Problem 6 (15 points)

An instructor gives a painted piece of metal to 2 students and asks: "This is one of the metals listed in the table of densities. What metal do you think it is?"

The students measure the object and find that the mass is 139.2 +/-- 0.1g and the volume is 16.0 +/-- 0.5 cm^3.

 Student 1 says: "It must be nickel."

 Student 2 says: "Don't forget the uncertainty. It might be silver."

A. What would you conclude from the data?

Table of densities

Substance	Density
Tungsten	19 g/cm^3
Lead	11.3 g/cm^3
Silver	10.5 g/cm^3
Copper	8.9 g/cm^3
Nickel	8.7 g/cm^3
Brass	8.5 g/cm^3
Iron	7.9 g/cm^3

I would conclude that with such a large uncertanty in the Volume, it could be either Brass, Nickel, or Copper. They all fit within the range of uncertainty.

Dr. Saul: Good solution, but should also mention that is the sample is probably not silver since the density for silver lies outside the range of possible densities. This is a composite solution from 2 students.

mass 139.1g — 139.2g — 139.3g

Volume 15.5cm³ — 16.0cm³ — 16.5cm³

−0.1g +0.1g

−0.5cm³ +0.5cm³   highest

Possibilities of density

$$\frac{mass}{volume} \quad \frac{139.1g}{15.5\ cm^3} \approx 8.97\frac{g}{cm^3}$$

$$\boxed{\frac{139.3g}{15.5\ cm^3} \approx 8.99\ \frac{g}{cm^3}}$$

$$\frac{139.1g}{16.5\ cm^3} = \boxed{8.43\frac{g}{cm^3}}$$

$$\frac{139.3g}{16.5\ cm^3} \approx 8.44\ g/cm^3$$

lowest   It could be Brass, Nickel, or Copper.

B. Do you agree with student 1, student 2, or neither? Explain your reasoning.

Student Solution: (Dr. Saul: hits all the key points)

I disagree with student 1 b/c it doesn't have to be nickel. (Like in part a, it could be Brass, nickel, or copper.)

I disagree with Student 2 b/c it cannot be silver even when remembering the uncertainty. But I do think it is imparative to remember the uncertainty so I do agree with that part of the statement. :)