

Unit 1: Physical and Chemical Properties of Matter

Practice Free Response 1

Directions: The suggested time is about 15 minutes for answering the constructed response section of the chemistry test. The parts within a question may not have equal weight. For calculations, show all your work in the spaces provided after each part. Pay particular attention to the proper use of units. Be sure your final answer is rounded to the correct number of significant figures. Make sure your work is legible. Illegible work will receive a grade of zero.

Question 1 [10 POINTS]

A student performed a laboratory experiment to determine the identity of an unknown metal. The data table below summarizes the information collected by the student throughout the lab.

- Step 1:** Obtain the mass of a dry, empty container.
- Step 2:** Fill container completely with water and determine combined mass of container and water.
- Step 3:** Empty and completely dry the container.
- Step 4:** Place metal sample in container and determine combined mass of container and metal sample.
- Step 5:** Fill container with metal sample completely with water and determine combined mass of container, metal sample, and water.

Data Table 1

Mass of empty container	88.0g
Mass of container filled with water ONLY	116.0g
Mass of container with metal sample ONLY	166.4g
Mass of container with metal sample AND water	183.2g

- A.** Calculate the following. Use 1.00 g/mL as the density value of water for all of your calculations.
- i.** What is the volume of the empty container? [1 POINT]

 - ii.** What is the mass of the metal sample added to the container? [1 POINT]

 - iii.** The container with the metal sample in it was filled with water. What is the mass of the water added to the container when it also contains the metal sample? [1 POINT]

 - iv.** What is the volume of the water added to the container with the metal sample still in the container? [1 POINT]

v. What is the density of the metal? **[2 POINTS]**

B. Which of the following metals is most likely the identity of the unknown? **[1 POINT]**

Element	Symbol	Density (g/mL)
Aluminum	Al	2.70g/mL
Neodymium	Nd	7.01g/mL
Copper	Cu	8.96g/mL
Silver	Ag	10.5g/mL
Tungsten	W	19.3g/mL
Platinum	Pt	21.5g/mL

C. In step 5 of the procedure, if the student had spilled some of the water out of the container with the metal sample so that it was not completely filled before taking a mass measurement would the calculated density of the metal sample increase, decrease, or remain the same? Mathematically justify your answer. **[2 POINTS]**

D. After completing the experiment as outlined above, the student cut the metal piece in half. Will the density of the cut metal pieces be smaller, larger, or equal to the density of the original metal sample? Explain. **[1 POINT]**