

Name \_\_\_\_\_



## **Physical Properties of Matter**

**Background Information:** By definition, all matter has the properties of mass and volume.

The **MASS** of an object is a measurement of how much matter it contains.

The **VOLUME** of an object is the amount of space it occupies.

Mass and volume are Size-dependent properties because they depend on the size of the object.

Another physical property, density, does not depend on the size of an object. **DENSITY** measures the amount of mass in a given volume. To calculate the density of an object, divide its mass by its volume.

**Problem:** To compare the physical properties of pennies minted before 1982 with those of pennies minted after 1982.

**Question:** Is there a difference in the properties of pennies minted before 1982 and after 1982?

**Prediction (Use a complete sentence):**

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**Materials:**

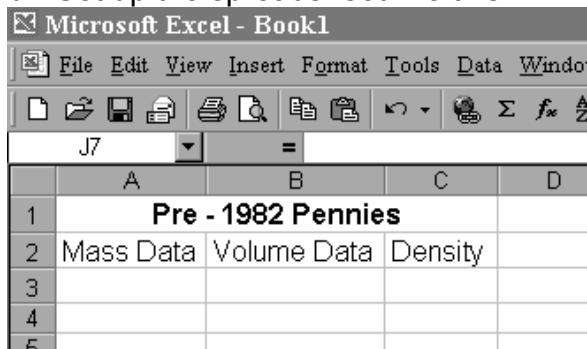
Computer with Excel	15 Pre-1982 pennies	15 Post-1982 pennies
Graduated cylinder	Triple beam balance	Water

**Procedure:**

1. Make a ***data chart*** to record the mass, volume and density of your 15 Pre-1982 pennies. When your chart is complete, have your ***teacher check and initial it.***
2. Use the triple beam balance to find the mass of each of your pennies. Record this data in your data chart.
3. Pour 25 mL water into the graduated cylinder. Use water displacement to find the volume of each of your pennies. Record this data.

4. Find the density of each penny using an Excel spreadsheet:

- a. Launch Excel - 
- b. Set up the spreadsheet like this:



	A	B	C	D
1	<b>Pre - 1982 Pennies</b>			
2	Mass Data	Volume Data	Density	
3				
4				
5				

Use a clear, easy-to-read font!

- c. Enter the mass data of each pre-1982 penny in the first column.
- d. Enter the volume data of each pre-1982 penny in the second column.
- e. Find the density of the pennies by using the formula: **mass ÷ volume**. **To do this on the spreadsheet use the formula:**

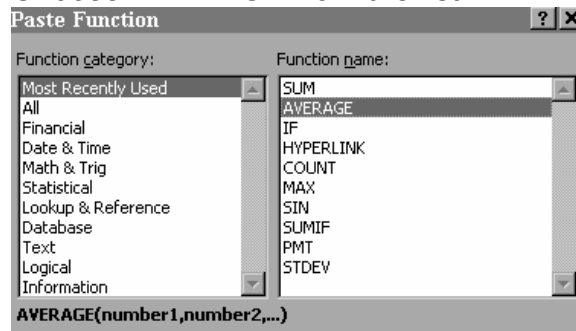
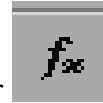
	A	B	C
1	<b>Pre-1982 Pennies</b>		
2	<b>Mass</b>	<b>Volume</b>	<b>Density</b>
3			=a3/b3
4			

Get your teacher's initials at this step:

- f. Find the MEAN or AVERAGE density of the pennies:
  - i. Select the cell below the densities:

	A	B	C
1	<b>Pre-1982 Pennies</b>		
2	<b>Mass</b>	<b>Volume</b>	<b>Density</b>
3	3	1	3
4	3	1	3
5	3	1	3
6	3	1	3
7	3	1	3
8	3	1	3
9	3	1	3
10	3	1	3
11	3	1	3
12	3	1	3
13	3	1	3
14	3	1	3
15	3	1	3
16			
17			

- ii. Choose FUNCTION from the toolbar
- iii. Choose AVERAGE from the list:



5. Repeat the procedure with the POST-1982 pennies.

**Data:**

Record the mean density of the PRE-1982 pennies \_\_\_\_\_

Record the mean density of the POST-1982 pennies \_\_\_\_\_

**Data Analysis:**

Use Excel to make a BAR GRAPH to compare the mean density data you collected. Remember to TITLE & LABEL the graph. Print your graphs and staple them to this handout.

**Conclusions:**

What does the data tell you about the density of pennies minted before 1982 and after 1983?

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What can you infer from this data?

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**Questions for Review:**

1. Is density a physical or chemical property? Explain your answer.

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2. Did a physical or chemical change take place in pennies in 1982? Explain your answer.

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3. Is this investigation descriptive or experimental? Explain your answer.

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4. What is the INDEPENDENT VARIABLE in this investigation?

5. What is the DEPENDENT VARIABLE in this investigation?

6. Why is a BAR GRAPH the best way to display data for this investigation?