The following experiment is illustrated in *Figure 5-38*. The overflow can is filled to the spout with water. The heavy metal cube is first weighed in still air and weighs 10 lb. It is then weighed while completely submerged in the water and it weighs 3 lb. The difference between the two weights is the buoyant force of the water. As the cube is lowered into the overflow can, the water is caught in the catch bucket. The volume of water which overflows equals the volume of the cube. The volume of irregular shaped objects can also be measured by using this method. If this experiment is performed carefully, the weight of the water displaced by the metal cube exactly equals the buoyant force of the water, which the scale shows to be 7 lb.

Archimedes (287–212 B.C.) performed similar experiments. As a result, he discovered that the buoyant force which a fluid exerts upon a submerged body is equal to the weight of the fluid the body displaces. This statement is referred to as Archimedes' principle. This principle applies to all fluids, gases as well as liquids. Just as water exerts a buoyant force on submerged objects, air exerts a buoyant force on objects submerged in it.

The amount of buoyant force available to an object can be calculated by using the following formula:

Buoyant Force = Volume of Object × Density of Fluid Displaced

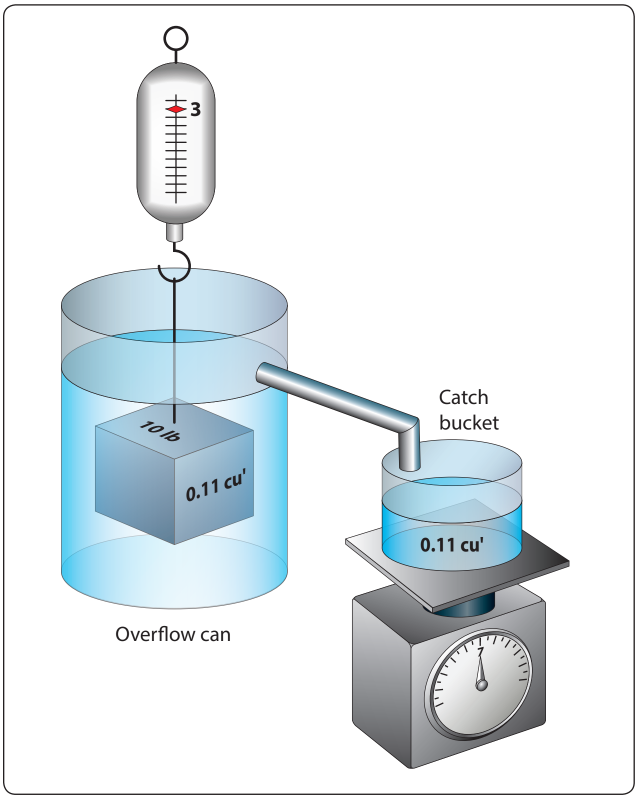

Figure 5-38. *Example of buoyancy.*

If the buoyant force is more than the object weighs, the object will float. If the buoyant force is less than the object weighs, the object will sink. For the object that sinks, its measurable weight will be less by the weight of the displaced fluid.

Example: A 10-ft^3 object weighing 700 lb is placed in pure water. Will the object float? If the object sinks, what is its measurable weight in the submerged condition? If the object floats, how many cubic feet of its volume is below the water line?

Buoyant Force = Volume of Object × Density of Fluid Displaced
= 10 (62.4)
= 624 lb

The object will sink because the buoyant force is less than the object weighs. The difference between the buoyant force and the object's weight will be its measurable weight, or 76 lb.

Two good examples of buoyancy are a helium filled airship and a seaplane on floats. An airship is able to float in the atmosphere and a seaplane is able to float on water. That means both have more buoyant force than weight. *Figure 5-39* is a DeHavilland Twin Otter seaplane, with a gross takeoff weight of 12,500 lb. At a minimum, the floats on this airplane must be large enough to displace a weight in water equal to the airplane's weight. According to Title 14 of the Code of Federal Regulations (14 CFR) part 23, the floats must be 80 percent larger than the minimum needed to support the airplane. For this airplane, the necessary size of the floats would be calculated as follows:

Divide the airplane weight by the density of water.
12,500 ÷ 62.4 = 200.3 ft^3

Multiply this volume by 80%.
200.3 × 80% = 160.2 ft^3

Figure 5-39. *DeHavilland Twin Otter seaplane.*