

Eureka! Density!

By Cindy Grigg

¹ What is density? Density is simply the amount of "stuff" in a given space. Scientists measure density by dividing the mass of something by its volume ($d = m/v$). This is a story about how the concept of density was first "discovered."

² It is the story of a Greek mathematician named Archimedes who lived around 250 B.C. The King of Syracuse, where Archimedes lived, thought that he was being cheated by the metal craftsman who made his golden crown. The King called Archimedes to him and gave him the task of finding out whether the craftsman had replaced some of the gold in the King's crown with silver. Silver was worth less money than gold, and it also was an insult to the King to be wearing a crown that was not pure gold.



³ The King gave Archimedes some rules. Archimedes could not damage the crown in any way. He could not melt down the crown to see if it was made of other metals. He could not scratch the crown to see if there was silver underneath the golden outside. Archimedes thought about the problem while taking a bath. As he entered the bathing pool, he noticed that water spilled over the sides of the pool. 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 finding out if the King's crown was made of pure gold.

⁴ Archimedes knew that silver is not as "heavy" as gold. (Actually, silver has less density than gold.) Because an amount of silver occupies more space than an equivalent amount of gold, Archimedes placed the craftsman's crown and a pure gold crown of the same mass 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 cheating the King! Legend has it that Archimedes was so excited about his discovery that he ran naked through the streets of Syracuse shouting "Eureka! Eureka!" which is the Greek word for "I have found it!"

⁵ When Archimedes stepped into his bathing pool, not only did he realize that water spilled over the edges, but he also noticed something that we all notice when we go swimming - he felt lighter. The ability of an object to float when it is placed in a liquid is called buoyancy, and it is related to density. If an object is less dense than the liquid in which it is placed, it will float on the liquid. If it is denser than the liquid, it will sink.

⁶ For example, wood floats on water because it is less dense. Steel sinks because it is denser than water. How can large steel ships float? Large ships have a tremendous amount of space in them that is filled with air. The cabins, halls, and dining room are all filled with air. While steel is denser than water, air is less dense. Metal ships can float because their total density is less than that of the water that they float on. When the Titanic struck an iceberg, water rushed in and replaced the air in the ship's hull. As a result, the total density of the ship changed and caused the ship to sink.

⁷ Archimedes had a problem to solve. He came up with a hypothesis based upon his observations, and he found a way to test his hypothesis. Archimedes used the scientific method to solve the King's problem. Archimedes also used what he knew and applied it to his problem. This is the basis for all science. You can be a scientist like Archimedes, too!

Name _____

Science Pd _____

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<p>1. Who "discovered" the concept of density?</p> <p><input type="radio"/> A Archimedes</p> <p><input type="radio"/> B Aristotle</p> <p><input type="radio"/> C Ptolemy</p> <p><input type="radio"/> D Galileo</p>	<p>2. About how long ago did Archimedes live?</p> <p><input type="radio"/> A 2,000,000 years ago</p> <p><input type="radio"/> B 250 years ago</p> <p><input type="radio"/> C 2,000 years ago</p> <p><input type="radio"/> D 2,260 years ago</p>
<p>3. Where did Archimedes live?</p> <p><input type="radio"/> A France</p> <p><input type="radio"/> B New York</p> <p><input type="radio"/> C Rome</p> <p><input type="radio"/> D Greece</p>	<p>4. What did the King want Archimedes to do?</p> <p><input type="radio"/> A Find gold.</p> <p><input type="radio"/> B Find out if the crown was pure gold.</p> <p><input type="radio"/> C Find out if the craftsman had cheated him.</p> <p><input type="radio"/> D Both B and C</p>
<p>5. How did Archimedes find the truth?</p> <p><input type="radio"/> A He took a bath.</p> <p><input type="radio"/> B He weighed the crowns.</p> <p><input type="radio"/> C He put two crowns in water and saw which one displaced more water.</p> <p><input type="radio"/> D He melted the crowns.</p>	<p>6. What does "Eureka!" mean?</p> <p><input type="radio"/> A I have found it!</p> <p><input type="radio"/> B I have forgotten my clothes!</p> <p><input type="radio"/> C I have saved the King!</p> <p><input type="radio"/> D I have lost it!</p>
<p>7. If an object is less dense than the liquid it is put into, it will _____.</p> <p><input type="radio"/> A Shine</p> <p><input type="radio"/> B Float</p> <p><input type="radio"/> C Melt</p> <p><input type="radio"/> D Sink</p>	<p>8. If an object has a higher density than the liquid it is put into, it will _____.</p> <p><input type="radio"/> A Melt</p> <p><input type="radio"/> B Float</p> <p><input type="radio"/> C Sink</p> <p><input type="radio"/> D Shine</p>

