

A Cylinder Container Can Hold 2.45 L Of Water. Its Radius Is 4.00 Cm. What Is The Volume Of It In Cubic

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Understanding the volume of a cylinder is fundamental in various scientific, engineering, and everyday applications. Whether you're designing a container, calculating storage capacities, or just curious about the dimensions of everyday objects, knowing how to determine the volume of a cylinder is essential. In this article, we will explore how to calculate the volume of a cylindrical container that holds 2.45 liters of water, with a known radius of 4.00 centimeters.

Introduction to Cylinder Volume Calculation

A cylinder is a three-dimensional geometric shape characterized by two parallel circular bases connected by a curved surface. Its volume represents the capacity of the container – in this case, how much water it can hold. The general formula for the volume of a cylinder is:

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

Where:

- V is the volume
- r is the radius of the circular base
- h is the height of the cylinder
- π (pi) is approximately 3.1416

Given the radius and the volume in liters, our goal is to find the height of the cylinder, or vice versa, depending on the problem's framing.

Understanding the Given Data

Let's review the provided information:

- The container can hold 2.45 liters of water.
- The radius of the cylinder's base: 4.00 cm.

Our task is to determine the volume of this cylinder in cubic centimeters (cm^3). Since the volume is given in liters, conversion is necessary to express it in cubic centimeters for consistency, because 1 liter equals 1000 cubic centimeters.

Key conversions:

- 1 liter = 1000 cm^3
- Therefore, 2.45 liters = $2.45 \times 1000 = 2450 \text{ cm}^3$

Converting Volume from Liters to Cubic Centimeters

To work seamlessly with the formula, we convert the volume:

$$V = 2.45 \text{ liters} = 2450 \text{ cm}^3$$

This conversion simplifies calculations and ensures units are consistent.

Calculating the Height of the Cylinder

Knowing the volume and the radius, we can rearrange the volume formula to solve for height (h):

$$V = \pi r^2 h$$
$$h = \frac{V}{\pi r^2}$$

Plugging in the known values:

$$h = \frac{2450}{\pi \times (4.00)^2}$$

Calculating step-by-step:

1. Square the radius:

$$(4.00)^2 = 16$$

2. Multiply by (π):

$$\pi \times 16 \approx 3.1416 \times 16 \approx 50.2656$$

3. Divide the volume by this value:

$$h = \frac{2450}{50.2656} \approx 48.7 \text{ cm}$$

Result: The height of the cylinder is approximately 48.7 centimeters.

Understanding the Dimensions of the Cylinder

Knowing both the radius and height allows us to describe the physical dimensions of the container precisely:

- Radius: 4.00 cm
- Height: approximately 48.7 cm

This information can be useful for manufacturing, storage planning, or estimating the physical size of the container.

Calculating the Exact Volume in Cubic Centimeters

While we've already converted and calculated the volume based on the provided data, let's verify the calculation by directly substituting into the formula:

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

Using $(r = 4.00 \text{ cm})$ and $(h \approx 48.7 \text{ cm})$:

$$V = 3.1416 \times 16 \times 48.7$$

Calculations:

- $(3.1416 \times 16 = 50.2656)$
- $(50.2656 \times 48.7 \approx 2450 \text{ cm}^3)$

This confirms our earlier conversion and calculations.

Applications and Practical Implications

Understanding the volume of a cylinder has numerous practical applications across different fields:

- Industrial Storage: Designing tanks and containers requires precise volume calculations to optimize space.
- Cooking and Food Industry: Cylindrical containers like cans are manufactured with specific capacities.
- Laboratory Equipment: Measuring cylinders and other apparatus depend on accurate volume calculations.
- Engineering Projects: Structural and mechanical designs often involve cylindrical components where volume and dimensions are critical.

Additional Calculations and Considerations

1. Surface Area Calculation

In some cases, knowing the surface area of the cylinder is useful, especially for insulation or coating purposes.

Surface area formula:

$$A = 2\pi r^2 + 2\pi r h$$

Where:

- $(2\pi r^2)$ is the area of the two circular bases.
- $(2\pi r h)$ is the lateral surface area.

Calculating:

- Base areas:

$$2 \times 3.1416 \times 16 = 100.53 \text{ cm}^2$$

- Lateral surface area:

$$2 \times 3.1416 \times 4 \times 48.7 \approx 2 \times 3.1416 \times 4 \times 48.7 \approx 1228.94 \text{ cm}^2$$

- Total surface area:

$$100.53 + 1228.94 \approx 1329.47 \text{ cm}^2$$

2. Volume Validation

Alternatively, if the height is known, the volume can be computed directly, confirming the container's capacity.

3. Practical Design Consideration

When designing a cylindrical container with a known capacity, engineers can use these calculations to determine the optimal dimensions for manufacturing, considering factors like material strength, stability, and usability.

Summary of Key Findings

- The container's volume is 2450 cm³.
- The height of the cylinder, based on the given volume and radius, is approximately 48.7 centimeters.
- The calculations are consistent with the volume formula $(V = \pi r^2 h)$.
- Understanding these dimensions helps in various applications, from manufacturing to scientific experiments.

Conclusion

Calculating the volume of a cylinder involves straightforward mathematical principles grounded in geometry. By knowing the radius and volume, we can determine the height of the cylinder, which is crucial for designing containers, understanding storage capacity, and performing scientific calculations. The key steps involve converting units appropriately, applying the volume formula, and verifying calculations for accuracy.

In summary, a cylinder container that holds 2.45 liters of water with a radius of 4.00 cm has a volume of 2450 cubic centimeters and a height of approximately 48.7 centimeters. This knowledge empowers engineers, scientists, and students to approach problems involving cylindrical shapes confidently and accurately.

Keywords for SEO optimization:

- Cylinder volume calculation
- Cylinder capacity in cubic centimeters
- How to find height of a cylinder
- Volume of a cylindrical container
- Convert liters to cubic centimeters
- Engineering calculations for cylinders
- Geometric formulas for cylinders
- Practical applications of cylinder volume

Frequently Asked Questions

What is the formula to find the volume of a cylinder?

The volume of a cylinder is given by $V = \pi r^2 h$, where r is the radius and h is the height.

Given the radius of 4.00 cm and volume of 2.45 L, how can we find the height of the cylinder?

First, convert the volume to cubic centimeters ($1 \text{ L} = 1000 \text{ cm}^3$), so $2.45 \text{ L} = 2450 \text{ cm}^3$. Then, rearrange $V = \pi r^2 h$ to find $h = V / (\pi r^2)$. Plug in $r = 4 \text{ cm}$ to find h .

What is the approximate height of the cylinder with a 4.00 cm radius and 2.45 L volume?

Using $V = 2450 \text{ cm}^3$, $r = 4 \text{ cm}$, $h = 2450 / (\pi \times 4^2) \approx 2450 / (\pi \times 16) \approx 2450 / 50.27 \approx 48.7 \text{ cm}$.

How do you convert liters to cubic centimeters for volume calculations?

Since 1 liter equals 1000 cubic centimeters, multiply the volume in liters by 1000 to convert to cm^3 .

Is the given volume of 2.45 L consistent with the cylinder's radius of 4.00 cm?

Yes, converting 2.45 L to 2450 cm^3 and calculating the height with the given radius yields a reasonable height of approximately 48.7 cm, consistent with the cylinder's dimensions.

What is the approximate volume of the cylinder in cubic centimeters?

The volume is approximately 2450 cubic centimeters, as given by the initial volume in liters converted to cm^3 .

Additional Resources

A Cylinder Container Can Hold 2.45 L Of Water. Its Radius Is 4.00 Cm. What Is The Volume Of It In Cubic?

Understanding the capacity and dimensions of cylindrical containers is fundamental in both everyday life and scientific contexts. When it comes to calculating the volume of such containers, precise measurements and clear formulas are essential. In this analysis, we explore the problem of determining the exact volume of a cylindrical water container with a specified capacity and radius, emphasizing the importance of unit conversions, geometric principles, and practical applications.

Introduction: The Significance of Volume Calculations in Cylindrical Containers

Cylindrical containers are ubiquitous—found in laboratories, kitchens, industrial storage units, and even in packaging. Their geometric simplicity makes volume calculations straightforward when the necessary measurements are known. However, accurate conversion and understanding of units are crucial for applications ranging from scientific experiments to manufacturing processes.

Knowing the volume of a container helps in:

- Ensuring proper storage capacity
- Calculating material requirements for manufacturing
- Understanding liquid quantities in scientific experiments
- Designing containers for specific applications

The problem at hand involves a container that holds 2.45 liters of water, with a radius of 4.00 centimeters. The task is to determine the container's volume in cubic centimeters, a more fundamental measurement that directly relates to its physical dimensions.

Understanding the Problem: Key Data and Units

Before delving into calculations, let's clarify the given data:

- Capacity of the container: 2.45 liters
- Radius of the container (r): 4.00 centimeters

The goal is to determine the actual volume of the container in cubic centimeters (cm^3).

Why cubic centimeters?

Cubic centimeters are a standard volume unit in the metric system, directly

matching the dimensions of the container, which are given in centimeters. Since 1 liter equals 1000 cubic centimeters, converting liters to cubic centimeters is straightforward and essential for consistency.

Converting Capacity from Liters to Cubic Centimeters

Step 1: Recall the conversion factor:

- 1 liter = 1000 cm³

Step 2: Convert the given capacity:

- 2.45 liters = 2.45 × 1000 cm³ = 2450 cm³

This conversion reveals the total volume the container holds, which is crucial for the subsequent geometric analysis.

Understanding the Geometry: The Cylinder Formula

The volume V of a cylinder is given by the formula:

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

Where:

- V = volume of the cylinder
- $\pi \approx 3.1416$
- r = radius of the base (in centimeters)
- h = height of the cylinder (in centimeters)

Given that $r = 4.00$ cm and $V = 2450$ cm³, the problem reduces to solving for h , the height of the container.

Calculating the Height of the Cylinder

Step 1: Rearrange the volume formula to solve for h :

$$h = V / (\pi r^2)$$

Step 2: Insert the known values:

$$h = 2450 \text{ cm}^3 / (\pi \times (4.00 \text{ cm})^2)$$

Calculate the denominator:

$$(4.00 \text{ cm})^2 = 16.00 \text{ cm}^2$$

$$\pi \times 16.00 \text{ cm}^2 \approx 3.1416 \times 16.00 \approx 50.2656 \text{ cm}^2$$

Step 3: Compute the height:

$$h \approx 2450 \text{ cm}^3 / 50.2656 \text{ cm}^2 \approx 48.7 \text{ cm}$$

Result: The height of the container is approximately 48.7 centimeters.

This calculation indicates that the container, with a radius of 4 cm, must be about 48.7 cm tall to hold 2.45 liters of water.

Confirming the Volume: Cross-Verification

Given the initial data, it's good practice to verify the calculation:

$$V = \pi r^2 h \approx 3.1416 \times 16.00 \text{ cm}^2 \times 48.7 \text{ cm} \approx 3.1416 \times 16.00 \times 48.7 \approx 3.1416 \times 779.2 \approx 2447.5 \text{ cm}^3$$

This is very close to the calculated 2450 cm³, with the minor discrepancy due to rounding. Such precision confirms the reliability of the calculation process.

Implications and Practical Considerations

Understanding the volume and height of the container has several practical implications:

- Design and Manufacturing: Knowing the exact height required for a specific volume allows manufacturers to produce containers that meet precise specifications, ensuring they can hold the intended amount of liquid without excess space or spillage risk.

- **Storage Optimization:** In environments where space is limited, understanding the dimensions ensures efficient storage solutions, especially when stacking or fitting containers into designated areas.
- **Scientific Applications:** Precise volume measurements are critical when conducting experiments that depend on accurate liquid quantities, such as chemical reactions or biological studies.
- **Material Estimation:** For manufacturing, knowing the dimensions helps estimate the amount of material (metal, plastic, glass) needed to produce the container, influencing cost and resource planning.

Extended Analysis: Variations and Further Calculations

While the primary goal was to find the volume in cubic centimeters, several related calculations could enrich understanding:

1. Surface Area Calculation

The surface area (A) of a cylinder includes the lateral surface and the two circular ends:

$$A = 2\pi r h + 2\pi r^2$$

Using $r = 4.00$ cm and $h \approx 48.7$ cm:

- Lateral surface area: $2\pi r h \approx 2 \times 3.1416 \times 4.00 \times 48.7 \approx 2 \times 3.1416 \times 194.8 \approx 2 \times 611.4 \approx 1222.8$ cm²
- Top and bottom area: $2\pi r^2 \approx 2 \times 3.1416 \times 16 \approx 2 \times 50.2656 \approx 100.53$ cm²
- Total surface area: $\approx 1222.8 + 100.53 \approx 1323.33$ cm²

This information is valuable for material estimation and surface finishing considerations.

2. Material Thickness and Construction

If the container's walls are of a known thickness, say t , the internal volume can be adjusted accordingly, affecting the total height or material used. Such considerations are crucial in manufacturing processes.

3. Volume Adjustment for Different Radii

Suppose the radius increases or decreases; understanding how it affects the

height for the same volume can inform design choices.

Broader Context: The Role of Geometry in Real-World Applications

The calculation exemplifies how fundamental geometric principles underpin many real-world scenarios. From designing beverage bottles to constructing industrial tanks, understanding the relationships between dimensions and volume is vital.

In the context of environmental management, such calculations help optimize water storage solutions, ensuring minimal waste and maximum efficiency. In manufacturing, they influence cost-effectiveness and resource allocation.

Furthermore, educationally, mastering these calculations sharpens problem-solving skills and deepens understanding of how mathematical formulas translate into tangible objects.

Conclusion: Synthesis of Data and Geometric Principles

In conclusion, the detailed analysis reveals that a cylindrical container capable of holding 2.45 liters of water, with a radius of 4.00 centimeters, must have a volume of approximately 2450 cubic centimeters. This volume correlates with a height of roughly 48.7 centimeters, derived through the application of the cylinder volume formula and unit conversions.

This exploration underscores the importance of precise measurements, conversions, and geometric understanding in practical applications. Whether designing containers, managing resources, or conducting scientific research, such foundational calculations are indispensable.

By comprehensively analyzing the problem, we appreciate how the simplicity of the cylinder's shape masks the complexity and utility of geometric principles in everyday life and industry. This case exemplifies the seamless connection between mathematical theory and practical utility, highlighting the enduring relevance of geometry in solving real-world problems.

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