Chemistry

Unit 2: Heat and Energy in the Earth's Systems

Workbook 2

Name: _____ Period: _____

Guiding Question:

Do Now:

Important Definitions and Equations:

Notes:

_____ is a measure of how much mass there is in a given volume, or the mass per unit volume.

$$density = \frac{mass}{volume}$$

or, in short form:

$$d = \frac{m}{v}$$

The units for density are usually g/mL or g/cm3. 1 mL = 1 cm^3 so the two are the same.

Density is an intensive property:

_____ are properties that do not depend on shape, size, or the amount of matter.

Examples: color, density, melting point, and hardness

_____ are properties that change when the amount of matter changes

Examples: mass, volume, length, and shape

Response:

Workbook Date:

5 How Dense is This?

Intro to Density

Purpose

To use measurement techniques to investigate various substances and determine densities.

Materials

- Scale
- Ruler
- Graduated Cylinder
- Thermometer
- Various substances to measure.

Part 1: Collecting Data

Measuring objects can be done in different ways and represented differently as well. In science we use the metric system of measuring, which means that grams, liters, and meters are used rather than pounds, ounces, and feet.

Using the guided walk throughs for measuring substances at your lab station, determine the specific values for the substances listed below in the data table.

- Irregular object: _____
    1. Measure the mass of the object and record below
    2. Volume displacement:
        a. Fill a graduated cylinder about half way with water
        b. Read and record the ***volume of only water***
        c. Carefully slide the plastic rod into the graduated cylinder
        d. Read and record the ***volume of object and water***
        e. Determine the ***volume of object only*** by subtracting the two previous volumes
- Cube: _____
    1. Measure the mass of the cube and record below
    2. Volume:
        a. Measure the length, width and height of the cube and record below
        b. Determine the Volume = length x width x height
- Block: _____
    1. Measure the mass of the wood block and record below
    2. Volume:
        a. Measure the length, width and height of the block and record below
        b. Determine the Volume = length x width x height
- Unknown Solution : _____
    1. Measure the ***mass of the empty graduated cylinder***
    2. Add some solution to the graduated cylinder
    3. Read and record the volume
    4. Measure the ***mass of the graduated cylinder and solution***, record
    5. Subtract the two masses to determine ***mass of the solution***

Workbook Date:

<table>
<tr><th>Object</th><th colspan="3">Mass (g)</th><th colspan="4">Volume (mL)</th></tr>
<tr><td rowspan="2">Irregular object:
_____</td><td colspan="3" rowspan="2"></td><td>Volume of water only (mL)</td><td>Volume of object and water (mL)</td><td colspan="2">Volume of object only (mL)</td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
<tr><td rowspan="2">Cube:
_____</td><td colspan="3" rowspan="2"></td><td>Length</td><td>Width</td><td>Height</td><td>Volume (cm^3=mL)</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Block:
_____</td><td colspan="3" rowspan="2"></td><td>Length</td><td>Width</td><td>Height</td><td>Volume (cm^3=mL)</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Unknown Solution:
_____</td><td>Mass empty grad. cylinder</td><td>Mass grad. cylinder and solution</td><td>Mass of solution</td><td colspan="4" rowspan="2"></td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

Part 2: Determining Density

Density is an important property of many objects and substances and is unique. It allows for various phenomena to be observed by people and is useful for solving different problems (making sure a boat floats to the underlying mechanisms of energy and matter cycling in the interior of the Earth).

Density is determined by the following equation:

$$density = \frac{mass}{volume}$$

or, in short form:

$$d = \frac{m}{v}$$

Where mass is measured in g and volume in mL or cm^3. Transfer the data from part 1 to the data table on the next page. Then determine the densities of the objects you measured using the equation above.

Workbook Date:

Object	Mass (g)	Volume (mL or cm^3)	Denstiy
Irregular object: _____			
Cube: _____			
Block: _____			
Unknown Solution: _____			

Questions

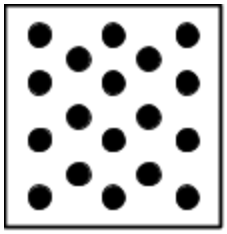
1. Which object has the highest density?

2. Which object has the lowest density?

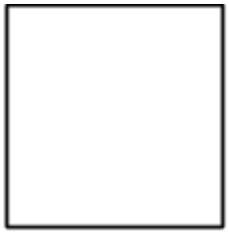
3. What does it mean to say that a substance has a high density?

4. If you had a 1 mL cube of the solution, what would its mass be? How do you know?

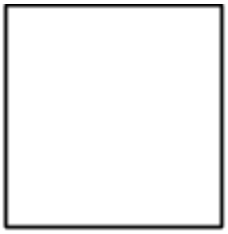
5. Density is actually a measurement of how closely particles are packed within a certain volume. The density of water is 1.00g/mL or 1.00g/cm^3. It's particle model is given below. Draw particle models for the other 4 substances given the density packing of water's particles (Hint: are there going to be more or less in the box).



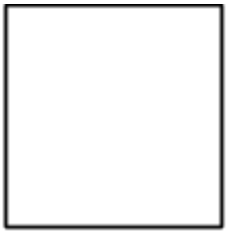
Water



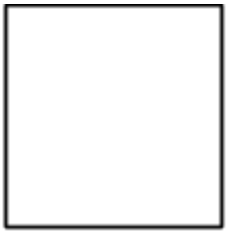
Irregular Object: _____



Cube: _____



Block: _____



Unknown Solution: _____

Guiding Question:

Do Now:

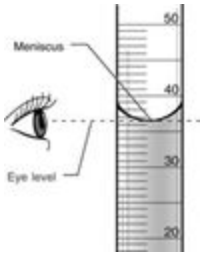
Important Definitions and Equations:

Notes:

Mass

- _____ measures the amount of matter an object contains.
  - In science, mass is usually measured in grams (g) or kilograms (kg).
  - 1 kg = 1000 g
- Weight is related to the force of gravity acting on an object.
  - On Earth mass and weight represent the same thing. However, on other planets your weight will be different (because the force of gravity is different), but your mass will be the same (because you still contain the same amount of matter).
  - Weight is usually measured in pounds (lb).
  - 1 lb = 454 g

Volume



- _____ measures how much space an object takes up.
- Volume can be measured in many different ways:
  - Liquids use a graduated cylinder
    - Make sure to read the volume from the bottom of the meniscus.
  - Dry powders use a measuring cup
  - Regularly shaped solids use a geometric formula

    Volume = l•w•h
  - Irregularly shaped solids or small objects use water displacement (the volume of the object = volume of water & object – initial volume of water).

Response:

6 Can You Graph This?

MS: Graphing

Many chemical experiments involve changing only one variable in order to see how another variable will change. The results of experimental procedures can be listed in a table, but it is often helpful to look at a graph to find trends in the data.

Data consisting of two variables can be graphed using a coordinate plane. Each point on the coordinate plane can be identified by a pair of numbers (x,y) called **coordinates**.

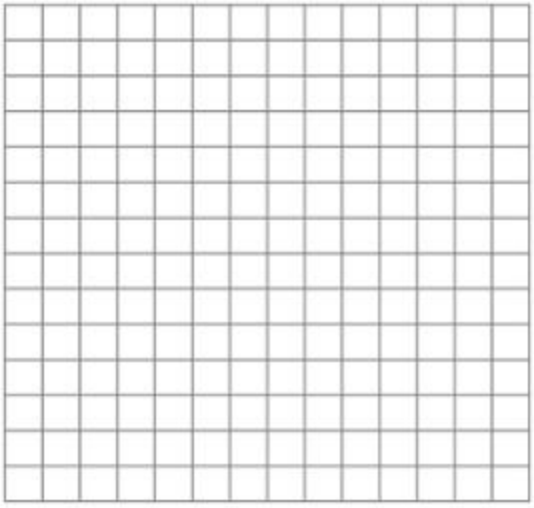
The quantity that the experimenter is changing is called the **independent variable**. It is graphed on the horizontal axis, the x-axis. The resulting measurement, or the **dependent variable,** is graphed on the vertical axis, the y-axis. Any variable that does not change is called a **controlled variable**. When you title a graph, you always title it: *Dependent variable vs. Independent variable*.

Example: A student is studying acids and bases. She is trying to determine how antacids (like Alka-Seltzer) react with acids (like vinegar). When she mixes the two she sees a lot of fizzing, but she also notices that the vinegar is a little colder after she dissolved an Alka-Seltzer tablet in it. She sets up a separate experiment to see how the number of tablets affects the temperature of the vinegar.

	Number of Alka-Seltzer Tablets	Volume of Vinegar (mL)	Room Pressure (kPa)	Initial Temp (°C) (Vinegar Solution)	Final Temp. (°C) (Final Mixture)
Trial 1	1	100.0	84	23.5	22.6
Trial 2	2	100.0	84	23.5	21.5
Trial 3	3	100.0	84	23.5	20.4
Trial 4	4	100.0	84	23.5	19.2
Trial 5	5	100.0	84	23.5	18.1

Use the data table above to answer the following questions:

1. What was the independent variable in this experiment? _____
2. What was the dependent variable? _____
3. Which variables were controlled? _____
4. Plot the data below. Make sure to label each axis and give the graph a title.

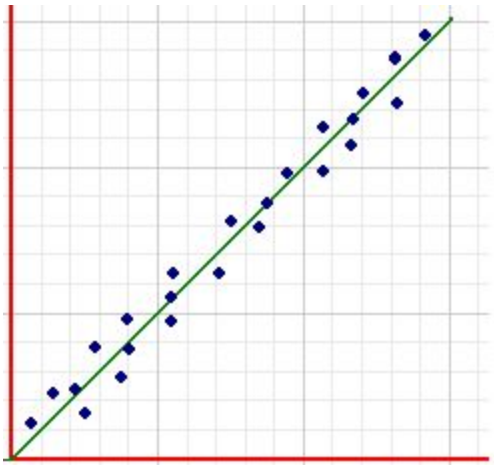


Guiding Question:

Do Now:

Important Definitions and Equations:

Notes:



- A _____ goes through the middle of all the data, rather than _____.
- It is useful for _____ of an unknown variable given part of the data point.
    - If you know x, you can find y by following the x value up to the line and over to the y value
    - If you know y, you can find x by following the y value over to the line and down to the x value

Response:

7 Massive Change
Using Graphical Data

Purpose

To generate graphs relating quantity and mass or height for pennies to determine the quantity of pennies in an unknown roll of pennies.

Part 1: Generating a graph from data

Materials

- 10 Pennies (after 1983)
- Ruler
- Scale

Directions

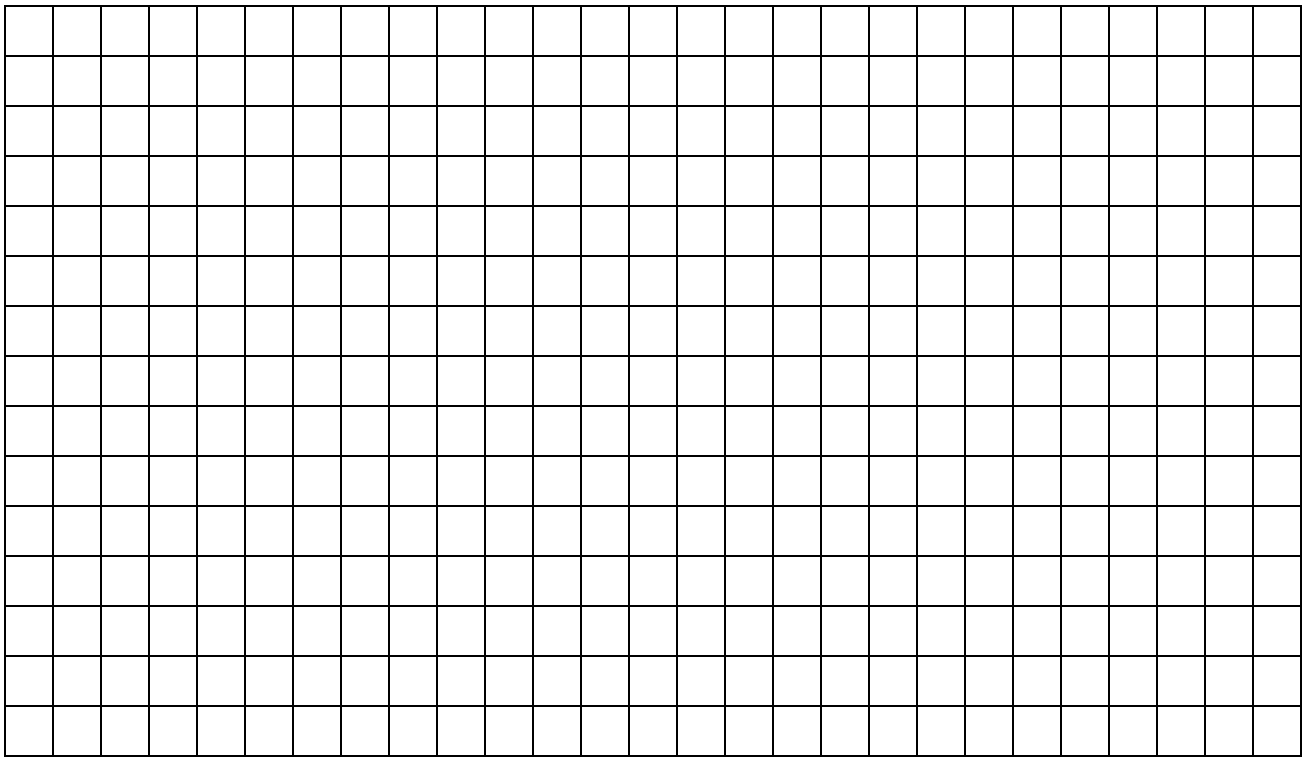
1. Obtain 10 pennies (dated 1984 or later) and a ruler -- these may be at your station already
2. Measure the mass of 1 penny and record on the table below
3. Add another penny to the scale and record the mass below; repeat until you have the mass of all 10 pennies.
4. Measure the height of a stack of 1 penny and record on the table below (it may be better to turn the stack on its side)
5. Add another penny to the stack and measure the height of that stack; repeat until you have the height of a stack of pennies 1 through 10 tall.
6. Graph your data following the steps below and watch the short video on how to sketch a “best-fit line”

Data

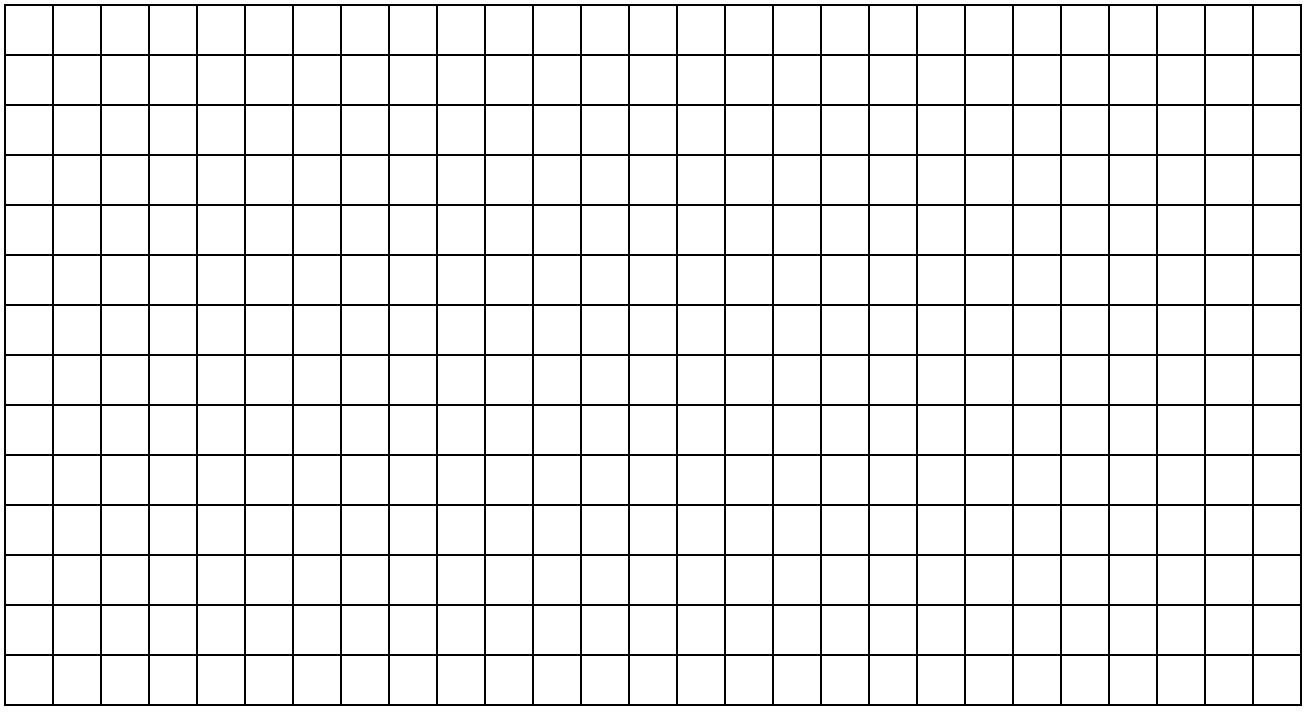
Number of Pennies	Mass of Pennies (g)	Height of stack of Pennies (cm)
1		
2		
3		
4		
6		
8		
10		

Graph

Mass vs. Number of Pennies



Height of Stack of Pennies vs. Number of Pennies



Workbook Date:

<u>Part 2:</u> Determining the Quantity of an Unknown Sample of Pennies from Graphical Data

Materials

- Roll of pennies
- Ruler
- Scale

Directions

1. Obtain roll of unknown pennies; **DO NOT OPEN/UNWRAP PENNIES**, you will receive a point deduction.

2. Record Roll Number: _____

3. Measure the mass of the roll; record below
4. Measure the height of the stack of the roll; record below
5. Use your graph to determine the number of pennies.

Data

	Mass of Pennies (g)	**Height of stack of Pennies (cm)**
Unknown Sample		

Quantity of Pennies: _____

When finished, have the teacher check your answer and return your roll of pennies.