Name _____ Class _____ Date _____

Penny Densities

All pennies are exactly the same, right? Probably not! After all, each penny was made in a certain year at a specific mint, and each has traveled a unique path to reach your classroom. But all pennies are similar. In this lab, you will conduct an investigation to gather data about the differences and similarities among a group of pennies.

OBJECTIVES

Determine the mass, volume, and density of objects.

Identify patterns and trends in data.

Construct graphs from data.

Recognize the slope of a linear graph to be the constant in the relationship $y = kx$.

MATERIALS

- balance, metric
- graduated cylinder, 100 mL
- paper, notebook (3 sheets)
- paper towels
- pennies (10)
- water

SAFETY INFORMATION

PROCEDURE

1. Write the numbers 1 through 10 on a sheet of paper, and place a penny next to each number.

2. Use the metric balance to find the mass of each penny to the nearest 0.1 g. Return each penny to its place on the paper and record each measurement next to the number of that penny.

3. On a table that your teacher will provide, make a mark in the correct column of the table for each penny you measured.

4. Separate your pennies into two piles, based on the class data. Label a sheet of paper Pile 1 and place the pile of lower-mass pennies on the sheet. Label a second sheet of paper Pile 2 and place the pile of higher-mass pennies on the sheet.

5. Measure and record the mass of each pile. Write the mass on the paper you are using to identify the pile.

6. Fill a graduated cylinder halfway with water. Carefully measure the volume in the cylinder, and record it.

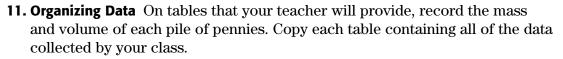7. Carefully place the pennies from one pile into the graduated cylinder. Measure and record the new volume.

▌Penny Densities *continued*

8. Carefully pour out the water into the sink, and remove the pennies from the graduated cylinder. With a paper towel, dry off the pile of pennies.

9. Repeat steps 6 through 8 for the other pile.

ANALYZE THE RESULTS

10. Analyzing Data Determine the volume of the displaced water by subtracting the initial volume from the final volume. This amount is equal to the volume of the pennies. Record the volume of each pile of pennies.

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11. Organizing Data On tables that your teacher will provide, record the mass and volume of each pile of pennies. Copy each table containing all of the data collected by your class.

12. Analyzing Data Calculate the density of each pile by dividing the total mass of the pennies by the volume of the pennies. Show your work below.

13. Constructing Graphs Construct a graph of mass versus volume for each pile of pennies using the data collected by your class.

Penny Densities *continued*

14. **Recognizing Patterns** Do your graphs show a linear or nonlinear relationship between mass and volume? Explain your reasoning.

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DRAW CONCLUSIONS

15. **Analyzing Graphs** Determine the slope of the line on each graph.

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16. **Evaluating Data** Compare the two values for density that you found for each pile.

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| Penny Densities *continued*

17. **Defending Conclusions** The slope of a line on a graph of mass versus volume represents the density of the material. Show how the formula for calculating density can be rearranged into the form $y = kx$ to support this claim.

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BIG IDEA QUESTION

18. **Evaluating Methods** By analyzing your data and the pennies, can you identify any patterns that would allow you to separate the pennies into the same groups without conducting an investigation? Explain your answer.

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