MiSP Weathering and Erosion Worksheet #1 L3

Name ________________________________ Date______________
L 1, 2, 3

MASS WASTING - GLACIAL CREEPING

Advance Preparation – Making Glacial Ooze
Recipe for each lab group:

The substance used in this lab as a model for glacial ooze is sometimes called Gak or Glop. It is a polymer formed from sodium borate and Elmer's glue.

1. Add 50 ml. of Elmer's glue directly into a 250 ml beaker (no need for graduated cylinder)
2. Using a graduated cylinder, add 50 ml of H_2O to the glue and stir well to combine
3. Add 2 drops of food color and stir well to produce an even pastel color.
4. Add 30 ml of borax solution (4%) to glue/ H_2O mixture and stir well to combine
5. Knead in your hands or in a plastic bag
6. Return glacial ooze to the beaker and let it take on the shape of the container. Cover the beaker with cellophane or foil.
7. Wash your hands – ***borax can be an eye irritant***
8. Glacial Ooze may not be removed from class

Introduction: You will observe, measure, and graph data using a model of slow down slope movement. Mass wasting is the name for all of the earth processes by which gravity pulls materials downward. Some of the processes, like landslides and avalanches, are rapid while others, like soil creeping and glacial movement, occur so slowly that observations are difficult to obtain. A polymer will be used to model glacial movement.

Problems: How do glaciers and other slow moving earth materials move down a slope? Do glaciers or other earth material move down the slope at a constant speed?

Materials:
covered 250 ml beaker containing glacial ooze
clear plastic sheet with metric scale
ramp - clipboard or stiff cardboard
stopwatch
tape
blocks or books to raise one end of the ramp

Safety – The glacial ooze contains sodium borax that can be an eye irritant. Wash your hands after handling.

Procedure:

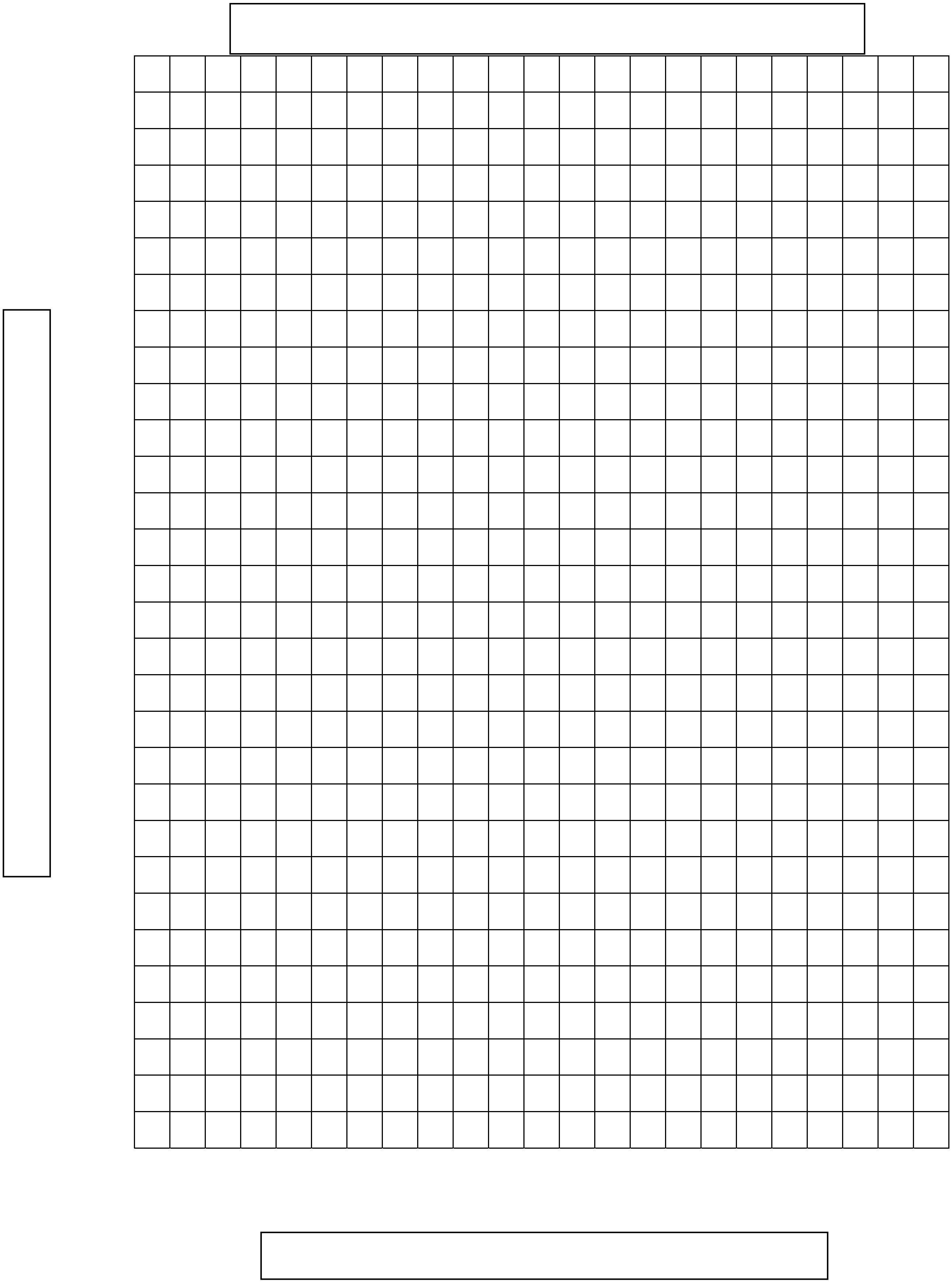
1. Follow your teacher's instructions for setting up the materials.
2. Uncover and quickly lay the beaker of glacial ooze on its side so that the rim of the beaker is exactly on the 0 cm mark on the metric ruler. Use the tape to hold the beaker in the correct location. ****The glacial ooze must flow down the metric scale on the ruler****
3. Start the stop watch when the glacial ooze flows across the 0 cm line on the ruler.
4. While the glop is moving down the board, take distance measurements every half minute (0.5 minute) for a maximum of 10 minutes.
5. Read, to the nearest tenth of a centimeter, the location of the front of the glacial ooze on the metric scale. Record your observations on the data table.
6. After completing the readings, set the beaker upright on the table, peel the glacial ooze from the plastic sheet, return it to the beaker, and cover the beaker.
7. Return the container of glacial ooze to your instructor.

Data:

Time (minutes)	Distance (cm)

Graph the data on the next page to show the relationship between time (minutes) and the distance the glacial ooze moved

- Label the X axis
- Label the Y axis
- Connect the data points.



Discussion L1-3

1a. Calculate the average speed (average rate of movement) of the glacial ooze during the first three minutes of observation to the nearest tenth of a cm/min. Show your work.

Speed (cm/minute) = $\frac{\text{Distance traveled between 0 and 3 minutes}}{\text{3 minutes}}$

1b. Calculate the average speed (average rate of movement) of the glacial ooze during the last three minutes (7 to 10 minutes) to the nearest tenth of a cm/min. Show your work.

Speed (cm/minute) = $\frac{\text{Distance traveled between 7 and 10 minutes}}{\text{3 minutes}}$

1c. Look at your graph. How does your graph show the differences in speeds/rates that you calculated in questions 1a and 1b?

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2. Explain what causes the speed (rates of movement) for the first three minute to be different than the last three minutes of observation.

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3a. Use the graph to predict what distance (cm) down the slope the glacial ooze would be after 12 minutes?

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3b. Material that is more liquid will move downhill faster than material which is "stiffer", (less fluid or more viscous). Using a different color pen or pencil, draw a line on the graph that would show the movement of a more liquid glacial ooze.

4. This activity presented a model for down slope movements like mudflows, soil creep, or glacier activity. In nature, what could happen to increase the rate of movement of sediment or ice in these earth features?

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Discussion L2-3

5. Look at the graph you drew. Notice that, instead of being a straight line, it is a curve. We will compare two sections of the graph (0 to 3 minutes and 7 to 10 minutes) by calculating each section's unit rate of change (slope). Draw a best-fit line for each section, if necessary. *(When using best fit lines, the ordered pairs to determine slope must be from the best fit lines, not from your data chart.)*

$$\text{Unit Rate of Change} = \frac{\Delta \text{ Distance (cm)}}{\Delta \text{ Time (minutes)}} = \frac{\Delta y}{\Delta x} = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

Graphed data	Ordered Pair used for calculation (x_1, y_1) (x_2, y_2)	Δ Distance (cm) Δ y	Δ Time (minutes) Δ x	Unit Rate of Change (slope) Δ y/Δ x
0 to 3 minutes				
7 to 10 minutes				

6a. Both unit rates of change (slopes) are positive numbers. What does that tell you about the relationship between time and distance?

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6b. Which section of the graph (0 to 3 or 7 to 10 minutes) had the greater slope? What does that tell you about the glacial ooze during the time period with the greater unit rate of change?

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6c. How do the unit rates of change compare to your answers to 1a and 1b? So, what does unit rate of change (slope) on this graph tell you?

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Discussion L3

7. Determine the y-intercept for the line segment from 0 to 3 minutes. Use the equation for a line to calculate the y-intercept. Use the line or best fit line you used in #5. The equation for a line is

$y = mx + b$
where m is the unit rate of change (slope) and
b is the y-intercept

Y Intercept
m = Ordered pair (x, y) = (____ , ____) y = mx +b Solve for b:

8. Based on the unit rate of change that you calculated above and the y intercept, write an equation for the line segment or best fit line from 0 to 3 minutes. Remember that the equation for a line is **y = mx + b** and m is the unit rate of change (slope) and b is the y intercept.

Equation - 0-3 minutes

9a. Using the equation above, calculate the distance of the glacial ooze at 1.75 minutes. Show work.
x = 1.75 minutes

y = ___________________________ cm

9b. Why would it be incorrect to use the equation in 9a to calculate the distance of the glacial ooze at 9.25 minutes?

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