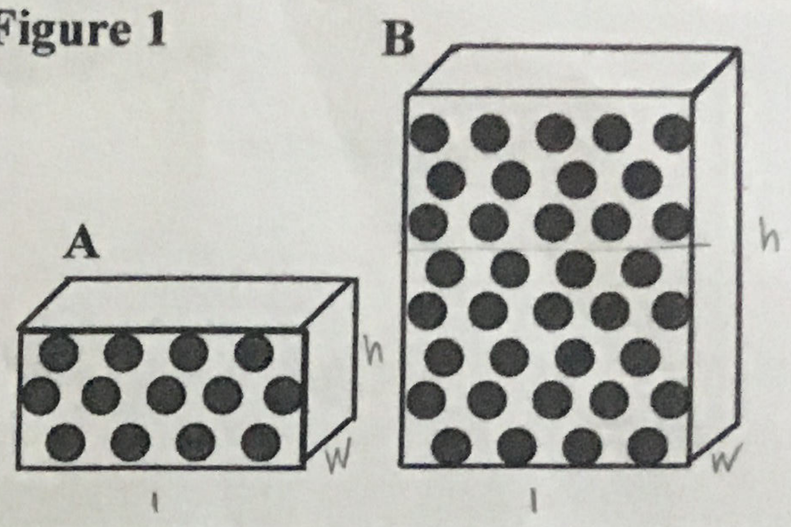
Name Fernanda More Date 10·1·2019 Pd 7

Chemistry – Unit 2 Matter & Energy

Mass, Volume, and Density

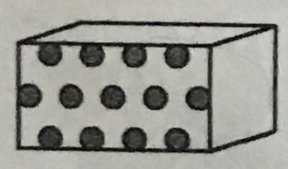
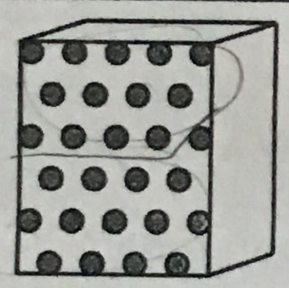
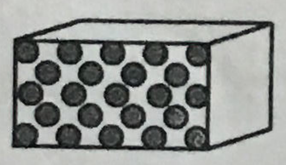
1. Study the matter shown in Figure 1. Each dot represents a particle of matter. [*Assume the particles are uniformly distributed throughout each object, and particles of the same size have the same mass.*]
   a. In the table below, show how the masses, volumes, and densities of A and B compare by adding the symbol <, >, **or** = to the statement in the second column.
   b. Explain your reasoning for each answer in the last column.

Figure 1



Property	Relationship	Reasoning
Mass	A < B	B has more particles than A
Volume	A < B	B has more height
Density	A = B	Density is proportional. } Mass and volume increase at the same rate.

Figure 2

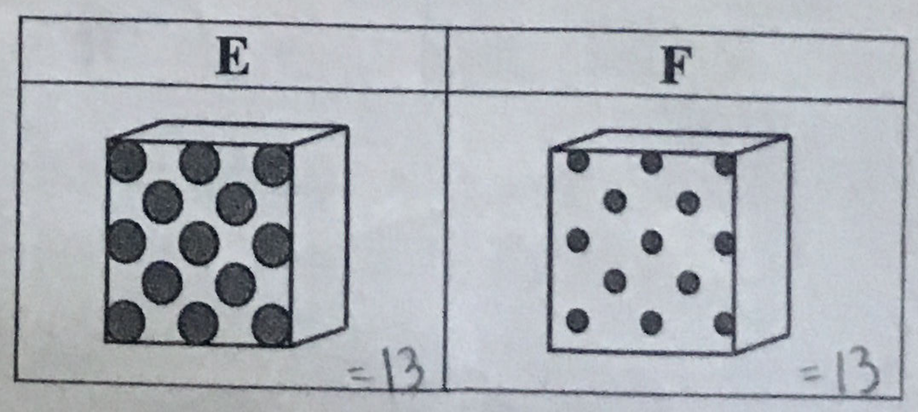
A	B	C
		

2. Study the matter in Figure 2. [*Assume the particles are uniformly distributed throughout each object, and particles of the same size have the same mass.*]
   a. In the table below show how the masses, volumes, and densities compare by adding the symbol <, >, **or** = to the statement in the second column.
   b. Explain your reasoning for each answer in the last column.

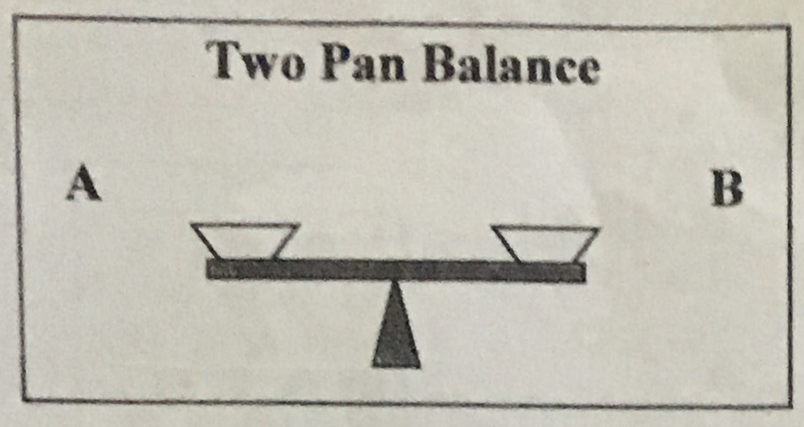
Property	Relationship	Reasoning
Mass	A < B A < C	A has a smaller number of particles than B and C
Volume	A < B A = C	B volume is larger than A. A and C look like they have the same volume.
Density	A = B A < C	A and B have the same number of particles in the same space so they have the same density. C has more particles than A

3. Is object E or object F more dense? [*Assume the particles are uniformly distributed throughout each object, and particles with a larger size have a larger mass.*] Explain your reasoning.

They both have the same number of particles and the same size but E's particles are bigger so they have a greater mass. Therefore E will be more dense



4. In Figure 4 below, a graph shows the relationship between mass and volume for two substances, A and B. Use the graph to answer questions about these two substances.



You have built a simple two-pan balance shown above to compare the masses of substances **A** and **B**.

a. What would happen to the balance if you put **equal masses** of **A** and **B** in the two pans? Explain your reasoning.

It would stay balanced, equal masses have the same number of particles, but substance B would take up more space.

b. What would happen to the balance if you put **equal volumes** of **A** and **B** in the two pans? Explain your reasoning.

@ 40ml SA = 53 SB = 16

No matter what you do A is always going to have more mass

c. Find the slope of the line for both A and B using correct units. State the physical meaning of the slope for each substance

Slope = $\frac{y}{x} = \frac{y_2 - y_1}{x_2 - x_1}$ (B) $= \frac{24-6}{60-20} = \frac{18}{40} = 0.45$ g/ml (A) $\frac{28}{20} = 1.4$ g/ml

d. If you put **10.0 mL of A** in one balance pan, how much **mass of B** would you need in the other pan to make it balance? Explain your reasoning.

10, 14 = 1.4 10 ml, 14g
X, 14 = 0.45 = 31ml, 14g
v m

14.0 g because that's the mass A and B both need to have to balace if A has a volume of 10.0 ml.

e. If you put **35.0 mL of B** in one balance pan, what **volume of A** would you need in the other pan to make it balance? Explain your reasoning.

11.0 ml because like that they will both have the same mass

35, 16 = 0.45
11, 16 = 1.4
16 ÷ 35 = 0.45
16 ÷ 11 = 1.4

f. Water has a density of 1.00 g/mL. Sketch the line representing water on the graph in Figure 4.

on the graph.

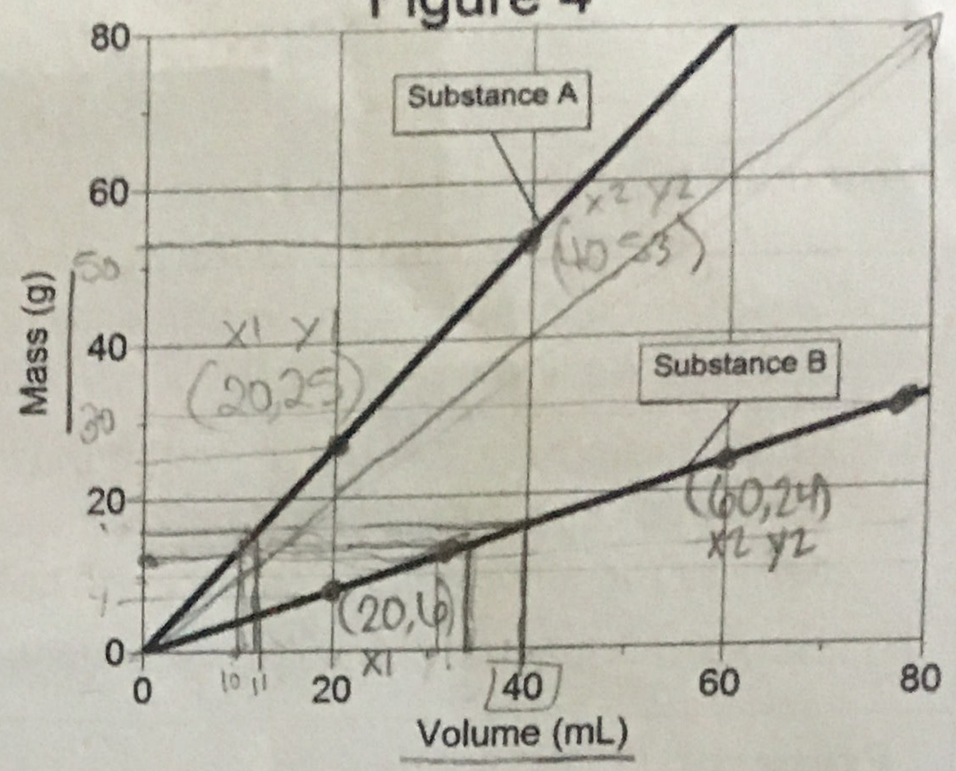
g. Determine whether substance A and B will sink or float when placed in a bucket of water.

A: (sink) float B: sink (float) (circle correct response)

Defend your answer using the mass vs. volume graph, and your outstanding understanding of density.

The slope of substance A is greater than 1.00 which means it'll sink
The slope of substance B is smaller than 1.00 so it will float.

Figure 4

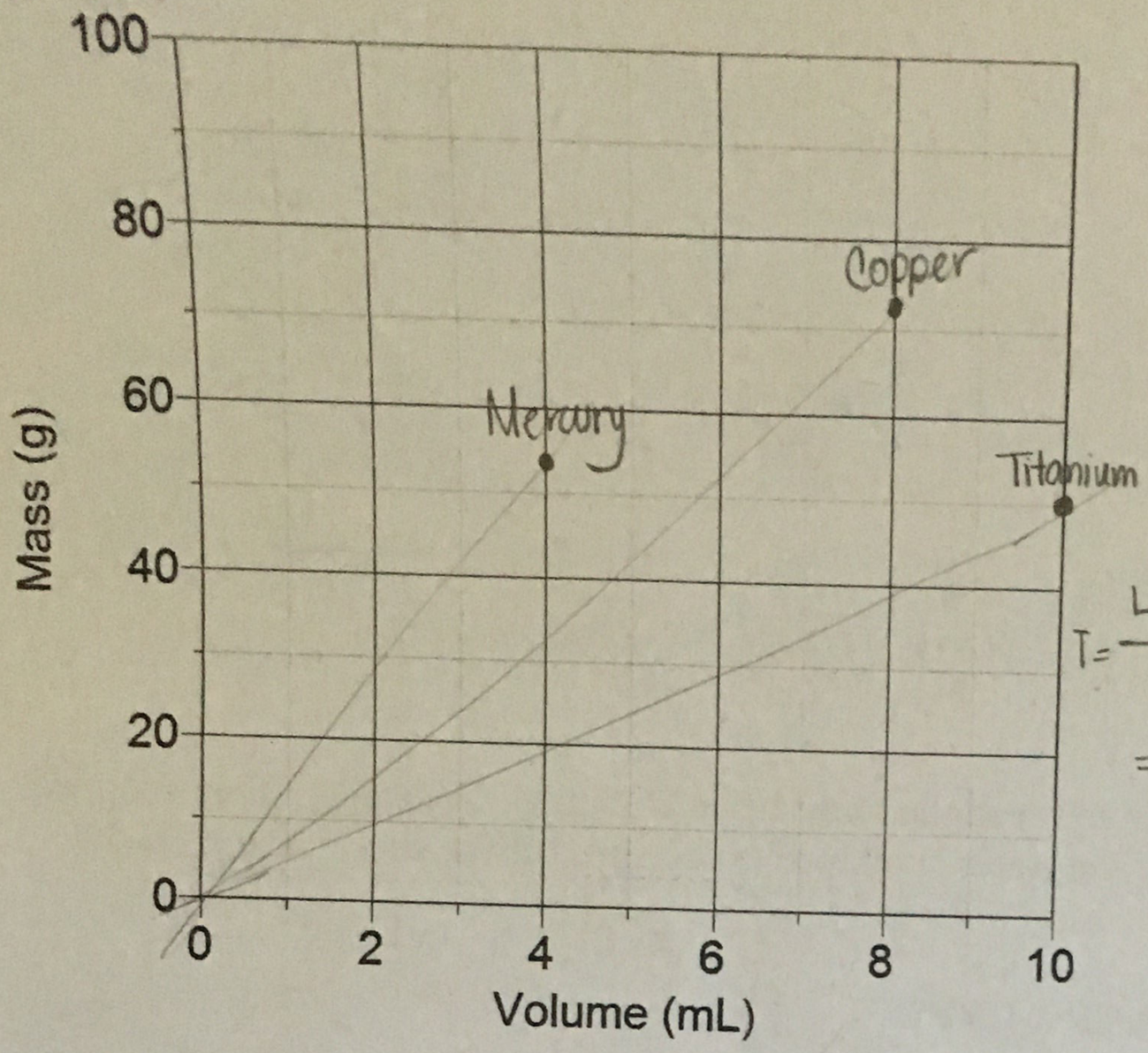


Refer to the table of densities to answer the following questions.

Substance	Density (g/mL)
Aluminum	2.70
Titanium	4.54
Zinc →	7.13
Tin	7.31
Iron	7.87
Nickel →	8.90
Copper	8.96
Silver	10.50
Lead →	11.35
Mercury	13.55
Gold	19.30

$D = \frac{M}{V}$

5. Sketch a graph of mass vs volume for titanium, copper and mercury.



$T = \frac{4.25}{1} = \frac{\text{mass}}{10\text{ ml}}$ = 0.45g

$C = \frac{8.96}{1} = \frac{\text{mass}}{8\text{ ml}}$ = 71.68g

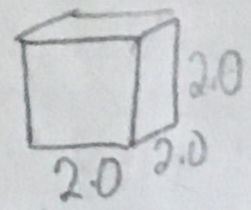
$M = \frac{13.55}{1} = \frac{\text{mass}}{4\text{ ml}}$ = 54.2g

6. You made some cubes out of each metal in the table that each measures 2.00 cm on every side. (all except mercury – why can't you make a cube of mercury?) Because mercury is a liquid

a. What is the volume of each cube in **cm³**? in **mL**? (Show your thinking)

V = 8.00 cm³ V = 8 mL

1 cm³ = 1 ml



l x w x h
2 x 2 x 2
= 8

= 8.00 cm³

b. Find the mass of these metal cubes: (Show your work below) $D = \frac{M}{V}$

lead cube 90.8 g

nickel cube 71.2 g

zinc cube 57.0 g

$11.35 = \frac{x}{8\text{ ml}}$ = 90.8

$8.90 = \frac{x}{8}$ = 71.2

$7.13 = \frac{x}{8}$ = 57.04 = 57.0

7. Alicia's cheapskate boyfriend gave her a ring he claims is 24 carat gold. Alicia is skeptical. After chemistry class the next day she measures the mass of the ring, finds the volume of the ring by water displacement, and then calculates the density of the ring. Should she treasure the ring as his first truly generous gift to her, or throw it at him the next time he walks by? **Defend your answer.**

DATA:

Mass:	**15.28 g**
Final volume:	**43.7 mL**
Initial volume:	**42.2 mL**

43.7
-42.2
1.5

Volume of ring: 1.5 ml

Density: 10 g/ml

$\frac{15.28}{1.5} = 10.18$

Gold = 19.30 g/ml

Alicia should throw it at him for lying and go find an honest boyfriend

$D = \frac{M}{V}$

8. A student filled a graduated cylinder with water and read the miniscus at 25.8 mL. The student then dropped a solid material into the graduated cylinder and the water level rose to 35.9 mL. If the solid material had a density of 2.99 g/mL, determine the mass of the solid object.

35.9
-25.8
10.1

$2.99 = \frac{x}{10.1\text{ml}} = 30.2\text{g}$

EXTRA CREDIT

Refer to the table of densities on page 3 of this worksheet to answer these questions:

7.87 8.96 4.54

You have some iron wire, copper wire, and titanium wire (all the same gauge, or diameter). Your lab group measured out a length of wire that is exactly 10.00g for each type of metal wire.

a. Which of these 3 metal wires would be the longest?

the copper wire

$7.87 = \frac{10.00\text{g}}{x} = 1.27\text{ ml iron}$

$8.96 = \frac{10.00\text{g}}{x} = 1.12\text{ ml copper}$

$4.54 = \frac{10.00\text{g}}{x} = 2.20\text{ml titanium}$

b. Which of these 3 metal wires would be the shortest?

the titanium

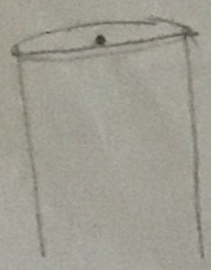
c. Explain your reasoning for answers a. and b.

Because the one with the less volume needs more amount of wire to be equal to the others and the one with more will need less.

d. If every 1.0 cm length of the titanium wire has a mass of 0.15 g, how long would the 10.00g wire be? (Hint: write a conversion ratio for the two quantities you are working with)

$\frac{10.00\text{g}}{0.15\text{g}} \times \frac{1.00\text{cm}}{1} = 66.7\text{ cm}.$

e. What is the diameter of the titanium wire? (Hint: diameter is related to volume; assume it is a cylinder – Geometry! Oh, yeah!)



$2.20 = 66.7 \times 3.14 \times r^2$

$\frac{2.20}{209.438} = \frac{209.438 \cdot r^2}{209.438}$

$\sqrt{r^2} = \sqrt{0.0105}$

$V = h \times \pi \times r^2$

$66.7 \cdot 3.14 \cdot 0.0105$

$= 2.19\overline{9099}$

$= 2.20$ ✓

$r = 0.1025\text{ cm} \times 2 =$ **diameter = 0.205 cm**