1) A thin sheet of gold foil has an area of $A = 3.12$ cm² and weighs $m = 6.5$ mg. How thick is the sheet? ($\rho = 19300$ kg/m³)

Solution:

The weight of gold foil $m = \rho V = \rho A h$. Thus, the thick of foil is

$$h = \frac{m}{\rho A} = \frac{6.5 \times 10^{-3}}{19300 \times 3.12 \times 10^{-4}} = 0.001 \text{ m} = 1 \text{ mm}$$

Answer: 1 mm

2) An irregular piece of metal weighs $m = 10$ g in air & $m' = 8.0$ g when submerged in H₂O.

a.) Determine the volume of the metal & its density

b.) If the same piece of metal weighs $m'' = 8.5$ g when immersed in a particular oil, what is the density of the oil?

Solution:

The weight of piece of metal in H₂O

$$m'g = mg - \rho_W gV$$

Thus, the volume of a piece of metal

$$V = \frac{m - m'}{\rho_W} = \frac{10 - 8.0}{1.0} = 2.0 \text{ cm}^3$$

The density of a piece of metal

$$\rho_{\text{metal}} = \frac{m}{V} = \frac{10}{2} = 5.0 \text{ g/cm}^3$$

The weight of piece of metal in oil

$$m''g = mg - \rho_{\text{oil}} gV$$

So

$$\rho_{\text{oil}} = \frac{m - m''}{V} = \frac{10 - 8.5}{2.0} = 0.75 \text{ g/cm}^3$$

Answers:

$V = 2.0 \text{ cm}^3$

$\rho_{\text{metal}} = 5.0 \dfrac{\text{g}}{\text{cm}^3}$

$\rho_{\text{oil}} = 0.75 \text{ g/cm}^3$