

## Density Problem 3: Density of Copper Pennies

A student wanted to calculate the density of the metal in copper coins. She placed a graduated cylinder with some amount of water on a balance. To this set up, she gradually added pennies. Each time she added some pennies, the level of the water in the graduated cylinder rose and the mass increased. She read the volume of water in the graduated cylinder, followed by the mass of the system. Her data is listed below.

Volume (mL)	5.13	9.76	12.99	19.55	25.00
Mass (g)	154.1	198.7	224.5	285.1	332.5

Prepare a good graph that best represents the data collected: title, axes labeled, good scale, etc.

Put answers here but do not show your work here. That goes on a separate sheet of paper.

X <sub>1</sub> for slope	Y <sub>1</sub> for slope	X <sub>2</sub> for slope	Y <sub>2</sub> for slope	X <sub>3</sub> for y-intercept	Y <sub>3</sub> for y-intercept

The density of the copper in the coins is

The mass of the water and cylinder is

The correct form for the equation for the line is  
(use the correct variables and units)

- What should the volume read on the graduated cylinder when the mass is 175.0 g? Are you extrapolating or interpolating?
  - Explain the difference between extrapolation and interpolation.
- The volume on the graduated cylinder is 20.5 mL. What mass does this represent?
- Using the equation to extrapolate, what would the mass be when the volume is 35.0 mL?
- Before 1982, pennies were made of a copper alloy of 95% Cu and 5% Zn. Now they are made using electro-plating copper metal to Zn. The density of zinc is 7.14g/mL.
  - How would changing the composition of the penny affect the slope of the line in the graph?
  - Would the slope be larger or smaller than the slope you calculated?
- We learned in class two physical properties. Which one allows us to graph density? Why is important for this physical property to be in effect for us to be able to graph density?
- The accepted value for the density of copper is 8.96g/mL. Calculate the %error using the experimentally determined density for copper and the accepted value for the density of copper
- Put the graph in your lab book AFTER you finish Exp 2.** Use good techniques for graphing as discussed in class and the graphing handout. All numerical values need units and correct significant figures; this includes the equation for the line. On a separate sheet in

your lab book, show how you set your scale mathematically and all the calculations listed on this page.

WHEN YOU TURN THIS IN, **DO NOT STAPLE IT TO EXPERIMENT 2.** TURN IT IN AS A SEPARATE ITEM.