Using our density equation of ρ = mass/volume, we see that the higher the density, the more mass $1cm^3$ of a sample will have. So, if we had a 1 cm^3 chunk of osmium, it would weigh 22.59 g (about 3.5 times the mass of the zirconium and about 10 times the mass of the sodium chloride). Same volume, but very different masses of matter due to the different densities.

Physics is frequently just getting comfortable with various equations formulated to explain observations of the physical world, and density is a good example of exploring the density relationship in equation form. For example, if you were wondering, we can get the mass of $1cm^3$ of osmium from our equation from its known density of $22.59g/cm^3$:

$$\rho = \text{mass/volume}$$

$$22.59g/cm^3 = \text{mass}/1cm^3$$

$$22.59g/cm^3 \times 1cm^3 = \text{mass}$$

(the cm^3 cancel each other out)

$$22.59g/\cancel{cm}^3 \times 1\cancel{cm}^3 = \text{mass}$$

$$22.59g = \text{mass}$$

Let's explore the equation part of physics a little further. We can make some basic calculations if we know two factors of the ρ = mass/volume equation. For example, if we have 126 cm^3 of lead (Pb, atomic number 82), what mass of lead do we have? Well, with just that information, you can't figure out! You need the density of lead (which you can find online if it isn't given to you). The density of lead is 11.34 g/cm^3 and, knowing that you have $126cm^3$ of it, you can figure out the mass of that amount of lead. Here's how we'd figure it out:

$$\rho = \text{mass/volume}$$

$$11.34g/cm^3 = \text{mass}/126cm^3$$

$$126cm^3 \times 11.34g/cm^3 = \text{mass}$$

$$126\cancel{cm}^3 \times 11.34g/\cancel{cm}^3 = \text{mass}$$

1,428.84g = mass; so, $126cm^3$ of lead has a mass of 1,428.84g.

You can also use the density equation to figure out how much volume you will need to accommodate a certain mass of solid. Let's say you have 252 grams of calcium chloride (density of 2.15 g/cm^3). What volume would you need to accommodate this mass of calcium chloride?

$$\rho = \text{mass/volume}$$

$$2.15g/cm^3 = 252g/\text{volume}$$

$$\text{volume} \times 2.15g/cm^3 = 252g/\cancel{\text{volume}} \times \cancel{\text{volume}}$$

$$\text{volume} = 252g/2.15g/cm^3$$

$$\text{volume} = 252g\ cm^3/2.15g$$

$$\text{volume} = 252\cancel{g}\ cm^3/2.15\cancel{g}$$

volume = $117.21cm^3$; so, 252g of sodium chloride takes up a volume of $117.21cm^3$.