

Dynamics and Statics

Is it pure gold?

Archimedes' principle in practice

(Ireland)

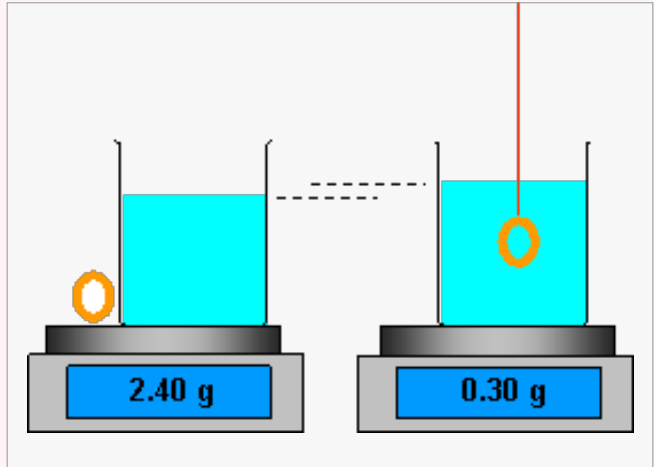
Background

Archimedes' Principle
(as applied to water)

A body immersed in water displaces some water and feels lighter. The weight of the displaced water is exactly equal to the apparent loss of weight of the body.

You will need...

- ✓ Electronic balance
- ✓ small beaker with water
- ✓ object to be tested (e.g. gold ring)
- ✓ very thin wire
(to suspend the ring)



Procedure

1. Place the beaker of water on the scales. Press 'Tare' to zero the reading.
2. Place the ring on the scales (beside the beaker) and take the reading. This is the mass of the ring (m).
3. Then suspend the ring in the water and take another reading. (This causes the water level to rise slightly.)

So what happened?

The water exerts an upthrust on the ring and the ring exerts an equal and opposite force on the water and so on the scales. The second reading is the weight of water displaced.

Since the density of water is approximately 1 g cm^{-3} , the volume of the ring in cubic centimetres (V) is **numerically equal to the mass, in grams, of water displaced.**

Using the figures shown in the diagram the density (ρ) of the ring would be

$$\begin{aligned}\rho &= m/V \\ &= 2.4 \div 0.3 \\ &= 8 \text{ g cm}^{-3}\end{aligned}$$

(so it's not gold!)

Metal	Density
Platinum (100%)	21.4
'950 Platinum'	20.1
Gold (24 carat =100%)	19.3
22 carat	17.7 to 17.8
18 ct Yellow	15.2 to 15.9
18 ct White	14.7 to 16.9
14 carat	12.9 to 14.6
9 carat	10.9 to 12.7
Silver (100%)	10.5
Sterling Silver (92.5%)	10.2 to 10.3
Copper	9
Steel	7.75 to 8.05