Density

Inquiry Activity

Name: _____ Period: ____ Date:_____

Essential Question: How is density affected by the mass and volume?

I. **Investigative Question:** How do I calculate the density of an object?

II. **Hypothesis:** (If, then, because)

_____

_____

_____

III. **Materials:** Jenga block, 250 mL. graduated cylinder, 50 mL. graduated cylinder, 50 mL. beaker, 100g weight, medicine dropper, ruler, candle, plastic spoon and bread knife

IV. Experimental Design:

A. Calculate the density of water.

1. Weigh and record the mass of the 250 mL. graduated cylinder.
2. Pour 100 mL. of water into the 250 mL. graduated cylinder.
3. Weigh and record the mass of the 250 mL. graduated cylinder with 100 mL. water.

Mass of the graduated cylinder with 100 mL. water **A**	**Mass of the graduated cylinder** **B**	**Mass of water (C) (C=A-B)** **C**	**Volume of water in the 250 mL. graduated cylinder** **D**	**Density of water** **Density of water= C/D**

B**. Calculate the density of saltwater.**

1. Weigh and record the mass of the 250 mL. graduated cylinder.
2. Fill the 250 mL. beaker with 200 mL. of water.
3. Dissolve 2 tablespoons of salt in the 200 mL. water.
4. Transfer 100 mL. of the saltwater to the 250 mL. graduated cylinder.
5. Weigh and record the mass of the graduated cylinder with 100 mL. saltwater.
6. Subtract the mass of the graduated cylinder from the mass of the graduated cylinder with 100 mL. saltwater.
7. Calculate the density of the saltwater by using the equation Density = mass of saltwater / volume of saltwater.

Mass of the graduated cylinder with 100 saltwater mL. water **A**	**Mass of the graduated cylinder** **B**	**Mass of saltwater (C=A-B)** **C**	**Volume of water in the 250 mL. graduated cylinder** **D**	**Density of saltwater** **Density of saltwater** = C/D

C. Determining the density of the Jenga block.

1. Weigh and record the mass of the Jenga block.
2. Measure and record the length of the Jenga block.
3. Measure and record the width of the Jenga block.
4. Measure and record the height of the Jenga block.

Mass of the	**Length of the**	**Width of the**	**Height of the**	**Volume (V)**	**Density of Jenga block**

Jenga block A	Jenga block (l)	Jenga block (w)	Jenga block (h)	of Jenga block V = l x w x h	Density of Jenga block = A/V

D. Determining the density of an irregular solid using water displacement method.

1. Determine the volume of **100 g** irregular solid.
2. Pour 200 mL. water into a graduated cylinder.
3. Carefully drop the 100g weight into the water and record the **new volume**.

Mass of the 100g weight A	Original volume of water B	New volume of water C	Amount of water (D) displaced in mL. (D= C-B) D	Density of irregular solid Density = mass/volume Density = A/D

E. Comparing densities.

1. Pour 350 mL. water into the 500 mL. graduated cylinder.
2. Carefully drop the Jenga block in the water.
3. Record the new volume after dropping the Jenga block in the water in table F.
3. How much of the Jenga block sunk? _____

Density of water from Table A g/mL.	Density of Jenga block from Table C g/mL.	Why did the wooden block float?

F. Interpreting results (Higher Order Thinking Skills)

Original volume of water in mL. A	New volume of water in mL. B	Increase in the volume of water after dropping the Jenga block. (C= B-A) C	How many grams is the volume in column C 1g = 1 mL D	Mass of the Jenga block from Table C E	Research! What can you say about Archimedes principle?
350 mL.					

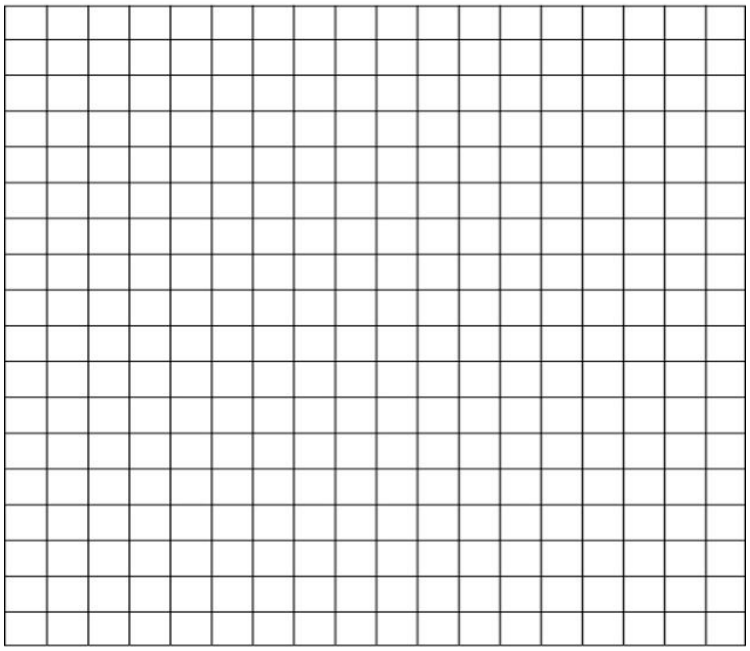
G. Mass VS. Density

1. Cut a candle into three different lengths.
2. Label the candle pieces as 1,2, and 3.
3. Determine the volume of each candle by water displacement.
4. Determine the density of each candle by using the equation D=mass/volume

	Mass (g) Determined by using the balance.	**Volume (mL.)** Determined through water displacement.	**Density (g/mL.)** Mass/volume
Candle #1			
Candle #2			
Candle #3			

H. Graphing Data: You can use Microsoft Excel to create a line graph of your data.

Y-Axis



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X-Axis

How does the density line compare with the mass and volume line?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Clarifying Questions:

1. **Why did the Jenga block float and the 100g weight sink in water?**
   _____
   _____
2. **What method did you use to determine the volume of the irregularly shaped solid?**
   _____
3. **Which is more dense water or saltwater? Explain your answer.**
   _____
   _____
4. **How do you calculate the density of an object?**
   _____
   _____

Name: _____Period: _____ Date: _____

Density is a measure of how tightly a certain amount of matter is packed into a given volume. Density can be calculated by dividing an object's mass by its volume. It is commonly measured in grams per milliliter or grams per cubic centimeter.

The **density of the Earth is 5.513 g/cm^3**. This is an average of all of the material on the planet. Water is much less dense than iron, hence an average is needed for ease of use. Earth is the most dense planet in the Solar System.

Ocean density: The density of seawater and wind play a vital role in causing ocean currents and circulating heat because of the fact that **dense water and air sinks** below less dense. Salinity, temperature and depth all affect the density of seawater. The more the stuff is packed in, the higher the density. Seawater is not just water – it has lots of chemicals packed into it. This means it is denser than pure water. The higher the salinity, the higher the density.

Seawater density varies from place to place because it is affected by **salinity and temperature**. **High salinity makes water denser**. This is because there is more salt packed into the water. **High temperature makes water less dense**. As water gets warmer, its molecules spread out, so it becomes less dense. As it gets colder, it becomes denser, but **becomes less dense when it turns to ice**. Ice floats!

The densities of the layers of Earth are listed below in g/cm^3:

Continental crust: 2.6 - 2.8
Oceanic crust: 3.0 - 3.5
Mantle: 4.5 - 10
Core (average): 10.7 or 12
Inner core (solid): 13.5

It does not list a density for the liquid outer core. Other sources suggest that it has a density between 10 and 12.3 g/cm^3.

Density of Earth's atmosphere: The most dense layer of the atmosphere is the troposphere is the most dense layer because it is at the bottom of the atmosphere. The troposphere is where all our weather happens. It also has the highest air pressure. But more specifically, the earths atmosphere is most dense at the surface.

Warm rises (less dense) and cool sinks (more dense), this is called **convection**. Convection happens in the atmosphere, causing **weather changes**. Convection happens inside the earth or in the mantle, causing **plate tectonic movements**. Convection happens in the ocean causing **currents**. Convection happens in the outer core, giving Earth its **magnetic field**.

Clarifying Questions: Answer on a separate sheet of paper with your name and class period.

1. What is density?
2. What is the most dense planet in the solar system?
3. Why do we have ocean currents?
4. How is density affected by temperature?
5. How is density affected by salinity?
6. Why does the water become more dense as you go deeper into the ocean?
7. What is the most dense layer of Earth?
8. What is the most dense layer of the atmosphere?
9. Explain why the lowest layers (troposphere, inner core, deep ocean) are the most dense layer.
10. What causes weather changes, plate movements, and ocean currents?

http://www.universetoday.com/26771/density-of-the-earth/http://sciencelearn.org.nz/Contexts/The-Ocean-in-Action/Science-Ideas-and-Concepts/Ocean-density

http://www.planetseed.com/faq/geology/density-earths-layers

Youtube:

Density: https://www.youtube.com/watch?v=GnBQ6vIutDM

Archimedes principle: https://www.youtube.com/watch?v=eQsmq3Hu9HA

Mass vs. density: https://www.youtube.com/watch?v=u5sMhH0rQmA

5 facts about density: https://www.youtube.com/watch?v=zlkpZZW29b0

Egg floating in the middle: https://www.youtube.com/watch?v=cipDtvN6ClQ