Archimedes Displacement Experiment

Martyn Shuttleworth99.7K reads

Science Fair Demonstration

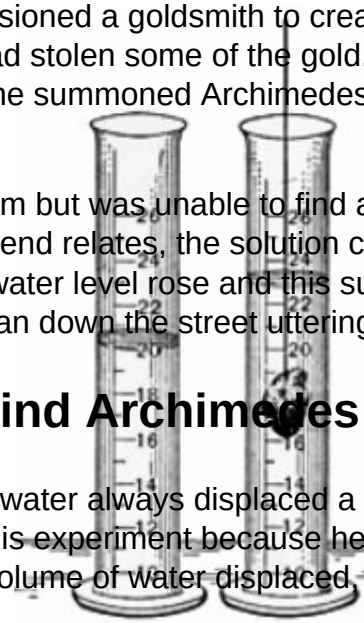
The Ancient Greek mathematician, Archimedes, is most famous for running naked down the street shouting 'Eureka! Eureka!' (I have it! I have it!), after finding out the solution to a tricky problem.

While he contributed much more to science than this, including building the foundations of the study of hydrostatics (how fluids behave), and writing volumes of work on the properties of solids, his famous experiment is perfect for a science fair demonstration.

Why Did Archimedes Shout Eureka

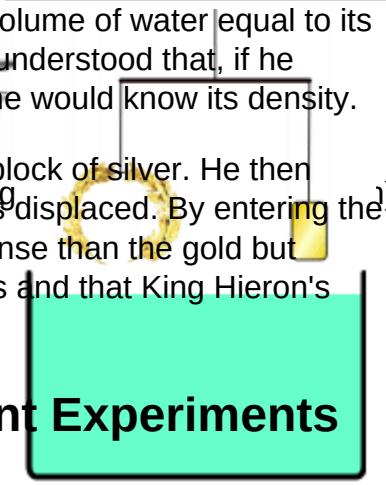
King Hieron II of Syracuse had commissioned a goldsmith to create him a crown from a lump of gold, but suspected that the smith had stolen some of the gold, replacing it with cheaper silver. Unable to prove his suspicions, he summoned Archimedes and asked him to devise a way of finding out if this was true.

Archimedes [1] grappled with this problem but was unable to find a solution to this tricky dilemma, however hard he tried. As legend relates, the solution came to him as he bathed; as he sat in the bath, he noticed how the water level rose and this suddenly inspired him. The rest is history, as the ancient scientist ran down the street uttering his famous cry.



What is the Science Behind Archimedes Principle?

He realized that an object immersed in water always displaced a volume of water equal to its own volume. This formed the basis of his experiment because he understood that, if he divided the weight of an object by the volume of water displaced, he would know its density.



Submerged and Displacing))

For his experiment, he weighed the crown, a block of gold, and a block of silver. He then immersed each in water, carefully measuring how much water was displaced. By entering the figures into the equation, he calculated that the crown was less dense than the gold but denser than the silver, indicating that it was a mixture of the metals and that King Hieron's suspicions were correct.

Recreate Archimedes' Water Displacement Experiments

You Need:

Archimedes Water Balance (Creative Commons [2])

- A graduated measuring jug or cylinder
- Water
- Three similar sized objects, such as three pebbles (limestone, granite and brick), three metal objects (iron, lead and aluminum are good choices) or three beads (wood, glass and metal). Whatever you use, try to find a measuring cylinder or jug that is large enough to fit the objects without allowing the water to spill over the edge, yet small enough to allow accurate measurement.
- A calculator

How to Perform the Experiment:

1. Pour some water into the jug, making sure that there is enough to cover the object completely.
2. Note the volume
3. Immerse one of the objects in the water - note that, if the object floats, you will have to gently push it under with your finger
4. Measure the new volume
5. Repeat the process with the other two objects
6. For each object, you can now calculate the density - Density = Mass/VolumeFor example: If a block of wood weighs 6 grams and displaces 8 milliliters of water6 g /8 ml = 0.75 g/ml

A Human floating in the Dead Sea, due to the high density of the water here (Creative Commons [3])

Under normal circumstances, water has a density of 1g/ml, so any object with a density of less than this will float; any object with a density of more than this will sink.

You can take this experiment further an experiment with other liquids, such as saltwater, corn syrup, or vegetable oil. This will make things a little more complicated but will also give you many things to talk about in your science fair demonstration.

Archimedes Principle Experiment

Buoyancy and Density

Archimedes Horse Experiment

Bibliography

Paipetis, S.A. & Ceccarelli, M. (2010). *The Genius of Archimedes: 23 Centuries of Influence on Mathematics, Science and Engineering. Proceedings of an International Conference held at Syracuse, Italy, June 8-10, 2010.* Dordrecht, Germany: Springer

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