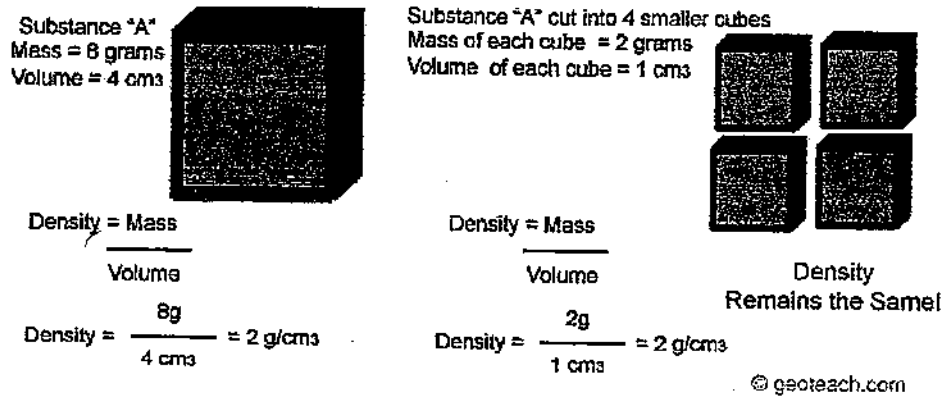
DENSITY
Earth Science Lesson & Worksheet

I- Formula for Density: Density = Mass/Volume

II- Fact: Given the *same substance* but in different sizes, or amounts with each having a different mass when placed on a scale, they all have the ***SAME*** density.

Density is a constant for a substance no matter how big or small the substance may be.

Let's see this rule in action using illustrations and what I call "baby simple math".



When the cube was cut into 4 equal parts, both the mass and volume decreased proportionately by one fourth.

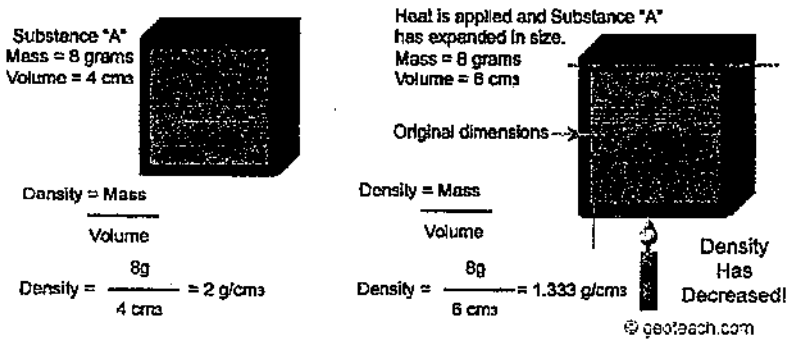
After computing the densities using the correct equation, the results are: ***The density remains the same.***

The same would hold true if a substance was double or tripled in size because the mass and volume will also increase proportionately, once again yielding the same density results.

VOLUME HAS INCREASED DUE TO HEATING - MASS REMAINED THE SAME

DENSITY DECREASES

Let's see this "apply heat" rule in action using illustrations and "baby simple math".

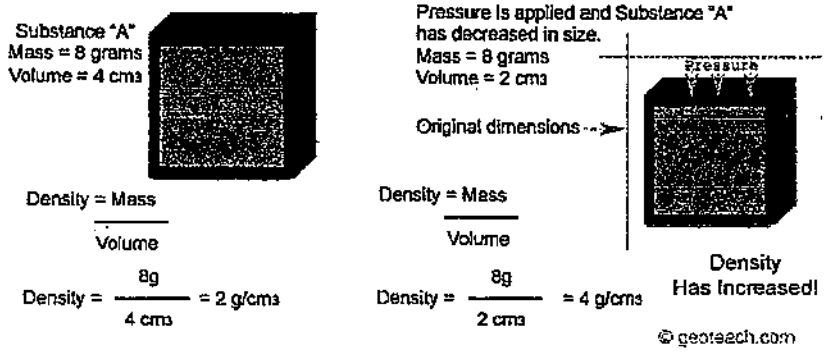


V- Fact: Applying ***PRESSURE*** **increases the density of a substance.**

Let's apply some science to this situation, too.
We know that **PRESSURE MAKES AN OBJECT CONTRACT.** So, it gets smaller, meaning its ***VOLUME decreases DUE TO COMPRESSION***. *It takes up less space.*

However, did the mass decrease because pressure was applied?
Once again, Mass is the amount of matter in a substance, in other words its molecules or atoms.
Did the number of molecules in the substance decrease just because we added pressure? NO!
Think of compressing a marshmallow with your finger. You can squash it and reduce its size but you still have the same number of molecules in the marshmallow that you started with.

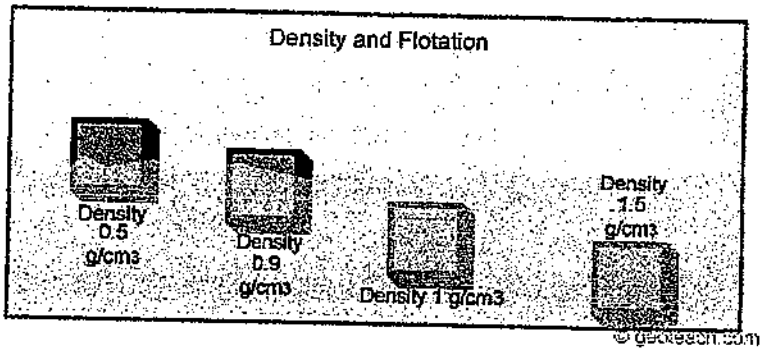
VOLUME DECREASED DUE TO PRESSURE – MASS REMAINED THE SAME – DENSITY INCREASES



DENSITY AND FLOTATION

Keep this fact in mind! The assigned value for density of water at 4°C (39° F) is 1 g/cm^3.

Now look at this illustration showing 4 objects, with different densities, and their buoyancy (ability to float) in water. Pay close attention to the densities of the objects as compared to water.



If an object floats in water: Its density is less than that of water, as with the first 2 blocks on the left.

If an object remains suspended in water: Its density is equal to that of water, as with the third block from the left.

If an object sinks in water: Its density is greater than that of water, as with the block all the way to the right.

Which of the 4 blocks do you think would have damaged and sank the Titanic if these blocks were actually icebergs in the ocean?

If you said the block with the 0.9 g/cm^3 density, you would be correct. Icebergs float approximately 90% below the water surface.

Therefore, the majority of the sharp, jagged edged iceberg would have been hidden from view

NAME: _____ DATE: _____

CLASS: _____ TEACHER: _____

DENSITY
Earth Science Printable Worksheet

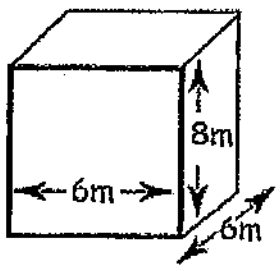
Directions: This worksheet accompanies and follows this lesson: ***DENSITY.***
Be sure you consult the lesson page before answering these questions.
Answer all the questions on this page.
Be sure to show all your calculations.
Rewrite the final answer for any calculations on the line provided.
Print out this assignment and submit it to your teacher. Unless otherwise directed, staple your pages.

1-Write the formula for density:

2- Rewrite the formula if density and mass are given and you need to find the VOLUME:

3- Rewrite the formula if density and volume are given and you need to find the MASS:

4- The illustration below shows the dimensions of an unidentified substance. Calculate its density with appropriate units. Round your answer to tenths place. Show your work.



Mass = 600 grams

Show Your Work Here:

Final Answer: _____

5a - Look at the following illustration which shows the mass and volume for the mineral Gypsum and the sedimentary rock Shale.
Calculate the average density for both Gypsum and Shale, with units.

Gypsum		
Sample	Mass (g)	Volume (cm^3)
1	2.0	1
2	8.0	4
3	16.0	8

Shale		
Sample	Mass (g)	Volume (cm^3)
1	3.0	1
2	12.0	4
3	18.0	6

Show Your Work Here:

Final Answer - Density of Gypsum: _____

Final Answer - Density of Shale: _____

5b- If a sample of Gypsum and a sample of shale are place into a bowl water, what can be said concerning the buoyancy of each sample?

Gypsum: _____

Shale: _____

6- If substance "X" has a density of 6.0 g/cm^3 and the substance is divided into 6 parts. Now, what is the density of each new piece of substance "X"? Circle the correct answer.

A) 36.0 g/cm^3 B) 1.0 g/cm^3 C) 3.0 g/cm^3 D) The density remains the same.

7- The water temperature of a lake is analyzed and found to be 4°C. Water has a density of 1 g/cm^3 at 4°C. A sample of water is taken from the lake and its density recalculated immediately. There has been no drop nor increase in the temperature of the water sample. What is the new density of the water sample?

Answer: _____

8- A substance has a density of 4.5 g/cm^3. The substance is heated and its density recalculated. What is the new recorded density? Circle the correct answer.

A) 5.2 g/cm^3 B) 8.4 g/cm^3 C) 3.8 g/cm^3 D) The density remains the same.

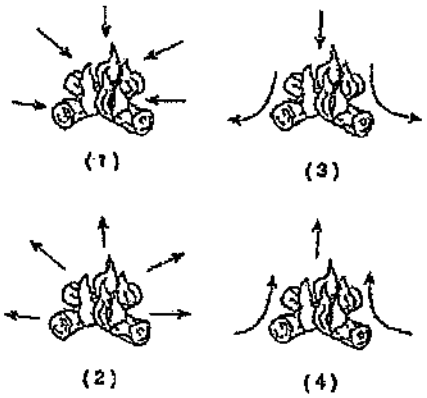
9- A substance has a density of 8.0 g/cm^3. Pressure is applied to the substance, compressing its size. Its density recalculated. What is the new recorded density? Circle the correct answer.

A) 1.6 g/cm^3 B) 8.6 g/cm^3 C) 4.0 g/cm^3 D) The density remains the same.

10- The density of calcite is 2.7 g/cm^3. When a sample of the mineral calcite is heated, which of the following will be calcite's new density? Circle the correct answer.

A) less than 2.7 g/cm^3 B) exactly 2.7 g/cm^3 C) between 2.7 and 3.0 g/cm^3
D) greater than 3.0 g/cm3

11- Look at the following illustration which shows the pattern of heat as it rises from a campfire. Which of the 4 pictures correctly shows the way heat will rise? Circle the correct one.



Explain why you picked that specific picture as your answer.

12- Explain how it is possible for a hot air balloon, which obviously contains air, to rise in the atmosphere, which is also air.

13- On a molecular level, explain why is cold air denser than warm air?

14- If an object is placed into a bowl of water and it remains suspended, what can be said of the density of that object when compared to the density of water?

15- Explain why icebergs floating in Arctic waters present unseen dangers to ships at sea.

16- How is water an exception to the rule that the solid phase of a substance is denser than the liquid phase?

17a- Complete: Warm air will _____ while cold air will _____.

17b- Explain why this happens:_____

18- The density of a sample of quartz is 2.7 g/cm^3. When placed into a graduated cylinder filled with water, its volume was determined to be 6.0 cm^3. Find the MASS of this quartz sample. Show Your Work Here:

Final Answer : _____

Due Date: _____

Be sure to check with your teacher to verify you can receive extra credit.
Ask your teacher when the assignment is due and how much credit you will receive.