LESSON MAKER PRO

Mixing by the Mole

Calculate concentration and plan dilutions.

HIGH SCHOOL · CHE.8

CHE.8 "Students will demonstrate an understanding of the nature of properties of various types of chemical solutions. Use mathematical and computational analysis to quantitatively express the concentration of solutions using concepts such as..."

NAME _____ DATE _____

MOLARITY AND DILUTION

Molarity (M) is moles of solute divided by liters of solution: M = mol/L. To dilute a solution, add solvent without changing the moles of solute, so $M_1V_1 = M_2V_2$. Use the same volume unit on both sides of a dilution equation.

WORKED EXAMPLE

A solution contains 0.45 mol of solute in a final volume of 0.90 L. What is its molarity?

1. Write the rule: M = mol/L.
2. Substitute: M = 0.45 mol/0.90 L.
3. Divide: M = 0.50 mol/L.

Answer: 0.50 M

PRACTICE 6 problems

1 What is the molarity of a solution containing 3.0 mol of solute in 2.0 L of solution?

ANSWER _____

2 What is the molarity of a solution containing 0.24 mol of solute in 0.12 L of solution?

ANSWER _____

3 How many moles of solute are in 3 L of a 4 M solution?

ANSWER _____

4 A solution contains 0.06 mol of solute in a final volume of 200 mL. What is its molarity?

ANSWER _____

5 You dilute 100 mL of a 6 M solution to a final volume of 300 mL. What is the new molarity?

ANSWER _____

6 How many milliliters of an 8 M stock solution do you need to make 400 mL of a 2 M solution?

ANSWER _____

APPLY IT Show your work

1 An outdoor club is testing how road salt affects seeds. You need 250 mL of 0.20 M NaCl solution and have a 1.0 M NaCl stock solution. How many milliliters of stock and how many milliliters of water will you use? Assume the volumes add.

WORK SPACE

ANSWER _____

2 A science fair team dissolves 0.16 mol of NaCl and adds water until the final solution volume is 800 mL. What is the solution's molarity? How many moles of NaCl are in a 100 mL sample of this well-mixed solution?

WORK SPACE

ANSWER _____

CHALLENGE One step up

You first use a 2.0 M stock solution to make 300 mL of a 0.40 M solution. You then take 50 mL of that new solution and add water until its final volume is 200 mL. How many milliliters of stock did you use in the first step, and what is the molarity after the second step? Show both dilution equations.

WORK SPACE AND ANSWER

Mixing by the Mole

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	What is the molarity of a solution containing 3.0 mol of solute in 2.0 L of solution?	**1.5 M**
2	What is the molarity of a solution containing 0.24 mol of solute in 0.12 L of solution?	**2 M**
3	How many moles of solute are in 3 L of a 4 M solution?	**12 mol**
4	A solution contains 0.06 mol of solute in a final volume of 200 mL. What is its molarity?	**0.3 M**
5	You dilute 100 mL of a 6 M solution to a final volume of 300 mL. What is the new molarity?	**2 M**
6	How many milliliters of an 8 M stock solution do you need to make 400 mL of a 2 M solution?	**100 mL**

PART 2 · APPLY IT

1. **50 mL of stock and 200 mL of water** Use (1.0 M)V_1 = (0.20 M)(250 mL) to find V_1 = 50 mL. Subtract 50 mL from 250 mL to get 200 mL of water.
2. **0.20 M; 0.020 mol of NaCl** Convert 800 mL to 0.800 L, then calculate 0.16 mol/0.800 L = 0.20 M. A 100 mL sample is 0.100 L, so it contains (0.20 mol/L)(0.100 L) = 0.020 mol.

CHALLENGE

(2.0 M)V_1 = (0.40 M)(300 mL), so V_1 = 60 mL of stock. (0.40 M)(50 mL) = M_2(200 mL), so M_2 = 0.10 M.

Accept equivalent molarity notation such as mol/L. For the dilution problems, students may use either milliliters or liters if the volume units match within each equation.