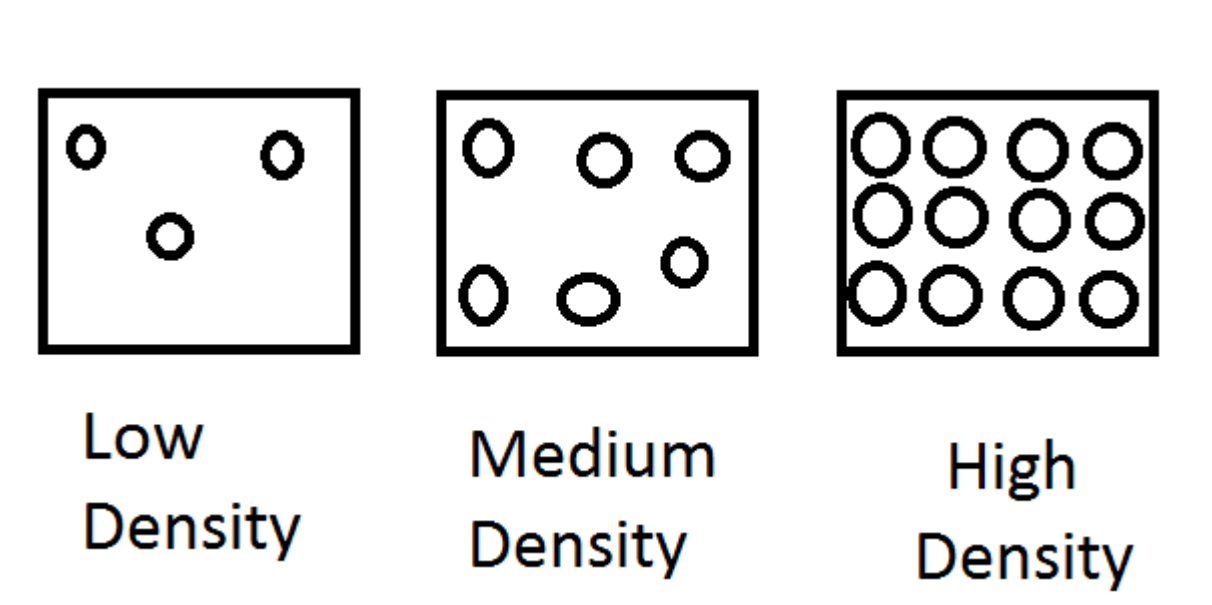
DENSITY

- Density –

  Density is how much mass is packed into a given volume. (Crowdedness)

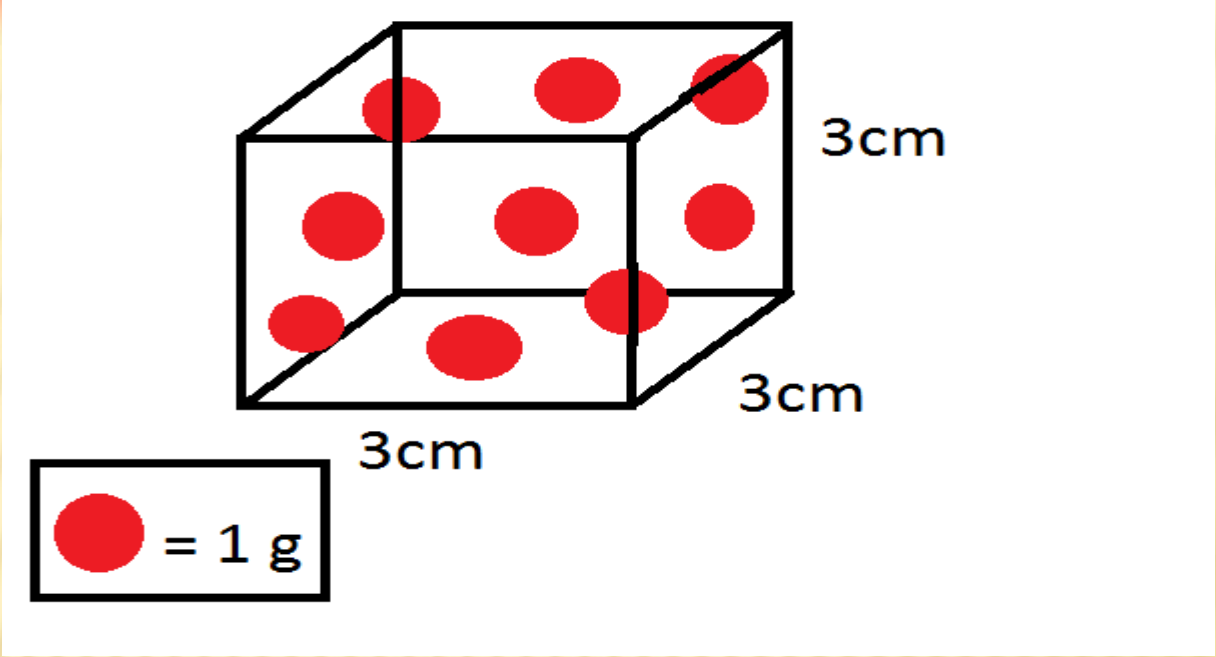


HOW TO FIND DENSITY

- How do you find Density?
- Density is how much mass is in a given volume.

$$D = \frac{\text{Mass}}{\text{Volume}} \quad \text{or} \quad D = \frac{M}{V}$$

DENSITY



Mass = 9g
Volume = 27cm3

$D = \frac{9g}{27cm3}$

D = .33 g/cm3

UNITS

- MAKE SURE TO USE THE PROPER UNITS!!!

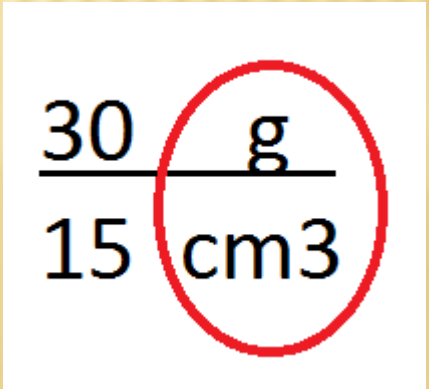
Ex $\frac{30\ g}{15\ cm3}$.

You can divide 30 by 15… 2 times

But you can not divide g by cm3

so you leave it that way.

D = 2 g/cm3



DENSITY PROBLEMS

Object 1) Mass 30g Volume 10cm3

$$D = \frac{30g}{10cm3}$$

D = 3.0 g/cm3

Object 2) Mass 20g Volume 40cm3

$$D = \frac{20g}{40cm3}$$

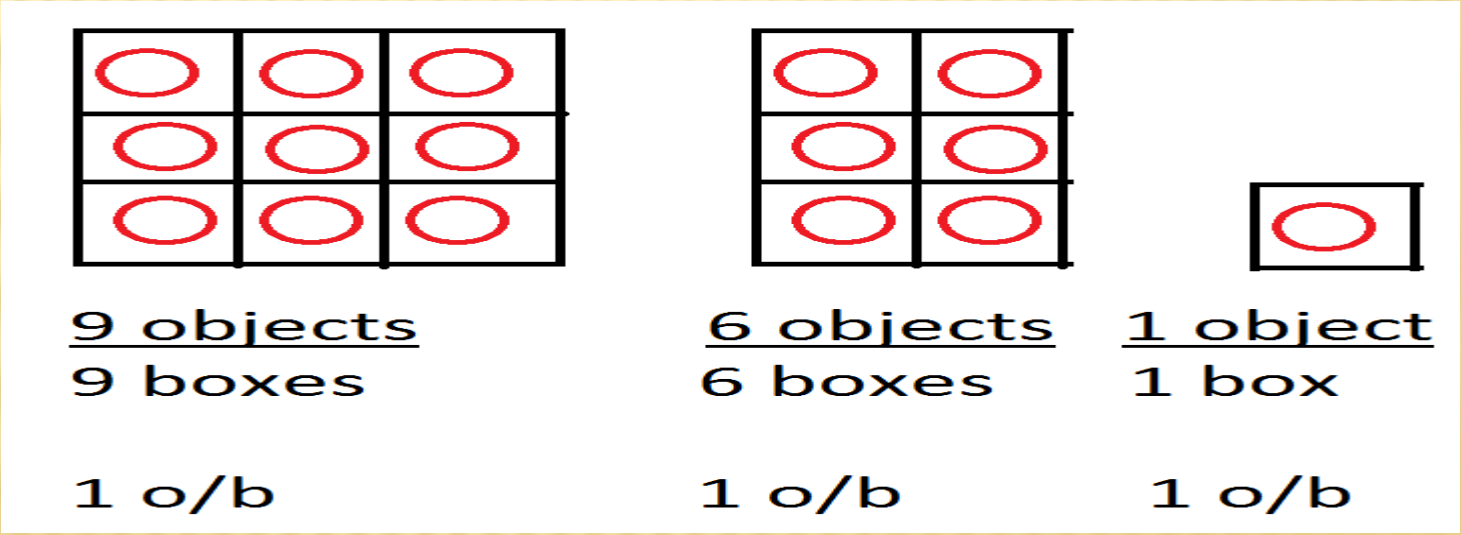
D= .5g/cm3

DENSITY UNIT ORDER

- You can not flip the units.
- 2 g/cm3 is not the same as 2 cm3/g
- Just as 30 students/classroom
- Is not the same as 30 classrooms/student

SIZE AND DENSITY

- Does cutting an object in half reduce density?
- Cutting an object in ½ does not change its Density!!! When you reduce the volume you are also reducing the mass by the same %.

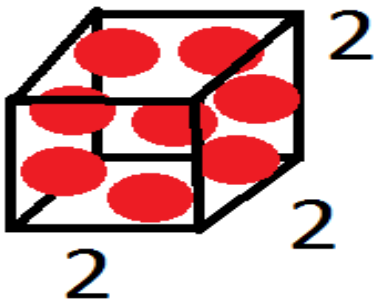


SIZE DOES NOT CHANGE DENSITY, DENSITY IS CROWDEDNESS

DENSITY AND WEIGHT.

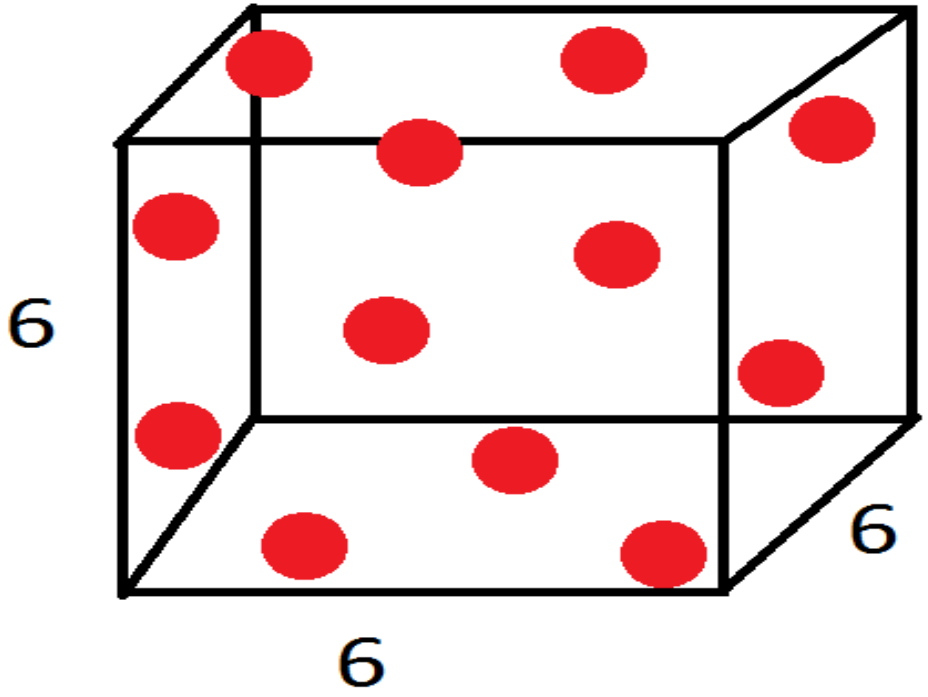
- Is Density the same as weight?
- Density does not mean weight or size.
- A light object can be very small and compact and therefore have a high density (a rock)
- A heavy object can be large and spread out and therefore have a low density (cruise ship)

DENSITY AND WEIGHT.



$D = \frac{8g}{8cm3}$

$D = 1g/cm3$



$D = \frac{12\ g}{216\ cm3}$

$D = .055\ g/cm3$

WHAT CAN CHANGE DENSITY

What can change density:

1) Adding or removing mass but not changing the volume.

(When the titanic took on water it changed its mass but not its volume so it sank)

2) Changing the Volume and not the mass

Increasing or decreasing temperature changes the volume but not the mass.

(hot air balloons rise because gas expands)

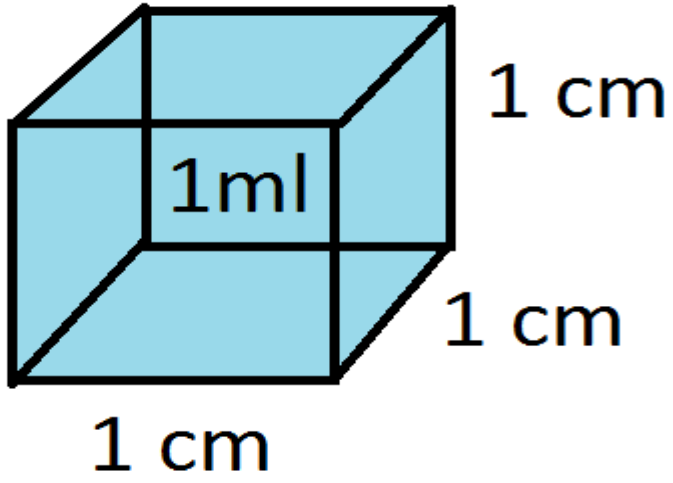
Increasing or decreasing pressure will change the volume but not the mass.

(squishing a pillow)

DENSITY IN SOLIDS AND LIQUIDS

- How much liquid would it take to fill a 1 cm3 box?

To fill a 1 cm3 box
it would take 1 ml of liquid

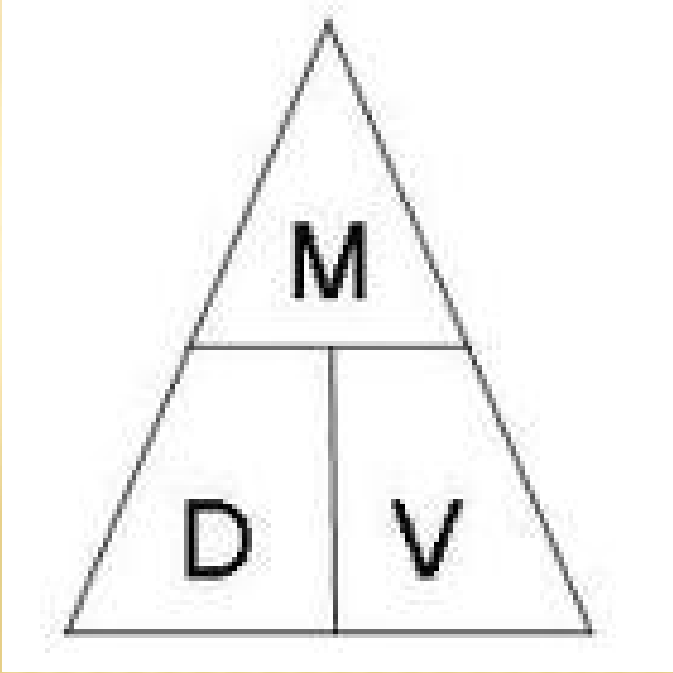


Therefore... 1cm3 = 1ml

DENSITY TRIANGLE.

Knowing density, how can we find volume or mass of an object?

- The Density Triangle
- AKA Density Dorito



DENSITY TRIANGLE

D=?

D = M/V

10g/5cm3 = 2 g/cm3

V=?

V = M/D

10g/2g/cm3 = 5cm3

M = ?

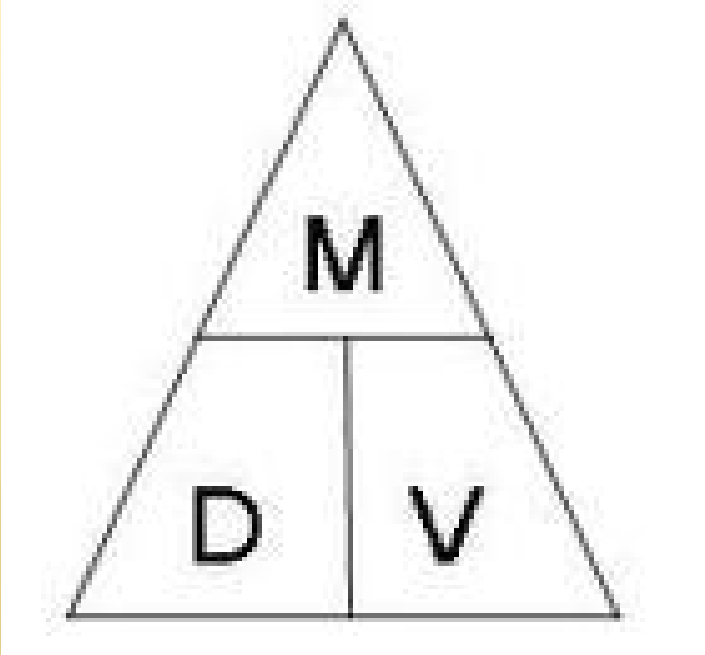
M = DxV

5cm3 x 2 g/cm3 = 10g

D = 2 g/cm3

M = 10 g

V = 5 cm3



DENSITY LAB (GENERAL)

- What is Mass? (How to find it)
- What is Volume?
- Regular Objects? (how to find volume)
- Irregular Objects? (how to find volume)
- What is Density?
- Formula for Density?
- Does size change density? (why)
- What 2 ways you can change density? (why)
- Explain the Density triangle?

DENSITY OF ROSE QUARTZ LAB (R)

- Density of Rose Quartz

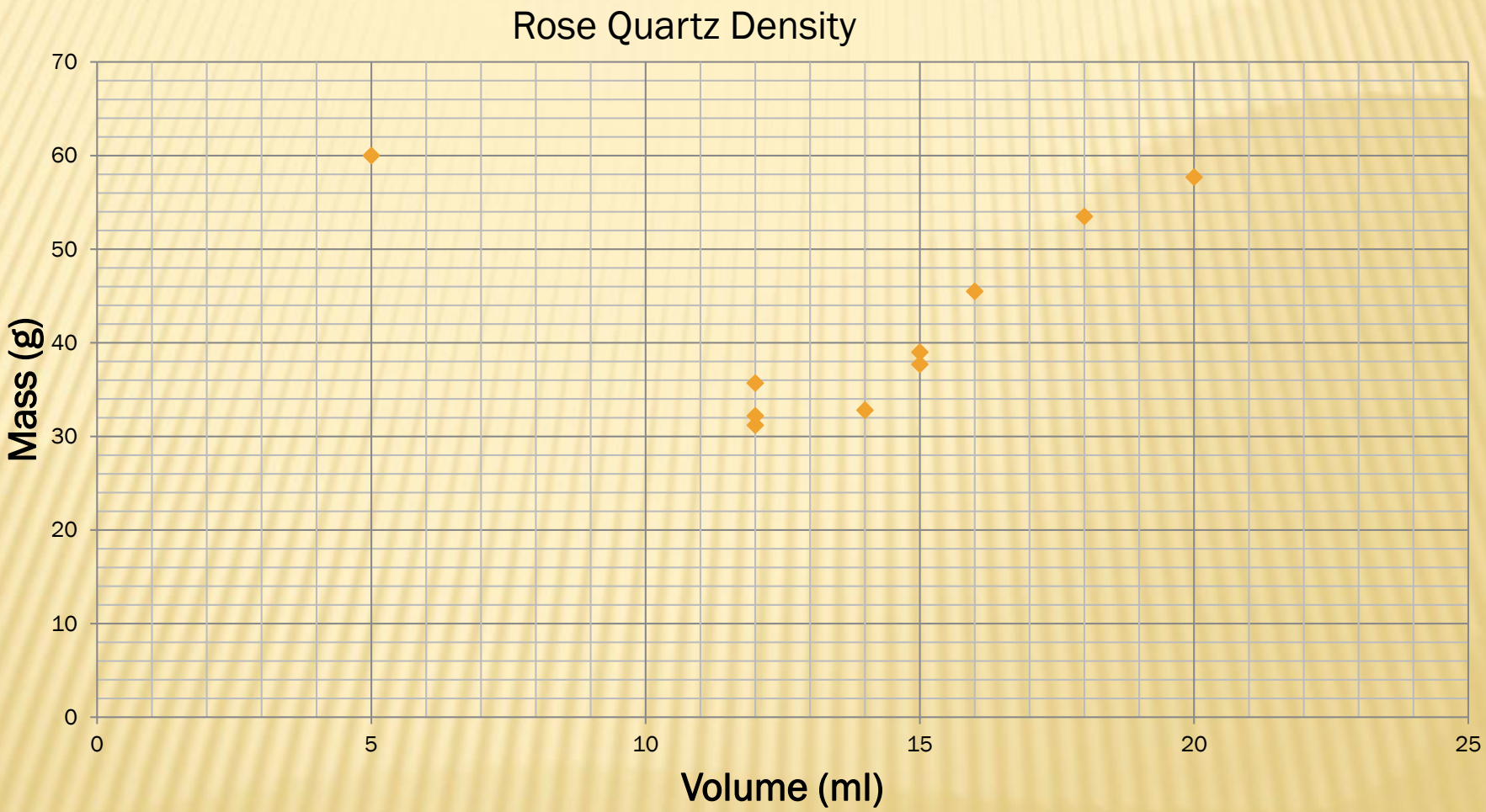
- In this activity you will be investigating the density of Rose Quartz. Each lab group will be given an unknown sample size piece of Rose Quartz. It will be your task to find the volume, mass and density of your sample. Each lab group will then record their results on the board. Then using the class results plot a graph showing the relationship of the mass of the quartz to the volume of the quartz for each sample. A conclusion about your graph's results and the relationship you have discovered should be described.

DENSITY OF ROSE QUARTZ (R)

Mass (g)	Volume (ml)	Density

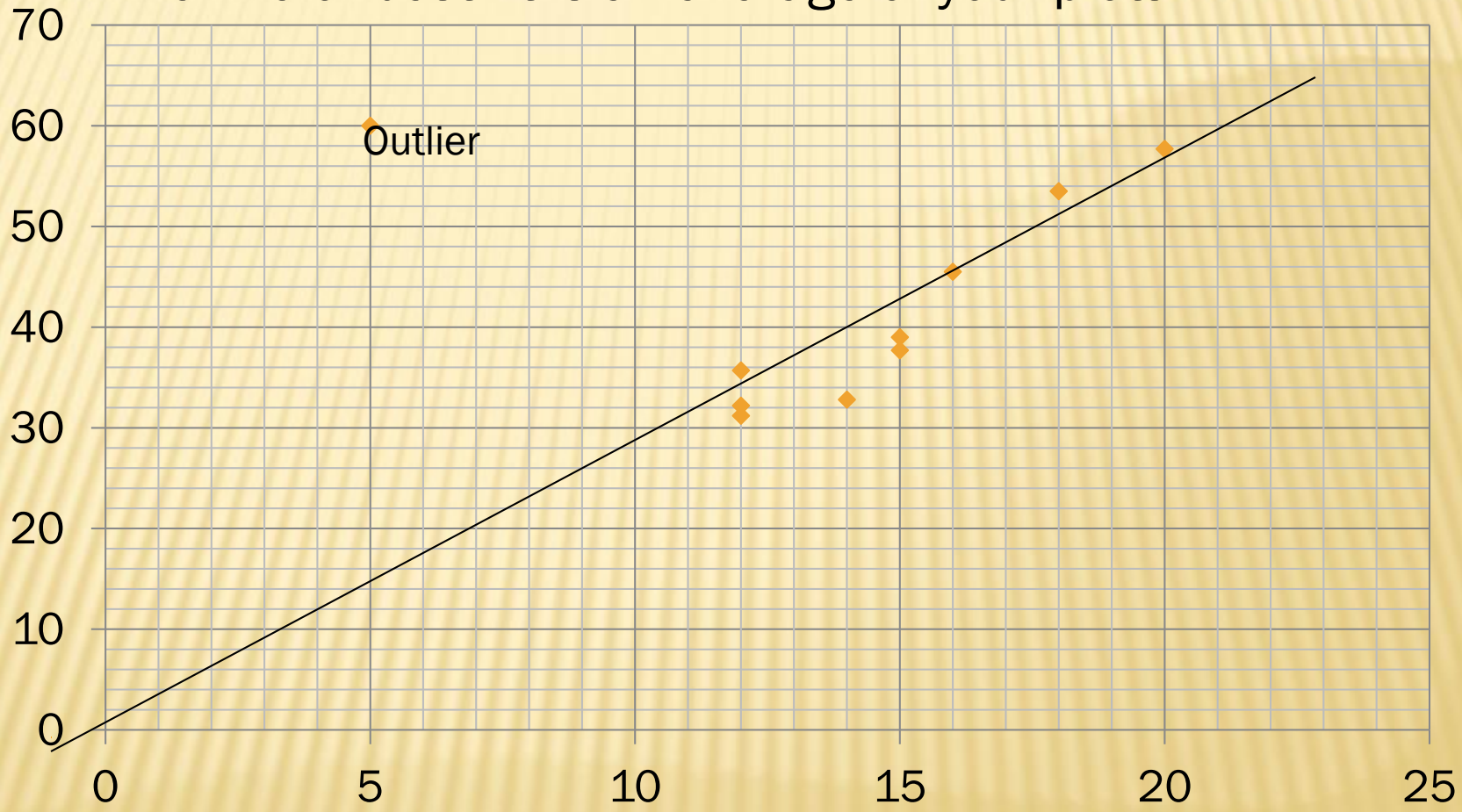
Graph: Portrait view: Y-axis = mass, X-axis = Volume

ROSE QUARTZ DENSITY (R)



LINE OF BEST FIT (R)

The line of best fit is an average of your plots.



Outlier:

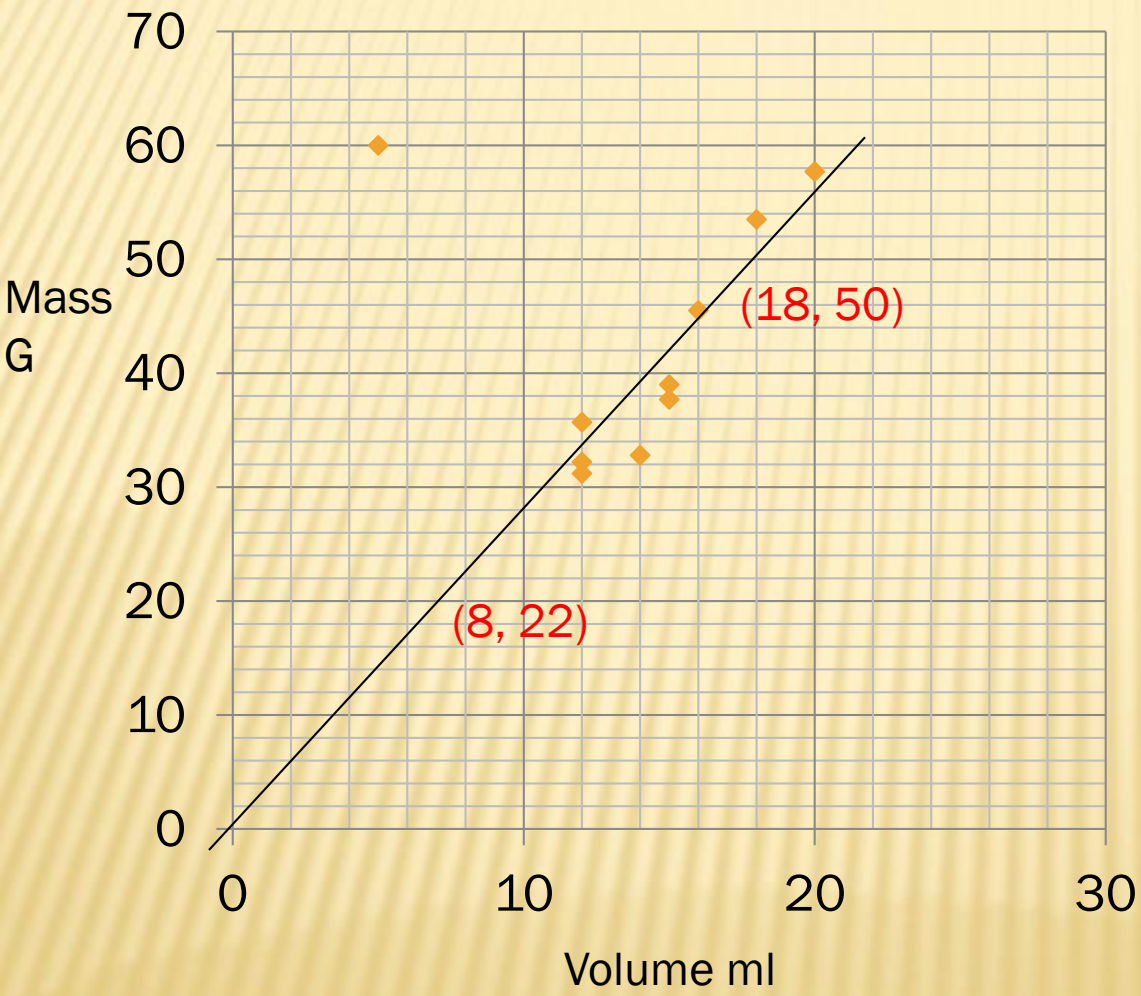
Outliers do not fit with the norm. Major outliers can be removed.

SLOPE (GRADIENT) (R)

- What is slope or gradient?
- Slope or Gradient is your steepness.
- Formula?
- Change in field value
- Distance

- Or change in Y (rise)
- change in X (run)

SLOPE OF A LINE (R)



Pick any two points on your line.
(best if on both axis)

SLOPE = $\frac{\text{CHANGE IN Y}}{\text{CHANGE IN X}}$

SLOPE = $\frac{50 - 22 \text{ g}}{18 - 8 \text{ ml}}$

SLOPE = $\frac{28 \text{ g}}{10 \text{ ml}}$

SLOPE = 2.8 g/ml

Since your density does not change with size, your slope IS your density.

ROSE QUARTZ PERCENT ERROR (R)

- Rose Quartz % Error
- Experimental density = 2.8 g/cm3
- True density 2.65 g/cm3

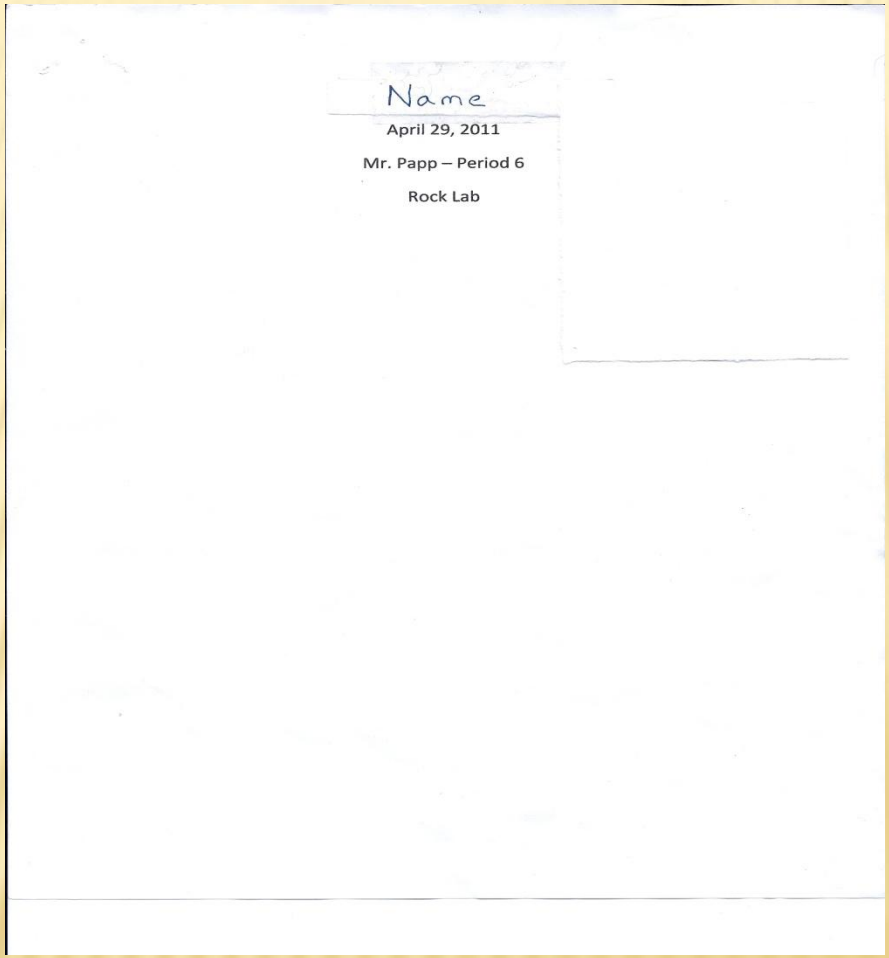
- What is our percent error

- $\frac{2.8 - 2.65}{2.65} \times 100$

- $\frac{.15}{2.65} \times 100$

- Percent error = 5.7 %

HOW TO WRITE A LAB – COVER PAGE (R)



HOW TO WRITE A LAB– PURPOSE/PROCEDURE (R)

Purpose: To learn about the 3 types of rocks, their classifications, and the rock cycle

Procedure:

Equipment:

- 3 igneous rocks
- 3 sedimentary rocks
- 3 metamorphism rocks
- Colored pencils
- ESRT
- 3 rock type sheets

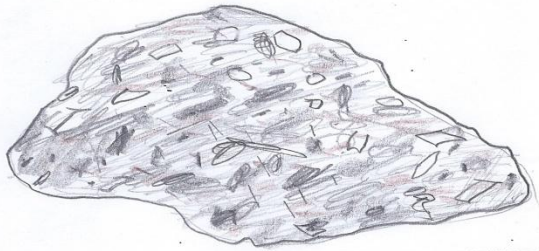
To start this lab, we received three rock type sheets and labeled one of them igneous, one of them sedimentary and one of them metamorphic. Then, each table got 3 igneous rocks (granite, scoria, and obsidian) and we drew them onto our sheet with colored pencils. After that, we looked at the igneous rock identification chart in our Earth Science Reference Table and we copied down the characteristics of each rock onto the sheet. We repeated these steps for 3 sedimentary rocks (sandstone, breccias, and shale) and for 3 metamorphic rocks (gneiss, quartzite, and marble). After we completed all three sheets, we learned about the rock cycle and how and how any rock type with the right conditions can turn into any other rock.

HOW TO WRITE A LAB – DATA (R)

Igneous

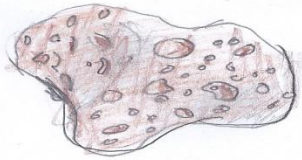
NAME _____ DATE 4/11 PERIOD 6

CLASS Granite



REASONS
intrusive
1mm to 10 mm
coarse
non-vesicular

CLASS Scoria



REASONS
extrusive
non-crystalline
glassy
vesicular

CLASS obsidian

REASONS
extrusive
non-crystalline
glassy
non-vesicular

HOW TO WRITE A LAB – CONCLUSION (R)

A rock is a naturally occurring solid aggregate of minerals. Basically, it's just a collection or group of minerals. There are three types of rocks: igneous, sedimentary, and metamorphic. Igneous rocks are formed with the cooling or solidification of molten rock (magma or lava). Time is the biggest thing that affects igneous rocks. Intrusive cooling is when magma cools inside the Earth. It cools very slow and can grow large crystals. The more time it has to cool, the larger the crystals can grow. Extrusive cooling is when lava cools outside the Earth. It cools fast and has small or no crystals. Glassy is rapid cooling, vesicular is gas pockets, and fine grained is not visible. Igneous is the most common rock type (over 200 types) and it makes up the bottom 95% of the lithosphere. Sedimentary rocks are rocks formed from pieces of sediment that get recombined to make a new rock. They form at Earth's surface and within bodies of water. There are 3 types of sedimentary rocks: clastic, chemical, and organic. Clastic is made up of fragments and pieces and categorized by grain size (conglomerate=large, sandstone=sand size, shale=clay (smallest)). Chemical is when dissolved sediment comes out of water crystalline. The two types of chemical sedimentary rocks and they are precipitates and evaporites. Precipitates are when the water rains out, and evaporites are when the water leaves. Organic sedimentary rocks have two types: chemical and bioclastic. Chemical is dissolved calcite precipitates out to form limestone. Bioclastic is "living pieces". For example limestone is formed by the compaction of shells and coal is formed by the compaction of plant remains. Metamorphic rocks are rocks that "changed" due to heat and pressure. Foliated metamorphic rock is layered or folded rocks 92 types: mineral alignment- minerals line up in layers; bonding- minerals separate by type or colors). Non-foliated metamorphic rock is when there is no distinct mineral alignment or layers. Non-foliated rocks break into angular pieces and they're named based on size and what rock they came from. Contact metamorphism is when heat is directly applied to the rock to change it. Regional metamorphism is when an entire are is put under so much pressure that it changes the rock. The rock cycle shows how any rock type with the proper conditions can turn into any other rock type (including a new version of itself). For example, any rock can break down into sediment and reform into a sedimentary rock and any rock can be given heat and pressure and reform as a metamorphic rock. Some everyday uses of rocks are coal used in power plants to make electricity, marble for monuments, pumice in rough hand soaps and emery boards, and granite for kitchen countertops.

ROSE QUARTZ CONCLUSION. (R)

- Conclusion:
- What is density
- Formula for density
- Does size affect density (why or why not)
- what does effect density (why)
- what is a line of best fit
- what is % error/deviation
- what errors could have been made.

DENSITY OF WATER LAB (R)

- Directions: Each group will find the mass and volume of 4 objects. You will have to find the mass and volume of 2 wooden blocks, an unknown amount of water and a rock. Record this information on the chart below. From this chart, graph the volume of each object versus its mass. Put the mass on the “Y” axis and the volume on the “X” axis. Each group will also report their findings for water to the rest of the class. Next, you will construct a scatter plot graph of these four objects connecting the plot line to the *origin* (0,0 point)of the graph. Then create a *line of best fit* for the class' water data, again starting at the origin and removing any major outliers. After you have completed this, find the *slope* (rise over run)of each line to determine the objects' densities. Finally, using this information, determine the placement of the line that would represent the density of Rose Quartz .

CLASS WATER RESULTS (R)

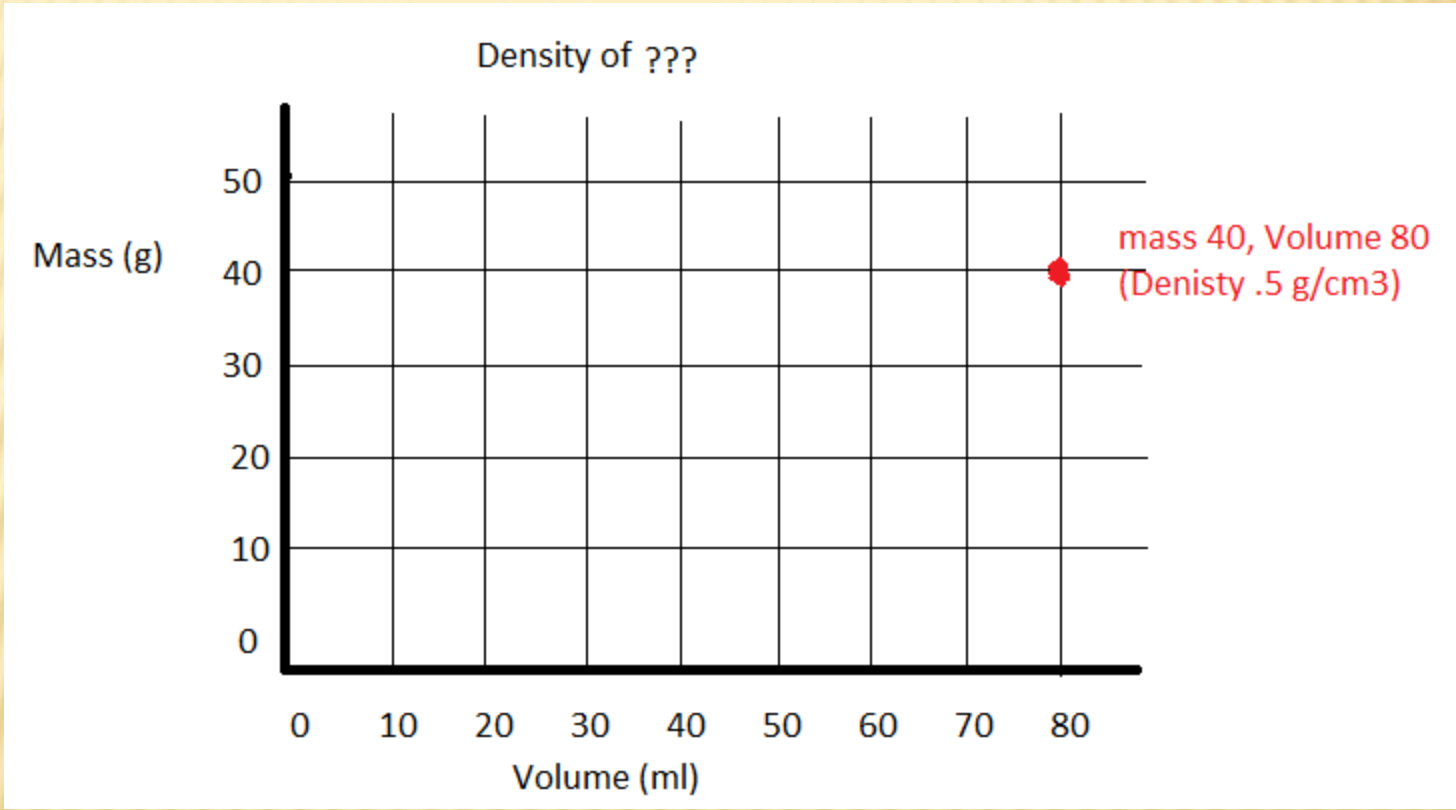
Mass (g)	Volume (ml)		Mass (g)	Volume (ml)		Mass (g)	Volume (ml)

H20 LAB (GENERAL)

- Each group will find the density of:
- - 1 block of wood.
- - 1 piece of rose quartz
- - 1 an unknown amount of H20
- Next students will graph the density of all 3 objects to see if anything about density can be discovered.

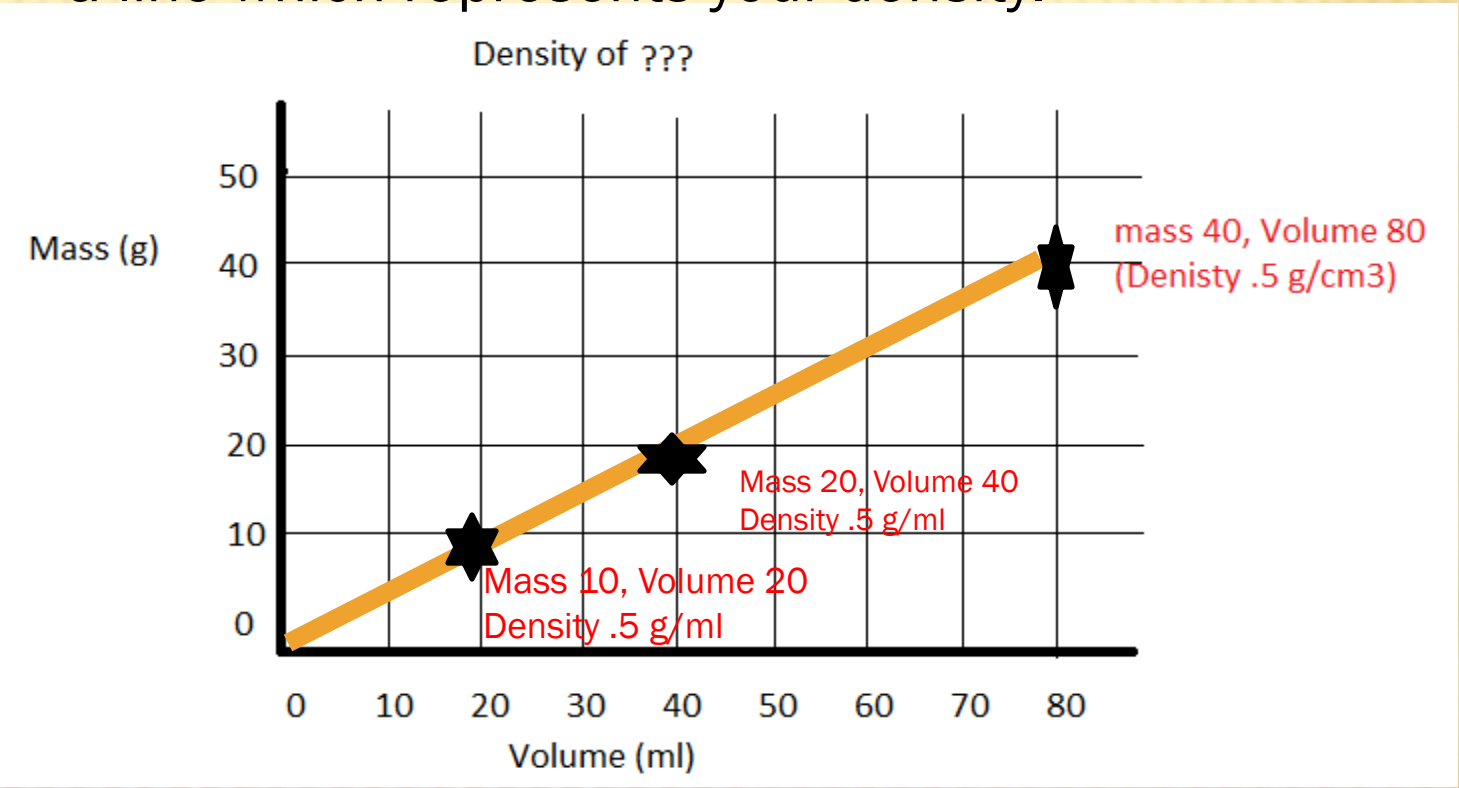
DENSITY LINE

How do you find density with just 1 point?



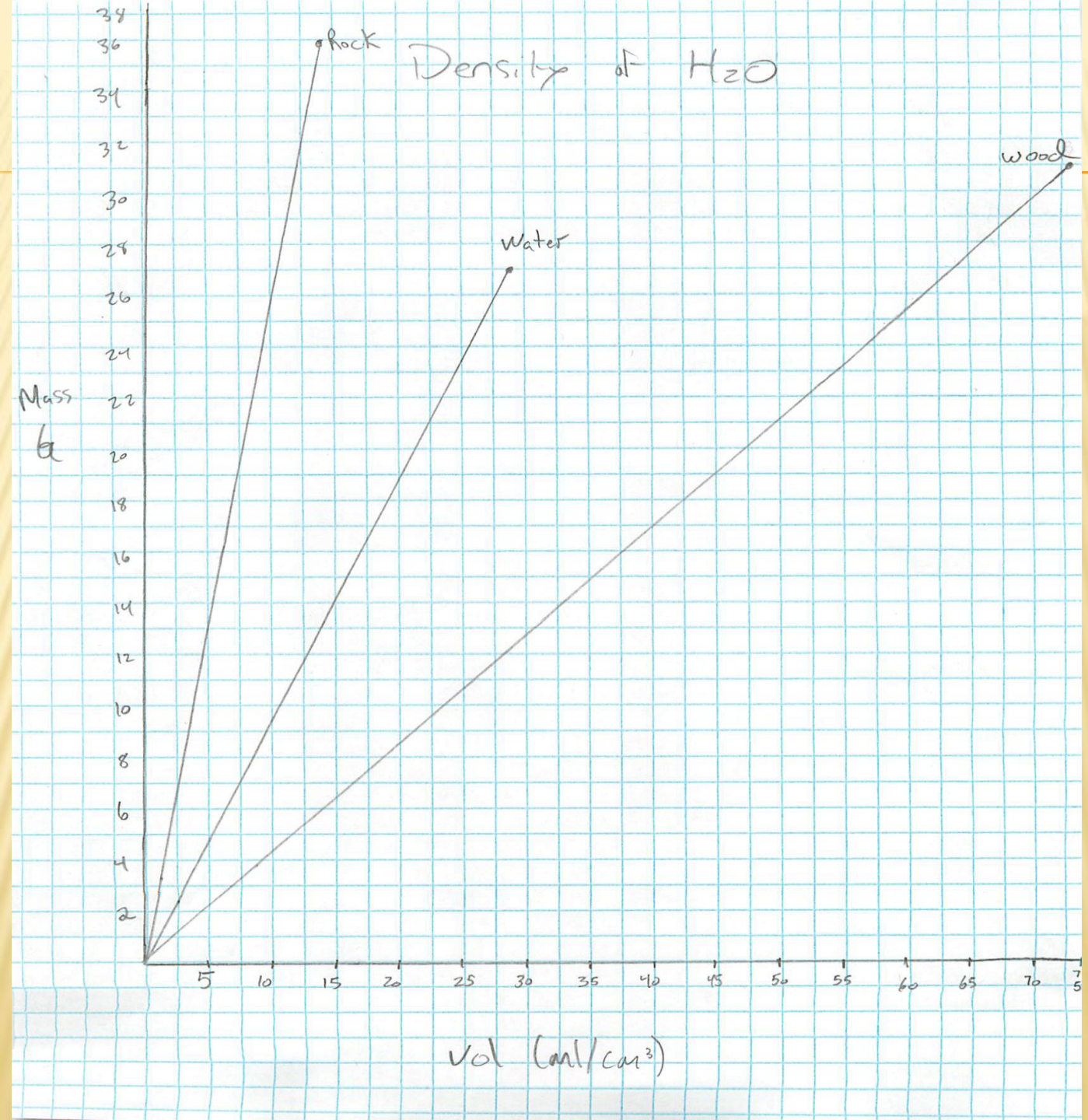
DENSITY LINE

A line connected from a plot to the origin creates a line which represents your density.



Why does this work?

This works because size does not affect density!


Density of H_2O
Rock
Water
wood
Mass g
34
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
5
10
15
20
25
30
35
40
45
50
55
60
65
70
Vol (ml/cm³)

DENSITY OF WATER

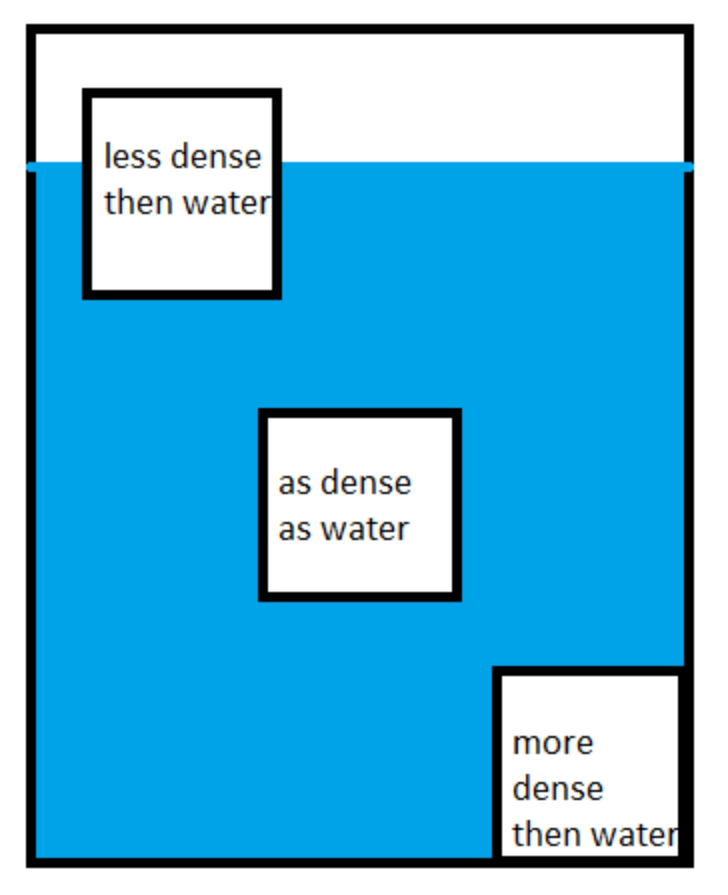
- What is the density of water?
- The density of water is 1 g/ml or 1 g/cm^3

- What will happen to an object with a density higher then 1 g/ml?
- An object denser then 1 g/ml will sink.

- What will happen to an object with a density less then 1 g/ml?
- An object less dense then 1 g/ml will float.

- What happens to an object with the same density as water?
- An object with the same density as water (or what ever liquid it is contained in) will remain in suspension. (in the middle)

DENSITY OF WATER



Floating
< 1 g/ml

Suspension
= 1 g/ml

Sinking
>1 g/ml

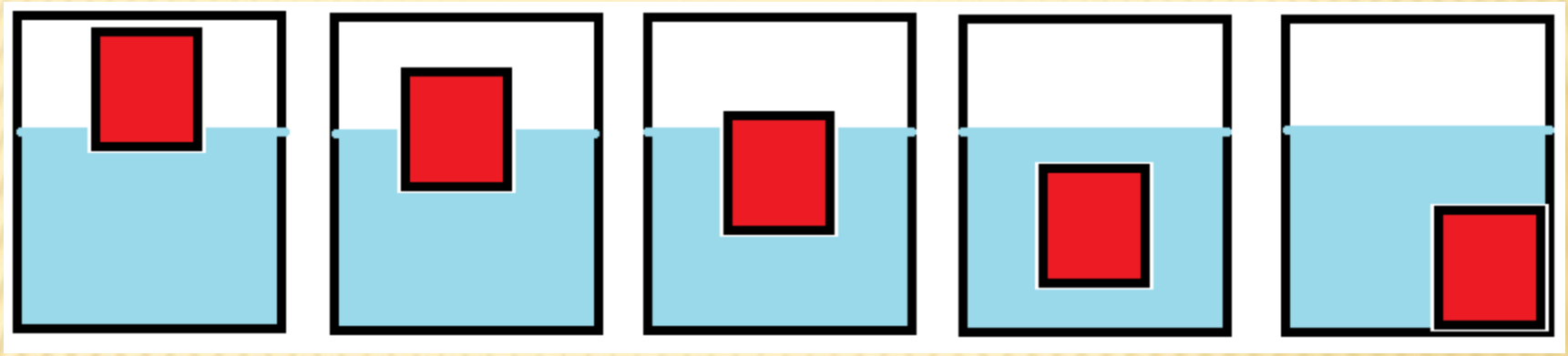
Less dense objects sit above more dense objects (think chicken fights)

FLOATING

- Do all objects float at the same height?
- Objects float at different heights.

- What decides how high an object will float?
- The height an object rests on the top of the water depends on its density.
- The lower the density, the higher up it will float.

OBJECTS IN WATER



D ~ .1 g/ml	D ~ .5g/ml	D ~ .9 g/ml	D = 1 g/ml	D > 1 g/ml
Styrofoam	Wood	Ice or water logged wood	submarine	Rock


PING PONG BALL
LAMP OIL
RUBBING ALCOHOL
SODA CAP
VEGETABLE OIL
BEADS
WATER
CHERRY TOMATO
DISH SOAP
MILK
DIE
100% MAPLE SYRUP
POPCORN KERNEL
CORN SYRUP
HONEY
BOLT

DENSITY OF WATER LAB CONCLUSION

- How can you represent all densities of an object on a graph when you only have 1 point?
- Why does that work?
- Density of Water?
- Objects more/less/same density as water do what?
- Draw 5 beakers to represent the density of:

  .1g/ml, .5g/ml, .9g/ml, 1g/ml, 2g/ml
- Why does ice float?
- Why did the Titanic Sink (in terms of density)?