

Answer on Question#38855-Chemistry-Inorganic Chemistry

Question

If the copper is drawn into wire whose diameter is 8.00 mm , how many feet of copper can be obtained from the ingot? The density of copper is 8.94 g/cm³. (Assume that the wire is a cylinder whose volume is $V=\pi r^2h$, where r is its radius and h is its height or length)

Answer

The volume of the copper ingot (V) is calculated as a quotient of mass (m) to the density (ρ) of copper:

$$V = \frac{m}{\rho}$$

The wire is a cylinder whose volume is

$$V = \pi r^2 h,$$

where r is its radius and h is its height or length.

When equating the equations we have

$$\pi r^2 h = \frac{m}{\rho},$$

whence

$$h = \frac{m}{\rho \pi r^2}$$

We know that:

$$\rho = 8.94 \text{ g/cm}^3$$

$$r = d/2 = 8.00/2 = 4.00 \text{ mm} = 0.400 \text{ cm}$$

$$\pi = 3.14$$

When substituting the values into the equation we will get the answer in **cm**, while it is asked "how many **feet**". 1 cm = 0.03281 feet, so the formula to get the copper length in feet is:

$$h = \frac{0.03281 \cdot m}{\rho \pi r^2} = \frac{0.03281 \cdot m}{8.94 \cdot 3.14 \cdot 0.4^2} = 0.007305 \cdot m$$

Since it is not specified, what is the mass of the ingot, let us calculate the wire length for the mass values from 1 g to 1000 g. Some discrete results are given in table below

Table

m , g	1	5	10	50	100	150	200	300	400	500	700	1000
h , feet	0.0073	0.0365	0.0731	0.3653	0.7305	1.0958	1.4610	2.1915	2.9220	3.6525	5.1135	7.3050

The length for any mass from the calculated range may be determined using the graph

