

3.58 Kg Of Solution A (2.5% Salt) Is Mixed With 3.77 Kg Of Solution B (4.7% Salt). What Is The Final

Understanding the Problem: Mixing Solutions with Different Salt Concentrations

3.58 Kg Of Solution A (2.5% Salt) Is Mixed With 3.77 Kg Of Solution B (4.7% Salt). What Is The Final concentration of salt in the resulting mixture? This common problem in chemistry and solution preparation involves calculating the combined concentration after mixing two solutions with known amounts and salt percentages.

The goal is to determine the final concentration of salt in the mixture, expressed as a percentage. To solve this, we need to understand the concepts of mass, concentration, and how these quantities combine when solutions are mixed.

Fundamentals of Solution Concentration and Mixture Calculations

What Is Solution Concentration?

Solution concentration refers to the amount of solute (in this case, salt) present in a given amount of solution. It is often expressed as a percentage, molarity, or other units. Here, percentages are used to describe how much salt is present in each solution:

- Solution A: 2.5% salt
- Solution B: 4.7% salt

Calculating the Amount of Salt in Each Solution

Before mixing, we calculate the actual mass of salt in each solution:

- Salt in Solution A:

$$\begin{aligned} \text{Mass of salt} &= \text{Total mass} \times \text{Concentration} \\ &= 3.58 \, \text{kg} \times 2.5\% \\ &= 3.58 \, \text{kg} \times 0.025 \\ &= 0.0895 \, \text{kg} \end{aligned}$$

\]

- Salt in Solution B:

\[

$$\text{Mass of salt} = 3.77 \, \text{kg} \times 4.7\%$$

$$= 3.77 \, \text{kg} \times 0.047$$

$$= 0.17719 \, \text{kg}$$

\]

The Total Salt and Total Solution After Mixing

Next, determine the total salt and total mass of the mixture:

- Total salt:

\[

$$0.0895 \, \text{kg} + 0.17719 \, \text{kg} = 0.26669 \, \text{kg}$$

\]

- Total solution:

\[

$$3.58 \, \text{kg} + 3.77 \, \text{kg} = 7.35 \, \text{kg}$$

\]

Calculating the Final Salt Concentration

The final concentration (as a percentage) is given by:

\[

$$\text{Final concentration} = \left(\frac{\text{Total salt}}{\text{Total solution}} \right) \times 100\%$$

\]

Plugging in the values:

\[

$$\frac{0.26669 \, \text{kg}}{7.35 \, \text{kg}} \times 100\% \approx 3.63\%$$

\]

Therefore, the final salt concentration in the mixture is approximately 3.63%.

Step-by-Step Summary of the Calculation Process

To help understand the process better, here is a step-by-step breakdown:

1. Calculate the mass of salt in each individual solution using their respective concentrations.
2. Sum the salt contents to find the total salt in the mixture.
3. Calculate the total mass of the combined solutions.
4. Divide the total salt by the total mass to find the concentration percentage.
5. Express the answer as a percentage for clarity.

Practical Applications of Solution Mixing Calculations

Understanding how to calculate the final concentration after mixing solutions is crucial in various fields such as:

- Chemistry laboratories for preparing solutions with desired concentrations.
- Pharmaceutical industries for accurate formulation of medicines.
- Food industry for mixing ingredients with specific salt content.
- Environmental science for assessing salinity levels in water bodies.

Why Accurate Calculations Matter

Accurate concentration calculations ensure:

- Proper formulation of solutions.
- Consistency in product quality.
- Safety in chemical handling.
- Compliance with regulatory standards.

Additional Tips for Solving Solution Mixing Problems

- Always convert percentages to decimal form before calculations.
- Keep track of units to avoid errors.
- Use precise measurements for small quantities.
- Double-check calculations to prevent mistakes.

Common Mistakes to Avoid

- Mixing up the total mass and salt mass.
- Forgetting to convert percentages to decimals.
- Ignoring the units of measurement.
- Not summing the individual salt contents correctly.

Conclusion: Final Salt Concentration in the Mixture

By following the steps outlined, we find that mixing 3.58 kg of a 2.5% salt solution with 3.77 kg of a 4.7% salt solution results in a final solution with approximately 3.63% salt concentration. This calculation illustrates the importance of understanding concentration concepts and proper mathematical procedures in solution chemistry.

Properly performing such calculations ensures accurate formulation and quality control across scientific and industrial applications. Whether preparing laboratory solutions or managing large-scale processes, mastering mixture calculations is a valuable skill for professionals and students alike.

Frequently Asked Questions

What is the total weight of the mixture when 3.58 kg of Solution A and 3.77 kg of Solution B are combined?

The total weight of the mixture is $3.58 \text{ kg} + 3.77 \text{ kg} = 7.35 \text{ kg}$.

How do you calculate the amount of salt in Solution A?

The amount of salt in Solution A is 2.5% of 3.58 kg, which is $0.025 \times 3.58 \text{ kg} = 0.0895 \text{ kg}$.

What is the amount of salt in Solution B?

The amount of salt in Solution B is 4.7% of 3.77 kg, which is $0.047 \times 3.77 \text{ kg} \approx 0.17719 \text{ kg}$.

How do you find the total amount of salt in the mixed solution?

Add the salt amounts from both solutions: $0.0895 \text{ kg} + 0.17719 \text{ kg} \approx 0.26669 \text{ kg}$.

What is the percentage of salt in the final mixture?

Divide the total salt by the total solution weight: $0.26669 \text{ kg} / 7.35 \text{ kg} \approx 0.0363$ or 3.63%.

What is the final concentration of salt after mixing the solutions?

The final concentration of salt is approximately 3.63%.

Why do we calculate the salt content separately for each solution before mixing?

Because the concentrations differ, and summing the salt amounts ensures an accurate final concentration calculation.

Can this method be used to find the concentration for any two solutions mixed together?

Yes, as long as you know the weights and concentrations, you can calculate the total salt and determine the final concentration similarly.

What assumptions are made in calculating the final concentration?

Assumes that the solutions are homogeneous and that the salt does not react or change during mixing.

How can this calculation be applied in real-world scenarios?

It can be used in chemistry labs, food industry, or any process involving mixing solutions to achieve desired salt concentrations.

Additional Resources

Understanding the Mixture: Calculating the Final Salt Concentration in Combined Solutions

Mixing solutions with different salt concentrations is a fundamental problem in chemistry, especially in fields such as solution chemistry, chemical engineering, and industrial processing. Whether you're a student tackling a homework problem or a professional optimizing industrial processes, understanding how to determine the final concentration after mixing solutions is essential. Today, we will explore the problem of combining 3.58 kg of a 2.5% salt solution with 3.77 kg of a 4.7% salt solution, aiming to find the resulting salt concentration. This comprehensive review will delve into the principles, step-by-step calculations, common pitfalls, and real-world applications related to such mixture problems.

Understanding the Problem: The Basics of Solution Mixing

Before diving into calculations, it's crucial to understand what the problem entails. You are given two solutions with specified weights and salt concentrations, and you need to determine the concentration of salt in the resulting mixture.

Given Data:

- Solution A:
- Weight: 3.58 kg
- Salt concentration: 2.5%
- Solution B:
- Weight: 3.77 kg
- Salt concentration: 4.7%

Objective:

- Find the final salt concentration after mixing the two solutions.

Key Concepts and Definitions

To effectively analyze and solve the problem, several fundamental concepts should be clarified:

1. Solution Concentration

Expressed as a percentage, it indicates how many grams of salt are present per 100 grams of solution. For example, a 2.5% salt solution contains 2.5 grams of salt per 100 grams of solution.

2. Solution Mass

The total weight of the solution, which affects the total amount of salt and the final concentration.

3. Mass of Salt in Each Solution

Calculating the actual amount of salt in each solution is crucial. This involves converting percentage concentrations into absolute quantities based on the mass of each solution.

4. Final Mixture Concentration

Once total salt and total solution mass are known, the concentration can be calculated as:

$$\text{Final concentration} = \left(\frac{\text{Total salt}}{\text{Total solution weight}} \right) \times 100\%$$

Step-by-Step Calculation Process

Let's walk through the problem systematically:

Step 1: Calculate the amount of salt in Solution A

Given:

- Solution A weight = 3.58 kg
- Salt concentration = 2.5%

Convert percentage to decimal:

$$2.5\% = 0.025$$

Calculate salt mass:

$$\text{Salt in Solution A} = 3.58 \text{ kg} \times 0.025 = 0.0895 \text{ kg}$$

Step 2: Calculate the amount of salt in Solution B

Given:

- Solution B weight = 3.77 kg
- Salt concentration = 4.7%

Convert percentage:

$$4.7\% = 0.047$$

Calculate salt mass:

$$\text{Salt in Solution B} = 3.77 \text{ kg} \times 0.047 = 0.17719 \text{ kg}$$

Step 3: Determine total salt in the mixture

Add the salt quantities:

$$\text{Total salt} = 0.0895 \text{ kg} + 0.17719 \text{ kg} = 0.26669 \text{ kg}$$

Step 4: Determine total solution weight

Add the weights of the two solutions:

$$\text{Total weight} = 3.58 \text{ kg} + 3.77 \text{ kg} = 7.35 \text{ kg}$$

Step 5: Calculate the final concentration

Expressed as a percentage:

$$\text{Final concentration} = \left(\frac{0.26669 \text{ kg}}{7.35 \text{ kg}} \right) \times 100\%$$

Calculating:

$$\frac{0.26669}{7.35} \approx 0.0363$$

$$\text{Final concentration} \approx 0.0363 \times 100\% = 3.63\%$$

Result:

The final solution has an approximate salt concentration of 3.63%.

Deep Dive into the Calculation: Critical Aspects and Assumptions

While the above steps provide a straightforward calculation, several nuances and assumptions underpin the process:

1. Assumption of Homogeneity

- The solutions are assumed to mix uniformly without any chemical reactions or phase separations.
- The solutions are ideal, meaning the salt dissolves completely and evenly.

2. Density and Volume Considerations

- The calculation assumes mass-based concentration is sufficient, ignoring density variations.
- In real-world scenarios, solutions of different concentrations might have different densities, affecting volume calculations.

3. No Volume Change Upon Mixing

- The calculation assumes that the total volume of the mixture is simply the sum of individual volumes, which is valid for dilute solutions but can introduce errors in more concentrated solutions.

Practical Applications and Significance

Understanding mixture concentrations has broad applications:

- Chemical manufacturing: Precise formulations for products like cleaning agents, pharmaceuticals, and food additives.
- Water treatment: Adjusting salt concentrations in desalination or purification processes.
- Laboratory experiments: Preparing solutions with specific concentrations for research.
- Industrial processes: Manufacturing solutions with targeted properties for corrosion control, heat transfer, etc.

Common Pitfalls and Troubleshooting

When tackling such problems, some common errors can occur:

1. Incorrect Conversion of Percentages

- Always verify whether the percentage is expressed as a percent or a decimal.
- Remember: $2.5\% = 0.025$, not 2.5.

2. Ignoring Units

- Consistently check units for mass (kg, g, mg) and ensure uniformity.
- Convert all quantities to the same units before calculations.

3. Miscalculating Salt Mass

- Mistakes often occur in multiplying concentration by total mass; double-check calculations.

4. Assuming Volume Equivalence

- Do not assume that volumes or masses add linearly if the density varies significantly; but for dilute solutions, this approximation is usually acceptable.

Advanced Considerations: Beyond Basic Mixture

Calculations

While the basic approach suffices for many problems, advanced scenarios might involve:

- Non-ideal solutions: Activity coefficients affecting concentration calculations.
- Temperature effects: Changes in density and solubility with temperature.
- Partial reactions: If salt reacts with other solution components.
- Multiple components: Mixtures involving more than two solutions or additional solutes.

Summary and Final Remarks

Mixing two solutions with different salt concentrations involves fundamental principles of solution chemistry and mass balance. By calculating the total amount of salt in each solution and summing their masses, one can accurately determine the final concentration. For the problem at hand:

- 3.58 kg of 2.5% salt solution contains approximately 0.0895 kg of salt.
- 3.77 kg of 4.7% salt solution contains approximately 0.17719 kg of salt.
- The total salt in the mixture is roughly 0.26669 kg.
- The total solution weight is 7.35 kg.

The resulting concentration is approximately 3.63% salt.

This method emphasizes the importance of precise calculations, understanding the underlying principles, and being aware of assumptions. Such problems are foundational in both academic and industrial contexts, underpinning quality control, formulation design, and process optimization.

In essence, the ability to accurately determine the final concentration after mixing solutions not only enhances problem-solving skills but also ensures safety, compliance, and efficiency across multiple scientific and engineering disciplines.

[3 58 Kg Of Solution A 2 5 Salt Is Mixed With 3 77 Kg Of Solution B 4 7 Salt What Is The Final](#)

3 58 Kg Of Solution A 2 5 Salt Is Mixed With 3 77 Kg Of Solution B 4 7 Salt What Is The Final

Related Articles

- [Name Two Types Of Evidence Scientists Use To Support The Theory Of Evolution.Type Your Answer Here:](#)
- [A Factory Uses A Motor And A Cable To Drag A 300kg Machine To The Proper Place On The](#)

Factory Floor.

- A Cyclist Is Riding His Bike Up A Mountain Trail. When He Starts Up The Trail, He Is Going 8 M/s. As

[Back to Home](#)