Measurement Lab Report

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Contents

1 Using Pipettes

Laboratory temperature: **21.0°C**
Mass of beaker: **50g**

Data Table 1: Water	**Trial 1**	**Trial 2**	**Trial 3**
Tared mass of water	$5.826g$	$6.113g$	$6.111g$
Volume of water (mL)	$5.00mL$	$5.00mL$	$5.00mL$
Density of water ($\frac{g}{mL}$)	$1.17\frac{g}{mL}$	$1.22\frac{g}{mL}$	$1.22\frac{g}{mL}$
Average density of water ($\frac{g}{mL}$)	$1.20\frac{g}{mL}$		

Finding the theoretical density

a) Graph the density of water (y) versus temperature (x) from Reference Table I and find the line of best fit. Write the equation for the line below.

Equation should look like:

$[Density] = slope * [temperature] + y - intercept$

$d(t) = -0.000165t + 0.00297$ **b)** Given your line of fit, determine the

theoretical density of the water given the temperature of the room. Show your calculations and your final answer.

$$d(21.0) = -0.000165(21.0) + 0.00297 \tag{1}$$
$$d(21.0) = -0.003465 + 0.00297 \tag{2}$$
$$d(21.0) = -0.000495\frac{g}{mL} \tag{3}$$

Determine the % error of your average density of water using the theoretical density from question 2b

$$\frac{1.20\frac{g}{mL} + 0.000495\frac{g}{mL}}{-0.000495\frac{g}{mL}} \tag{4}$$
$$-\frac{80033}{33}\% \tag{5}$$

If some of the water evaporated after you added it to the beaker but before you recorded the mass, what effect would this have on your calculated density.

This would likely reduce the overall calculated density because water vapor is less dense than liquid water.

Looking back at your observations, give one reason why your average density is different than the theoretical value from your answer in 2b. Your explanation must relate to your error (e.g. if your density is lower than the reported density, your explanation must explain why the density is lower).

One reason why my average density is perhaps different from The theoretical density, is because the theoretical density can not account for all of the variables which could impact the measurement. One such example would be the temperature of the beaker, which might offset the temperature of the water.

2 Part 2: Density Determination of Seawater

Mass of beaker: **29.049g**

Data Table 1: Seawater	**Trial 1**	**Trial 2**	**Trial 3**
Tared mass of seawater	$5.692g$	$5.707g$	$5.698g$
Volume of seawater (mL)	$5.00mL$	$5.00mL$	$5.00mL$
Density of seawater ($\frac{g}{mL}$)	$1.14\frac{g}{mL}$	$1.14\frac{g}{mL}$	$1.14\frac{g}{mL}$
Average density of seawater ($\frac{g}{mL}$)	$1.14\frac{g}{mL}$		

Using your results from Part 1 and Part 2, how many times more dense is seawater than fresh water (hint: use a ratio)? Show your calculations and give your final answer. Use equation editor for your math.

NOT DONE

Considering your results, is it easier for you to float on the ocean or on a freshwater lake? Explain.

NOT DONE

Data Table 1: Penny Composition	**Trial 1**	**Trial 2**	**Trial 3**
Number of pennies	30	35	25
Total mass of pennies (g)	$81.254g$	$93.753g$	$68.166g$
Initial volume of water (mL)	$50.8mL$	$50.5mL$	$50.0mL$
Final volume of water (mL)	$61.0mL$	$63.0mL$	$59.0mL$
Volume the pennies occupy (mL)	$10.2mL$	$12.5mL$	$9.0mL$
Density of a penny ($\frac{g}{mL}$)	$7.97\frac{g}{mL}$	$7.50\frac{g}{mL}$	$7.6\frac{g}{ml}$
Average density of a penny ($\frac{g}{mL}$)	$7.7\frac{g}{mL}$		

3 Part 3: Determination of the Composition of a Penny through a Density Study

Show your calculations and give your final answers for the % zinc and % copper in the modern penny. Use equation editor for you math.

$$8.96x\frac{g}{mL} + 7.13\frac{g}{mL} - 7.13\frac{g}{mL}x = 7.7\frac{g}{mL} \tag{6}$$

$$x(8.96\frac{g}{mL} - 7.13\frac{g}{mL}) + 7.13\frac{g}{mL} = 7.7\frac{g}{mL} \tag{7}$$

$$x(1.83\frac{g}{mL}) = 7.7\frac{g}{mL} - 7.13\frac{g}{mL} \tag{8}$$

$$x = \frac{0.57\frac{g}{mL}}{1.83\frac{g}{mL}} \tag{9}$$

$$x = .31\frac{g}{mL} * 100 \tag{10}$$

$$x = 31\% \tag{11}$$

$$x - 1 = 69\% \tag{12}$$

Zinc: 69%
Copper: 31%

Did you need to know the exact number of pennies measured to solve for the density of a penny? Why or why not?

Yes, if for example you measured the mass of one penny followed by measurements of over 30 pennies, your overall average would be skewed by the single penny. however if you were given a range of 25 to 30 pennies like we were in our lab, you could calculate a fairly accurate average density without knowing the exact number of pennies.

Your professor will provide you with the actual composition of the modern penny. Determine the % error for the % zinc. Looking back at your observations, give a possible source of error from your results. Your source of error must be consistent with your observations in lab and with your results.

The percent error based on my findings, and the true density: **-29.2308%**. There are a number of reasons why our results did not fair well against the actual density of the modern penny. During our lab we observed the following possible sources of error:

1. On several occasions, the pipette created bubbles and failed to empty completely.
2. On our second trial measuring the density of water, we may have improperly dried the beaker.
3. During all three trials, bubbles formed under and around the pennies as they lay stacked.
4. The pennies never laid flat, leaving room for error.
5. On trial 2 of measuring the density of the pennies, the pennies did not dry completely

Could you reliably use the procedures and calculations in Part 3 to identify the % composition of a nickel coin (75 % Cu/ 25 % Ni)? Why or why not?

Given my general inaccuracy with the penny composition, I think that I personally would have a hard time identifying the % composition of a nickel coin. I'm sure this could be done with great accuracy under the trained hands of a scientist however.