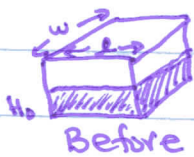
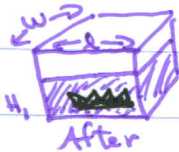


The Archimedes crown affair

- to see if a crown is made of pure gold (if there were any jewels as such they are removed)
- it is at least consistent with the crown being made of gold if it has the same density as gold - density (mass/volume) being a property of a material and not of an amount of material
- the mass is easily measured with a scale, but how to (or calculate) measure the volume of the crown?



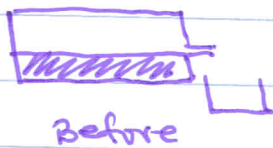
Before



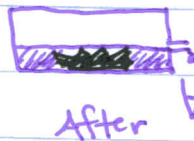
After

$$\text{Vol}_{\text{crown}} = (H_1 - H_0) \cdot l \cdot w$$

Because the water is "incompressible", the crown displaces the water by an amount equal to the volume of the crown (assuming no air bubbles as such).



Before

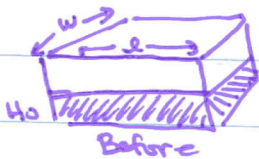


After

↑
spilled out

Alternative: set it up so it is ready to spill, place the crown in and measure the volume of spilled water

What if we had a styrofoam crown? It would float - partially submerge and reach "equilibrium"



Before



H₁

$$\text{Vol}_{\text{submerged}} = (H_1 - H_0) \cdot l \cdot w$$

$$\neq \text{Vol}_{\text{crown}}$$

The floating, styrofoam crown has a weight (experiences a gravitational attraction to the Earth proportional to its mass) and that weight is balanced by (equal + opposite to) the buoyant force due to the displaced water.