

A Rectangular Prism Is 15 Centimeters Long, 2 Centimeters Wide, And 6 Centimeters High. What Is The Surface

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Understanding the surface area of a rectangular prism is an essential concept in geometry, with practical applications in packaging, manufacturing, and design. This article provides a comprehensive explanation of how to calculate the surface area of a rectangular prism, specifically one measuring 15 centimeters in length, 2 centimeters in width, and 6 centimeters in height. Whether you're a student preparing for exams or a professional working on a project, mastering this calculation will enhance your geometric problem-solving skills.

Introduction to Rectangular Prisms

A rectangular prism, also known as a rectangular box or cuboid, is a three-dimensional geometric shape with six rectangular faces. Its defining features include:

- Length (L): The measurement of the prism along its longest side.
- Width (W): The measurement of the prism across its shorter side.
- Height (H): The measurement from the base to the top of the prism.

In our case, the dimensions are:

- Length = 15 cm
- Width = 2 cm
- Height = 6 cm

Understanding these measurements is crucial for calculating the surface area, which is the total area covered by all the faces of the prism.

What Is Surface Area?

Surface area refers to the total area of all the exterior surfaces of a three-dimensional object. For a rectangular prism, this involves summing the areas of its six rectangular faces. Calculating surface area is vital in various contexts such as:

- Coating or painting the surface of objects.
- Determining the amount of material needed for wrapping or covering.
- Assessing the heat transfer or insulation properties.

Calculating the Surface Area of a Rectangular Prism

The surface area (SA) of a rectangular prism can be calculated using the formula:

Surface Area Formula

$$SA = 2 \times (L \times W + L \times H + W \times H)$$

This formula accounts for all six faces, grouped into three pairs of identical rectangles:

- Two faces measuring Length $\times$ Width
- Two faces measuring Length $\times$ Height
- Two faces measuring Width $\times$ Height

Step-by-Step Calculation

Let's apply this formula to our specific dimensions:

1. Calculate the area of each pair of faces:

- Length $\times$ Width: $15 \text{ cm} \times 2 \text{ cm} = 30 \text{ cm}^2$
- Length $\times$ Height: $15 \text{ cm} \times 6 \text{ cm} = 90 \text{ cm}^2$
- Width $\times$ Height: $2 \text{ cm} \times 6 \text{ cm} = 12 \text{ cm}^2$

2. Sum these areas:

$$- 30 \text{ cm}^2 + 90 \text{ cm}^2 + 12 \text{ cm}^2 = 132 \text{ cm}^2$$

3. Multiply the sum by 2 (since each pair appears twice):

$$- 2 \times 132 \text{ cm}^2 = 264 \text{ cm}^2$$

Thus, the total surface area of the rectangular prism is 264 square centimeters.

Understanding the Calculation Process in Detail

Breaking down the process provides insight into why the formula works and how to adapt it for different dimensions.

Calculating Each Face Area

- Faces measuring Length and Width: These are the top and bottom faces of the prism.
- Faces measuring Length and Height: These are the front and back faces.
- Faces measuring Width and Height: These are the side faces.

Each pair is identical in size, so calculating one and multiplying by two simplifies the process.

Using the Formula for Different Dimensions

Suppose the dimensions change; the same steps apply:

- Identify each pair of faces.
- Calculate their areas.
- Sum the areas.
- Multiply by two for the total surface area.

This approach is universally applicable to all rectangular prisms.

Practical Applications of Surface Area Calculations

Understanding surface area calculations is more than an academic exercise. It has real-world applications such as:

- Packaging Design: Ensuring boxes have enough material for wrapping.
- Manufacturing: Estimating paint, coating, or insulating material needed.
- Storage Optimization: Assessing how much surface coverage is required for protective layers.
- Educational Purposes: Enhancing spatial reasoning and problem-solving skills.

Additional Tips for Accurate Calculations

- Always double-check measurements before calculations.
- Use consistent units; convert measurements to the same unit if necessary.
- Break down complex shapes into simpler components for easier computation.
- Practice with different dimensions to strengthen understanding.

Conclusion

Calculating the surface area of a rectangular prism with dimensions 15 centimeters long, 2 centimeters wide, and 6 centimeters high involves understanding the structure of the shape and applying the appropriate formula. The surface area for this specific prism is 264 square centimeters, derived from the sum of the areas of all six faces. Mastering this calculation not only improves geometric proficiency but also enables practical application in various fields, from manufacturing to design.

Summary of Key Points:

- Rectangular prisms have six rectangular faces.
- Surface area is calculated using the formula: $SA = 2 \times (L \times W + L \times H + W \times H)$.
- For the given dimensions, the surface area is 264 cm².
- Understanding and calculating surface area is essential in many real-world contexts.

By practicing these calculations and understanding the underlying principles, you can confidently determine the surface area of any rectangular prism, making your geometric comprehension more robust and applicable across numerous scenarios.

Frequently Asked Questions

What is the surface area of a rectangular prism that is 15 cm long, 2 cm wide, and 6 cm high?

The surface area is 264 square centimeters.

How do you calculate the surface area of a rectangular prism?

Surface area is calculated by finding the sum of the areas of all six faces: $2(\text{length} \times \text{width}) + 2(\text{length} \times \text{height}) + 2(\text{width} \times \text{height})$.

What is the formula used to find the surface area of a rectangular prism?

Surface Area = $2(lb + lh + wh)$, where l is length, w is width, and h is height.

Using the given dimensions, what is the total surface area of the prism?

For $l=15$ cm, $w=2$ cm, and $h=6$ cm, the surface area is $2(15 \times 2 + 15 \times 6 + 2 \times 6) = 2(30 + 90 + 12) = 2(132) = 264$ cm².

Why is calculating the surface area of a rectangular prism important?

It helps determine the amount of material needed to cover the object or for packaging and storage purposes.

Can the surface area of a rectangular prism change if its dimensions change?

Yes, changing any of the dimensions (length, width, or height) will alter the surface area.

What units are used to measure the surface area of a rectangular prism?

The units are square centimeters (cm^2) in this case.

What is the significance of knowing the surface area in real-world applications?

It helps in estimating the amount of paint, covering materials, or wrapping needed for the object.

If the dimensions of the prism increase, how does the surface area change?

The surface area increases, typically at a faster rate than the linear dimensions, since it depends on the squares of the dimensions.

Additional Resources

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Understanding the surface area of a rectangular prism is fundamental in many real-world applications, from packaging to manufacturing, and even in educational settings to reinforce geometric concepts. In this article, we will explore the process of calculating the surface area of a rectangular prism with specific dimensions: a length of 15 centimeters, a width of 2 centimeters, and a height of 6 centimeters. We will discuss the significance of surface area, provide detailed calculations, analyze the features and potential applications, and consider some common pitfalls and tips for accurate computation.

Understanding the Rectangular Prism

A rectangular prism, also known as a cuboid, is a three-dimensional shape with six rectangular faces. Each face pairs with another of equal size, making the shape symmetrical along its length, width, and height dimensions. The core features include:

- Length (L): The longest side of the prism, in this case, 15 centimeters.
- Width (W): The shorter side, in this case, 2 centimeters.
- Height (H): The vertical dimension, in this case, 6 centimeters.

Visualizing the prism helps in understanding how each face contributes to the total surface area. The prism's faces include:

- Two faces measuring L x W
- Two faces measuring L x H
- Two faces measuring W x H

The focus of our calculation is to determine the total surface area, which quantifies the total area covered by all six faces.

Calculating the Surface Area

The surface area (SA) of a rectangular prism is calculated by summing the areas of each of its six faces. Since the faces come in pairs of identical rectangles, the formula simplifies to:

$$SA = 2(L \times W) + 2(L \times H) + 2(W \times H)$$

Given the specific dimensions:

- L = 15 cm
- W = 2 cm
- H = 6 cm

Let's break down the calculation step by step:

Step 1: Calculate each pair of face areas

- L x W: $15 \text{ cm} \times 2 \text{ cm} = 30 \text{ cm}^2$
- L x H: $15 \text{ cm} \times 6 \text{ cm} = 90 \text{ cm}^2$
- W x H: $2 \text{ cm} \times 6 \text{ cm} = 12 \text{ cm}^2$

Step 2: Double each face area to account for its opposite face

- $2(L \times W): 2 \times 30 \text{ cm}^2 = 60 \text{ cm}^2$
- $2(L \times H): 2 \times 90 \text{ cm}^2 = 180 \text{ cm}^2$
- $2(W \times H): 2 \times 12 \text{ cm}^2 = 24 \text{ cm}^2$

Step 3: Sum all contributions for the total surface area

$$SA = 60 + 180 + 24 = 264 \text{ cm}^2$$

Thus, the surface area of the rectangular prism is 264 square centimeters.

Features and Significance of Surface Area

Understanding the surface area of a rectangular prism has practical importance across various fields:

- Packaging: Determines the amount of material needed to wrap or cover a box.
- Manufacturing: Helps in estimating painting or coating requirements.
- Storage and Space Planning: Assists in calculating surface exposure for insulation or other treatments.
- Educational Value: Reinforces understanding of geometric formulas and spatial reasoning.

Pros of Knowing Surface Area:

- Precise material estimation for manufacturing or packaging.
- Cost calculation for coating or painting surfaces.
- Design optimization for space and material efficiency.

Cons / Limitations:

- Assumes perfect rectangular shape; irregularities can affect calculations.
- Does not account for internal volume or other physical properties.
- Requires accurate measurements; small errors can lead to significant miscalculations.

Applications and Real-World Examples

Knowing the surface area helps in diverse sectors:

- Packaging Industry: For example, designing boxes for products where material cost is proportional to surface area.
- Construction: Estimating the amount of paint or sealant needed for rectangular surfaces.
- Storage Solutions: Designing containers that optimize surface coverage for insulation or aesthetic purposes.
- Educational Demonstrations: Teaching students about surface area calculations through practical examples.

For instance, if a company wants to manufacture a box with the given dimensions and needs to paint the exterior, knowing the surface area (264 cm²) helps in purchasing the right amount of paint, considering coverage rates.

Common Pitfalls and Tips for Accurate Calculation

While calculating surface area is straightforward, several common mistakes can occur:

- Incorrect Dimensions: Always verify measurements before calculations.
- Misapplication of Formula: Remember that each pair of faces contributes twice the area.
- Unit Consistency: Ensure all measurements are in the same units; conversions are necessary if not.
- Ignoring Hidden Faces: All six faces contribute; do not forget to account for all.

Tips for accuracy:

- Break down the problem into smaller parts for clarity.
- Use parentheses to organize calculations.
- Double-check each step before summing.

Conclusion

Calculating the surface area of a rectangular prism with dimensions 15 cm by 2 cm by 6 cm yields a total of 264 square centimeters. This measurement is not only a fundamental geometric computation but also has practical applications across various industries and educational contexts. Understanding how each face contributes to the total surface area enables better planning, cost estimation, and design optimization. By following structured steps and verifying each calculation, one can confidently determine surface areas for a wide range of rectangular shapes, facilitating effective decision-making and resource management in real-world scenarios.

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