The Density Of Gold Is 19kg/cm Find The Volume Of A) 38g B)0.095kg. Solve This Question And Give Explanation

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Understanding the concept of density and its application in calculating volume is fundamental in physics and material science. In this article, we will explore how to determine the volume of gold given its density and mass. Specifically, we will focus on the problem: "The density of gold is 19 kg/cm³. Find the volume of a) 38 grams and b) 0.095 kilograms of gold." We will walk through the calculations step by step and provide clear explanations to ensure a comprehensive understanding.

What Is Density?

Before diving into the calculations, it is essential to understand what density means.

Definition of Density

Density is a physical property that measures how much mass is contained within a given volume of a material. It is mathematically expressed as:

$$ \text{Density} (\rho) = \frac{\text{Mass} (m)}{\text{Volume} (V)} $$

Where:
- ρ = density
- m = mass
- V = volume

Units of Density

Density can be expressed in various units depending on the context:
- kg/m³ (kilograms per cubic meter)
- g/cm³ (grams per cubic centimeter)
- kg/cm³ (kilograms per cubic centimeter)

In our problem, the density is given as 19 kg/cm³, which is quite high and typical for dense materials like gold.

Understanding the Problem

Given:
- Density of gold, $\rho = 19\, \text{kg/cm}^3$
- Mass of gold:
- A) 38 grams
- B) 0.095 kilograms

Find:
- The volume for each case.

Important Conversion Factors

To work consistently, we need to convert all quantities into compatible units, particularly mass units, since density is given in kg/cm³.

Conversion:
- 1 kilogram (kg) = 1000 grams (g)
- Therefore:
- 38 g = 38 / 1000 = 0.038 kg
- 0.095 kg remains as is

Calculating Volume: The Basic Formula

Using the density formula:

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

Where:
- V = volume
- m = mass
- ρ = density

This formula allows us to determine the volume by dividing the mass by the density.

Calculating Volume for 38g (0.038kg) of Gold

Step 1: Write down the known values

- Mass, $m = 0.038\, \text{kg}$
- Density, $\rho = 19\, \text{kg/cm}^3$

Step 2: Apply the formula

$$ V = \frac{0.038\, \text{kg}}{19\, \text{kg/cm}^3} $$

Step 3: Perform the division

$$ V = \frac{0.038}{19} \text{cm}^3 $$

$$ V \approx 0.002 \text{cm}^3 $$

Result:

The volume of 38 grams of gold is approximately 0.002 cm³.

Calculating Volume for 0.095kg of Gold

Step 1: Write down the known values

- Mass, $m = 0.095\, \text{kg}$
- Density, $\rho = 19\, \text{kg/cm}^3$

Step 2: Apply the formula

$$ V = \frac{0.095\, \text{kg}}{19\, \text{kg/cm}^3} $$

Step 3: Perform the division

$$ V = \frac{0.095}{19} \text{cm}^3 $$

$$ V \approx 0.005 \text{cm}^3 $$

Result:

The volume of 0.095 kilograms of gold is approximately 0.005 cm³.

Summary of Results

Mass	Conversion to kg	Calculated Volume
38 g	0.038 kg	≈ 0.002 cm³
0.095 kg	0.095 kg	≈ 0.005 cm³

Note: The calculated volumes are extremely small because of the high density of gold. This reflects how dense gold is compared to many other materials.

Additional Insights and Real-World Applications

Why Is Density Important?

Density plays a crucial role in various fields, including:
- Material selection in engineering
- Determining purity of precious metals
- Designing objects with specific weight and volume constraints
- Identifying materials through their density measurements

Gold’s High Density

Gold’s high density (19 kg/cm³) makes it a valuable and compact material. For comparison:
- Water density: 1 g/cm³
- Gold’s density: 19,000 kg/m³ (equivalent to 19 kg/cm³)

This high density explains why gold objects are often small yet heavy.

Common Mistakes to Avoid in Density Calculations

- Forgetting to convert units consistently
- Mixing units (e.g., grams with kilograms) without conversion
- Incorrectly applying the formula V = m / ρ
- Miscalculating with decimal points or division errors

Conclusion

Calculating the volume of a substance using its density is straightforward once the correct

units are used and the formula is applied properly. In this case, with gold's density at 19 kg/cm³, the volumes for 38 grams and 0.095 kilograms are approximately 0.002 cm³ and 0.005 cm³, respectively. These tiny volumes demonstrate the incredible density of gold and highlight the importance of understanding physical properties in practical applications.

By mastering these calculations, students and professionals can better understand material properties, conduct accurate measurements, and make informed decisions in science and engineering contexts.

Frequently Asked Questions

What is the formula to find the volume of a substance when its mass and density are known?

The formula is Volume = Mass / Density. You divide the mass of the object by its density to find its volume.

Given the density of gold as 19 kg/cm³, how do you convert grams or kilograms to match the units used in the formula?

Since the density is in kg/cm³, convert grams to kilograms by dividing by 1000 (1 g = 0.001 kg). This ensures consistent units when calculating volume.

How do you calculate the volume of 38 grams of gold given its density?

Convert 38 g to kg: 38 g = 0.038 kg. Then, use Volume = Mass / Density = 0.038 kg / 19 kg/cm³ ≈ 0.002 cm³.

What is the volume of 0.095 kg of gold with a density of 19 kg/cm³?

Using the formula: Volume = 0.095 kg / 19 kg/cm³ ≈ 0.005 cm³.

Why is understanding the relationship between mass, density, and volume important in physics?

It helps in calculating the physical properties of materials, understanding their behavior, and solving practical problems involving material measurements.

Additional Resources

Density of Gold and Calculating Volume: A Comprehensive Guide

Understanding the relationship between the density of a substance and its volume is a fundamental concept in physics and chemistry. When dealing with materials like gold, which are often measured in terms of their density and mass, it becomes essential to understand how to determine the volume given the density and mass. In this detailed analysis, we will explore a specific problem involving the density of gold, walk through the step-by-step solution, and explain the concepts involved thoroughly.

Understanding Density: The Core Concept

What is Density?

Density is a physical property that defines how much mass is contained within a specific volume of a substance. It is expressed mathematically as:

$$\text{Density} (\rho) = \frac{\text{Mass} (m)}{\text{Volume} (V)}$$

Where:
- ρ (rho) is the density,
- m is the mass,
- V is the volume.

This relationship allows us to find any one of these three quantities if the other two are known.

Units of Density

Density can be expressed in various units depending on the context:
- SI units: kilograms per cubic meter kg/m^3,
- Customary units: grams per cubic centimeter g/cm^3,
- Specific units: in this problem, the density is given as kg/cm, which is unconventional and possibly a typo or an approximation. Typically, density of solids like gold is expressed in kg/m^3 or g/cm^3.

In our problem, the given density is 19 kg/cm, which appears to be a simplified or specific unit designation. We'll interpret this as the density being 19 kg per cubic centimeter (kg/cm^3) for the purpose of calculations, unless specified otherwise.

Analyzing the Given Data

The problem states:

> The Density of Gold is 19 kg/cm. Find the volume of (A) 38 g and (B) 0.095 kg.

This involves two parts:
1. Calculating the volume for a mass of 38 grams.
2. Calculating the volume for a mass of 0.095 kilograms.

Before proceeding, it's crucial to clarify the units and ensure consistency throughout the calculations.

Unit Conversion and Consistency

Since the density is given in kg/cm^3, and the masses are in grams and kilograms, we need to convert mass units to kilograms for consistency.

- Mass in grams to kilograms:

$$
38\, \text{g} = \frac{38}{1000} = 0.038\, \text{kg}
$$

- Mass is already in kilograms for part B:

$$
0.095\, \text{kg}
$$

Calculating Volume: The Fundamental Formula

Given the formula:

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

where:
- V is the volume,
- m is the mass,
- ρ is the density.

We can directly substitute the given values to find the volume.

Part A: Volume of 38 g (0.038 kg) of Gold

Step 1: Write the known values

- Mass $m = 0.038\, \text{kg}$,
- Density $\rho = 19\, \text{kg/cm}^3$.

Step 2: Apply the formula:

$$
V = \frac{m}{\rho} = \frac{0.038\, \text{kg}}{19\, \text{kg/cm}^3}
$$

Step 3: Perform the calculation:

$$
V = \frac{0.038}{19} \approx 0.002 \text{ cm}^3
$$

Step 4: Interpret the result

The volume of 38 grams of gold is approximately 0.002 cubic centimeters.

Part B: Volume of 0.095 kg of Gold

Step 1: Known values

- Mass $m = 0.095\, \text{kg}$,
- Density $\rho = 19\, \text{kg/cm}^3$.

Step 2: Apply the formula:

$$
V = \frac{0.095}{19} \approx 0.005\, \text{cm}^3
$$

Step 3: Final interpretation

The volume of 0.095 kg of gold is approximately 0.005 cubic centimeters.

Deep Dive Into the Results and Their Implications

Why Are These Volumes So Small?

The computed volumes, especially for small masses, seem surprisingly tiny because of the high density value. To put this into perspective:
- Gold has a density of approximately 19,320 kg/m^3 in standard units.
- Our given density (19 kg/cm^3) translates to:

$$
19\, \text{kg/cm}^3 = 19 \times 10^6\, \text{kg/m}^3
$$

which is significantly higher than the standard density of gold, indicating perhaps an error or a different context.

Key Point: Usually, the density of gold is about 19.3 g/cm^3 or 19300 kg/m^3. The given value (19 kg/cm) suggests a different unit system or an unusual context, so it's critical to verify the units.

Clarifying the Units and Correcting Potential Errors

Since the typical density of gold is about 19.3 g/cm^3, it's plausible that the problem intended to say "the density of gold is 19.3 g/cm^3" rather than "19 kg/cm".

If we assume the intended density is 19.3 g/cm^3, then:

- Convert the density to kg/cm^3:

$$
19.3\, \text{g/cm}^3 = 0.0193\, \text{kg/cm}^3
$$

\]

- Recalculate the volumes accordingly.

Revised calculations:

Revised Part A: Volume of 38 g of Gold

$$
m = 38\, \text{g} = 0.038\, \text{kg}
$$
$$
\rho = 19.3\, \text{g/cm}^3 = 0.0193\, \text{kg/cm}^3
$$

$$
V = \frac{m}{\rho} = \frac{0.038}{0.0193} \approx 1.967\, \text{cm}^3
$$

Result: Approximately 1.97 cm^3

Revised Part B: Volume of 0.095 kg of Gold

$$
V = \frac{0.095}{0.0193} \approx 4.926\, \text{cm}^3
$$

Result: Approximately 4.93 cm^3

Summary and Final Insights

- The key to solving any such problem lies in understanding units and ensuring consistency.
- If the problem's given density is 19 kg/cm^3, the resulting volumes are extremely small, which is physically unlikely for gold.
- More realistically, the density of gold is approximately 19.3 g/cm^3, which translates to 0.0193 kg/cm^3. Using this, the volumes are about 2 and 5 cubic centimeters for the given masses, respectively.
- These calculations reinforce a critical principle: always verify the units and the context of data provided.

Practical Applications and Related Concepts

Understanding density and volume calculations has broad applications, including:
- Material science: Determining quantities of metals and alloys.
- Geology: Calculating the volume of mineral deposits.
- Manufacturing: Designing objects with specific mass and volume constraints.
- Forensics and jewelry: Authenticating gold items based on volume and density measurements.

Conclusion

The problem of calculating the volume of gold given its density and mass is straightforward when the units are consistent and correctly interpreted. The key steps involve:
- Converting all units to compatible forms,
- Applying the formula $V = \frac{m}{\rho}$,
- Carefully interpreting the resulting values.

In this specific case, assuming the standard density of gold (~19.3 g/cm^3), the volumes for 38 g and 0.095 kg are approximately 1.97 cm^3 and 4.93 cm^3, respectively. These calculations exemplify the importance of precision in scientific data interpretation and demonstrate the fundamental relationship between density, mass, and volume.

Final note: Always double-check the units and source data in real-world

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