

ARCHIMEDES DISPLACEMENT EXPERIMENT

As modified from: <http://www.experiment-resources.com/displacement-experiment.html>

Background: 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 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.

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.

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.

Materials:

A graduated cylinder

Scale

Water

Three similar metal objects

Calculator

String

Method:

1. Pour some water into cylinder, making sure that there is enough to cover the object completely.
2. Record the volume
3. Immerse one of the objects in the water
4. Measure the new volume
5. Repeat the process with the other two objects
6. For each object, you can now calculate the density:

$$\text{Density} = \text{Mass} / \text{Volume}_{\text{Displaced}}$$

For example: If a block of wood weighs 6 grams and displaces 8 milliliters of water

$$6 \text{ g} / 8 \text{ ml} = 0.75 \text{ g/ml}$$

| | Mass (g) | Starting V (ml) | Ending V (ml) | Displaced V (ml) | Density (g/ml) |
|-----------|-------------|--------------------|------------------|---------------------|-------------------|
| Unknown A | | | | | |
| Unknown B | | | | | |
| Unknown C | | | | | |

Using the table below, try to determine the metals of each unknown

| Material | Density (g/ml) |
|----------|----------------|
| Water | 1.00 |
| Aluminum | 2.70 |
| Iron | 7.87 |
| Lead | 11.36 |
| Brass | 8.50 |

Your Guess:

Unknown A _____

Unknown B _____

Unknown C _____