

What Is The Volume Of A Sphere With A Diameter Of 32.5 M, Rounded To The Nearest Tenth Of A Cubic Meter?

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Understanding the volume of a sphere is a fundamental aspect of geometry that finds applications across various fields such as engineering, physics, architecture, and even everyday calculations. When given a specific diameter—like 32.5 meters—it becomes essential to accurately determine the volume, often rounded to a certain decimal place for practical use. In this article, we will explore how to calculate the volume of a sphere with a diameter of 32.5 meters, step-by-step, and understand the mathematical principles behind the calculation. We will also discuss the significance of precise measurements and how rounding impacts real-world applications.

Understanding the Sphere and Its Dimensions

What Is a Sphere?

A sphere is a perfectly round, three-dimensional geometric object where every point on its surface is equidistant from its center. Think of objects like balls, planets, or bubbles—these are all examples of spheres in the real world.

Key Dimensions of a Sphere

The primary measurements for a sphere include:

- Diameter (d): The distance across the sphere through its center.
- Radius (r): The distance from the center to any point on the surface.
- Circumference: The perimeter around the sphere, which is a circle.
- Surface Area: The total area covering the surface of the sphere.
- Volume: The amount of space enclosed within the sphere.

Given the diameter, calculating the volume requires understanding the relationship between these dimensions, especially the radius.

Calculating the Volume of a Sphere

The Volume Formula

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

$$V = \frac{4}{3} \pi r^3$$

Where:

- (π) (Pi) is approximately 3.14159
- (r) is the radius of the sphere

Step-by-Step Calculation

Given the diameter $(d = 32.5)$ meters, follow these steps:

1. Determine the radius:

$$r = \frac{d}{2} = \frac{32.5}{2} = 16.25 \text{ meters}$$

2. Calculate the cube of the radius:

$$r^3 = (16.25)^3$$

3. Compute the volume using the formula:

$$V = \frac{4}{3} \pi r^3$$

4. Round the result to the nearest tenth:

Since practical applications often require rounded figures, the final step involves rounding the computed volume to one decimal place.

Performing the Calculation

Calculating (r^3)

Let's compute:

$$16.25^3 = 16.25 \times 16.25 \times 16.25$$

Breaking it down:

- First, $16.25 \times 16.25 = 264.0625$
- Next, $264.0625 \times 16.25 = 4293.359375$

So,

$$r^3 \approx 4293.359375$$

Calculating the Volume

Now, plug into the volume formula:

$$V = \frac{4}{3} \pi \times 4293.359375$$

Using $\pi \approx 3.14159$:

$$V \approx \frac{4}{3} \times 3.14159 \times 4293.359375$$

Calculate step-by-step:

- $\frac{4}{3} \times 3.14159 \approx 4.18879$
- Multiply:

$$4.18879 \times 4293.359375 \approx 17988.468$$

Final Rounded Volume

Rounding to the nearest tenth:

$$V \approx 17988.5 \text{ cubic meters}$$

Therefore, the volume of a sphere with a diameter of 32.5 meters is approximately 17,988.5 cubic meters.

Implications of the Calculation

Why Is Accurate Calculation Important?

Precise volume calculations are crucial in various contexts:

- Engineering: For designing spherical tanks, domes, or other structures.
- Environmental Science: Estimating the volume of natural spherical objects like planets or celestial bodies.
- Manufacturing: When creating spherical objects with specific volume requirements.
- Education: Teaching students about geometric relationships and measurement accuracy.

Impact of Rounding

While rounding to one decimal place simplifies figures, it can lead to slight inaccuracies, especially in large-scale applications. For example:

- In engineering projects, even minor deviations can affect structural integrity or capacity.
- In scientific measurements, precise values are essential for calculations and modeling.

Hence, understanding when and how to round is vital for maintaining accuracy and reliability in calculations.

Additional Considerations

Using Different Units

While this example used meters, the same principles apply regardless of units—just ensure consistency throughout calculations.

Estimating Surface Area

Alongside volume, the surface area of a sphere can be useful:

$$A = 4\pi r^2$$

For a diameter of 32.5 meters:

$$r = 16.25 \text{ meters}$$

$$A = 4 \times 3.14159 \times (16.25)^2$$

$$A \approx 4 \times 3.14159 \times 264.0625$$

$$A \approx 4 \times 3.14159 \times 264.0625 \approx 3314.9 \text{ square meters}$$

This information supports understanding the surface characteristics of the sphere.

Summary and Conclusion

Calculating the volume of a sphere with a given diameter involves understanding the relationship between diameter, radius, and volume. For a diameter of 32.5 meters:

- The radius is 16.25 meters.
- The volume, calculated using $V = \frac{4}{3}\pi r^3$, is approximately 17,988.5 cubic meters when rounded to the nearest tenth.

This calculation exemplifies the importance of precise mathematical methods in practical applications. Whether designing large spherical tanks, estimating natural objects' sizes, or educational purposes, mastering sphere volume calculations is a valuable skill in the realm of geometry and applied sciences.

Remember:

- Always convert the diameter to radius before applying the volume formula.
- Use precise values for constants like π for accurate results.
- Round the final answer appropriately based on the context of use.

By understanding these principles, you can confidently determine the volume of any sphere given its

diameter, ensuring accuracy in both academic and real-world scenarios.

Frequently Asked Questions

How do you calculate the volume of a sphere with a given diameter?

To calculate the volume of a sphere, use the formula $V = (4/3)\pi r^3$, where r is the radius, which is half of the diameter.

What is the radius of a sphere with a diameter of 32.5 meters?

The radius is half of the diameter, so $r = 32.5 / 2 = 16.25$ meters.

What is the approximate volume of a sphere with a diameter of 32.5 meters, rounded to the nearest tenth?

The volume is approximately 17909.4 cubic meters.

How do you round the volume of a sphere to the nearest tenth?

After calculating the volume, identify the first decimal place and round accordingly; for example, 17909.43 becomes 17909.4.

Why is it important to use π (pi) in the volume calculation of a sphere?

π is a mathematical constant used in formulas involving circles and spheres; it ensures accurate calculation of the volume based on the sphere's geometry.

Can the volume of the sphere be calculated without a calculator?

While possible with approximations, it's much easier and more accurate to use a calculator to compute $(4/3)\pi r^3$, especially with decimal values.

What are some real-world applications of calculating the volume of a sphere?

Calculating the volume of spherical objects is useful in fields like engineering, astronomy, medicine (e.g., modeling cells or planets), and manufacturing.

Additional Resources

What Is The Volume Of A Sphere With A Diameter Of 32.5 M, Rounded To The Nearest Tenth Of A Cubic Meter?

Understanding the size and volume of spherical objects is a fundamental aspect of geometry with practical applications spanning engineering, architecture, astronomy, and even recreational sports. In particular, calculating the volume of a sphere with a given diameter offers insights into the object's capacity, mass, and spatial requirements. Today, we focus on a specific problem: determining the volume of a sphere with a diameter of 32.5 meters, then rounding that volume to the nearest tenth of a cubic meter. This seemingly straightforward question involves a blend of geometric formulas, precise calculations, and an appreciation of the sphere's properties.

Fundamental Concepts: The Sphere and Its Volume

Before delving into calculations, it's essential to understand what defines a sphere and how its volume is computed.

What Is a Sphere?

A sphere is a perfectly round, three-dimensional object where every point on its surface is equidistant from its center. This distance is known as the radius, typically denoted as r . The sphere's symmetry makes it a fundamental shape in geometry, with properties that are well-understood and formulas that are straightforward once the radius or diameter is known.

Key Dimensions: Diameter and Radius

- Diameter (d): The straight-line distance passing through the center, connecting two points on the surface. In our problem, this is 32.5 meters.
- Radius (r): Half of the diameter, extending from the center to the surface. Calculated as:

$$r = d / 2$$

Using the given diameter:

$$r = 32.5 / 2 = 16.25 \text{ meters}$$

Having established the radius, we are now equipped to calculate the volume.

Mathematical Formula for the Volume of a Sphere

The volume (V) of a sphere is given by a well-known geometric formula:

$$V = (4/3) \times \pi \times r^3$$

Where:

- π (pi) is a mathematical constant approximately equal to 3.141592653589793.
- r is the radius of the sphere.

This formula embodies the relationship between the sphere's size and its capacity, derived through calculus and geometric principles.

Why Does the Formula Work?

The derivation of the sphere's volume is rooted in calculus, specifically in integrating the area of cross-sectional disks from the bottom to the top of the sphere. The result, however, is elegant and straightforward for practical calculations once the radius is known.

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

Let's proceed with the calculation based on the given diameter:

1. Calculate the radius:

$$r = 32.5 / 2 = 16.25 \text{ meters}$$

2. Compute r^3 (cube of the radius):

$$r^3 = (16.25)^3$$

To compute this:

- $16.25 \times 16.25 = 264.0625$
- $264.0625 \times 16.25 = 4296.6796875$

So,

$$r^3 \approx 4296.6796875$$

3. Multiply by π :

$$\pi \times r^3 \approx 3.141592653589793 \times 4296.6796875$$

Calculating:

$$- 3.141592653589793 \times 4296.6796875 \approx 13,503.955$$

4. Multiply by $(4/3)$:

$$(4/3) \times 13,503.955 \approx 1.33333333333 \times 13,503.955 \approx 18,004.607$$

Therefore, the volume of the sphere is approximately 18,004.607 cubic meters.

Rounding to the Nearest Tenth

The problem requires the volume to be rounded to the nearest tenth of a cubic meter.

- The calculated volume: $18,004.607 \text{ m}^3$
- Rounded to one decimal place: $18,004.6 \text{ m}^3$

Final answer: The volume of the sphere with a diameter of 32.5 meters is approximately 18,004.6 cubic meters.

Implications and Practical Applications

Understanding the volume of such a large sphere has tangible implications across various fields:

- Engineering and Construction: When designing spherical tanks or domes, knowing the volume helps in determining capacity, material requirements, and structural stability.
- Environmental Science: Spherical models of planets or water bodies often require volume calculations for resource estimation.
- Manufacturing and Material Science: For spheres used in ball bearings or other machinery, volume influences weight and material costs.
- Astronomy: Calculating the volume of celestial bodies (like planets and moons) based on their diameters is crucial for understanding their mass and gravitational pull.

Additional Considerations: Accuracy and Limitations

While our calculation provides a precise estimate, it's important to recognize factors that could influence real-world applications:

- Measurement Precision: The initial diameter measurement (32.5 meters) is assumed exact. Slight variations can affect the volume.
- Material Density: To determine weight, density must be considered alongside volume.
- Shape Deviations: Real-world objects may not be perfect spheres, introducing minor errors in volume estimates.

Conclusion

Calculating the volume of a sphere with a given diameter is an essential skill in geometry with broad practical relevance. For the specific case of a sphere measuring 32.5 meters across, the volume is approximately 18,004.6 cubic meters when rounded to the nearest tenth. This measurement not only satisfies mathematical curiosity but also provides critical insights for engineering, environmental science, and various technological fields. As with all mathematical models, understanding the assumptions and limitations ensures that such calculations are applied effectively and accurately in real-world scenarios.

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