

Solutions and Molarity

Introduction:

To calculate the molarity (M) of each aqueous solution, use the formula:

$$\text{Molarity (M)} = \text{Moles of solute} / \text{Volume of solution in liters}$$

Given:

$$\text{Molar mass of NaCl} = 58.44 \text{ g/mol}$$

Step A: Calculating Molarity for 26.0 g NaCl in 7.59 L

Given Data:

$$\begin{aligned}\text{Mass of NaCl (solute)} &= 26.0 \text{ g} \\ \text{Volume of solution} &= 7.59 \text{ L}\end{aligned}$$

Convert Mass to Moles:

$$\begin{aligned}\text{Moles of NaCl} &= \text{Mass of NaCl} / \text{Molar mass of NaCl} \\ \text{Moles of NaCl} &= 26.0 \text{ g} / 58.44 \text{ g/mol} \\ \text{Moles of NaCl} &= 0.445 \text{ mol}\end{aligned}$$

Explanation: The number of moles of NaCl is calculated by dividing the given mass by the molar mass of NaCl.

Calculate Molarity:

$$\begin{aligned}\text{Molarity (M)} &= \text{Moles of NaCl} / \text{Volume of solution in L} \\ \text{Molarity (M)} &= 0.445 \text{ mol} / 7.59 \text{ L} \\ \text{Molarity (M)} &= 0.0586 \text{ M}\end{aligned}$$

Explanation: The molarity is calculated by dividing the number of moles by the solution's volume in liters.

Final Molarity for Part A:

The molarity of the solution is 0.0586 M.

Step B: Calculating Molarity for 18.1 g NaCl in 310 mL

Given Data:

$$\begin{aligned}\text{Mass of NaCl (solute)} &= 18.1 \text{ g} \\ \text{Volume of solution} &= 310 \text{ mL}\end{aligned}$$

Convert Volume to Liters:

$$\begin{aligned}\text{Volume in Liters} &= 310 \text{ mL} / 1000 \text{ mL/L} \\ \text{Volume in Liters} &= 0.310 \text{ L}\end{aligned}$$

Explanation: The volume is converted from mL to L for compatibility in the molarity formula.

Convert Mass to Moles:

$$\begin{aligned}\text{Moles of NaCl} &= \text{Mass of NaCl} / \text{Molar mass of NaCl} \\ \text{Moles of NaCl} &= 18.1 \text{ g} / 58.44 \text{ g/mol} \\ \text{Moles of NaCl} &= 0.310 \text{ mol}\end{aligned}$$

Explanation: The number of moles of NaCl is calculated by dividing the given mass by the molar mass of NaCl.

Calculate Molarity:

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Molarity (M) = Moles of NaCl / Volume of solution in L
Molarity (M) = 0.310 mol / 0.310 L
Molarity (M) = 1.00 M
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Explanation: The molarity is calculated by dividing the number of moles by the solution's volume in liters.

Final Molarity for Part B:

The molarity of the solution is 1.00 M.

Step C: Calculating Molarity for 83.0 g NaCl in 760 mL

Given Data:

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Mass of NaCl (solute) = 83.0 g
Volume of solution = 760 mL
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Convert Volume to Liters:

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Volume in Liters = 760 mL / 1000 mL/L
Volume in Liters = 0.760 L
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Explanation: The volume is converted from mL to L for compatibility in the molarity formula.

Convert Mass to Moles:

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Moles of NaCl = Mass of NaCl / Molar mass of NaCl
Moles of NaCl = 83.0 g / 58.44 g/mol
Moles of NaCl = 1.42 mol
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Explanation: The number of moles of NaCl is calculated by dividing the given mass by the molar mass of NaCl.

Calculate Molarity:

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Molarity (M) = Moles of NaCl / Volume of solution in L
Molarity (M) = 1.42 mol / 0.760 L
Molarity (M) = 1.87 M
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Explanation: The molarity is calculated by dividing the number of moles by the solution's volume in liters.

Final Molarity for Part C:

The molarity of the solution is 1.87 M.

Summary of Final Molarities:

- Part A: 0.0586 M
- Part B: 1.00 M
- Part C: 1.87 M