Name:

Period:

LAB 9.2 - CALCULATING DENSITY

BACKGROUND

We have explored what happens when we collect *quantitative* data on a Cartesian diver. Now we will analyze that data and come to some conclusions.

PROBLEM

What is the density of the Cartesian diver at each of the different positions within the bottle?

MATERIALS

- Ruler
- Calculator
- Textbook

PROCEDURE

1. Examine the data in table 9.2-1 and on graph 9.2-2.

2. What relationship between mass and volume does the best-fit line show for the subsurface floating diver?

3. Where is the data plotted for the surface floating objects in relationship to the best-fit line?

   a. Is there a pattern to this data?

   b. What does the location of this data in relation to the best-fit line suggest about the relationship between mass and volume of a floating object?

4. Where is the data plotted for the sinking objects in relationship to the best-fit line?

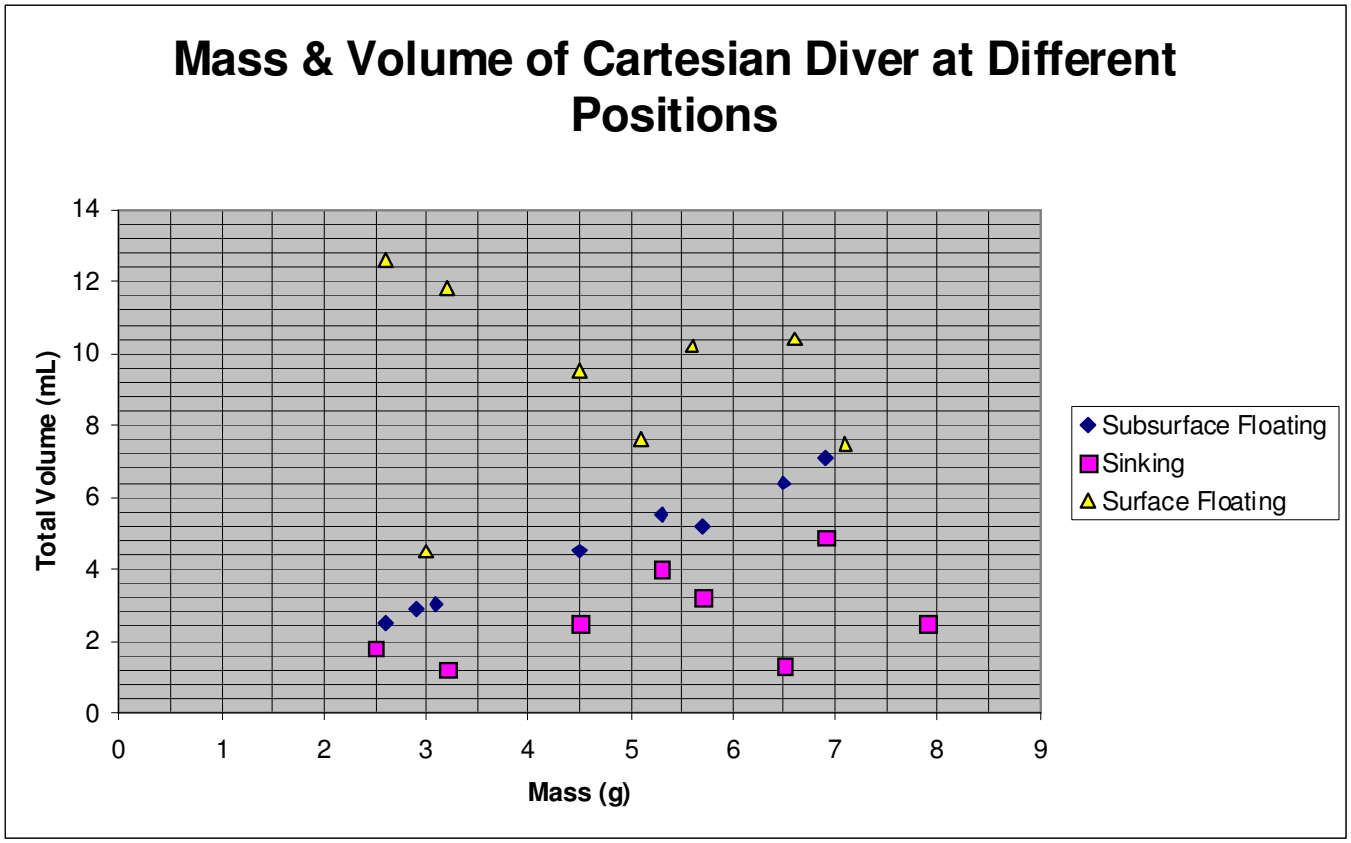
   a. Is there a pattern to this data?

   b. What does the location of this data in relation to the best-fit line suggest about the relationship between mass and volume of a sinking object?

DATA

Table 9.2-1: Cartesian Diver Mass & Volume Using Different Sized Divers

Diver Position	Mass (g)	Volume (mL)
Surface Floating	3.2	11.8
	4.5	9.5
	2.6	12.6
	6.6	10.4
	5.1	7.6
	3	4.5
	5.6	10.2
	7.1	7.5
Subsurface Floating	3.1	3
	4.5	4.5
	2.6	2.5
	6.5	6.4
	5.3	5.5
	2.9	2.9
	5.7	5.2
	6.9	7.1
Sinking	3.2	1.2
	4.5	2.5
	2.5	1.8
	6.5	1.3
	5.3	4
	7.9	2.5
	5.7	3.2
	6.9	4.9



Density is the relationship between mass and volume of an object or a substance.

Density is a calculated property - we cannot measure density directly. We must first measure the mass and the volume of an object or a substance, then we compare the two in a mathematical formula.

$$\text{Density} = \frac{\text{Mass (g)}}{\text{Volume (mL)}}$$

If we divide the mass unit (grams) by the volume unit (milliliters) we get a new unit called gram-milliliters

$$\frac{\text{Grams (g)}}{\text{Milliliters (mL)}} = \text{Gram-Milliliters } (^{g}/_{mL})$$

Therefore density is expressed in the units $^{g}/_{mL.}$

5. Calculate the average mass for the Cartesian diver at each position.
   a. Floating _____ b. Subsurface _____ c. Sinking _____

6. Calculate the average volume for the Cartesian diver at each position.
   a. Floating _____ b. Subsurface _____ c. Sinking _____

7. Calculate the average density for the Cartesian diver at each position by dividing the average mass by the average volume.
   a. Floating _____ b. Subsurface _____ c. Sinking _____

8. How does the density of a sinking Cartesian diver compare to the density of a subsurfacing Cartesian diver?

9. How does the density of a floating Cartesian diver compare to the density of a subsurface floating diver?

SUMMARY

Explain, in your own words, what you now know about the density of floating, sinking, and subsurface floating objects.