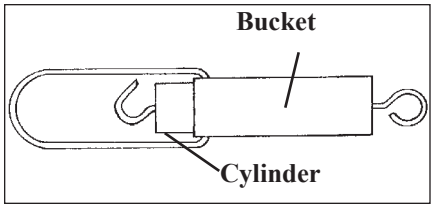
611-2110 (30-120) Bucket and Cylinder

Introduction:

The Bucket and Cylinder Apparatus is used to verify the Archimedes Principle, or law of buoyancy, named after the Greek mathematician. 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.

This apparatus consists of two cylindrical aluminum pieces - one solid, one hollow. The cylinder (solid) fits snugly into bucket (hollow). The outer volume of the solid cylinder is exactly 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 illustrated below.



How To Use:

Materials Required

- **Triple Beam Analytical Balance**
  (accurate to within .1 gram)
- **Container with water**
- **Set of weights**

Length of fishline needed for weighing on your balance is included.

Hang the hook on bucket from ring on cylinder as shown in *Figure 1*. Weigh both pieces by hooking the handle on the cylinder on one arm of the analytical balance, then counter-balancing with the appropriate number of weights.

Lift up container of water carefully under solid cylinder so cylinder is entirely submerged but does not touch the sides or bottom of the vessel.

Equilibrium is upset as block is buoyed up.

Balance tilts toward left, showing that Bucket and Cylinder now weigh less than they did before.

Still keeping the cylinder submerged, now fill the Bucket with water, as shown in *Figure 2*. The addition of weight equal to the buoyant force restores the equilibrium of the balance.

Repeat the experiment using kerosene, alcohol or some other liquid.

You should get similar results.

Fig. 1

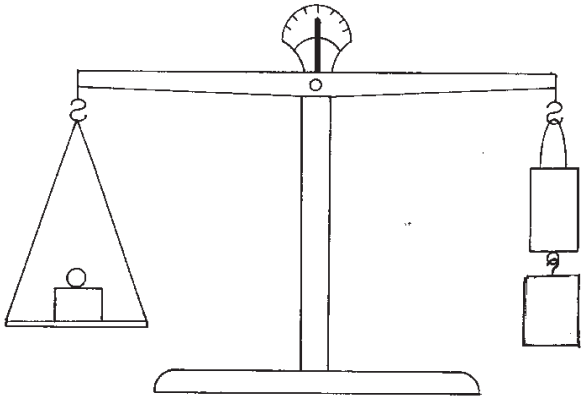
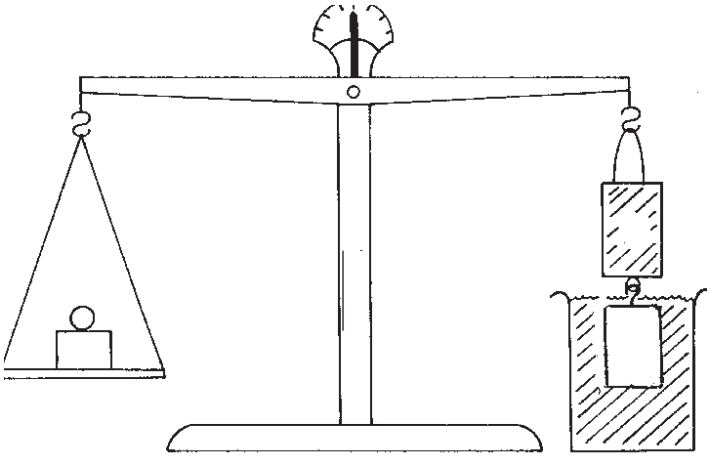


Fig. 2



Another way to use this apparatus is illustrated below. Fit the solid cylinder inside the bucket as shown. Submerge both cylinder and bucket in your container of water. Use the length of dacron line to attach the handle of bucket to one arm of the triple beam balance and weigh both pieces by counterbalancing with the appropriate number of weights.

Hang the cylinder from ring on bucket. Submerge both in the container of water. Since the cylinder no longer fills the bucket and the bucket is now submerged, it naturally fills completely with water.

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 analytical balance proves 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 buoyance. The experiments prove that the loss in weight (buoyancy) of an object when submerged in a liquid equals the weight of the liquid displaced.

Fig. 3

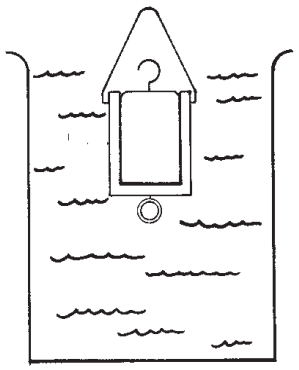
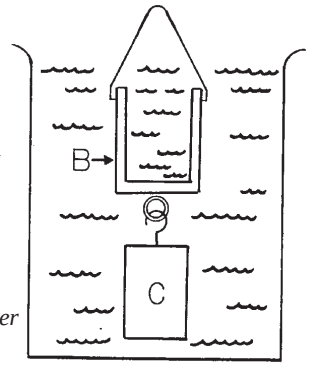


Fig. 4



How To Teach with Bucket and Cylinder:

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.

Warranty and Parts:

We replace all defective or missing parts free of charge. We accept Master Card and Visa, school P.O's. All products warranted to be free from defect for 90 days. Does not apply to misuse, accident and/or normal wear and tear.

P/N 24-3120