LESSON MAKER PRO

Two Ways to Concentrate

Find concentration using solution volume or solvent mass.

HIGH SCHOOL · CHE.5.a

CHE.5.a "Use mathematics and computational thinking to express the concentrations of given solutions in terms of molarity and molality."

NAME _____ DATE _____

CHOOSE THE DENOMINATOR

Molarity (M) is moles of solute divided by liters of solution. Molality (m) is moles of solute divided by kilograms of solvent. Convert milliliters to liters or grams to kilograms before dividing; when needed, find moles by dividing grams of solute by its molar mass.

WORKED EXAMPLE

A solution contains 0.12 mol of solute. Its final volume is 0.30 L, and it contains 0.24 kg of solvent. Find its molarity and molality.

1. M = 0.12 mol / 0.30 L = 0.40 M.
2. m = 0.12 mol / 0.24 kg = 0.50 m.

Answer: 0.40 M and 0.50 m

PRACTICE 6 problems

1 A solution contains 0.20 mol of solute in 0.10 L of solution. Find its molarity.

ANSWER _____

2 A solution contains 0.45 mol of solute dissolved in 0.15 kg of solvent. Find its molality.

ANSWER _____

3 A solution contains 0.60 mol of solute and has a final volume of 150 mL. Find its molarity.

ANSWER _____

4 A solution contains 0.36 mol of solute dissolved in 180 g of water. Find its molality.

ANSWER _____

5 A solution contains 0.48 mol of solute and 240 g of solvent. Its final volume is 0.40 L. Find both its molarity and molality.

ANSWER _____

6 A student dissolves 10 g of NaOH in 200 g of water. The molar mass of NaOH is 40 g/mol. Find the solution's molality.

ANSWER _____

APPLY IT Show your work

1 A sports drink contains 0.08 mol of glucose in 0.40 L of finished drink. What is the molarity of glucose?

WORK SPACE

ANSWER _____

2 For a classroom test of an ice-melting mixture, a student dissolves 0.50 mol of salt in 250 g of water. What is the molality of the salt?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A lab makes an electrolyte for a model battery using 0.54 mol of solute and 360 g of solvent. The final solution volume is 0.45 L. Find its molarity and molality. Which has the larger numerical value, and why do the calculations use different denominators?

WORK SPACE AND ANSWER

Two Ways to Concentrate

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A solution contains 0.20 mol of solute in 0.10 L of solution. Find its molarity.	**2.0 M**
2	A solution contains 0.45 mol of solute dissolved in 0.15 kg of solvent. Find its molality.	**3.0 m**
3	A solution contains 0.60 mol of solute and has a final volume of 150 mL. Find its molarity.	**4.0 M**
4	A solution contains 0.36 mol of solute dissolved in 180 g of water. Find its molality.	**2.0 m**
5	A solution contains 0.48 mol of solute and 240 g of solvent. Its final volume is 0.40 L. Find both its molarity and molality.	**1.2 M and 2.0 m**
6	A student dissolves 10 g of NaOH in 200 g of water. The molar mass of NaOH is 40 g/mol. Find the solution's molality.	**1.25 m**

PART 2 · APPLY IT

1. **0.20 M** Divide 0.08 mol by the finished solution volume, 0.40 L.
2. **2.0 m** Convert 250 g of water to 0.250 kg of solvent, then divide 0.50 mol by 0.250 kg.

CHALLENGE

Molarity is 0.54 mol / 0.45 L = 1.2 M. Molality is 0.54 mol / 0.360 kg = 1.5 m, which has the larger numerical value. Molarity uses solution volume, while molality uses solvent mass.

Accept equivalent decimal forms. Check that students use the final solution volume for molarity and the solvent mass for molality.