Density Lab

9/22/09

Purpose:

The purpose of this lab is to use density to identify two unknown metals.

Procedure:

Odd numbered lab stations (see number of top lab drawer) should begin with Part A. Even numbered lab stations should begin with Part B. You should then do the other part after you are finished with the part you are supposed to start with. ***All lab groups should gather their own data*** (do not share your values with any other group).

Part A: metal block

1. Determine the mass in grams of the metal block. Write the value down on scratch paper for now. Do not round off the value. Be sure to include units.
2. Determine the length, width and height (in centimeters) of the metal block. Do not start your measuring from the end of the ruler, but start at some other whole number in the middle part of the ruler and adjust your reading accordingly. Be sure to estimate to the nearest ***.05 cm***. It does not matter which sides of the block you designate as the length, width or height as long as you end up with three measurements going in different directions (i.e., x, y and z axes). Record these values on the same scratch paper that has the mass written down on it.
3. Have your teacher check your data for accuracy and precision. After they have been approved, ***record*** these values in **non-erasable ink** on your data sheet.

Part B:

1. Count out the number of tacks assigned to your lab station (leave any extra that you might have in the beaker). Make sure they are all dry. Determine their mass and ***record*** the mass in the appropriate column of the class data table at the front of the room. Do not round off this value.
2. If you're at stations 1 through 6 perform steps 3 and 4. If you're at stations 7 through 18 perform steps 5 and 6.
3. Get out your ***small*** graduated cylinder. Place 6.5 mL of deionized water (±.2 mL) in it. ***Record*** your ***exact*** starting volume (read the bottom of the meniscus) on the data table at the front of the room. Make sure you estimate to the nearest ***.1 mL***.
4. Place the number of tacks assigned to your lab group into the graduated cylinder. Make sure they are all immersed below the water and that there are no air bubbles trapped among the tacks. ***Record*** the final volume on the data table at the front of the room. Make sure you estimate to the nearest ***.1 mL***. Proceed to step 7.
5. Get out your ***large*** graduated cylinder. Place 50.0 mL of deionized water (±2 mL) in it. ***Record*** your ***exact*** starting volume (read the bottom of the meniscus) on the data table at the front of the room. Make sure you estimate to the nearest ***.5 mL***.
6. Place the number of tacks assigned to your lab group into the graduated cylinder. Make sure they are all immersed below the water and that there are no air bubbles trapped among the tacks. ***Record*** the final volume on the data table at the front of the room. Make sure you estimate to the nearest ***.5 mL***

7. Put back all the equipment you used. Be sure to dry the tacks before returning them to the beaker. Do not lose any in the trash or down the drain. Shake out any excess water from the graduated cylinder and dry the ***outside***. Wipe down your desk top, lock your drawer and return your key.
8. Once the teacher has approved the class results on the data table at the front of the room, record the values onto your data sheet. Once completed take the data sheet to your teacher to have it ***stamped***.

Data:

Data Sheet - Density Lab

Part A:

Mass of metal block 16.30g

Length of metal block 2.50cm

Width of metal block .... 1.00 cm

Height of metal block 0.80cm

Part B:

Station	Number of Tacks	Mass (g)	Initial Volume (mL)	Final Volume (mL)
1	10	12.18	6.5	8.0
2	12	14.62	6.4	8.0
3	15	18.28	6.5	8.4
4	18	21.94	6.5	8.9
5	20	24.37	6.5	9.3
6	22	26.80	6.5	9.5
7	25	29.27	50.0	54.5
8	28	34.14	50.5	54.0
9	30	34.55	50.0	54.0
10	32	39.00	50.0	54.0
11	35	42.66	50.0	55.0
12	38	46.29	50.0	55.0
13	40	48.79	50.0	54.5
14	42	51.18	50.0	55.0
15	45	54.94	50.0	56.0
16	48	58.98	50.0	57.0
17	50	—	—	—
18	52	63.40	50.0	57.0

Calculations:

Be sure each calculation has each of the following:

- set-up
- correct scientific units attached to each number
- each number is written with the proper number of significant figures
- answer is boxed or circled

Part A:

- volume of the metal block
- density of metal block
- percent error

Part B:

- volume that the metal tacks occupy for each lab station
- Plot the mass and volume information for the tacks on a graph. The vertical axis should be for mass and the horizontal axis should be for the volume. Arrange your scales so that as much of the graph paper as possible is used. Draw a ***straight*** line (line of best fit) through the middle of the plot points. Be sure your line begins at 0,0. Give the graph its correct title (see notes as needed).
- Pick an arbitrary point on your line in the graph and mark it with an "X". Use the mass and volume that correspond to this point to calculate the experimental density of the metal.
- percent error

Calculations:

Part A:

- volume of the metal block:

$(2.50\ cm)(1.00\ cm)(0.80\ cm) = \boxed{2.0\ cm^3}$

- Density of Metal Block:

$\frac{16.30g}{2.0\ cm^3} = \boxed{8.2\ g/cm^3}$

- % Error

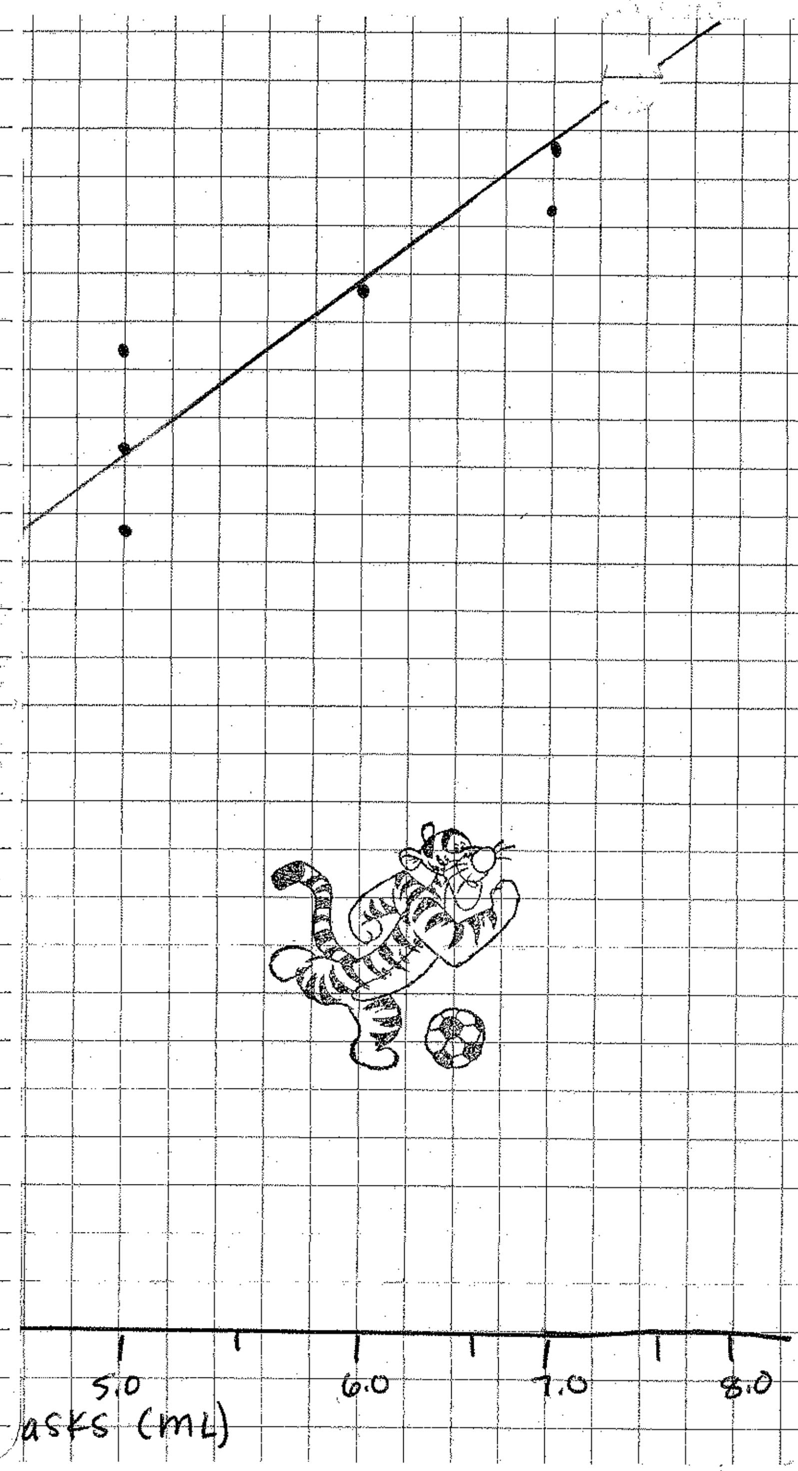
$\frac{7.87\ g/cm^3 - 8.2\ g/cm^3}{7.87\ g/cm^3} \times 100 = \boxed{4\ \%\ Error}$

Part B:

- volume that the metal tacks occupy for each lab station

Lab station	Initial volume (mL)	—	Final (mL)	=	volume
1	6.5 mL	—	8.0 mL	=	1.5 mL
2	6.4 mL	—	8.4 mL	=	1.6 mL
3	6.5 mL	—	8.4 mL	=	1.9 mL
4	6.5 mL	—	8.9 mL	=	2.4 mL
5	6.5 mL	—	9.3 mL	=	2.8 mL
6	6.5 mL	—	9.5 mL	=	3.0 mL
7	50.0 mL	—	54.5 mL	=	4.5 mL
8	50.0 mL	—	54.0 mL	=	3.5 mL
9	50.0 mL	—	54.0 mL	=	4.0 mL
10	50.0 mL	—	54.0 mL	=	4.0 mL
11	50.0 mL	—	55.0 mL	=	5.0 mL
12	50.0 mL	—	55.0 mL	=	5.0 mL
13	50.0 mL	—	54.5 mL	=	4.5 mL
14	50.0 mL	—	55.0 mL	=	5.0 mL
15	50.0 mL	—	56.0 mL	=	6.0 mL
16	50.0 mL	—	57.0 mL	=	7.0 mL
17	———		———		———
18	50.0 mL	—	57.0 mL	=	7.0 mL

- Graph


5.0
6.0
7.0
8.0
asks (mL)

Experimental Density of arbitrary point.

$\frac{32.0\,g}{3.5\,mL} = \boxed{9.1\,g/mL}$

% Error

$\frac{8.96\,g/mL - 9.1\,g/mL}{8.96\,g/mL} \times 100 = \boxed{1\%}$ Error

Questions:

1. Why should you start the straight line at 0,0?
2. Why didn't the plot points from the class line up in a straight line?
3. Why should a person use the "X" point on the line to calculate the density of the tacks instead of using one of the original plot points (representing one set of data from one of the lab stations)?
4. Suppose the tacks were wet when you determined their mass. Explain how this would affect the calculated density?
5. Suppose that some air bubbles were trapped with the tacks in the graduated cylinders when the volume of your tacks was being determined. Explain how this would affect the calculated density?

1. Why should you start straight line at 0,0?

2. Why did'nt the plot points from the class line up in a straight line?

3. Why should a person use the "X" point on the line to calculate the density of the tacks instead of using one of the original plot points?

4. Suppose the tacks where wet when you determaind the mass. Explain how this could affect the calculation of density?

5. Suppose that their were some air bubbles were trapped with the tacks in the graduated cylinder when the valume of the tasks were being determine. Explain how this could affect the calculation of density?

Conclusion:

In this lab, we identified two unknown metals by calculating the density. The first metal was Iron with 7.87 g/cm3 as the actual density, And 8.2 g/cm3 as experimental and 4% error. The second was Copper, with actual density of 8.94 g/cm3 and our experimental of 9.1 g/cm3 and 1% error.