611-2115 (30-125) Archimedes Principle

Materials Required

- Water bath (20cm deep)
- Spring scale (200g) **or**
- Triple beam analytical balance and weights
- Ring stand

Warranty and Parts:

We replace all defective or missing parts free of charge. Additional replacement parts may be ordered toll-free. We accept MasterCard, Visa, checks and School P.O.s. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse or normal wear and tear. Intended for children 13 years of age and up. This item is not a toy. It may contain small parts that can be choking hazards. Adult supervision is required.

Introduction:

The 30-125 Archimedes Principle apparatus is used to verify the law of buoyancy, named after the Greek mathematician Archimedes. It can be defined as: **The apparent loss in weight of a floating or submerged body is equal to the weight of the fluid that it displaces.**

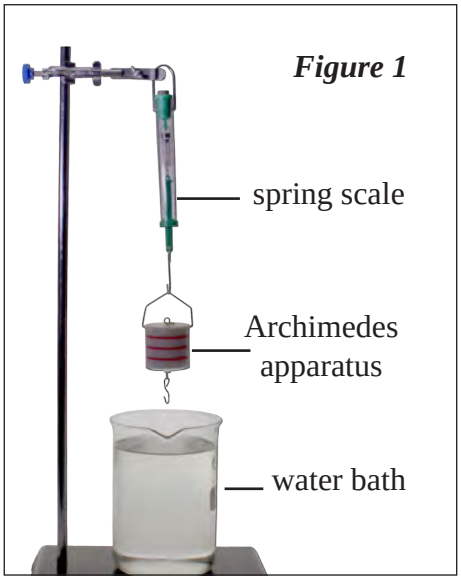
Although objects seem to weigh less when submerged in water, this is only because the object is buoyed up by a force equal to the weight of the fluid displaced.

The Archimedes Principle apparatus consists of two cylindrical pieces - one solid, one hollow. The cylinder (white) fits snugly into bucket (clear). The outer volume of the white cylinder is equal to the inner volume of the bucket. The cylinder has a hook on one end and the bucket has a handle on one end and ring on the other. They are pictured above.

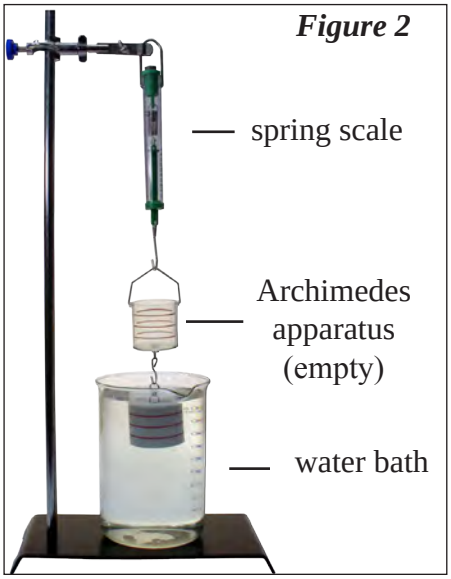
How To Use:

This experiment may be performed with either a spring scale or a balance to quantify the results. The instructions are demonstrated using a spring scale, however for more accuracy, a balance should be used. An example of the balance set-up is shown on the back page.

1. Begin by setting up the water bath and ringstand as in ***Figure 1***.



2. Hang the cylinder and the bucket from the spring scale as shown. Record the weight of both pieces as shown on the spring scale. See ***Figure 1***.
3. Separate the Archimedes Principle apparatus, and hang the cylinder from the bottom of the bucket.
4. Lower the spring scale until the top surface of the cylinder is just below the surface of the water. Measure the weight of the apparatus. It will appear as though the cylinder and bucket weigh less in water. See ***Figure 2***.



5. Keeping the cylinder submerged, fill the Bucket with water, as shown in ***Figure 3***. Measure the weight on the spring scale. Note that the addition of weight equal to the buoyant force of the water returns the spring scale to the

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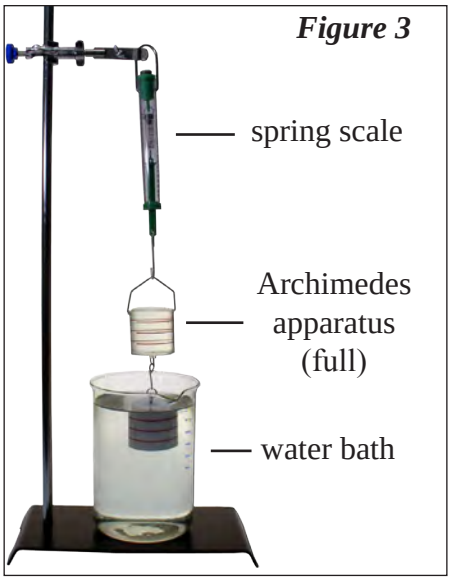
Figure 3

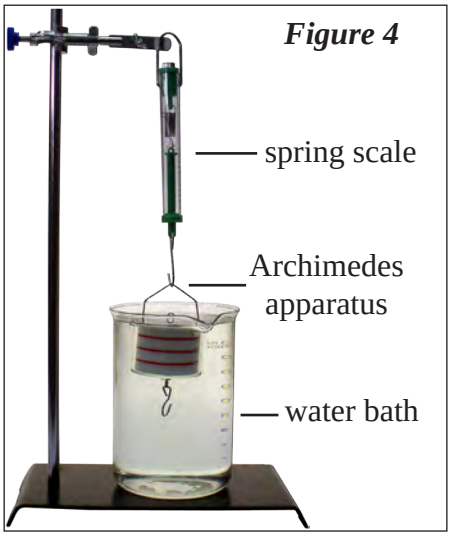


original value. This demonstrates that the weight of the water in the bucket is equal to the weight of the water displaced by the cylinder.

Another way to use this apparatus is illustrated below:

1. Fit the cylinder inside the bucket as shown in ***Figure 4***. Submerge

Figure 4

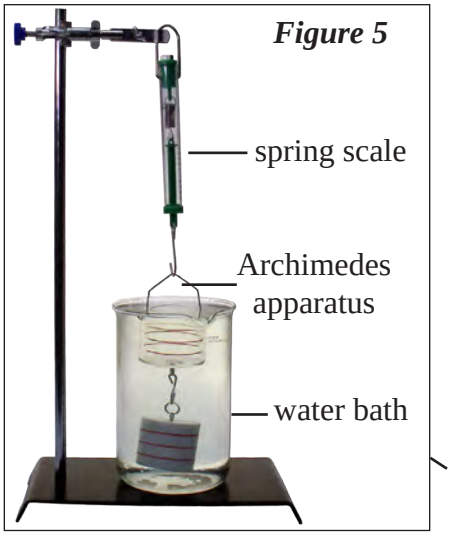


both cylinder and bucket in your container of water until water just covers the top of the apparatus.

2. Weight the cylinder and bucket.

3. Hang the cylinder from ring on bucket. Submerge both in the con-

Figure 5



tainer of water. Since the cylinder no longer fills the bucket and the bucket is now submerged, it naturally fills completely with water. See ***Figure 5***.

4. At this point in the experiment it is often assumed that cylinder, bucket and water inside the bucket add up to a weight greater than the weight attained when the cylinder is inside the bucket. However, the equilibrium evidenced by the spring scale proves that they weigh the same.

Why is this so? In submerging, the cylinder has displaced a volume of water equal to its own, which causes the buoyancy. The experiments prove that the loss in weight (buoyancy) of an object when submerged in a liquid equals the weight of the liquid displaced.

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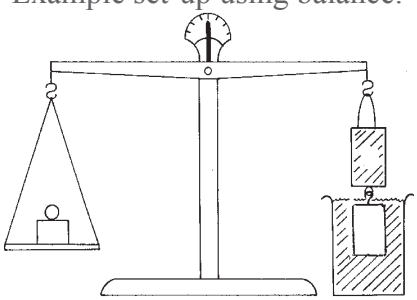
Example set-up using balance:



How To Teach with Archimedes Principle:

Concepts Taught:

Principle of Archimedes; buoyancy; mass/volume/buoyancy relations. Density, specific gravity.

Curriculum Fit:

PS & CS/ Matter, properties. Unit: Observation and Measurement of Physical Properties. Grades 6 - 10.

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