

Title: Mole Lab

Purpose:

- To observe samples of 1 mole of elements
 - To identify metals based on physical characteristics
 - To calculate size of atoms of different elements

Materials:

- metal samples, calibrated to contain 1 mole of particles
- balance
- ruler
- calculator

Procedure:

1. Examine the metal samples
 2. Arrange in order of increasing size
 3. Record your descriptions in the data table
 4. Determine the density of the samples and record in Data Table 1
(Hint: Refer to the Metal Density Lab for to remind you how to determine the density)
 5. Calculate the percent error for your observed density value compared to the reference value
Record in data table as *density ± percent error*
 6. Identify the samples based on density values, molar mass, and appearance
(Note: use the periodic table and reference tables in the chemistry textbook)
 7. Calculate the mass of a single atom for each metal
(Hint: since each sample contains 1 mole exactly, divide the mass of the metal sample by the number of atoms in 1 mole)
 8. Calculate the volume of an individual atom
Assume that the atoms in each specimen are shaped like a cube, arranged in a regular pattern with no spaces between atoms
(Remember, the empty space, aka void, is within the atom anyway).
(Hint: volume of an atom = volume of sample / number of atoms in the specimen)
Since the sample contains 1 mole of atoms, you know how many atoms it contains
 9. Calculate the diameter of an individual atom of each specimen
(Hint: Draw a picture of a sphere within a cube. What would the diameter of the sphere be? Ah, remembering the joys of geometry)
 10. Calculate the radius of an individual atom of each specimen
(Hint: You know the diameter from #9, so what is the radius?)
 11. Construct a graph of atomic radius vs atomic mass for the 4 samples
Draw a line of best fit and determine the slope if *appropriate*
 12. Construct a graph of atomic radius vs density for the 4 samples
Draw a line of best fit and determine the slope if *appropriate*



Results

Data Table 1: Characteristics of Sample Metals

Sample	Description	Mass* (g)	Volume (cm ³)	Density ± % (g/cm ³)	Identity	Single Atom			
						Mass (g)	Volume (cm ³)	Diameter (cm)	Radius (cm)
1									
2									
3									
4									

*The mass of each sample is a molar mass, since the samples are calibrated to contain one mole of atoms!

Discussion:

- Follow lab grading guidelines
- Summarize what you did
- State the identity of each metal sample and discuss the evidence to support your identification
(You need at least 3 different *bits* of evidence)
- Discuss the relation among atomic mass, radius, and density
(Remember to support your statements with data!)
- Identify 2–3 sources of error and indicate how these errors might impact the results
- Provide 1–2 suggestions for improving the procedure

Conclusion: You should have a testable statement about the

- *identify of the samples*
- *relation of atomic radius and molar mass*
- *relation of atomic radius and density*

(Note: It is valid to conclude that there is no relation between 2 of the variables, but you must state this if your data do not show a relation!)

Reflection: Personal commentary about what you learned from this lab.

