

Objective

- Find the density in a coin and use it to help identify the metal.
- Use a Vernier caliper.

Materials

- Coins of standard metals
 - Japan 1 Yen (1955-1989)
 - Denmark 2 øre (1948-1972)
 - Italy 50 Lire (1955-1989)
 - France 1 Franc (1959-2001)
- Vernier caliper

Procedure

Density is a property of materials that can be used to help identify the material. It is calculated using $\rho = \frac{m}{V}$. The coins are essentially short cylinders, so the volume can be calculated using $V = \pi r^2 h$. The measurements for the radius and height will be measured with a caliper.

To use can caliper, put the object between the jaws. The sliding jaw has a scale. Start by reading where the zero mark on the sliding scale lines up with the main scale.

Round down if the zero mark is between

two marks on the scale. Then find where a mark on the sliding scale lines up perfectly with a mark on the main scale. Use that mark on the sliding scale as the next digit for your measurement.

1. Choose a coin and measure its diameter.
2. Divide by 2 to get the radius, r , and record it in the table.
3. Measure the thickness, h , of the coin and record it in the table.
4. Calculate the volume of the coin.
5. Calculate the density of the coin.
6. Repeat steps 1-5 for the other coins.
7. Each coin is a different metal from the table. Your measurements will not be the same as the densities in the table, but choose which metal you think the coin is.

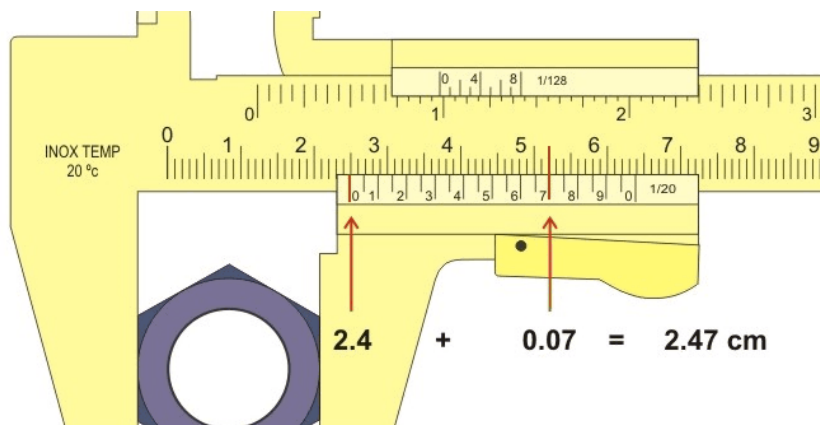


Figure 1: How to read a Vernier caliper (wikicommons/Joaquim Alves Gaspar)

Metal	Density (g/cm ³)
Aluminum	2.70
Zinc	7.13
Steel	7.90
Nickel	8.90
Copper	8.96

Coin	Mass, m (g)	Radius, r (cm)	Thickness, h (cm)	Volume (cm ³)	Density (g/cm ³)	Metal
Japan 1 Yen	1.0					
France 1 Franc	6.0					
Italy 50 Lire	6.25					
Denmark 2 øre	3.2					

8. Where do you think the error comes from?

9. Suggest a way to reduce this error.