

# A Solution Is Prepared By Adding 35.0 ML Of A Propylamine, C<sub>3</sub>H<sub>7</sub>NH<sub>2</sub>, To Enough Water To Make 1.70 L Of

**A Solution Is Prepared By Adding 35.0 ML Of A Propylamine, C<sub>3</sub>H<sub>7</sub>NH<sub>2</sub>, To Enough Water To Make 1.70 L Of** a comprehensive solution. This process involves careful measurement, understanding chemical properties, and precise calculations to achieve the desired concentration. Whether you're preparing this solution for a laboratory experiment, educational demonstration, or industrial application, understanding each step ensures safety, accuracy, and effectiveness.

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## Understanding Propylamine (C<sub>3</sub>H<sub>7</sub>NH<sub>2</sub>)

### Chemical Properties of Propylamine

Propylamine, also known as n-propylamine, is an organic compound with the molecular formula C<sub>3</sub>H<sub>7</sub>NH<sub>2</sub>. It belongs to the class of primary amines, characterized by a nitrogen atom attached directly to a carbon chain.

- Physical State: Colorless liquid at room temperature
- Odor: Ammonia-like smell
- Boiling Point: Approximately 48°C
- Solubility: Highly soluble in water due to the amino group

### Uses of Propylamine

Propylamine is widely used in various industries, including:

- Synthesis of pharmaceuticals and agrochemicals
- Manufacturing of dyes and pigments
- As a building block in organic synthesis

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## Preparing the Solution: Step-by-Step Process

### 1. Understanding the Purpose

The goal is to prepare a specific volume of aqueous solution with a known concentration of propylamine. The process involves:

- Measuring the volume of propylamine
- Calculating the amount of solute (propylamine) in moles
- Diluting with water to achieve the final volume

## 2. Calculating the Amount of Propylamine

Given data:

- Volume of propylamine = 35.0 mL
- Final volume of solution = 1.70 L (1700 mL)

Step 1: Convert the volume of propylamine to liters

- 35.0 mL = 0.035 L

Step 2: Find the density of propylamine

- Density  $\approx$  0.75 g/mL (standard value)

Step 3: Calculate the mass of propylamine

- Mass = Volume  $\times$  Density = 35.0 mL  $\times$  0.75 g/mL = 26.25 g

Step 4: Calculate moles of propylamine

- Molar mass of C<sub>3</sub>H<sub>7</sub>NH<sub>2</sub>:
- Carbon (C): 3  $\times$  12.01 g/mol = 36.03 g/mol
- Hydrogen (H): 7 + 2 = 9  $\times$  1.008 g/mol = 9.072 g/mol
- Nitrogen (N): 14.01 g/mol
- Total molar mass  $\approx$  36.03 + 9.072 + 14.01  $\approx$  59.11 g/mol
- Moles = Mass / Molar mass = 26.25 g / 59.11 g/mol  $\approx$  0.444 moles

Step 5: Determine the molarity of the solution

- Molarity (M) = Moles / Volume in liters
- M = 0.444 mol / 1.70 L  $\approx$  0.261 M

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## Preparing the Solution

### 1. Gathering Materials

- Propylamine (C<sub>3</sub>H<sub>7</sub>NH<sub>2</sub>)
- Distilled or deionized water
- Volumetric flask (at least 1.70 L)
- Pipette or graduated cylinder
- Protective equipment (gloves, goggles)

## 2. Procedure

1. Carefully measure 35.0 mL of propylamine using a graduated pipette or cylinder.
2. Pour the measured propylamine into the volumetric flask.
3. Slowly add distilled water to the flask, swirling gently to mix.
4. Continue adding water until the total volume reaches exactly 1.70 L.
5. Cap the flask and invert multiple times to ensure thorough mixing.

## 3. Safety Precautions

- Propylamine is flammable and has a strong odor; handle in a well-ventilated area.
- Wear appropriate protective gear.
- Avoid inhalation and skin contact.
- Store the solution in a labeled container away from heat sources.

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## Applications and Importance of Precise Solution Preparation

### 1. Laboratory Experiments

Accurate solutions are essential for titrations, reaction kinetics, and other quantitative analyses. Proper preparation ensures reproducible results and valid data.

### 2. Industrial Processes

In manufacturing, exact concentrations of chemicals like propylamine can affect product quality and safety. Precise measurements optimize reactions and reduce waste.

### 3. Educational Demonstrations

Prepared solutions help students understand concepts of molarity, dilutions, and chemical properties through hands-on experiments.

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# Calculating Concentrations and Dilutions

## Understanding Molarity

Molarity (M) expresses the number of moles of solute per liter of solution. In this case:

- The final solution has a molarity of approximately 0.261 M.

## Performing Dilutions

If a different concentration is needed, use the dilution formula:

$$C_1 V_1 = C_2 V_2$$

Where:

- $C_1$  = initial concentration
- $V_1$  = volume of initial solution used
- $C_2$  = desired concentration
- $V_2$  = final volume

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## Conclusion

Preparing a solution of propylamine by adding 35.0 mL to enough water to make 1.70 L involves precise measurement, understanding of chemical properties, and meticulous methodology. This process ensures that the resulting solution has the desired concentration, which is vital for scientific accuracy, industrial efficiency, and educational purposes. Proper safety measures and calculation techniques are essential for successful preparation and application of the solution.

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## Additional Tips for Successful Solution Preparation

- Always use calibrated instruments for measurement.
- Verify the purity of propylamine if high accuracy is required.
- Label the solution clearly with concentration, date, and safety information.
- Store the solution in a suitable container away from light and heat.

By following these guidelines and understanding the underlying chemistry, you can confidently prepare solutions like the one described, ensuring reliable and effective results in all your chemical endeavors.

## Frequently Asked Questions

### **What is the molarity of propylamine in the solution if 35.0 mL of C<sub>3</sub>H<sub>7</sub>NH<sub>2</sub> is added to 1.70 L of water?**

First, calculate moles of propylamine: density or molar mass is needed. The molar mass of C<sub>3</sub>H<sub>7</sub>NH<sub>2</sub> is approximately 59.11 g/mol. Assuming density similar to water or given mass, if the 35.0 mL is equivalent to a certain mass, then moles = (mass in grams) / 59.11 g/mol. Without density, if 35.0 mL is pure liquid and assuming a typical density close to water, the molarity can be approximated accordingly.

### **How do you calculate the molarity of propylamine in the prepared solution?**

Molarity is calculated by dividing the moles of solute (propylamine) by the total volume of solution in liters:  $M = \text{moles of C}_3\text{H}_7\text{NH}_2 / 1.70 \text{ L}$ .

### **What is the significance of adding 35.0 mL of propylamine to water in solution preparation?**

Adding 35.0 mL of propylamine determines the amount of solute introduced, which affects the concentration (molarity) of the solution, influencing its chemical properties and reactivity.

### **Why is it important to know the molar mass of propylamine when preparing the solution?**

Knowing the molar mass allows accurate conversion from volume to moles, enabling precise calculation of the solution's molarity.

### **If the density of propylamine is 0.75 g/mL, how many grams of C<sub>3</sub>H<sub>7</sub>NH<sub>2</sub> are added?**

$\text{Mass} = \text{volume} \times \text{density} = 35.0 \text{ mL} \times 0.75 \text{ g/mL} = 26.25 \text{ grams of propylamine.}$

### **What are common uses of propylamine in chemical laboratories?**

Propylamine is commonly used as a precursor in organic synthesis, in pharmaceutical manufacturing, and as a solvent or reagent in chemical reactions.

### **How does the addition of water affect the concentration of propylamine in the solution?**

Adding water dilutes the propylamine, decreasing its molarity and concentration in the solution.

## What safety precautions should be taken when handling propylamine?

Propylamine is toxic and volatile; proper protective equipment such as gloves, goggles, and working in a fume hood are recommended to prevent inhalation and skin contact.

## How would the solution's pH be affected by the addition of propylamine?

Propylamine is a weak base, so its addition will increase the pH, making the solution more basic.

## What is the purpose of preparing a solution with propylamine and water in chemical experiments?

Preparing such solutions allows researchers to study the chemical properties, reactivity, and applications of propylamine in various reactions and processes.

## Additional Resources

Propylamine Solution Preparation: An In-Depth Guide

Creating a precise chemical solution requires meticulous attention to detail, understanding of the chemical properties involved, and accurate measurement techniques. In this article, we delve into the process of preparing a solution by adding 35.0 mL of propylamine ( $\text{C}_3\text{H}_7\text{NH}_2$ ) to enough water to produce 1.70 liters of solution. We explore the fundamental concepts, calculations involved, and practical considerations to ensure accuracy and safety in laboratory settings.

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## Understanding Propylamine ( $\text{C}_3\text{H}_7\text{NH}_2$ )

Before embarking on solution preparation, it is essential to understand the chemical involved—propylamine.

## Chemical Properties

- Molecular formula:  $\text{C}_3\text{H}_7\text{NH}_2$
- Molecular weight: Approximately 59.11 g/mol
- Physical state: Colorless liquid at room temperature
- Odor: Fishy or amine-like smell
- Boiling point: About  $87^\circ\text{C}$
- Solubility: Fully miscible with water due to its amine group

Propylamine is classified as a primary amine, which makes it both a useful intermediate in organic synthesis and a compound that requires careful handling due to its volatility and potential health hazards.

## Safety Precautions

- Always use in a well-ventilated fume hood.
- Wear appropriate personal protective equipment: gloves, lab coat, and safety goggles.
- Avoid inhalation and skin contact, as propylamine can be irritating.
- Store in a tightly sealed container away from incompatible substances.

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## Step-by-Step Solution Preparation Process

Preparing a solution involves several key steps: calculating the amount of propylamine needed, measuring the compound accurately, diluting with water, and ensuring the solution's homogeneity.

### 1. Calculating the Mass of Propylamine

Given the volume of propylamine to be added:

- Volume of propylamine (V): 35.0 mL
- Density of propylamine ( $\rho$ ): approximately 0.753 g/mL

Using the relation:

$$\text{Mass} = \text{Density} \times \text{Volume}$$

$$\text{Mass} = 0.753 \, \text{g/mL} \times 35.0 \, \text{mL} = 26.36 \, \text{g}$$

Result: Approximately 26.36 grams of propylamine are needed for the solution.

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### 2. Calculating the Moles of Propylamine

Knowing the molar mass allows us to determine the number of moles:

$$\text{Moles} = \frac{\text{Mass}}{\text{Molecular weight}}$$

$$\text{Moles} = \frac{26.36 \text{ g}}{59.11 \text{ g/mol}} \approx 0.446 \text{ mol}$$

This is crucial for understanding the molarity of the resulting solution and for any subsequent chemical calculations or reactions.

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### 3. Determining the Total Volume of Water Needed

The goal is to prepare 1.70 L of solution total, which includes the volume of propylamine and water. Because the volume of the added propylamine is small relative to the total volume, and because mixing can lead to volume contraction or expansion, it's best practice to:

- Measure water to approximately 1.70 L.
- Add propylamine gradually, mixing thoroughly.
- Adjust the volume to precisely 1.70 L after addition.

Practical Tip: Use a volumetric flask or a graduated cylinder for high accuracy.

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## Practical Considerations in Solution Preparation

While calculations provide a theoretical basis, real-world factors influence the actual process.

### Measuring Propylamine Accurately

- Use a calibrated burette or pipette for liquid transfer.
- For safety, transfer propylamine slowly to prevent splashing or release of vapors.
- Confirm the volume using appropriate measurement devices.

### Dilution and Mixing

- Add the measured propylamine to a container containing less than 1.70 L of water.
- Stir or swirl the mixture gently but thoroughly to ensure uniform distribution.
- If necessary, add water gradually until the total volume reaches exactly 1.70 L.

## pH and Concentration Considerations

- Propylamine is a weak base; its addition will increase the solution's pH.
- For applications sensitive to pH, measure the pH after preparation.
- Calculate molarity:

$$\text{Concentration (M)} = \frac{\text{moles of propylamine}}{\text{volume in liters}} = \frac{0.446 \text{ mol}}{1.70 \text{ L}} \approx 0.262 \text{ M}$$

This molarity indicates a moderately concentrated amine solution, suitable for various chemical reactions or analytical procedures.

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## Applications and Uses of the Prepared Propylamine Solution

Such a solution has multiple applications across chemistry and industry:

- Organic synthesis: As a building block for pharmaceuticals, dyes, and polymers.
- Buffer solutions: In pH adjustments for reactions requiring basic conditions.
- Reagent in analytical chemistry: For titrations or calibration standards.
- Industrial processes: As an intermediate in manufacturing processes.

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## Quality Control and Storage

Ensuring solution integrity involves:

- Labeling: Clearly mark the container with concentration, date of preparation, and safety information.
- Storage: Keep in a tightly sealed container, preferably under inert atmosphere if long-term storage is required.
- Stability: Propylamine solutions are generally stable but should be checked periodically for contamination or evaporation.

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## Summary and Final Remarks

Preparing a solution by adding 35.0 mL of propylamine to water to make 1.70 L of solution is a straightforward process that combines precise measurement, understanding of chemical properties, and safety considerations. Accurate calculation of the compound's mass and molarity provides a solid foundation for subsequent laboratory work or industrial applications. Proper handling, mixing, and storage ensure the solution remains effective and safe for its intended purpose.

This detailed overview underscores the importance of combining theoretical calculations with practical skills to achieve optimal results in chemical solution preparation. Whether used for research, manufacturing, or analytical purposes, such meticulousness ensures consistency, safety, and success in chemical endeavors.

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