Name _____

Video Quiz

Directions: Fill in the blank with the correct word from the list at the bottom of the page. Not all words from the list will be used.

1. Anything that takes up space is made of _____.

2. A _____.is a characteristic of matter.

3. _____.properties describe how mater changes into new matter.

4. Color, shape, and texture are _____.properties.

5. _____.is the amount of matter in an object.

6. The weight of objects is commonly measured on a _____.

7. _____.is the amount of space something takes up.

8. Volume can be measured in milliliters or _____.centimeters.

9. _____.is the amount of matter per unit of volume.

10. Density equals mass divided by _____.

matter
chemical
color
cubic
density
mass
odor
physical
property
scale
texture
volume

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Page 2 of 5

Name _____

Discussion Questions

Directions: Answer the following questions in the spaced provided (use the back of the sheet if necessary) or as a group.

1. Describe some of the properties of matter.

2. Provide examples of chemical properties.

3. Provide examples of physical properties.

4. Provide an example of when you might want to know or calculate the volume of an object.

5. Provide an example of when you might want to know or calculate the density of an object.

6. Explain the difference between mass and weight.

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10a

Name _____

Post - Test : Properties of Matter

Directions: Answer the following questions in the spaces provided. Use the back of the shett if necessary.

1. _____ is anything that takes up space. (2 points)

2.. Everything we touch, _____ , and _____ is made of matter. (4 points)

3. List two examples of chemical properties of matter: _____ and _____ . (6 points)

4. List four examples of physical properties of matter: _____ and _____ and _____ and _____ . (8 points)

5. _____ is the amount of matter in an object. (2 point)

6. Why is the weight of a person on the moon less than on earth? (10 points)

7. Is the mass of an object different on the moon than on earth? (2 points)

8. Describe how one measures displacement. (10 points)

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10a

Name _____

Post - Test : Properties of Matter

9. The initial reading of the water level in a beaker is 150 ml. After placing an object in the beaker, the level rises to 221 ml. Calculate the volume of the object; show your calculations. (12 points)

10. What is the formula for volume? (10 points)

11. Calculate the following volume of an object with a regular shape if the height is 7 cm., the width is 5 cm., and the length is 10 cm.Show your calculations.(12 points)

12. What is the formula for density? (10 points)

13. Calculate the density of a brick that has a mass of 75 grams and a volume of 30 cubic centimeters. (12 points)

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Name _____

Calculating Volume

Directions: Read the following problems and answer the questions in the space provided.

1. Calculating volume of an object with a regular shape

While walking on the beach you found a piece of driftwood. You brought it home as a souvenir of your trip to the ocean. Because you are curious about its size, you want to calculate the volume of this piece of wood. The length of the piece of wood is 29 cm. The height of the piece of wood is 22 cm and the width is 12 cm. What is the volume of this piece of wood? Show your calculations.

2. Calculating volume of an object with an irregular shape

While playing outdoors you found a pretty quartzite rock. You thought that this would be a great addition to your aquarium. If you put this rock into your aquarium, the water will overflow, so you need to calculate how much water to take out of it. Obtain a 250 ml beaker and fill it with water until it reaches 150 ml. After you put in the quartzite rock the water level reads 218 ml. What is the volume of the quartzite rock? How much water do you need to remove from the aquarium? Show your calculations.

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Name _____

Calculating Density

Directions: Read the following problems and answer the questions in the space provided.

1. Calculate cm^3 and ml

Calculate how many cm^3 are in each ml of liquid:

6 ml of milk = _____ cm^3

31 ml of orange juice = _____ cm^3

54 cm^3 of root beer = _____ ml

2. Calculating density of an object with a regular shape

While at the store, you bought a box of cookies. Because you were intrigued by watching this video, you decided that you would like to find out the density of this box of cookies. The weight of the box of cookies is 8 ounces or 226.8 grams. The box measures 20 cm x 8 cm x 14 cm. What is its density? Show your calculations.

3. Calculating the density of an object with an irregular shape.

You would like to find the density of an unusually shaped piece of jewelry. Since the piece of jewelry has an irregular shape, you need to use displacement to calculate the volume. In a 300 ml beaker you pour 200 ml of water. When you place the piece of jewelry in the beaker the water level rises to 278 ml. What is the volume of the piece of jewelry? Show your calculations.

After computing the volume of the piece of jewelry, you need to calculate the weight. Upon placing the object on the scale, you find that it weighs 122 grams. Given this information, calculate the density. Show your calculations.

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Name: _____ Date: _____ Class: _____

INTEGRATED PHYSICS & CHEMISTRY
THE DENSITY OF SOLIDS

INTRODUCTION: Density is the ratio of mass to volume.

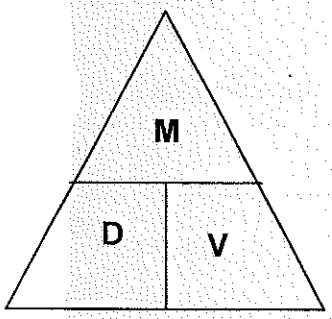
PROBLEM: What is the density of various solids? Does the density of a substance vary with shape and size?

HYPOTHESIS: _____

_____

MATERIALS: Cylinder Set containing: aluminum, brass copper and steel
Block Set containing: aluminum, brass, copper, steel, pine, oak, transparent acrylic block, PVC gray block, opaque polypropylene block , Triple Beam Balance, Graduated Cylinder(plastic) & metric ruler.

PROCEDURE:



1. Determine the mass of each sample using the triple beam balance and record in the data table.
2. Determine the volume of each block by multiplying the l x w x h and record in the data table.
3. Determine the volume of each cylinder using the water displacement method. Record in the data table.
4. Make a bar graph of the density blocks on a separate sheet of graph paper.

DATA & OBSERVATIONS:

DENSITY BLOCKS

SUBSTANCE	MASS IN g	VOLUME IN mL	DENSITY in g/mL
BRASS			
COPPER			
ALUMINUM			
STEEL			
PINE			
OAK			
TRANSPARENT			
GRAY			
OPAQUE			

8

9a

Name _____

Experiment!

Finding Density of Unknown Substances

Objective

In this experiment you will calculate the density of several objects, and then when provided with the density of different substances attempt to state the object's composition.

Materials

Beaker
Graduated cylinder
Water
Scale
Nail
Cork
White cube
White rock
Piece of wire

Procedure

1. Study the data table on the next page, and ask your teacher to explain any terms with which you may not be familiar.
2. Write the names of the objects provided by the teacher in the first column of the data table.
3. Calculate the weight of each object by using the scale or balance.
4. Next, calculate the object's volume using the displacement method described below..
    a. Pour water into a graduated cylinder or beaker, and record the volume of water in the con tainer on the data table.
    b. Place the object in the container and note the new level of the water. Record the value in the data table.
    c. To obtain the volume of the object subtract the initial volume of water from the volume of water after the object was placed in the container.
5. Calculate the density by dividing the mass by the volume.
6. Listed below are the densities of various objects. Using this list, match the density you calculated to the density of the materials in the chart.

Quartz	2.6 gr./cm.3
Water	1.0 gr./cm.3
Copper	8.9 gr./cm.3
Lead	11.3 gr./cm.3
Gold	19.3 gr./cm.3
Cork	.24 gr./cm.3
Sugar	1.6 gr./cm.3
Iron	7.9 gr./cm.3

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9b

Name _____

Experiment!

Finding Density of Unknown Substances

Data Table

Object	Mass (Weight)	Volume in container before object	Volume in container after object	Volume of object	Density (Density = Mass/Volume)	Composition of object

Conclusion

In the space below, describe any problems you encountered when performing the measurements and calculations. How could you have made your measurements more precise? What are some other methods that could be used to identify the composition of matter in objects?

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Name _____ Class _____ Date _____

REVIEW and REINFORCEMENT

Volume and Density

Section 2-3

KEY CONCEPTS

- Matter is anything that has mass and volume.
- Density is the mass per unit volume of an object.

Vocabulary Skills: Using Definitions

Write a short paragraph in which you explain how the following terms are related.

matter mass volume density property

The Case of the Missing Crown: Exploring the Main Ideas

Imagine that you are living in Europe in the Middle Ages. You have been summoned by the king of your land to help in a very important matter. Someone has stolen the king's solid gold crown. The king has issued a proclamation offering a reward of 500 gold coins for the safe return of his crown. The problem is that the king has received hundreds of crowns—and they all look exactly like the missing crown! Your job as a brilliant scientist is to find out which crown is the real one. The chart below shows some data that you have collected on one batch of crowns. Study the data, then answer the questions.

Crown #	Volume (cm^3)	Mass (g)	
1	180	1890	
2	180	486	
3	180	1404	
4	180	3474	
5	180	2034	

10

Name _____ Class _____ Date _____

CHAPTER 2

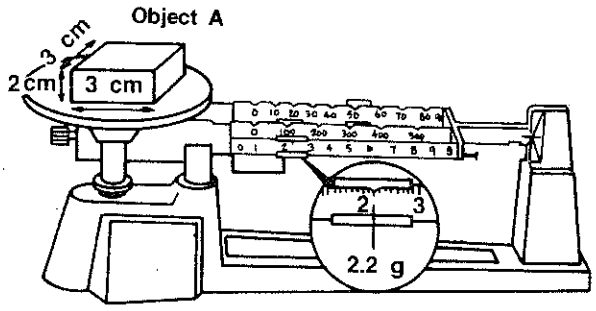
ACTIVITY ■ General Properties of Matter

Density Drill

Some objects tend to be "heavy," while other objects seem "light." But unless you are comparing the same volume of each object, these descriptions have little value. And that is where the concept of density comes in. Density refers to how much mass an object has in a particular volume. Scientifically, density is described as mass per unit volume, or density = mass/volume. Because mass is measured in grams, and volume is measured in cubic centimeters, the unit for density is grams per cubic centimeter.

If the mass and volume of an object are known, its density can be determined by dividing the volume value into the mass value. Similarly, if the density and mass are known, the object's volume can be determined by dividing the density value into the mass value. Finally, if an object's density and volume are known, its mass can be found by multiplying these two values. You can see how density, mass, and volume are related by doing this activity. In each situation, you are given enough information to determine the unknown value in the formula D = M/V.

A. 1. The mass of object A, as shown by the positions of the balance riders, is _____ g.



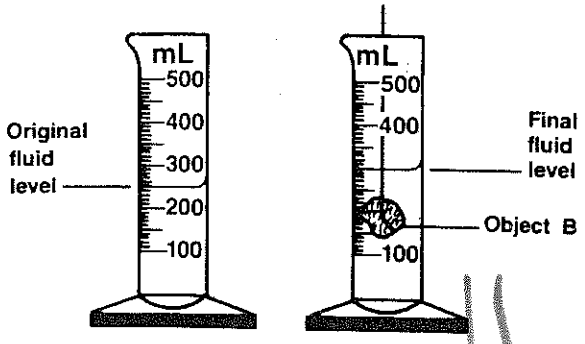
2. The volume of object A, as indicated by the given dimensions, is _____ cm^3.

3. Using the formula $D = \frac{M}{V}$, calculate the density of object A. _____ g/cm^3

4. If object A is cut into two equal parts, what is the density of one half of A? _____ g/cm^3 Of the other half? _____ g/cm^3. How does the density of object A compare to the density of half of object A? _____

B. 1. The mass of object B has been determined to be 125 gs.

2. The volume of object B, as indicated by the change in fluid level in the cylinder, is _____.



Name: _____ Date: _____ Class: _____

INTEGRATED PHYSICS & CHEMISTRY
DENSITY OF FLUIDS

INTRODUCTION: Why do you need to shake a bottle of dressing before you pour it on your salad? What does the density of liquids have to do with this? In this investigation, you will try to stack five liquids in a graduated cylinder in order to build a density column. You will be able to use your density column to predict the density of solid materials.

PROBLEM: Can you create a stack of liquids?

HYPOTHESIS: _____

_____

MATERIALS:

30 mL of Molasses
30 mL water
30 mL light corn syrup
Food coloring
Rubber stopper
Balance
100 mL graduated cylinder
30 mL vegetable oil
30 mL glycerin
Cork
small steel object

PROCEDURE:

1. You have been given 30 mL of each of five liquids. Using no more than 10 mL of each liquid, determine the density of each one. Be sure to use the most accurate techniques you have learned for finding the mass and volume of liquids.

2. Wash and dry your graduated cylinder between each measurement. Record your results in the table below.

Substance	Mass in grams	Volume in mL	Density in g/mL
Molasses			
Water			
Vegetable oil			
Light corn syrup			
Glycerin			

18

Myth busting video: Add video

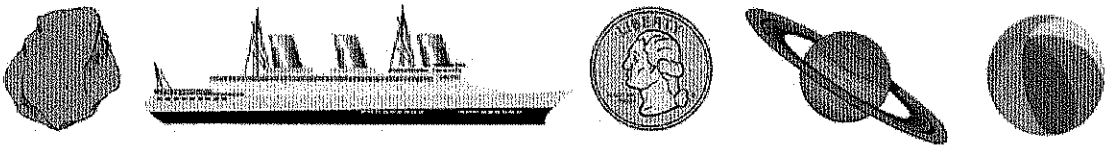
Name: _____ Date: _____

Student Exploration: Density Laboratory

Vocabulary: buoyancy, density, graduated cylinder, mass, matter, scale, volume

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. Of the objects below, circle the ones you think would float in water.



Rock | Cruise ship | Quarter | Saturn | Beach ball

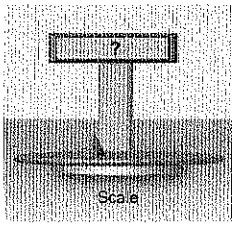
2. Why do some objects float, while others sink? _____

_____

_____

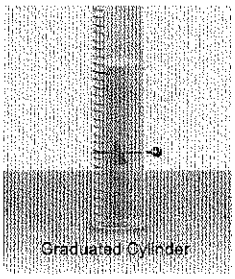
Gizmo Warm-up

The *Density Laboratory* Gizmo™ allows you to measure a variety of objects, then drop them in water (or other liquid) to see if they sink or float.



1. An object's **mass** is the amount of **matter** it contains. The mass of an object can be measured with a calibrated **scale** like the one shown in the Gizmo. Drag the first object onto the **Scale**. (This is object **1**.)

   What is the mass of object **1**? _____



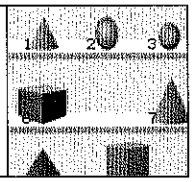
2. An object's **volume** is the amount of space it takes up. The volume of an irregular object can be measured by how much water it displaces in a **graduated cylinder**. Place object **1** into the **Graduated Cylinder**.

   What is the volume of object **1**? _____

   Note: While milliliters (mL) are used to measure liquid volumes, the equivalent unit cubic centimeters (cm^3) are used for solids. Therefore, write the volume of object **1** in cm^3.

3. Drag object **1** into the **Beaker of Liquid**. Does it sink or float? _____

13

Activity A: Float or sink?	Get the Gizmo ready: • Drag object **1** back to the shelf. • Check that **Liquid Density** is set to 1.0 g/mL.	

Question: How can you predict whether an object will float or sink?

1. Observe: Experiment with the different objects in the Gizmo. Try to determine what the floating objects have in common and what the sinking objects have in common.

2. Form hypothesis: Compare the floating objects, then do the same for the sinking objects.

   A. What do the floating objects have in common? _____

   _____

   B. What do the sinking objects have in common? _____

   _____

3. Collect data: Measure the mass and volume of objects 1 through 12, and record whether they float or sink in the table below. Leave the last column blank for now.

Object	Mass (g)	Volume (cm^3)	Float or sink?	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

(Activity A continued on next page)

Activity A (continued from previous page)

4. Analyze: Look carefully for patterns in your data.

   A. Does mass alone determine whether an object will float or sink? _____

      Explain: _____

   B. Does volume alone determine whether an object will float or sink? _____

      Explain: _____

   C. Compare the mass and volume of each object. What is true of the mass and volume of all the floating objects? _____

   D. What is true of the mass and volume of all the sinking objects? _____

      _____

5. Calculate: The **density** of an object is its mass per unit of volume. Dense objects feel very heavy for their size, while objects with low density feel very light for their size.

   To calculate an object's density, divide its mass by its volume. If mass is measured in grams and volume in cubic centimeters, the unit of density is grams per cubic centimeter (g/cm^3).

   Calculate the density of each object, and record the answers in the last column of your data table. Label this column "Density (g/cm^3)."

6. Analyze: Compare the density of each object to the density of the liquid, 1.0 g/mL. This is the density of water.

   A. What do you notice about the density of the floating objects? _____

      _____

   B. What do you notice about the density of the sinking objects? _____

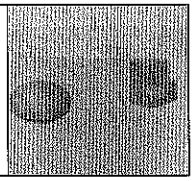
      _____

7. Draw conclusions: If you know the mass and volume of an object, how can you predict whether it will float or sink in water?

   _____

   _____

   _____

Activity B: Liquid density	Get the Gizmo ready: • Drag all the objects back onto the shelf. • Check that the **Liquid Density** is still 1.0 g/mL.	

Question: How does liquid density affect whether objects float or sink?

1. Observe: Place object **1** into the **Beaker of Liquid**. Slowly move the **Liquid Density** slider back and forth. What do you notice? _____

   _____

2. Form a hypothesis: **Buoyancy** is the tendency to float. How do you think the liquid density affects the buoyancy of objects placed in the liquid? _____

   _____

3. Predict: In the table below, write the density of each object. Then predict whether the object will float or sink in each of the fluids. Write "Float" or "Sink" in each empty box of the table.

Object	Object density	Liquid density		
		0.5 g/mL	1.0 g/mL	2.0 g/mL
1				
2				
3				
4				
5				

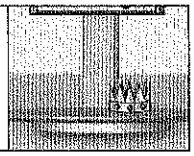
4. Test: Test your predictions using the Gizmo. Place a checkmark (√) next to each correct prediction, and an "X" next to each incorrect prediction.

5. Draw conclusions: What is the relationship between the object density, the liquid density, and the tendency of the object to float? _____

   _____

   _____

   _____

Extension: **King Hieron's crown**	Get the Gizmo ready: • Drag all the objects back onto the shelf. • Set the **Liquid Density** to 1.0 g/mL.	

Introduction: In the third century B.C., King Hieron of Syracuse asked the famous mathematician Archimedes to determine if his crown was made of pure gold. This was a puzzling problem for Archimedes—he knew how to measure the weight of the crown, but how could he measure the volume?

Archimedes solved the problem when he got into his bath and noticed the water spilling over the sides of the tub. He realized that the volume of the displaced water must be equal to the volume of the object placed into the water. Archimedes was so excited by his discovery that he jumped out of the bath and ran through the streets shouting "Eureka!"

Question: How can you tell if a crown is made of solid gold?

1. Think about it: Gold is one of the densest substances known, with a density of 19.3 g/cm^3. If the gold in the crown was mixed with a less-valuable metal like bronze or copper, how would that affect its density?

   _____

   _____

2. Observe: Drag each of the crowns into the liquid. Based on what you see, which crown do you think is densest? Explain why you think so.

   _____

   _____

3. Measure: Find the mass, volume, and density of each of the three crowns.

Crown	Mass (g)	Volume (cm^3)	Density (g/cm^3)
A			
B			
C			

4. Draw conclusions: Which of the three crowns was made of gold? _____

   Explain: _____

   _____

Team Meeting Rubric

Team Meeting	A(18-20 Points)	B (16-17 Points)	C (14-15 Points)	D/F
Frequency and Quality	Attends meetings regularly and ***always contributes*** to the discussions*	Attends meetings regularly and ***usually*** **contributes** to the discussions*	Attends meetings regularly and ***sometimes contributes*** to the discussions*	Attends meetings but ***rarely or never contributes*** to the discussions*

*Student raises thoughtful questions, analyzes issues, builds on others ideas, appropriately challenges others assumptions.

Group Member Name: _____ Score:_____

Group Member Name: _____ Score:_____

Group Member Name: _____ Score:_____

Group Member Name: _____ Score:_____

Comments:

10

MythBusters Student Peer Review Sheet

Discovery Education Science

Use the chart below to complete a peer review of the things that the MythBusters do in their science investigations. As a good peer reviewer, you should be on the lookout for anything they could have done better. Make a note of your changes and why you think this would be an improvement.

Inquiry	***How could the MythBusters improve their investigation?***
Develop the Question	
State a Hypothesis	
Design the Investigation	
Gather Data	

17

Lab Assignment: Density
Are modern pennies really made of copper? How can you tell?

Objectives:

- measure masses
- measure volumes by means of water displacement
- determine the density of pennies prior to 1982
- determine the density of pennies after 1983
- use Microsoft Excel to graph results

Materials needed:

- electronic centigram balance
- graduated cylinder, 50 mL
- 30 pennies pre-1982
- 30 pennies post-1983
- computer, printer
- Microsoft Excel software

Background:

Sometime around 250 B.C., the Greek mathematician Archimedes was given the task of determining whether a craftsman had defrauded the King of Syracuse by replacing some of the gold in the King's crown with silver. Archimedes thought about the problem while relaxing in a bathing pool. As he entered the pool, he noticed that water spilled over the sides of the pool. Archimedes had a moment of epiphany. He realized that the amount of water that spilled was equal in volume to the space that his body occupied. This fact suddenly provided him with a method for differentiating a mixed silver and gold crown from a pure gold crown. Because a measure of silver occupies more space than an equivalent measure of gold, Archimedes placed the craftsman's crown and an equivalent pure gold crown in two tubs of water. He found that more water spilled over the sides of the tub when the craftsman's crown was submerged. It turned out that the craftsman had been defrauding the King! Legend has it that Archimedes was so excited about his discovery that he ran naked through the streets of Sicily shouting Eureka! Eureka! (The Greek translation of "I have found it!").

Archimedes had used the concept of density to expose the fraud. Density is a physical property of matter that describes the degree of compactness of a substance, in other words, closely packed together the atoms of an element or molecules of a compound are. The more closely packed together the individual particles of a substance are, the more dense that substance is. Since different substances have different densities, density measurements are a useful means for identifying substances.

But what's this all have to do with pennies?

Modern pennies, it has been said, are not mostly copper. In fact, so the theory goes, it would cost more than a penny's worth of copper to produce a penny. So what are modern pennies made out of? We will use Archimedes' methods to figure out the density of both old pennies and new pennies. By comparing them with known values, we will determine the major constituent metal in both. [The pennies were switched in content sometime between 1982 and 1983.]

P.10

How will we do this?

1. Make two data tables. The first one should be labeled "Pre-1982 Pennies", the second one should be labeled "Post-1983 Pennies".

Pre-1982 Pennies

Number of pennies	Starting volume of water (mL)	Ending volume of water (mL)	Volume of pennies (mL)	Mass (g)
5				
10				
15				
20				
25				
30				

Post-1983 Pennies

Number of pennies	Starting volume of water (mL)	Ending volume of water (mL)	Volume of pennies (mL)	Mass (g)
5				
10				
15				
20				
25				
30				

2. Count out the number of pennies according to the table.
3. Measure the mass of the pennies on the electronic balance. Make sure to record your masses to the hundredths place, even if these values are zero.
4. Measure the volume through water displacement. Make sure all volumes are recorded to the tenths place.
    a. Measure 10.0 mL of water in a graduated cylinder. This is the *starting volume of water*.
    b. Put the five pennies that you've already weighed in the water and measure the volume of water with the five pennies. This is the *ending volume of water.*
    c. Calculate the volume of pennies by subtracting the starting volume from the ending.
    d. Continue to fill out the chart, weighing additional pennies and obtaining volumes by subtracting the original starting volume of water.
5. Use Microsoft Excel to chart your results.
    a. Enter your lab data exactly as I have shown in my table at the bottom of this section. Make sure volume is in the column before mass, otherwise it won't graph properly.
    b. Highlight the data to be graphed (mass and volume columns) and click on the *chart wizard* icon from the toolbar.
    c. Select *XY Scatter* from the options and choose the 3rd subtype (that shows points and connects them). Click Next
    d. Keep the data range shown and the *columns* radio button. Click Next.
    e. Add a title to your graph and add titles to the axes by clicking on the *titles* tab.
    f. Go to the *legend* tab and click off the "show legend" radio button. Click next

g. Click *as object in* so that the graph and your data points are shown on the same sheet. Click finish.
h. When the graph has been drawn, right click on the line and click *add trendline*.
i. Under the *type* tab, keep it linear. Under the *options* tab, click on *display equation on chart* button. Click OK

Your graph should look something like this from this sample data:

Number of pennies	Volume (mL)	mass (g)
5	2.1 mL	17.92 g
10	4.1 mL	35.98 g
15	6.2 mL	53.88 g
20	8.1 mL	71.99 g
25	10.3 mL	90.05 g
30	12.2 mL	107.95 g

Error! Not a valid link.

Note that the equation displayed is in the form of **y = mx + b**, which you know from algebra to be the equation of a straight line with a slope of **m.** The **m** here is rise over run, or change in x divided by change in y. When you put measured units in this equation, you come out with **grams ÷ milliliters.** These are the appropriate units for density! Thus: ***the slope of the line is the density of the pennies.*** In my example, the slope of the line is 8.8775 g/mL. If you look up densities, this is awfully close to that of copper, which is 8.96 g/mL.

Conclusion questions:

1. Compare the densities (slopes) calculated for you by Excel to those densities listed in the appendix of your text (beginning on page 855). What metal primarily constitutes the Pre-1982 set of pennies? What metal primarily constitutes the Post-1983 set?
2. Calculate a ***Percent error*** for each density determination. Theoretical densities, once again, are in the appendix.
3. How close were your data points to the trendline? What would cause some points to be off?
4. Explain what would cause the "b" value to be nonzero.
5. List and explain three experimentally sources of error.

What to hand in?

1. Copies of the two data tables and the associated graphs.
2. Answers to the conclusion questions. Show all work for calculations!

Bibliographic Reference

Day, Martha. "Density." Visionlearning Library Navigation. Visionlearning. 29 Jul 2004 <http://www.visionlearning.com/library/module_viewer.php?mid=37>.