# PhyzSpringboard:
# Eureka, I have Found It!


**THE CROWN AFFAIR**

A crown is hung from a spring scale and found to have a weight of 8.54 N. When the hanging crown is completely immersed in water, the reading on the spring scale drops to 8.09 N.

1. What is the mass of the crown?

$W = mg$

$m = W/g = 8.54\ N / 9.8\ m/s^2 = 0.87\ kg$

2. What is the buoyant force acting on the crown?

$B = W_{in\ air} - W_{in\ water} = 8.54\ N - 8.09\ N = 0.45\ N$

3. What weight of water was displaced by the crown when the crown was immersed?

$W = 0.45\ N$ (equal to the buoyant force)

4. What is the mass of the water that was displaced?

$m = W/g = 0.45\ N / 9.8\ m/s^2 = 0.046\ kg$

5. What is the volume of the crown?

$\rho = m/V$

$V = m/\rho = 0.046\ kg / 1000\ kg/m^3 = 4.6 \times 10^{-5}\ m^3$

6. What is the density of the crown?

$\rho = m/V = 0.87\ kg / 4.6 \times 10^{-5}\ kg/m^3 = 18{,}900\ kg/m^3$

7. Is the crown made of gold? Cite your evidence.

The density of gold is $19{,}300\ kg/m^3$

The density of the crown falls short by $400\ kg/m^3$; the gold may have been "diluted."