

Chemistry 512

Scarsdale High School

Periodic Trends

The attached laboratory assignment explores one of the many trends that can be observed within the Periodic Table. Density is a physical property of all materials. In this lab, the density of 3 materials that occur in the same group on the periodic table will be experimentally determined and plotted. From this graph, the density of a fourth element will be predicted. This prediction can easily be compared to the actual value to determine the percent error in the prediction.

The final report for will be shared via Google Doc in ONE report. The content for the lab report is described in detail below. The file name **MUST** follow the format listed directly below.

File Name: **SHS_CC_LB_PeriodicTrend_Lname**

Note: for “sec#”, write only the number – do not include “sec”

Periodic Trends

Lab Report Rubric

- Introduction
- Data Table
- Logger Pro Graph of density vs atomic number
- Germanium Density (Analysis and Conclusion Questions)
- Conclusion

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Lab Report Rubric

					Score
Due Date	On Time: 0 points	≤ 1 week late: -3 points	≤ 2 week late: -6 points	> 2 week late: -10 points	
	8-10 points	5-7 points	2-4 points	0-1	
Introduction	Integrates and properly discusses the appropriate concepts and principles with the planned experiment	Includes the appropriate concepts and principles	Includes some of the appropriate concepts and principles	Did not discuss the appropriate concepts and principles	
Data Table	Table included and clearly displays the relevant data. Data can be easily accessed in the table	Table displays the relevant data but is not well organized	Data included but lacks structure the structure of a table	Data not included	
Logger Pro Graph	Graph is fully and properly labeled and properly describes the information	Graph has not been properly labeled. Information difficult to understand	Graph is not labeled and the information does not correspond the data collected	Graph not included or not readable	
Germanium Density Prediction	Predicted density of Ge from the graph is included and the percent error is calculated	Predicted density of Ge from the graph is included	Predicted density of Ge does not correspond to prediction from the graph	Predicted density of Ge not included	
Conclusion	Proper integration of the experimental results as compared to the expected results proposed in the introduction. Error analysis supported by experimental data	Results presented but not compared to the introduction. Error analysis not supported by experimental data	Results presented	No results presented	
				Total Raw Score	
				Adjusted Score (divide by 5)	

Chemistry

Scarsdale Alternative School

Periodic Trends

Objective:

Investigate the periodic variation of density in group 14 elements.

Task:

Perform the experiments described in the attached lab procedure.

Lab Report:

1. Introduction
2. Data table
3. Graph of density vs atomic number
4. Analysis and conclusion questions
5. Conclusion

Due Date:

9

PERIODIC PROPERTIES

Text Reference
Section 6.2

PURPOSE

To investigate the periodic variation of density in Group 4A elements.

BACKGROUND

When the elements are arranged in order of increasing atomic number, they exhibit a periodic recurrence of properties. Elements in the same group in the periodic table tend to have similar physical and chemical properties. These similarities are due, in large part, to similarities among the electron configurations of the elements in a group. You can find periodic trends in certain properties, such as density, among the elements within a given group.

In this experiment, you will investigate the variation in density among three Group 4A elements. You will use your results to predict the density of another Group 4A element.

MATERIALS (PER PAIR)

safety goggles and apron	lead shot, Pb T
centigram balance	silicon, Si
100-mL graduated cylinder	distilled water
tin, Sn	

SAFETY FIRST!

In this lab, observe all precautions, especially the ones listed below. If you see a safety icon beside a step in the Procedure, refer to the list below for its meaning.



Caution: Wear your safety goggles. (All steps.)



Note: Return or dispose of all materials according to the instructions of your teacher. (Step 4.)



Note: Wash your hands thoroughly after completing this experiment.

PROCEDURE

You will determine the densities of the tin (Sn), lead (Pb), and silicon (Si) samples by water displacement. As you perform the experiment, record your data in Data Table 1. Note the appearance of these elements.



1. Determine the mass of the samples to the nearest 0.01 gram, using a centigram balance. Record the masses in Data Table 1.

2. Fill a 100-mL graduated cylinder about three quarters full with water, measure the volume, and record the measurement as "volume of water alone" in Data Table 1. Tilt the graduated cylinder and carefully slide one of the samples down the side. Make sure the sample is completely submerged in the water. Measure the volume and record the measurement as "volume of water + sample" in Data Table 1.

3. Repeat Step 2, using the other samples.



4. Dry the samples and return them to your teacher. Then wash your hands thoroughly with soap or detergent.



OBSERVATIONS

DATA TABLE 1: DENSITIES OF GROUP 4A ELEMENTS

	tin (Sn)	lead (Pb)	silicon (Si)
mass of sample (g)	1.21		
volume of water alone (mL)			
volume of water + sample (mL)			
volume of sample (mL)			
density of sample (mass/volume)			
appearance			

70 69

ANALYSES AND CONCLUSIONS

1. Calculate and record the densities of the tin, silicon, and lead samples in Data Table 1.

2. Prepare a graph of density versus period number for tin, silicon, and lead. *Use Graphical Analysis Program.*
3. Based on your graph, estimate the density of germanium, Ge. Compare your estimate with the accepted density of germanium (5.3 g/cm^3). Give possible sources of any errors.

4. Calculate the percent error between your estimated value and the accepted value for the density of germanium.

$$\text{percent error} = \frac{|\text{estimated value} - \text{accepted value}|}{\text{accepted value}} \times 100\%$$

GOING FURTHER

Develop a Hypothesis

Based on the data table, hypothesize about how density will vary among the elements in other groups in the periodic table.

Do Research

To test your hypothesis, look at the density graphs for Groups 1A through 8A in the Elements Handbook of your textbook.