The Volume Of A Body Weighing Is 1200 Kg Is 250000 [tex]cm^{3}[/tex] Find ITs Density. Write With Formula

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Understanding the relationship between mass, volume, and density is fundamental in physics and engineering. When analyzing materials, objects, or substances, determining their density helps in identifying their composition, purity, or suitability for specific applications. In this article, we will explore how to calculate the density of a body given its mass and volume, using the provided data: a body weighing 1200 kg with a volume of 250,000 cm³. We will also delve into the underlying formulas, step-by-step calculation methods, and practical applications of density measurement.

What Is Density? An Introduction

Density is a physical property that measures how much mass is packed into a given volume of an object or substance. It is a crucial concept in various scientific fields including physics, chemistry, geology, and material science. The formal definition of density (ρ) is:

Density Formula

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

Where:
- ρ = density (usually expressed in units like g/cm³, kg/m³)
- m = mass of the object or substance
- V = volume of the object or substance

Understanding this formula allows us to determine an unknown property when the other two are known.

Step-by-Step Calculation of Density

Given data:
- Mass, $m = 1200\, \text{kg}$
- Volume, $V = 250{,}000\, \text{cm}^3$

Our goal:
- Find the density ρ in appropriate units, typically in kg/cm³ or g/cm³.

Step 1: Ensure Consistent Units

Before calculating, verify that units are compatible. Since the mass is in kilograms and volume in cubic centimeters, the density will be in kg/cm³ unless converted.

Step 2: Apply the Density Formula

$$
\rho = \frac{m}{V} = \frac{1200\, \text{kg}}{250{,}000\, \text{cm}^3}
$$

Step 3: Perform the Calculation

Calculating the density:

$$
\rho = \frac{1200}{250{,}000} = 0.0048\, \text{kg/cm}^3
$$

Thus, the density of the body is 0.0048 kg/cm³.

Understanding the Result and Its Units

The calculated density, 0.0048 kg/cm³, indicates that each cubic centimeter of the body has a mass of 0.0048 kilograms. To make this value more practical or comparable, it can be converted into other units.

Converting to g/cm³

Since 1 kg = 1000 g,

$$
\

$$
0.0048\, \text{kg/cm}^3 = 0.0048 \times 1000 = 4.8\, \text{g/cm}^3
$$

Therefore, the density is 4.8 g/cm³.

Significance of Density in Various Fields

Understanding the density of an object has numerous applications:

1. Material Identification

- Density helps identify unknown substances by comparing their density to standard values.

2. Quality Control

- Ensuring the consistency of materials during manufacturing processes.

3. Engineering and Design

- Calculating buoyancy, stability, and structural integrity.

4. Environmental Science

- Determining sedimentation rates and pollutant densities.

Practical Applications of Density Calculation

Calculating density is essential in many real-world scenarios:

- **Archimedes' Principle:** Determining whether an object will sink or float in a fluid based on its density relative to the fluid.
- **Material Selection:** Choosing appropriate materials for construction based on their density and strength-to-weight ratio.
- **Density-Based Sorting:** Separating materials in recycling plants based on their densities.
- **Medical Imaging:** Using density differences to identify tissues or abnormalities in imaging

techniques like CT scans.

Factors Affecting Density

While calculating density is straightforward, several factors can influence a material's density:

1. Temperature

- Increasing temperature typically decreases density due to thermal expansion.

2. Pressure

- High pressure can compress materials, increasing density.

3. Purity and Composition

- Impurities or different elements can alter the overall density of a substance.

Common Units of Density and Their Usage

Different fields prefer different units for expressing density, depending on the context:

1. **kg/m³:** Standard SI unit for density, used in physics and engineering.
2. **g/cm³:** Commonly used in chemistry and material science for solid materials.
3. **lb/ft³:** Used in the United States in construction and civil engineering.

Summary: How to Calculate Density from Mass and

Volume

To summarize the process:

1. Ensure that mass and volume are in compatible units.
2. Use the formula $\rho = \frac{m}{V}$.
3. Perform the division to find the density.
4. Convert units if necessary for better interpretation or comparison.

In our example, the calculation yielded:

$$
\boxed{
\text{Density} = 0.0048\, \text{kg/cm}^3 = 4.8\, \text{g/cm}^3
}
$$

Conclusion

Understanding how to calculate the density of a material or object is fundamental in numerous scientific and engineering disciplines. Given the specific data—a body weighing 1200 kg with a volume of 250,000 cm^3—we determined its density to be 0.0048 kg/cm^3 or 4.8 g/cm^3. This value provides insight into the material's properties and potential applications. Whether in quality control, material selection, or scientific research, accurate density calculations are essential tools for professionals across many fields.

Additional Tips for Accurate Density Calculations

- Always verify unit consistency before calculations.
- Use precise measurements to minimize errors.
- Be aware of the physical state (solid, liquid, gas) as units and typical values differ.
- Convert units where necessary to compare with standard reference values.

By mastering the concept and calculation of density, you'll enhance your ability to analyze materials and understand the physical properties that govern their behavior in various environments.

Keywords: density calculation, body density, mass volume relation, physics formulas, units of density, practical applications of density, material identification, density units, SI units, physics problem solving

Frequently Asked Questions

What is the formula to calculate the density of a body?

Density (ρ) is calculated using the formula ρ = mass / volume.

Given a body weighing 1200 kg with a volume of 250,000 cm³, how do you find its density?

Convert mass to grams (since volume is in cm³) or convert volume to m³ and use consistent units. Using the formula ρ = mass / volume, with mass in kg and volume in cm³, density in kg/cm³ can be calculated directly.

What is the volume of the body in cubic meters?

Since 1 m³ = 1,000,000 cm³, the volume in m³ is 250,000 cm³ ÷ 1,000,000 = 0.25 m³.

How do you convert the mass from kilograms to grams for density calculation?

Multiply the mass in kg by 1000: 1200 kg × 1000 = 1,200,000 grams.

What is the density of the body in kg/cm³?

Using mass in kg and volume in cm³: ρ = 1200 kg / 250,000 cm³ = 0.0048 kg/cm³.

How do you express the density in SI units (kg/m³)?

Convert volume to m³: 0.25 m³, then density = 1200 kg / 0.25 m³ = 4800 kg/m³.

Why is it important to convert units before calculating density?

Converting units ensures consistency and accuracy in calculations, especially when using formulas that require compatible units.

What is the significance of calculating density in physics?

Density helps determine whether an object will float or sink in a fluid and is essential in material

identification and analysis.

Can you provide the step-by-step calculation for the density in kg/m³?

Yes. First, convert volume: 250,000 cm³ = 0.25 m³. Then, density ρ = 1200 kg / 0.25 m³ = 4800 kg/m³.

What is the final answer for the density of the body in kg/m³?

The density of the body is 4800 kg/m³.

Additional Resources

The Volume Of A Body Weighing Is 1200 Kg Is 250000 [tex]cm^{3}[/tex] Find Its Density is a classic physics problem that involves understanding the fundamental relationship between mass, volume, and density. These three quantities are interconnected through a simple but powerful formula used extensively in physics and engineering to characterize materials and objects. This problem not only tests your ability to manipulate formulas but also enhances your comprehension of how physical properties relate to each other. In this article, we will explore the concepts step-by-step, explain the relevant formulas, and illustrate how to solve such problems systematically.

Understanding the Concept of Density

What Is Density?

Density is a measure of how much mass is contained within a specific volume. It is a physical property that helps identify and differentiate materials. The formal definition of density (□) is:

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

where:
- ρ (rho) is the density,
- m is the mass of the object,
- V is the volume occupied by the object.

Density is typically expressed in units such as grams per cubic centimeter (g/cm³) or kilograms per cubic meter (kg/m³). The choice of units depends on the context and the magnitude of the quantities involved.

Why Is Density Important?

- Material Identification: Different materials have characteristic densities.
- Buoyancy and Floating: Understanding whether an object floats or sinks in a fluid depends on its density relative to the fluid.
- Engineering Applications: Material selection in construction, manufacturing, and design requires knowledge of density.

Given Data and What Is Being Asked?

The problem provides:
- Mass (m) = 1200 kg
- Volume (V) = 250,000 cm^3

The question asks: Find Its Density (ρ).

Before proceeding, it’s essential to recognize the units involved. The mass is in kilograms, and the volume in cubic centimeters. To compute density accurately, the units should be consistent.

Converting Units for Consistency

Why Convert Units?

Using consistent units ensures the correctness of the calculation. Since the mass is in kilograms and volume in cubic centimeters, the density will be in kg/cm^3 unless we convert units.

Conversion Factors

- 1 kilogram (kg) = 1000 grams (g)
- 1 cubic centimeter (cm^3) remains the same, but if we prefer density in kg/m^3, we need to convert volume accordingly.

Option 1: Calculate density in kg/cm^3 directly

- Since mass is in kg and volume in cm^3, the density will be in kg/cm^3.

Option 2: Convert volume to m^3

- 1 m = 100 cm
- 1 m^3 = $(100\ cm)^3$ = 1,000,000 cm^3

Thus, volume in m³:

$$
V = 250{,}000\,cm^{3} \times \frac{1\,m^{3}}{1{,}000{,}000\,cm^{3}} = 0.25\,m^{3}
$$

And the mass remains 1200 kg.

Then, the density in kg/m³:

$$
\rho = \frac{1200\,kg}{0.25\,m^{3}} = 4800\,kg/m^{3}
$$

Calculating Density: Step-by-Step

Depending on the preferred units, we can proceed with either approach.

Approach 1: Density in kg/cm³

$$
\rho = \frac{m}{V} = \frac{1200\,kg}{250{,}000\,cm^{3}}
$$

Calculating:

$$
\rho = \frac{1200}{250{,}000} \, \text{kg/cm}^3
$$

$$
\rho = 0.0048\, \text{kg/cm}^3
$$

Approach 2: Density in kg/m³

Convert volume:

$$
V = 0.25\,m^{3}
$$

Calculate:

$$
\rho = \frac{1200\,kg}{0.25\,m^{3}} = 4800\,kg/m^{3}
$$

Note: The standard density units for many materials are in kg/m³, making Approach 2 more common in practical applications.

Final Answer and Interpretation

Based on the calculations, the density of the body is:

$$
\boxed{
\rho = 4800\,kg/m^{3}
}
$$

This value indicates that the object has a density of 4800 kilograms per cubic meter, which is typical for certain metals and dense materials.

Additional Insights and Related Concepts

Comparison with Common Materials

- Water: 1000 kg/m³
- Aluminum: ~2700 kg/m³
- Steel: ~7850 kg/m³
- Gold: ~19,320 kg/m³

Given this, the object’s density suggests it might be made of a material denser than aluminum but less dense than steel, possibly an alloy or composite.

Practical Applications

- Material Identification: Knowing the density helps identify the material.
- Design Considerations: Engineers use density to determine weight and buoyancy.
- Quality Control: Variations in density can indicate imperfections or material inconsistencies.

Features, Pros, and Cons of Density Calculations

Features:
- Simple formula that relates mass, volume, and density.
- Widely applicable across physics, chemistry, and engineering.
- Allows for quick material identification and analysis.

Pros:
- Straightforward calculation once units are consistent.
- Enables comparison between different materials.
- Critical for understanding buoyancy, stability, and structural integrity.

Cons:
- Requires careful unit conversions to avoid errors.
- Assumes uniform density throughout the object.
- Not suitable for objects with non-uniform density without more advanced methods.

Summary and Conclusion

The problem of finding the density of a body given its mass and volume is a foundational exercise in physics. By understanding the relationship:

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

and converting units appropriately, one can quickly determine the density. In our example, with a mass of 1200 kg and a volume of 250,000 cm^3 (or 0.25 m^3), the density is calculated as 4800 kg/m^3. This value provides insight into the material's nature and can guide further analysis or decision-making.

Understanding and applying the concept of density is essential not only academically but also practically in various industries and scientific research. Mastery of these calculations equips you with a fundamental tool for analyzing physical properties and solving real-world problems efficiently.

In summary, the key steps to solve such problems include identifying the given data, converting units for consistency, applying the formula for density, and interpreting the results within the context of material properties. Whether in academic exercises or industrial applications, the ability to accurately compute and interpret density remains a vital skill.

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