

# Volume, Mass, & Density Stations

## Station 1: Volume by measurement

Calculate the volume of the eraser, wood block and book by multiplying *Length x Width x Height*. If you have too, round off to the nearest tenths place.

**Volume of the Object 1:** Length = \_\_\_\_\_ cm x Width = \_\_\_\_\_ cm x Height = \_\_\_\_\_ cm = \_\_\_\_\_ **cm<sup>3</sup>**

**Volume of the Object 2:** Length = \_\_\_\_\_ cm x Width = \_\_\_\_\_ cm x Height = \_\_\_\_\_ cm = \_\_\_\_\_ **cm<sup>3</sup>**

**Volume of the Object 3:** Length = \_\_\_\_\_ cm x Width = \_\_\_\_\_ cm x Height = \_\_\_\_\_ cm = \_\_\_\_\_ **cm<sup>3</sup>**

## Station 2: Float or Sink?

Water has a density of 1. If it floats, it has a density of less than 1. If it sinks, it has density greater than 1. Place each object (foam, metal bar, pencil, rubber stopper, pumice rock) in the water to see if it floats or sinks.

Did the pumice rock float or sink? \_\_\_\_\_ Pumice rock density is (circle the correct response) **greater** or **less** than 1.

Did the metal bar float or sink? \_\_\_\_\_ Metal bar density is (circle the correct response) **greater** or **less** than 1.

Did the foam float or sink? \_\_\_\_\_ Foam density is (circle the correct response) **greater** or **less** than 1.

Did the rubber stopper float or sink? \_\_\_\_\_ Rubber stopper density is (circle the correct response) **greater** or **less** than 1.

Did the wood block float or sink? \_\_\_\_\_ Pencil density is (circle the correct response) **greater** or **less** than 1.

## Station 3: Mass

Mass each object in grams. Round off to the tenths place. Convert to centigrams by multiplying your grams by 100 (centi = 100).

**Metal bar** = \_\_\_\_\_ grams & \_\_\_\_\_ centigrams      **Highlighter** = \_\_\_\_\_ grams & \_\_\_\_\_ centigrams

**Penny** = \_\_\_\_\_ grams & \_\_\_\_\_ centigrams      **Paper clip** = \_\_\_\_\_ grams & \_\_\_\_\_ centigrams

## Station 4: Volume by Displacement

What happens when you jump into a tub of water? Does the water level go up or down? When you got in, you displaced water, causing its level go up or increase. So how do you calculate the volume of an object that has an irregular shape? By displacement! To calculate volume by displacement, follow these simple steps:

1. Fill the graduated cylinder up to 20 milliliters (*This is your initial or original water level*)
2. Measure the initial or original water level (*should be 20 milliliters*)
3. Submerge each object (*water level should rise*)
4. Measure the new, final level of the water
5. Subtract the difference between your original or initial reading from the final reading. (*See equation below*)

### **Final -- Initial = Volume of object**

Record your results:

Object 1:

<i>Initial water level</i>	<i>Final water level</i>	<i>Volume of object</i>
_____ mL	_____ mL	_____ mL

Object 2:

<i>Initial water level</i>	<i>Final water level</i>	<i>Volume of object</i>
_____ mL	_____ mL	_____ mL

## Station 5: Review

1. What is the basic unit for mass:    **Gram**    **Meter**    **Liter**
2. What is the basic unit of length:    **Gram**    **Meter**    **Liter**
3. What is the basic unit of Volume:    **Gram**    **Meter**    **Liter**
4. Which of the following is **not** part of the metric system?    **Liter**    **Gallon**    **Gram**
5. Which of the following is **not** part of the metric system?    **Yard**    **Meter**    **Liter**
6. What would I use to find the volume of a drop?    **Liter**    **milliliter**    **meter**
7. What would I use to measure the distance between Sacramento to San Francisco?    **Meter**    **Kilometer**    **Centimeter**
8. What would I use to measure the distance of a foot ball field?    **Meter**    **Kilometer**    **Centimeter**
9. What would I use to measure the length of a pencil?    **Meter**    **Kilometer**    **Centimeter**
10. Lets say you weighed 9 kilograms, how many grams do you weigh? \_\_\_\_\_ grams
11. You drank a thousand milliliters of Gatorade, how many Liters did you drink? \_\_\_\_\_ liters
12. If you drove 5 kilometers to school this morning, how many meters did drive? \_\_\_\_\_ meters

## Station 6: Units of Density

Read the information below and answer the questions:

Density is a unit of measurement expressed in **grams/milliliters** or **grams/centimeters**. Density is equal to mass divided by volume. **Mass** is measured in grams, while **volume** is measured in either **milliliters (mL)** or **centimeters cubed (cm<sup>3</sup>)**. Well, as it turns out, 1 mL = 1 cm<sup>3</sup>.

Why? Let's say you have a cube with a length of 1 cm and width

of 1 cm and a height of 1 cm. Now, let's imagine this cube is empty and it needs to be filled water. How much water would it take to fill up the cube? In other words, what is the volume of the cube? Yep, you guessed it, 1 milliliter (mL). So, it takes one milliliter of water to occupy a cube that is 1 centimeter cubed (cm<sup>3</sup>). **Answer**

**the following questions by circling the best response.**

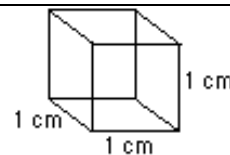
- Density is expressed in: **A. grams / milliliters**    **B. grams / centimeters**    **C. grams / centimeters cubed**    **D. A & C**
- 1 milliliter (mL) is equal to: **A. 1cm**    **B. 1mL**    **C. 1 cm<sup>3</sup>**    **D. A & B**
- How much water would it take to fill up 1 cubic centimeter? **A. 1cm**    **B. 1mL**    **C. 1 cm<sup>3</sup>**    **D. A & B**

$$\text{Density (g/mL or g/cm}^3\text{)} \rightarrow D = \frac{m}{V}$$

Mass (kg or g)  
Volume (mL or cm<sup>3</sup>)

$$D = \frac{\text{mass}}{\text{volume}} = \frac{\text{g}}{\text{mL}} \text{ or } \frac{\text{g}}{\text{cm}^3}$$

Volume of 1 cubic centimeter = 1 milliliter



## Station 7: Density Calculations

Density is equal to mass divided by volume ( $D = M/V$ ), where mass is measured in **grams (g)** and volume is measure in either **milliliters (mL)** or **centimeters cubed (cm<sup>3</sup>)**. If you know mass and volume, you can calculate Density. Show your work and record your answer in the box. **Be sure to include your units!!!!!!!!!!**

1. A block of wood has a volume of 30 ml and a mass of 20 g. What is its density?  
Show calculations for credit!!!!!!!!!!!!!!

Density =

2. A block of wood has a mass of 40 g and a length of 3 cm, a width of 2 cm and a height of 10 cm. What is its density? (Area = L X W X H)

Density =

3. An object is found to have a mass of 57.6 g. Find the object's density, given that its volume is 40.25 cm<sup>3</sup>.

Density =

4. Calculate the density of a material that has a mass of 52.457 g and a volume of 13.5 mL.

Density =

## Station 8: Density Unknowns

Your job is to determine the identity of each unknown metal. To do this, calculate the density of each unknown metal below.

Use the chart below to help you identify the unknown metal. **Remember, density is equal to mass divided by volume!!!!!!**

- 1) A sample of an unknown metal has a mass of 18 grams and a volume of 6.7 cm<sup>3</sup>. What is the name of the unknown metal? (HINT: Use the chart below.) Write your answer below and don't forget to show your calculations!!!!!!

Unknown Metal: \_\_\_\_\_

- 2) You received a ring from a cheap skate boyfriend who told you it is real gold. To see if he is lying, you measure the mass and volume of the ring. The mass of the ring is 18.6 grams and the volume is 2.1 mL. What metal is the ring made of?

Unknown Metal: \_\_\_\_\_

- 3) You find a shiny metallic object at the park. To figure out what it is, you decide to figure out it's density by calculating it's mass and volume. After weighing it you determine it has a mass of 88 grams (g) and a volume of 8.4 milliliters (mL). What is the metal?

Unknown Metal: \_\_\_\_\_

Substance	Density (g/mL)
Aluminum	2.70
Titanium	4.54
Zinc	7.13
Tin	7.31
Iron	7.87
Copper	8.96
Silver	10.50
Lead	11.35
Mercury	13.55
Gold	19.30

*Materials needed:*

*Pumice, wood block, book, metal bars, foam, pencil, penny, paper clip, highlighter, graduated cylinder, small rock, calculators, scales, tub of water*

## **Part 1**

*Eraser  
wood block  
book*

*ruler*

*metal cube*

## **Part 2**

*Pumice  
Gummy bear,  
Foam  
Metal bar  
Pencil  
Tub of water*

## **Part 3**

*Metal bar  
Highlighter  
Penny  
Paper clip  
Metal cube  
Scale*

## **Part 4**

*Graduated cylinder  
rock*