

A Cylinder Has A Base Diameter Of 10centimeters And A Height Of 7 Centimeters. What Is Its Volume In

A Cylinder Has A Base Diameter Of 10 centimeters And A Height Of 7 centimeters. What Is Its Volume In this comprehensive guide, we will explore how to calculate the volume of a cylinder when given specific dimensions. Understanding the process is essential for students, educators, engineers, and anyone interested in geometry and practical applications. We will delve into the formula, step-by-step calculations, related concepts, and real-world examples to provide a thorough understanding of this mathematical problem.

Understanding the Cylinder and Its Dimensions

What Is a Cylinder?

A cylinder is a three-dimensional geometric shape characterized by two parallel circular bases connected by a curved surface. It resembles everyday objects such as cans, pipes, and tubes. The key features of a cylinder include:

- Two congruent, parallel circular bases
- A curved lateral surface connecting the bases
- The height (or length) of the cylinder, which is the perpendicular distance between the bases

Given Dimensions

In our problem:

- The diameter of the base is 10 centimeters
- The height of the cylinder is 7 centimeters

From the diameter, we can derive the radius, which is essential for calculating the volume.

Calculating the Volume of a Cylinder

The Formula for Volume

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

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

Where:

- (r) is the radius of the base
- (h) is the height of the cylinder
- (π) is approximately 3.1416

Step-by-Step Calculation

Let's break down the calculation process:

1. **Determine the radius:** Since the diameter (d) is 10 cm, the radius (r) is half of that:

$$r = \frac{d}{2} = \frac{10\text{ cm}}{2} = 5\text{ cm}$$

2. **Insert the known values into the formula:**

$$V = \pi \times (5\text{ cm})^2 \times 7\text{ cm}$$

3. **Calculate the squared radius:**

$$(5\text{ cm})^2 = 25\text{ cm}^2$$

4. **Multiply by the height and pi:**

$$V = 3.1416 \times 25\text{ cm}^2 \times 7\text{ cm}$$

5. **Perform the multiplication:**

$$V = 3.1416 \times 25 \times 7$$

Calculating step-by-step:

$$25 \times 7 = 175$$

$$V = 3.1416 \times 175 \approx 549.78\text{ cm}^3$$

Thus, the volume of the cylinder is approximately 549.78 cubic centimeters.

Understanding the Significance of the Calculation

Why Is Calculating Volume Important?

Determining the volume of a cylinder has practical applications in various fields:

- Manufacturing: Knowing how much material is needed to produce cylindrical objects
- Science: Calculating the capacity of containers
- Engineering: Designing pipes, tanks, and other cylindrical structures
- Everyday life: Estimating liquid capacities in bottles and cans

Real-World Examples

- A soda can with a diameter of 10 cm and height of 7 cm can hold approximately 550 cm³ of liquid.
- A cylindrical water tank with these dimensions can store nearly 550 liters if scaled appropriately (considering 1 liter = 1000 cm³, the actual tank would be about 0.55 liters, so larger tanks are scaled versions).

Additional Concepts Related to Cylinder Volume

Surface Area of a Cylinder

While the focus here is volume, understanding surface area complements the knowledge:

- Surface area (A) includes the area of both bases and the lateral surface:

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

- Useful for painting, coating, or material estimation.

Units and Conversion

- Always ensure consistency in units during calculations.
- Convert units when necessary, e.g., from centimeters to meters for larger scale applications.

Summary of Key Points

- The core formula for the volume of a cylinder is $(V = \pi r^2 h)$.
- Given the diameter, find the radius by dividing by 2.
- Plug the radius and height into the formula and compute.
- For the given problem, the volume is approximately 549.78 cm³.
- Understanding these calculations is valuable for practical and educational

purposes.

Conclusion

Calculating the volume of a cylinder with a base diameter of 10 centimeters and a height of 7 centimeters involves straightforward application of the geometric formula. By understanding how to derive the radius and perform the necessary multiplications, students and professionals can accurately determine the capacity of cylindrical objects. Whether in academic settings, engineering designs, or everyday applications, mastering these calculations enhances problem-solving skills and practical understanding of three-dimensional shapes.

If you want to explore further, consider calculating the surface area, experimenting with different dimensions, or applying these principles to real-world design challenges.

Frequently Asked Questions

How do you calculate the volume of a cylinder with a given diameter and height?

The volume of a cylinder is calculated using the formula $V = \pi r^2 h$, where r is the radius (half of the diameter) and h is the height.

What is the radius of a cylinder with a diameter of 10 centimeters?

The radius is half of the diameter, so it is $10 \text{ cm} \div 2 = 5 \text{ centimeters}$.

How do you compute the volume of this specific cylinder with a diameter of 10 cm and height of 7 cm?

First, find the radius (5 cm), then apply the formula: $V = \pi \times (5)^2 \times 7 = \pi \times 25 \times 7 = 175\pi$ cubic centimeters.

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

Using $\pi \approx 3.1416$, the volume is approximately $175 \times 3.1416 \approx 549.78$ cubic centimeters.

Why is it important to convert the diameter to radius when calculating the volume of a cylinder?

Because the formula for the volume involves the radius squared, and the radius is half the diameter; using the radius ensures accurate calculation.

What are some common applications of calculating the volume of cylinders?

Applications include determining the capacity of containers like tanks, pipes, and cans in various engineering and manufacturing contexts.

Additional Resources

Cylinder Volume Calculation: An Expert Breakdown

When exploring the fascinating world of geometry and three-dimensional shapes, the cylinder stands out as one of the most common and versatile figures. Whether in everyday objects like cans, pipes, or storage tanks, cylinders are integral to numerous applications. Understanding how to determine the volume of a cylinder is essential for engineers, students, architects, and hobbyists alike. In this detailed review, we'll analyze a specific cylinder with a base diameter of 10 centimeters and a height of 7 centimeters, guiding you through the calculation process step-by-step, and explaining the underlying principles for a comprehensive grasp of the concept.

Understanding the Basics of a Cylinder

Before diving into the calculation, it's crucial to understand what a cylinder is and the key parameters involved.

What Is a Cylinder?

A cylinder is a three-dimensional geometric shape characterized by:

- Two identical circular bases
- A curved surface connecting these bases

Visually, think of a typical soda can or a pipe segment. The shape is symmetrical around its central axis, making calculations straightforward once the parameters are known.

Key Parameters of the Cylinder in Question

For this specific cylinder:

- Base Diameter (d): 10 centimeters
- Height (h): 7 centimeters

From these, we can derive other important measurements:

- Radius (r): Half of the diameter, which is essential for volume calculations.

$$r = \frac{d}{2} = \frac{10\text{ cm}}{2} = 5\text{ cm}$$

Understanding these two parameters—radius and height—is fundamental for calculating the volume.

The Formula for Cylinder Volume

The volume of a cylinder is a measure of the space contained within it. The standard formula is:

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

Where:

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

This formula derives from the area of the circular base (πr^2) multiplied by the height, effectively stacking the base area along the height to fill the entire volume.

Step-by-Step Calculation of the Cylinder's Volume

Now, let's delve into the actual calculation for this specific cylinder.

Step 1: Identify the Known Values

- Radius, $r = 5\text{ cm}$
- Height, $h = 7\text{ cm}$

Step 2: Apply the Volume Formula

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

Plugging in the known values:

$V =$

$$V = 3.1416 \times (5\text{ cm})^2 \times 7\text{ cm}$$

Step 3: Simplify the Equation

Calculate (r^2) :

$$(5\text{ cm})^2 = 25\text{ cm}^2$$

Multiply by (π) :

$$3.1416 \times 25\text{ cm}^2 = 78.54\text{ cm}^2$$

Then multiply by the height:

$$78.54\text{ cm}^2 \times 7\text{ cm} = 549.78\text{ cm}^3$$

Final Volume:

$$V \approx 549.78\text{ cm}^3$$

Thus, the volume of the cylinder is approximately 549.78 cubic centimeters.

Interpreting the Results and Practical Implications

Knowing that the volume is about 550 cubic centimeters offers valuable insights across various contexts:

- **Storage Capacity:** This figure indicates how much liquid or material the cylinder can hold. For instance, a cylindrical container with these dimensions can store just over half a liter of fluid (since 1 liter = 1000 cm³).
- **Design Considerations:** Engineers designing cylindrical components can use this information to optimize space, weight, and material usage.
- **Educational Purposes:** Students can relate this calculation to real-world objects, enhancing spatial awareness and mathematical understanding.

Additional Factors and Considerations

While the calculation here is straightforward, several other factors might influence or refine the process in practical applications.

Rounding and Precision

Depending on the context, you might round the final volume to a certain decimal place for simplicity. For most practical purposes, approximating to 550 cm³ suffices.

Material Thickness and Real-world Variations

In manufacturing, the thickness of the cylinder's walls could affect the internal volume. For example:

- Thick-walled cylinders: The internal volume would be less if the walls have significant thickness.
- Manufacturing tolerances: Slight variations in dimensions could lead to small differences in volume.

These considerations are vital in engineering and manufacturing, where precision impacts functionality.

Conversions and Units

If you need the volume in other units, conversions are straightforward:

Unit	Conversion Factor	Volume Equivalent
liters	1 liter = 1000 cm ³	0.55 liters (~550 cm ³)
cubic meters	1 m ³ = 1,000,000 cm ³	0.00055 m ³

Real-World Applications and Examples

Understanding the volume of a cylinder has multiple practical applications:

- Packaging and Storage: Determining how much content a cylindrical container can hold.
- Manufacturing: Calculating material requirements for manufacturing cylindrical parts.
- Fluid Dynamics: Estimating flow rates and capacities in piping systems.
- Educational Demonstrations: Visualizing the relationship between dimensions and volume for students.

Conclusion: Mastering Cylinder Volume Calculations

In summary, the volume of a cylinder with a base diameter of 10 centimeters and a height of 7 centimeters is approximately 549.78 cubic centimeters. This calculation exemplifies how foundational geometric formulas can be practically applied across various disciplines. Whether designing a new product, analyzing a storage solution, or simply enhancing mathematical literacy, understanding the process behind calculating cylinder volume empowers you to approach similar problems with confidence and clarity.

Remember, grasping the core principles—identifying the radius, applying the formula, and executing precise calculations—forms the backbone of effective problem-solving in geometry and related fields. As you encounter different cylinders with varying dimensions, this method remains your go-to approach for accurate and insightful volume estimations.

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