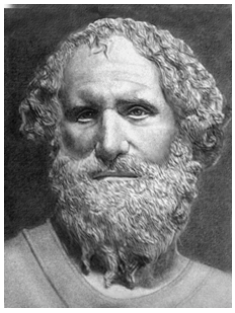
4.2 Archimedes- CLASS COPY: DO NOT WRITE ON!!!

Archimedes was a Greek mathematician who specialized in geometry. He figured out the value of pi and the volume of a sphere, and has been called "the father of integral calculus." During his lifetime, he was famous for using compound pulleys and levers to invent war machines that successfully held off an attack on his city for three years. Today he is best known for the Archimedes principle, which was the first explanation of how buoyancy works.

Archimedes' screw



Archimedes was born in Syracuse, on Sicily (then an independent Greek city-state), in 287 B.C. His letters suggest he studied in Alexandria, Egypt, as a young man. Historians believe it was there that he invented a device for raising water by means of a rotating screw or spirally bent tube within an inclined hollow cylinder. The device known as Archimedes' screw is still used in many parts of the world.

"Eureka!"- the Archimedes Story

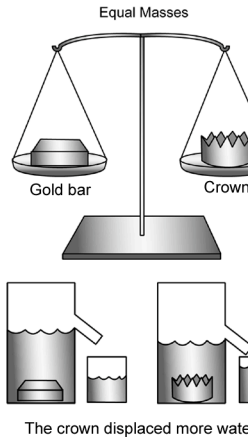
The king wanted a new crown – one made of pure gold. So he gathered up the gold from his treasury and commissioned an artisan to make it for him. After a period of time the artisan came to the king and presented him the crown that he had crafted. The king was generally pleased but a bit suspicious. He had a sneaking suspicion that the artisan had somehow duped him. He thought that the artisan may have mixed in to the crown a portion of silver – a lesser metal – so that he could keep some of the gold for himself. But the king did not know how to prove it. So he called up his trusted advisor, the Greek mathematician Archimedes. The king shared his suspicion with Archimedes and asked that he find a way to prove it.

Archimedes thought about the dilemma for some time but made no progress in solving it. On one particular day he went to a public bath. Upon entering the bath he noticed that when he stepped in water spilled out. And all of a sudden he figured it out. He solved the king's dilemma. He discovered that as he immersed himself in the tub, not only did the water level rise, but his apparent weight seemed to decrease. He realized that two objects of equal weight will displace different volumes of water when immersed unless their densities are equal. This is now known as Archimedes principle.

It is said that Archimedes leapt from the bath and ran naked through the streets shouting, "Eureka! Eureka!" (I have found it! I have found it!)

A massive problem

Archimedes realized that if he had equal masses of gold and silver, the denser gold would have a smaller volume. Therefore, the gold would displace less water than the silver when submerged.



Archimedes found the mass of the crown and then made a bar of pure gold with the same mass. He submerged the gold bar and measured the volume of water it displaced. Next, he submerged the crown. He found the crown displaced more water than the gold bar had and, therefore, could not be pure gold. The gold had been mixed with a less dense material. Archimedes had confirmed the king's doubts.

Why do things float?

Archimedes wrote a treatise titled *On Floating Bodies*, further exploring **density** and **buoyancy**. He explained that an object immersed in a fluid is pushed upward by a force equal to the weight of the fluid displaced by the object. Therefore, if an object weighs more than the fluid it displaces, it will sink. If it weighs less than the fluid it displaces, it will float. This statement is known as the ***Archimedes principle***. Although we commonly assume the fluid is water, the statement holds true for any fluid, whether liquid or gas. A helium balloon floats because the air it displaces weighs more than the balloon filled with lightweight gas.

Archimedes was killed by a Roman soldier during an invasion of Syracuse in 212 B.C.

CLASS COPY: DO NOT WRITE ON!!!

To Do:

A) Read **the article.**

B) **Take notes** on the reading on your binder paper- write **at least ten facts** about Archimedes' life and work. (2 facts from each section)

C) Reading Reflection**- Answer these questions on your binder paper.**

1. The boldface words in the article are defined in the glossary of your textbook. Look them up and then explain the meaning of each in your own words.

2. Imagine you are Archimedes and have to write your resume for a job. Describe yourself in a brief paragraph. Be sure to include in the paragraph your skills and the jobs you are capable of doing.

3. Describe the "Eureka" story that Archimedes is famous for.

4. Why does a balloon filled with helium float in air, but a balloon filled with air from your lungs sinks?