

The Area Of The Base Of A Rectangular Prism Is 12.7 Sq In And The Height Is 7.6 In. What Is The Volume?

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Understanding the Problem

When working with three-dimensional shapes like rectangular prisms, key measurements such as the area of the base and the height are essential for calculating the volume. In this scenario, we are provided with:

- The area of the base: 12.7 square inches
- The height of the prism: 7.6 inches

The goal is to determine the volume of this rectangular prism, which is a measure of the space it occupies in three dimensions.

Fundamental Concepts of Rectangular Prisms

What Is a Rectangular Prism?

A rectangular prism, also known as a cuboid, is a three-dimensional shape with six rectangular faces, twelve edges, and eight vertices. Its faces are rectangles, and it is characterized by three dimensions:

- Length (l)
- Width (w)
- Height (h)

The shape's volume depends on these three measurements.

Key Formulas

- Area of the Base (A): The area of the rectangle that forms the base of the prism.
- Volume (V): The total space occupied by the prism, calculated as:

$$V = \text{Area of Base} \times \text{Height}$$

In this case, since the base is a rectangle, its area is given by:

$$A = l \times w$$

Calculating the Volume

Given Data

- Area of the base, $(A = 12.7, \text{sq in})$
- Height, $(h = 7.6, \text{in})$

Step-by-Step Calculation

1. Identify the known quantities:

$$A = 12.7, \text{sq in}$$

$$h = 7.6, \text{in}$$

2. Use the volume formula:

$$V = A \times h$$

3. Substitute the known values:

$$V = 12.7, \text{sq in} \times 7.6, \text{in}$$

4. Perform the multiplication:

$$V = 12.7 \times 7.6$$

To multiply these, you can use standard multiplication or break it down:

- Multiply 12.7 by 7:

$$12.7 \times 7 = 89.0$$

- Multiply 12.7 by 0.6:

$$12.7 \times 0.6 = 7.62$$

- Add the two results:

$$89.0 + 7.62 = 96.62$$

5. Final answer:

$$V = 96.62 \text{ cubic inches}$$

Understanding the Result

The volume of the rectangular prism is 96.62 cubic inches. This measurement represents the total three-dimensional space contained within the prism.

Implications and Practical Applications

Knowing how to calculate the volume of a rectangular prism has numerous practical uses, including:

- Packaging: Determining the capacity of boxes.

- Construction: Calculating the amount of material needed for storage or walls.
- Manufacturing: Understanding how much product can fit within a given space.
- Education: Reinforcing concepts of geometry and volume calculations.

Additional Considerations

Understanding Base Dimensions

Since the area of the base is given as 12.7 sq in, and the base is rectangular, this means:

$$l \times w = 12.7$$

Without additional information, the specific dimensions of length and width cannot be determined individually; only their product is known.

Effect of Changing Dimensions

If the base dimensions or height change, the volume will correspondingly change. The direct proportionality between the base area, height, and volume underscores the importance of accurate measurements.

Summary

To summarize, calculating the volume of a rectangular prism involves multiplying the area of its base by its height. Given that the base area is 12.7 square inches and the height is 7.6 inches, the volume is:

$$V = 12.7 \times 7.6 = 96.62, \text{ cubic inches}$$

This straightforward calculation exemplifies the fundamental relationship between these measurements in three-dimensional geometry.

Final Remarks

Understanding how to compute the volume based on given base area and height is a vital skill in geometry, engineering, architecture, and many other fields. It reinforces the importance of basic geometric formulas and their applications to real-world problems. Always ensure measurements are in consistent units to obtain accurate results, and when dealing with more complex shapes, break down the problem into manageable parts using known formulas.

Frequently Asked Questions

What is the formula for finding the volume of a rectangular prism?

The volume of a rectangular prism is found by multiplying the area of its base by its height, i.e.,
 $\text{Volume} = \text{Base Area} \times \text{Height}$.

Given the base area of 12.7 sq in and height of 7.6 in, how do you calculate the volume?

Multiply the base area by the height: $12.7 \text{ sq in} \times 7.6 \text{ in} = 96.52 \text{ cubic inches}$.

What is the volume of a rectangular prism with a base area of 12.7 sq in and height of 7.6 in?

The volume is 96.52 cubic inches.

How do you verify the units when calculating the volume of a rectangular prism?

Multiply the area in square inches by the height in inches, resulting in cubic inches, which is the standard unit for volume.

Can the volume be expressed in different units? If so, how?

Yes, by converting inches to other units like centimeters and then calculating, or by converting the cubic inches value to liters or milliliters if needed.

What are common mistakes to avoid when calculating the volume of a rectangular prism?

Common mistakes include using incorrect base area or height values, mixing units, or forgetting to multiply the base area by the height.

If the base area was given as 12.7 sq in, what information is needed to find the volume?

The height of the prism is needed, which in this case is 7.6 inches.

How precise is the volume calculation for the given dimensions?

The calculated volume, 96.52 cubic inches, is precise based on the given measurements, assuming they are accurate to at least one decimal place.

What real-life objects could have a similar volume to this rectangular prism?

Objects like a small shoebox or a tissue box could have a similar volume of approximately 96.52 cubic inches.

How does understanding the volume help in practical scenarios?

Knowing the volume helps in assessing capacity, storage, and determining material requirements for manufacturing or packaging.

Additional Resources

Understanding the Volume of a Rectangular Prism: A Comprehensive Explanation

Introduction to Rectangular Prisms

A rectangular prism, often called a rectangular box or cuboid, is a three-dimensional geometric figure characterized by six rectangular faces. It is one of the most fundamental shapes studied in geometry because of its straightforward properties and practical applications in everyday life, such as boxes, bricks, and storage containers.

The key dimensions of a rectangular prism include:

- Length (l)
- Width (w)
- Height (h)

These measurements determine the shape's size and volume, which is the amount of space it occupies.

The Significance of Base Area and Height

In the context of a rectangular prism:

- The base area, denoted as A , refers to the area of the bottom face of the prism. Since the base is a rectangle, its area can be calculated by multiplying its length and width:

$$A = l \times w$$

- The height (h) of the prism is the perpendicular distance between the base and the top face.

Understanding the base area and height is crucial because they form the foundation for calculating the volume, which measures the capacity of the prism.

Given Data and Its Interpretation

Let's analyze the specific problem:

> The area of the base of a rectangular prism is 12.7 square inches, and the height is 7.6 inches. What is the volume?

Here, the key pieces of information are:

- Base Area (A): 12.7 sq in
- Height (h): 7.6 in

The task is to find the volume (V), which represents the space contained within the prism.

Fundamental Formula for Volume of a Rectangular Prism

The volume of a rectangular prism is obtained by multiplying the area of its base by its height:

$$V = A \times h$$

This formula simplifies the calculation because:

- Base area provides the two-dimensional measure of the bottom face.
- Height extends this area into the third dimension.

Using the provided data:

$$V = 12.7 \, \text{sq in} \times 7.6 \, \text{in}$$

Step-by-Step Calculation of the Volume

Let's proceed with the calculation:

1. Set up the multiplication:

$$V = 12.7 \times 7.6$$

2. Perform the multiplication:

- Break down the multiplication into simpler parts for clarity:

$$V = (12.7 \times 7) + (12.7 \times 0.6)$$

- Calculate each part:

$$12.7 \times 7 = 89.0$$

$$12.7 \times 0.6 = 7.62$$

3. Sum the results:

$$V = 89.0 + 7.62 = 96.62$$

Thus, the volume of the rectangular prism is approximately 96.62 cubic inches.

Significance of the Result

The calculated volume, 96.62 cubic inches, indicates the capacity of the prism. This measurement is useful in various practical contexts:

- Storage and Packaging: Knowing the volume helps in determining how much material or objects can fit inside the box.
- Manufacturing: Engineers and designers use volume calculations to optimize space utilization.
- Academic Purposes: It reinforces understanding of geometric principles and unit conversions.

Additional Considerations and Insights

Precision and Rounding

- The initial data is given with two decimal places, so it is appropriate to round the final answer to

two decimal places for consistency.

- Depending on context, sometimes rounding to the nearest whole number might be acceptable, which would make the volume approximately 97 cubic inches.

Units and Their Importance

- The units are consistent (inches), so the resulting volume is in cubic inches.
- When working with different units, always ensure conversions are handled properly before performing calculations.

Real-World Applications

- Construction: Calculating the volume of materials needed to fill a space.
- Logistics: Determining shipping container capacities.
- Design: Assessing space for products or components.

Alternative Approach: Inferring Dimensions from Base Area and Their Implications

While the problem provides the base area but not the individual dimensions, it's worth noting:

- The base rectangle could have many different pairs of length and width values that multiply to 12.7 sq in, such as:

$$(l, w) = (1.27\text{ in}, 10\text{ in}), \quad (2.54\text{ in}, 5\text{ in}), \quad (4\text{ in}, 3.175\text{ in}), \quad \text{etc.}$$

- However, since the volume depends on the base area and height, and not on the individual dimensions, the exact shape of the base does not affect the volume calculation unless further details are provided.

Visualizing the Problem

Imagine a rectangular box where:

- The bottom face measures 12.7 square inches, which could be, for example, 2 inches by 6.35 inches.
- The height extends upward by 7.6 inches.

The total space inside this box, or its volume, is what we've calculated.

Practical Examples

Let's look at some relatable examples to contextualize this volume:

- A shoebox: Many standard shoeboxes have a volume close to 96.62 cubic inches, making this calculation relevant for storage solutions.
- A small storage bin: This volume could fit roughly:
 - 96 small marbles (if each marble occupies 1 cubic inch), or
 - Several small books or devices.
- Liquid capacity analogy: If the prism were filled with water, it would hold about 96.62 fluid inches (assuming the same units), which helps in understanding capacity.

Summary and Takeaways

- The volume of a rectangular prism with a base area of 12.7 square inches and a height of 7.6 inches is calculated as:

$$V = 12.7 \times 7.6 = 96.62 \text{ cubic inches}$$

- The key steps involve understanding the relationship between base area, height, and volume.
- This calculation emphasizes the importance of unit consistency and the application of basic geometric formulas.
- Recognizing the various contexts where such calculations are relevant helps deepen understanding and appreciation for geometric principles.

Final Thoughts

Mastering the concept of calculating the volume of rectangular prisms is foundational in geometry and practical problem-solving. It underscores how simple multiplicative relationships underpin complex real-world applications. Whether designing packaging, planning storage, or solving academic problems, the ability to compute and interpret volume is invaluable.

By understanding the relationship between the base area and height, and knowing how to perform the calculations accurately, you are equipped with a critical skill in both academic and practical settings. Remember, always verify units, consider rounding appropriately, and visualize the problem to foster a deeper comprehension of geometric concepts.

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