

Foiled by Density

Floating or flailing foil

By Eric Muller



Introduction:

Fold and crumple aluminum foil to investigate density. By sinking or floating, compare foil's density to water.

Materials:

- Aluminum foil
- Clear container
- Water



Assembly:

1. Unroll about 20 cm of aluminum foil.
2. Tear this piece in half.
3. You should now have two equal sized pieces of aluminum.
 - a. With one of the halves: lightly crumple the aluminum foil into a wad or ball.
 - b. With the other half: carefully fold it in half repeatedly until you can no longer fold it. Make sure the foil is tightly compacted. You may even smash or step on your folded object to compact it even more.



4. Fill your clear container with water.

To do and notice:

Test the density of your aluminum foil objects by placing them in water.

Will your pieces sink or float? Make a prediction before dunking them in water.



What's going on?

The crumpled wad should float and the compact, folded aluminum object should sink.

Density is defined as the compactness of matter.
It can also be defined as the mass per unit volume.



The equation for density is:

$$\frac{\text{Mass}}{\text{Volume}} = \text{Density}$$

Water has a density of 1 gram/milliliters and a solid piece of Aluminum has a density of 2.7 gr/ml.

If the density of an object is lower than 1 or that of water, then it will float.

If the density of an object is higher than 1 (or that of water), then your object will sink.

Your pieces of aluminum foil have about the same mass (since you tore your original piece in half). However, the volumes are very different.



The crumpled piece of aluminum is not like a solid chunk of aluminum. It has a large volume compared to its mass. When you crumple it, you allow spaces to form between the creases (in the case of your object, lots of air is trapped). The aluminum atoms in this object are spread out. The matter in it is not too compact. So it's density is low and less than 1.

The folded piece of aluminum is closer to that of a solid piece of aluminum. It has a smaller volume compared to its mass. As you fold it and smash it, you force the atoms of aluminum to be compacted together. So it's density is higher and is greater than 1.

Going further:

Ships can be made of metals too. The metals have a density much greater than 1, but why don't they sink?

Ships are not solid blocks of metal. The metal is spread over a large volume; it is distributed as hulls, walls, decks, ceilings...etc. Matter is so spread out that the density is less than one...so it floats.



For a little more head scratching with foil, try an activity by Paul Doherty by clicking [here](#).

Resources:

Image of ship: <http://www.navy.mil/>