Mystery Liquid Line

Use mass and volume data to find density.

PHS.1.5 "Design and conduct an investigation using graphical analysis (e.g., line graph) to determine the density of liquids and/or solids."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the sentence that explains what a mass-versus-volume line's slope represents. Circle two rows in the table that you could use to calculate that slope.

The Unlabeled Bottle

1. A lab team wants to identify a clear liquid left in an unlabeled bottle. Appearance will not reveal its density, so the team measures mass at several volumes. They place an empty, dry container on a balance, then pour in measured portions of liquid. The table records the total mass each time.

MASS AND VOLUME MEASUREMENTS

Liquid volume (mL)	Total mass (g)
0	42
10	50
20	58
30	66

2. A volume of zero means the container is empty, not that the balance reads zero. A fair test uses the same container and liquid for every reading. Students can put volume on a graph's horizontal axis and total mass on its vertical axis. They plot each pair and draw a line that follows the pattern.

3. The line's rise divided by its run gives the added mass per added milliliter, which is the liquid's density in grams per milliliter. The point at zero volume shows the container's mass. If a reading sits far from the line, the team should check for a spill, a reading error, or a wet container before repeating the measurement.

2 ANSWER WITH EVIDENCE

Use the passage

1. To graph the table, which variable belongs on each axis? Include units.

2. At 20 mL, how much mass belongs to the liquid alone? Show how you used the table.

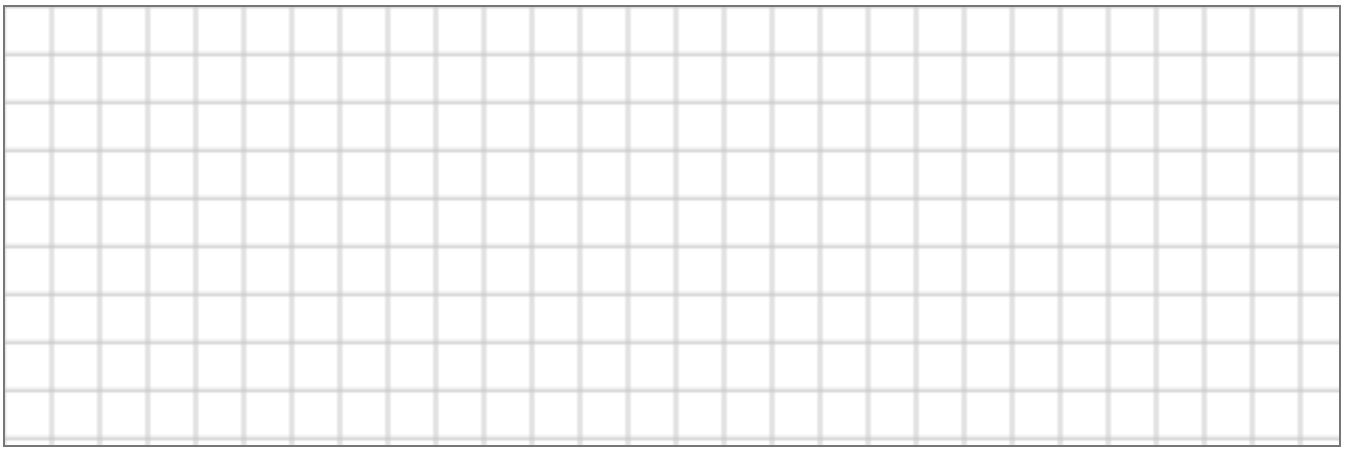
3. Use the 10 mL and 30 mL rows to calculate the slope of the mass-versus-volume line. What density does it give?

4. Why would the graphed line not pass through (0, 0)? Does this change the density found from its slope?

3 YOUR TURN

Your own words

Design a follow-up test for a different liquid in the same container. On the grid, label both axes, plot four *predicted* total masses at 0, 10, 20, and 30 mL, and draw a line. Below the grid, state how you would collect real measurements and find density from your measured graph.



ANSWER KEY

Mystery Liquid Line

HIGH SCHOOL · PHS.1.5

PART 1 · READ AND MARK

Underline the sentence that explains what a mass-versus-volume line's slope represents. Circle two rows in the table that you could use to calculate that slope. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	To graph the table, which variable belongs on each axis? Include units.	**Horizontal axis: liquid volume (mL). Vertical axis: total mass (g).**
2	At 20 mL, how much mass belongs to the liquid alone? Show how you used the table.	**58 g − 42 g = 16 g of liquid.**
3	Use the 10 mL and 30 mL rows to calculate the slope of the mass-versus-volume line. What density does it give?	**(66 g − 50 g) ÷ (30 mL − 10 mL) = 0.8 g/mL. The density is 0.8 g/mL.**
4	Why would the graphed line not pass through (0, 0)? Does this change the density found from its slope?	**The empty container has a mass of 42 g, so the line begins at (0, 42). This does not change the slope or the density.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Predicted graph: horizontal axis, liquid volume (mL); vertical axis, total mass (g). Plot (0, 42), (10, 52), (20, 62), and (30, 72), then draw a straight line through the points. For the real test, I would weigh the same dry container at each measured volume of the new liquid. I would plot the results and divide the line's rise in grams by its run in milliliters to find density.

For the open task, accept any consistent predicted masses that begin at 42 g and increase as volume increases. The written plan should describe measuring mass at multiple volumes and using the measured line's slope, in g/mL, as density.