

A Container Weighs 5kg When Empty But Weigh 13kg And 25kg When It Is Completely Full Of Water What Is

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What Is

Understanding the weight of containers when filled with water is a common problem encountered in various fields, including physics, engineering, and everyday life. This scenario often appears as a puzzle or practical problem where the goal is to determine the capacity of the container or the amount of water it can hold, based on given weight measurements. In this article, we will explore the details of such a problem, analyze the possible solutions, and explain the concepts involved in solving it.

Introduction to the Problem

Imagine a container that weighs 5 kilograms when empty. When filled with water, it measures 13 kilograms or 25 kilograms under different circumstances. The question arises: what is the actual capacity of the container, and what do these measurements imply?

This scenario suggests that there are two different filled weights, which could indicate different fill levels, different types of liquids, or errors in measurement. To understand and solve this problem, it's important to consider the following aspects:

- The weight of the empty container
- The weight of the water when the container is full

- The possible interpretation of the different full weights
- How to calculate the capacity of the container based on the given data

Understanding the Given Data

Let's break down the given information:

- Empty container weight: 5 kg
- First full weight: 13 kg
- Second full weight: 25 kg

From this, we can infer:

- The weight of water when the container is full in the first scenario: $13 \text{ kg} - 5 \text{ kg} = 8 \text{ kg}$
- The weight of water when the container is full in the second scenario: $25 \text{ kg} - 5 \text{ kg} = 20 \text{ kg}$

This suggests that the container is capable of holding at least two different amounts of water, possibly due to different fill levels or measurement conditions.

Possible Interpretations of the Problem

Before diving into calculations, it's essential to understand what these measurements could represent.

Here are some plausible interpretations:

1. The container is being filled to different levels, and the weights 13 kg and 25 kg correspond to different fill levels.

- The first fill level adds 8 kg of water
- The second fill level adds 20 kg of water

2. The measurements are taken at different times, or with different liquids, possibly with different densities.

- If the liquid is water, the densities are consistent, but if another liquid is involved, the difference in weights could be explained by different densities.

3. Measurement errors or variations in weighing equipment

- Slight differences could be due to measurement inaccuracies or calibration issues.

Most likely, the problem is designed around the first interpretation: the container, when filled to different levels, weighs 13 kg and 25 kg.

Calculating the Capacity of the Container

Assuming the scenario where the container is filled to two different levels, the goal is to find:

- The volume of water corresponding to 8 kg and 20 kg

- The total capacity of the container at full fill (assuming the maximum fill corresponds to 20 kg of water)

Step 1: Recall the density of water

- The density of water is approximately 1 kilogram per liter (kg/L) at standard temperature and pressure
- Therefore, 1 kg of water equals approximately 1 liter

Step 2: Convert water weights to volume

- For the first fill: 8 kg of water $\square$ 8 liters
- For the second fill: 20 kg of water $\square$ 20 liters

Step 3: Determine the container's capacity

Assuming the maximum fill corresponds to 20 liters, the total volume of the container when full is approximately 20 liters.

- The total weight when full: 25 kg
- The empty weight: 5 kg
- Water weight when full: 20 kg
- Volume of water when full: 20 liters

Thus, the total capacity of the container is approximately 20 liters.

Understanding the Significance of the Data

This problem illustrates several important concepts:

- Mass and volume relationship: For water, mass directly correlates with volume because of its density.
- Measuring partial fills: Different weights indicate different fill levels, which can be useful in practical applications like measuring liquids.
- Container capacity determination: Using the difference in weights and known densities, one can estimate the total capacity.

Additional Considerations and Clarifications

While the above calculations provide a plausible solution, some questions might arise:

Why are there two different full weights?

- Perhaps the container was filled to different levels during measurements
- Or, the measurements are taken with slightly different amounts of water, or with water at different temperatures affecting density marginally

Could the container be leaking or have an irregular shape?

- Irregular shapes or leaks could affect the measurements, but assuming a standard container, this is unlikely

What if the water is not pure?

- If the liquid is not pure water, the density could vary, affecting volume calculations

Summary of Key Points

- The empty container weighs 5 kg
- It is filled with water to two different levels, weighing 13 kg and 25 kg
- The difference in water weight between the two fills is 12 kg (20 liters), indicating the maximum fill volume
- The total capacity of the container is approximately 20 liters

Practical Applications of This Knowledge

Understanding how to determine the capacity of a container based on weight measurements is useful in various fields:

- Laboratory measurements: Precise filling of containers with liquids
- Industrial processes: Monitoring fluid levels in tanks
- Everyday life: Estimating the volume of containers without measuring tools
- Engineering design: Creating containers with specific capacities

Conclusion

The problem of a container weighing 5 kg when empty and 13 kg and 25 kg when filled with water demonstrates fundamental principles of physics and measurement. By analyzing the weight differences and applying knowledge of water's density, we deduce that the container's capacity is approximately 20 liters when fully filled.

This exercise emphasizes the importance of understanding the relationship between mass and volume, especially when measuring liquids. Whether in scientific experiments, industrial applications, or daily life, such calculations enable accurate estimations and better understanding of the physical properties involved.

Always remember to consider context, assumptions, and measurement accuracy when interpreting data like this, and use fundamental principles to guide your calculations for reliable results.

Frequently Asked Questions

What is the weight of the empty container?

The empty container weighs 5 kg.

How much does the container weigh when filled with water?

When completely filled with water, the container weighs 13 kg or 25 kg, indicating different scenarios or measurements.

What could be the reason for the two different full weights (13 kg and 25 kg)?

The two different weights suggest measuring the container with different amounts or types of water, or

possibly different containers or measurement conditions.

How can we determine the weight of the water inside the container?

Subtract the empty weight (5 kg) from the full weight (either 13 kg or 25 kg). For example, $13\text{ kg} - 5\text{ kg} = 8\text{ kg}$ of water, or $25\text{ kg} - 5\text{ kg} = 20\text{ kg}$ of water.

What is the maximum capacity of the container based on the given weights?

Based on the full weights, the container can hold either 8 kg or 20 kg of water, depending on the scenario.

What is the importance of knowing the empty and full weights of a container?

Knowing these weights helps determine the amount of water (or other substance) it contains, useful for measurement, storage, and ensuring proper capacity management.

Additional Resources

A Container Weighs 5kg When Empty But Weigh 13kg And 25kg When It Is Completely Full Of Water: What Is the Explanation?

Understanding the weight of a container when empty and when filled with water might seem straightforward at first glance, but it opens up a variety of interesting questions about measurements, volume, and the physics of fluids. In this guide, we'll delve deeply into the problem: A container weighs 5kg when empty but weighs 13kg and 25kg when it is completely full of water. What is — and then explore the implications, calculations, and concepts behind these measurements.

Introduction: The Puzzle of Changing Weights

Imagine a container that weighs only 5kg when empty. When filled with water, its total weight increases to 13kg and later to 25kg. This scenario suggests that the container can hold different volumes of water, or perhaps different amounts are being measured or observed at different times. The question arises: What is — and how do these weights relate to the container's capacity, the amount of water it holds, and the physical principles at play?

In real-world situations, such problems often relate to:

- Determining the volume of the container based on water weight
- Calculating the density or other properties
- Understanding the relationship between weight, volume, and mass

This guide aims to clarify these questions systematically.

Section 1: Fundamental Concepts

Before analyzing the specific problem, let's review some core principles.

1.1 Mass, Weight, and Density

- Mass: The amount of matter in an object, measured in kilograms (kg).
- Weight: The force exerted by gravity on an object's mass, often measured in newtons or, in everyday contexts, in kilograms (mass units). When we say "weighs 5kg," we're typically referring to mass, assuming standard gravity.
- Density: The mass per unit volume of a substance, expressed as kg/m^3 or g/cm^3 .

1.2 Water's Properties

- Density of water: At standard temperature ($\sim 4^{\circ}\text{C}$), water has a density of approximately 1000 kg/m^3 .
- Volume of water: Can be calculated as mass divided by density.

1.3 Measurement Units and Conversions

- 1 liter of water weighs approximately 1kg.
- 1 cubic meter (m^3) contains 1000 liters or approximately 1000kg of water.

Section 2: Analyzing the Data

Given data:

- Empty container weight: 5kg
- Weight when full of water: 13kg and 25kg

The discrepancy suggests that two different "full" measurements are taken, or perhaps the container is being filled in stages.

2.1 Interpreting the Measurements

- When empty: Weight = 5kg
- When "completely full of water": Weight = 13kg
- When completely full of water again, but with a different weight: 25kg

This indicates that the container can hold different volumes or that additional water is added in stages, or that the problem involves two different containers or measurements.

Section 3: Calculating the Water Volumes

3.1 First Full Measurement: 13kg

- Water weight: $13\text{kg} - 5\text{kg (empty container weight)} = 8\text{kg}$

Since 1 liter of water weighs 1kg:

- Volume of water = 8 liters

3.2 Second Full Measurement: 25kg

- Water weight: $25\text{kg} - 5\text{kg (empty container weight)} = 20\text{kg}$

- Volume of water = 20 liters

Note: The change from 8 liters to 20 liters suggests different fill levels or different containers.

Section 4: Possible Scenarios and Interpretations

4.1 Single Container, Different Fill Levels?

If it's the same container, the two measurements suggest:

- The container's capacity is at least 20 liters.
- Filling it partially or fully results in different weights.

But since it's "completely full" in both cases, perhaps the data refers to different containers or stages.

4.2 Two Different Containers?

- The first container holds 8 liters of water (total weight 13kg).
- The second holds 20 liters (total weight 25kg).

4.3 Incremental Filling

- Starting with the container at 13kg (8 liters), additional water is added, reaching 25kg (20 liters).

Section 5: Advanced Analysis – What Is the Capacity?

Assuming a single container, and given the measurements, let's explore the possibilities.

5.1 Calculating the Container's Capacity

- If the maximum fill is 20 liters, then the total capacity of the container is approximately 20 liters.

5.2 Confirming with Density

Since water density is approximately 1000kg/m^3 :

- Volume in cubic meters = mass of water / density

- For 8kg of water:

$$\text{Volume} = 8 \text{ kg} / 1000 \text{ kg/m}^3 = 0.008 \text{ m}^3 = 8 \text{ liters}$$

- For 20kg of water:

Volume = 20 kg / 1000 kg/m³ = 0.02 m³ = 20 liters

Thus, the container's capacity is approximately 20 liters.

Section 6: Final Explanation and What Is

What is in this context? Based on the analysis:

- The container's empty weight is 5kg.
- When filled with 8 liters of water, it weighs 13kg.
- When filled with 20 liters of water, it weighs 25kg.

Therefore, the key points are:

- The empty container weighs 5kg.
- The full capacity of the container is approximately 20 liters.
- The additional weight corresponds to the weight of water, calculated via water's density.

Section 7: Practical Applications and Related Concepts

Understanding such measurements is crucial in various fields:

- Cooking and Food Industry: Measuring ingredients by weight and volume.
- Engineering: Designing containers, tanks, and measuring devices.
- Science: Calculating densities, volumes, and material properties.
- Logistics: Estimating shipping weights and capacities.

Conclusion

The intriguing problem of a container weighing 5kg when empty but 13kg and 25kg when full of water leads us to a comprehensive understanding of measurement principles. By analyzing the weights, subtracting the container's weight, and applying water's density, we deduce that the container's capacity is approximately 20 liters. This exercise highlights the importance of precise measurements and the relationships between mass, volume, and density in practical and scientific contexts.

Remember: Always verify measurements, consider units carefully, and use fundamental physics principles to interpret data accurately. Whether in everyday life or advanced engineering, understanding the relationship between weight and volume is essential.

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