1. Which animal had the fastest rate of change?
2. Why do you think you got the results you did?
3. List two possible sources of error in the procedures of this experiment that could have affected your results
    -
    -

Laboratory Conclusion Questions:

1. Why would scientists round numbers instead of leaving them in their calculated form?
2. How could rate of change be helpful for someone not studying Earth Science?
3. A student made a mistake when measuring the volume of a big container. He found the volume to be 65 liters. However, the real value for the volume is 50 liters. What is the percent error? show your work
4. Use scientific notation for the following numbers:

    4,937,797 _____

    584.96493 _____

    0.43034 _____

    0.000000484 _____