The Volume Of A Cylinder Is 90 Cm3. If The Radius Is 3 Cm, What Is The Height Of The Cylinder?(A) 15

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Understanding the properties of cylinders and how to calculate their volume is fundamental in geometry, engineering, and various real-world applications. Whether you're a student preparing for exams, a professional working on design projects, or simply someone interested in mathematical computations, grasping the relationship between a cylinder's dimensions is essential. In this article, we will explore how to determine the height of a cylinder when its volume and radius are known, specifically focusing on the problem: The volume of a cylinder is 90 cm^3. If the radius is 3 cm, what is the height of the cylinder?

Let's delve into the concepts, formulas, and step-by-step calculations to find the answer, which notably turns out to be 15 cm. This process not only enhances your problem-solving skills but also deepens your understanding of geometric principles.

Understanding the Cylinder and Its Volume

A cylinder is a three-dimensional geometric shape characterized by two parallel circular bases connected by a curved surface. Its volume indicates how much space the shape occupies and is a crucial parameter in many fields — from manufacturing to architecture.

The formula for calculating the volume V of a right circular cylinder is:

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

Where:
- V = Volume of the cylinder
- π (Pi) ≈ 3.1416
- r = Radius of the circular base
- h = Height of the cylinder

Knowing the volume and radius, the goal is to find the height h.

Given Data and What We Need to Find

Let's consider the provided data:

- Volume, $V = 90\, \text{cm}^3$
- Radius, $r = 3\, \text{cm}$

The question asks: What is the height h of the cylinder?

Knowing these, we can rearrange the volume formula to solve for h:

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

This straightforward rearrangement sets the stage for our calculations.

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

Let's proceed with the calculation:

Step 1: Write down the known quantities

- $V = 90\, \text{cm}^3$
- $r = 3\, \text{cm}$
- $\pi \approx 3.1416$

Step 2: Calculate r^2

$$ r^2 = (3\, \text{cm})^2 = 9\, \text{cm}^2 $$

Step 3: Plug values into the formula for h

$$ h = \frac{90}{3.1416 \times 9} $$

Step 4: Calculate the denominator

$$ 3.1416 \times 9 = 28.2744 $$

Step 5: Final calculation

$$ h = \frac{90}{28.2744} \approx 3.18\, \text{cm} $$

Wait! The above calculation suggests a height of approximately 3.18 cm, which contradicts the initial statement that the answer is 15.

This discrepancy indicates an important reconsideration. Let's verify the problem's context and calculations.

Reassessing the Problem

The initial statement mentions: The volume of a cylinder is 90 cm³. If the radius is 3 cm, what is the height? and indicates an answer of 15.

But given our calculations, the height should be approximately 3.18 cm. So, is there a mistake or a different interpretation?

Possible explanation: The initial problem might be referencing a different volume, or perhaps there's a typo. Alternatively, maybe the problem states the volume as 900 cm^3 instead of 90 cm^3.

Let’s check what happens if the volume is 900 cm^3.

$$ h = \frac{900}{3.1416 \times 9} = \frac{900}{28.2744} \approx 31.83\, \text{cm} $$

No, that doesn’t give 15 either.

Alternative approach: Considering Volume as 135 cm^3

Suppose the volume is 135 cm^3:

$$ h = \frac{135}{3.1416 \times 9} = \frac{135}{28.2744} \approx 4.77\, \text{cm} $$

No, still not matching.

Potential Clarification: The problem states the answer is 15 cm

Given that the answer is 15, perhaps the volume is being considered in different units or there's a misinterpretation.

Let’s verify what volume would correspond to a height of 15 cm with the same radius:

$$ V = \pi r^2 h = 3.1416 \times 9 \times 15 = 3.1416 \times 135 = 424.115\, \text{cm}^3 $$

So, if the height is 15 cm, the volume is approximately 424.115 cm^3, not 90 cm^3.

Conclusion of Reassessment

Given the calculations, if the volume is 90 cm^3 and radius is 3 cm, the height should be approximately 3.18 cm, not 15 cm. Conversely, if the height is 15 cm and radius is 3 cm, the volume is approximately 424.1 cm^3.

This indicates that the initial statement might contain a typo or misinterpretation. For clarity, we will proceed under the assumption that the problem is asking:

"The volume of a cylinder is 90 cm^3. If the radius is 3 cm, what is the height of the cylinder?"

and that the answer is approximately 3.18 cm.

Understanding the Significance of the Calculation

Calculating the height of a cylinder when volume and radius are known has many practical applications:

- Engineering: Designing tanks or pipes with specific capacities.
- Manufacturing: Cutting materials to precise dimensions.
- Construction: Planning storage units or columns.
- Education: Enhancing geometric problem-solving skills.

By mastering this calculation, students and professionals can efficiently determine necessary dimensions in various projects.

Additional Factors and Variations in the Calculation

While the primary formula is straightforward, real-world scenarios might involve additional considerations:

- Material thickness: When considering hollow cylinders.
- Measurement units: Ensuring consistency across calculations.
- Precision: Rounding off to appropriate decimal places.
- Different shapes: Extending principles to other geometric forms.

Summary of Key Steps to Find the Height of a Cylinder

To summarize, the fundamental steps are:

1. Identify the given data: Volume V and radius r.
2. Recall the volume formula: $V = \pi r^2 h$.
3. Rearrange to solve for height: $h = \frac{V}{\pi r^2}$.
4. Substitute the known values.
5. Perform the calculation carefully, considering the value of π.
6. Interpret the result, ensuring it makes sense contextually.

Final Thoughts and Practical Tips

- Always double-check your units to avoid confusion.
- Use a calculator for precise calculations involving π.
- Round off your final answer appropriately, based on the context.

- Remember that small errors in input data can significantly impact the outcome.

Conclusion

Understanding how to calculate the height of a cylinder when its volume and radius are known is a fundamental aspect of geometry. In the specific case where the volume is 90 cm^3 and the radius is 3 cm, the height of the cylinder is approximately 3.18 cm, based on standard mathematical calculations.

However, if the problem's context indicates that the height is 15 cm, then the corresponding volume would be approximately 424.1 cm^3, assuming the same radius. This highlights the importance of carefully analyzing problem statements and verifying calculations.

Mastering these concepts enables you to solve various real-life problems involving cylinders, whether in academic settings, engineering designs, or everyday scenarios. Keep practicing with different values and contexts to strengthen your geometric problem-solving skills.

Keywords: cylinder volume calculation, geometric formulas, how to find cylinder height, volume of a cylinder, radius and height, mathematical problem-solving, geometry tips, practical applications of cylinder volume

Frequently Asked Questions

What is the formula for 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 volume of a cylinder is 90 cm^3 and the radius is 3 cm, how do you find the height?

Use the formula $V = \pi r^2 h$, then solve for h: $h = V / (\pi r^2)$. Plug in the values to get $h = 90 / (\pi \times 3^2)$.

What is the calculated height of the cylinder if the volume is 90 cm^3 and radius is 3 cm?

The height is approximately 3.18 cm, calculated as $h = 90 / (\pi \times 9) \approx 90 / 28.27 \approx 3.18$ cm.

Is the given answer of 15 cm for the height correct based on

the provided volume and radius?

No, based on calculations, the height is approximately 3.18 cm, not 15 cm.

Why does the calculated height differ from the answer choice of 15 cm?

Because the actual calculation shows a height of about 3.18 cm, indicating that 15 cm is not the correct height for the given volume and radius.

How do you verify the correctness of the height of a cylinder given its volume and radius?

Calculate the height using $h = V / (\pi r^2)$. If the result matches the given options, it confirms the correct height.

What is the importance of π in calculating the volume of a cylinder?

π is essential because it appears in the formula $V = \pi r^2 h$, representing the relationship between the circular base area and height.

Can the volume of a cylinder be calculated if only the height and radius are known?

Yes, using $V = \pi r^2 h$, you can find the volume if both height and radius are known.

What are common mistakes when calculating the volume of a cylinder?

Common mistakes include using incorrect formulas, confusing radius and diameter, or miscalculating π or the squared radius.

Based on the correct calculation, what should be the approximate height of the cylinder with volume 90 cm^3 and radius 3 cm?

The approximate height should be about 3.18 cm, not 15 cm.

Additional Resources

The Volume Of A Cylinder Is 90 Cm^3. If The Radius Is 3 Cm, What Is The Height Of The Cylinder?

Introduction

Mathematics often appears as an abstract discipline, yet its principles are deeply embedded in everyday life. Among the fundamental geometric shapes, the cylinder is one of the most common, appearing in everything from industrial containers to biological structures. Understanding how to determine the dimensions of a cylinder based on its volume can be both practically useful and intellectually stimulating.

One intriguing problem in this context asks: If the volume of a cylinder is 90 cm^3 and its radius is 3 cm, what is its height? This question, seemingly straightforward, invites a detailed exploration of the principles of geometry and volume calculation, as well as the mathematical reasoning involved in solving such problems.

The Geometric Foundations of a Cylinder

Definition and Components

A cylinder is a three-dimensional shape characterized by two parallel circular bases connected by a curved surface. Its primary dimensions include:

- Radius (r): the distance from the center to any point on the circular base.
- Height (h): the distance between the two bases, perpendicular to them.
- Volume (V): the measure of the space occupied within the cylinder.

The mathematical formula for the volume of a cylinder is:

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

where:

- $ V $ is the volume,
- $ r $ is the radius,
- $ h $ is the height,
- $ \pi $ (pi) is approximately 3.1416.

Understanding this formula is essential for solving problems related to cylindrical shapes.

Dissecting the Problem: Given Data and Goal

The problem provides:

- Volume $ V = 90 \, \text{cm}^3 $,
- Radius $ r = 3 \, \text{cm} $.

The task is to find the height $ h $.

This problem is a classic application of the volume formula, where the radius and volume are known,

and the height is unknown.

Step-by-Step Solution

Step 1: Write the Volume Formula

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

Substituting the known values:

$$
90 = \pi \times (3)^2 \times h
$$

Simplify:

$$
90 = \pi \times 9 \times h
$$

$$
90 = 9\pi h
$$

Step 2: Isolate the Height h

To find h:

$$
h = \frac{90}{9\pi}
$$

$$
h = \frac{10}{\pi}
$$

Step 3: Numerical Calculation

Using $\pi \approx 3.1416$:

$$
h \approx \frac{10}{3.1416} \approx 3.183 \, \text{cm}
$$

Interpreting the Result

The calculation indicates that, with a radius of 3 cm and a volume of 90 cm^3, the height of the cylinder is approximately 3.18 cm.

This result contrasts sharply with the multiple-choice options often presented in examination contexts, such as (A) 15 cm. The discrepancy suggests that the problem may involve a different interpretation or a typographical error in the options provided.

Critical Analysis and Common Pitfalls

Misinterpretation of the Problem

- Assuming the volume is in different units: If volume were in different units, calculations would change.
- Misreading the formula: Confusing the formula for volume with surface area or other properties.

Mathematical Oversights

- Forgetting to square the radius: The r^2 term is crucial; neglecting it leads to incorrect results.
- Forgetting to include π: Omitting π or approximating it improperly affects accuracy.

Re-evaluating the Multiple-Choice Option of 15 cm

Suppose the problem was misinterpreted, or the options intended to test understanding of the formula. Could the height be 15 cm?

Let's verify:

$$
V = \pi r^2 h = 3.1416 \times 9 \times 15 \approx 3.1416 \times 135 = 424.12 \, \text{cm}^3
$$

which is clearly much larger than 90 cm^3.

So, the option of 15 cm does not match the volume given unless the volume or radius is different.

Broader Implications and Applications

Understanding the relationship between the dimensions of a cylinder is crucial in various fields:

- Engineering: designing tanks, pipes, and structural components.
- Biology: modeling blood vessels and cellular structures.
- Manufacturing: calculating the capacity of containers.

This problem highlights the importance of precise calculations and comprehension of geometric

formulas.

Conclusion

The analysis confirms that, given a cylinder with a radius of 3 cm and a volume of 90 cm^3, the height calculates to approximately 3.18 cm. The multiple-choice option of 15 cm does not align with the mathematical solution, suggesting either a misprint or a different context.

This example underscores the importance of understanding fundamental formulas and their correct application. It also illustrates the necessity of careful problem interpretation to avoid misconceptions. As such, the problem serves as a valuable educational tool for students and professionals engaging with spatial calculations and geometric reasoning.

Final Remarks

While the initial question appears simple, its thorough analysis reveals the depth of understanding required to accurately interpret and solve geometric problems. The key takeaway is that precision in applying formulas, attention to units, and critical evaluation of options are essential skills in both academic and real-world contexts involving geometry and measurement.

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