

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

## **Eureka! Eureka! Archimedes and his crowning moment...it was his density**

### Part 1



Archimedes of Syracuse lived during the first century BC. He was a very brilliant man who literally experienced a “eureka moment”. In this investigation, you will learn about the earliest experiment that involved density. This is also a story of deception and ingenuity. Unfold this story by completing the following activity and using the Internet as a resource.

### Introduction:

1. What did Archimedes study? \_\_\_\_\_
2. Within his studies, he developed the principal of the \_\_\_\_\_. This instrument is the basis for mechanics.
3. Where is Syracuse, Sicily? \_\_\_\_\_
4. What king requested the assistance of Archimedes? \_\_\_\_\_

### The Plot Thickens:

As the story goes, the King commissioned a goldsmith to create a crown from a quantity of pure gold. This crown would have been for the placement on a statue of a god or goddess. Upon completion of the gold crown, rumors began to circulate that the crown was not made of pure gold. The King heard that the goldsmith had replaced some of the gold with an equal weight of silver. The goldsmith for profit kept the unused portion of gold. Not wanting to look foolish, the King enlisted the help of Archimedes. Because the crown was considered holy, Archimedes could not disturb the object in any way.

With this challenge on his mind, Archimedes headed for home. While at a public bath, Archimedes realizes that the more of his body sinks into the tub, the more water rises or is displaced. This would indicate that the water displaced is equal to body volume. As the story goes, according to Scientific American.com, “Because gold weighs more than silver, he reasons that a crown mixed with silver would have to be bulkier to reach the same weight as one composed only of gold; therefore it would displace more water than its pure gold counterpart.” At this point in the story, some would embellish, stating that Archimedes leapt from the tub shouting “Eureka! Eureka! I have found it!” However, there is no evidence that this part of the story actually took place at all.

### Density of Common Items:

Use reliable sources on the Internet to determine the density of the following items.

Material	Density (g/mL)
Water	
Aluminum	
Silver	
Gold	
Platinum	
Lead	

### Questions:

1. What method from lab could be used to determine the volume of the crown?  
\_\_\_\_\_
2. What was Archimedes conclusion concerning the King's crown? Was the crown pure gold or a combination of gold and silver. Explain using the words density, volume, mass, displacement, and water.

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## Part 2

### Hear Ye! Hear Ye!

A royal crown made of solid gold has been stolen! You have been summoned to perform a test similar to Archimedes. The King has offered a reward of 500 gold coins for the safe return of this stolen crown. Because of the healthy reward, 5 crowns have been presented to the king. It is your job to determine which crown is the “real deal”.

The mass of each crown is 714 grams. However, the volume of each crown seems to be different. Use the data below to calculate the density of each crown. The real crown should match the density of pure gold.

Crown	Volume (mL)	Calculated density	Which is the real crown and why
1	42.58		
2	28.62		
3	35.01		
4	36.96		
5	38.74		

### Part 3

Density of celestial bodies in our solar system

- Complete the data table below using reliable Internet sources.
- Density measurements should be labeled. Try to find numbers that are labeled g/mL or g/cm<sup>3</sup> (this may read g/c.c.).
- List 2 elements that compose the majority of the planet
- Indicate which planet is the densest
- Indicate which planet would float in water

Celestial body	Density	2 Elements	Most dense or float in water
Mercury			
Venus			
Earth			
Mars			
Jupiter			
Saturn			
Uranus			
Neptune			
Pluto			
Our sun			

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