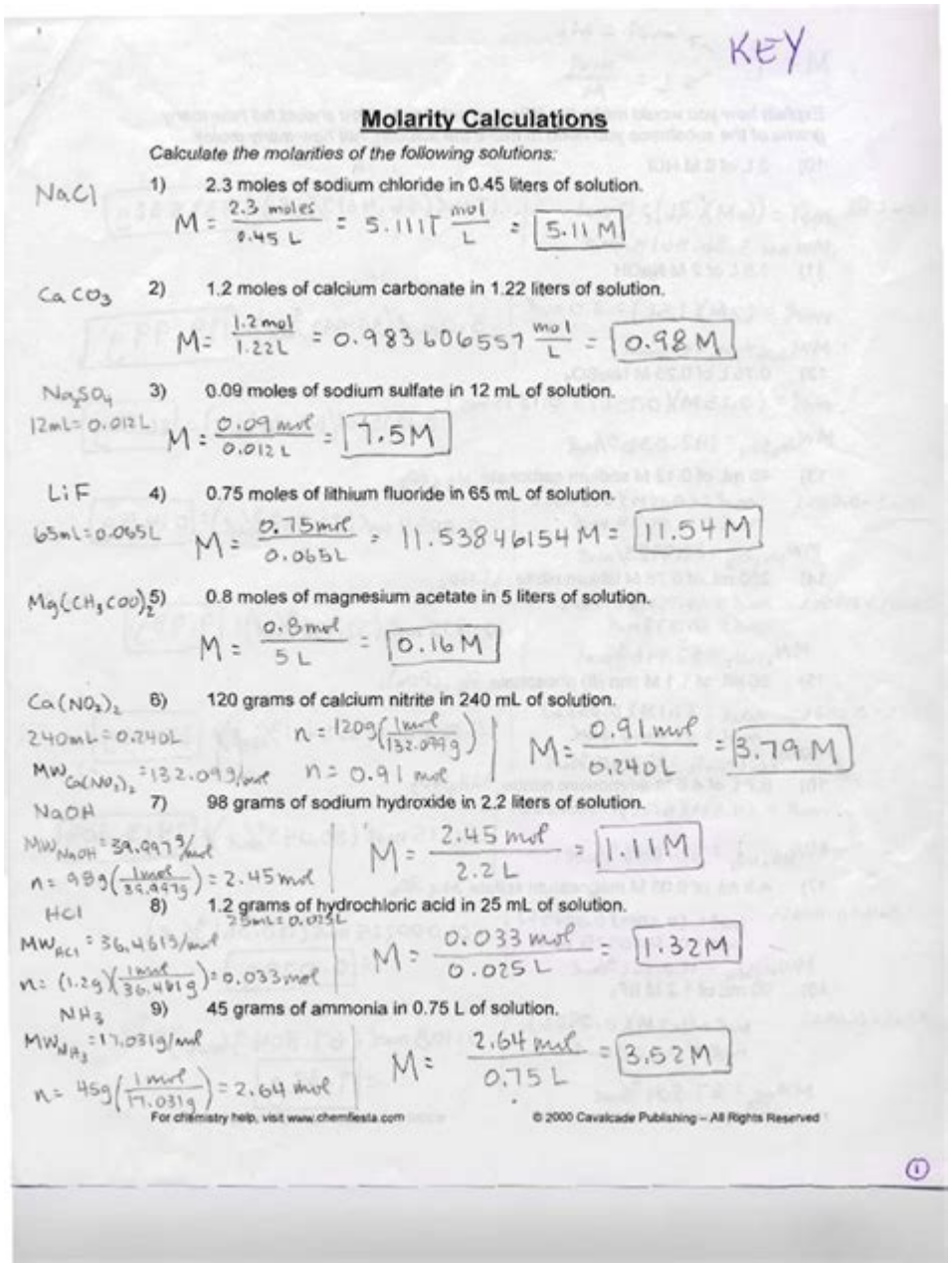
Calculating Molarity Worksheet Answer Key



KEY

Molarity Calculations

Calculate the molarities of the following solutions:

NaCl 1) 2.3 moles of sodium chloride in 0.45 liters of solution.

$M = \frac{2.3 \text{ moles}}{0.45 \text{ L}} = 5.111\overline{1} \frac{\text{mol}}{\text{L}} = \boxed{5.11 \text{ M}}$

$CaCO_3$ 2) 1.2 moles of calcium carbonate in 1.22 liters of solution.

$M = \frac{1.2 \text{ mol}}{1.22 \text{ L}} = 0.983606557 \frac{\text{mol}}{\text{L}} = \boxed{0.98 \text{ M}}$

Na_2SO_4 3) 0.09 moles of sodium sulfate in 12 mL of solution.

12mL = 0.012L

$M = \frac{0.09 \text{ mol}}{0.012 \text{ L}} = \boxed{7.5 \text{M}}$

LiF 4) 0.75 moles of lithium fluoride in 65 mL of solution.

65mL = 0.065L

$M = \frac{0.75 \text{ mol}}{0.065 \text{ L}} = 11.53846154 \text{ M} = \boxed{11.54 \text{ M}}$

$Mg(CH_3COO)_2$ 5) 0.8 moles of magnesium acetate in 5 liters of solution.

$M = \frac{0.8 \text{ mol}}{5 \text{ L}} = \boxed{0.16 \text{ M}}$

$Ca(NO_2)_2$ 6) 120 grams of calcium nitrite in 240 mL of solution.

240mL = 0.240L

$MW_{Ca(NO_2)_2} = 132.093 \text{ g/mol}$

$n = 120 \text{g} \left(\frac{1 \text{ mol}}{132.093 \text{ g}}\right)$ $n = 0.91 \text{ mol}$

$M = \frac{0.91 \text{ mol}}{0.240 \text{ L}} = \boxed{3.79 \text{ M}}$

NaOH 7) 98 grams of sodium hydroxide in 2.2 liters of solution.

$MW_{NaOH} = 39.997 \text{ g/mol}$

$n = 98 \text{g} \left(\frac{1 \text{ mol}}{39.997 \text{ g}}\right) = 2.45 \text{ mol}$

$M = \frac{2.45 \text{ mol}}{2.2 \text{ L}} = \boxed{1.11 \text{ M}}$

HCl 8) 1.2 grams of hydrochloric acid in 25 mL of solution.

25mL = 0.025L

$MW_{HCl} = 36.4613 \text{ g/mol}$

$n = (1.2 \text{g}) \left(\frac{1 \text{ mol}}{36.461 \text{ g}}\right) = 0.033 \text{ mol}$

$M = \frac{0.033 \text{ mol}}{0.025 \text{ L}} = \boxed{1.32 \text{M}}$

NH_3 9) 45 grams of ammonia in 0.75 L of solution.

$MW_{NH_3} = 17.031 \text{ g/mol}$

$n = 45 \text{g} \left(\frac{1 \text{ mol}}{17.031 \text{ g}}\right) = 2.64 \text{ mol}$

$M = \frac{2.64 \text{ mol}}{0.75 \text{ L}} = \boxed{3.52 \text{M}}$

Calculating molarity worksheet answer key is a fundamental tool in the study of chemistry, specifically in understanding the concentration of solutions. Molarity, defined as the number of moles of solute per liter of solution, is a crucial concept that finds applications in various scientific disciplines, from analytical chemistry to biochemistry. This article will provide a comprehensive overview of molarity, how to calculate it, and include a sample worksheet along with detailed answer keys to enhance comprehension and application of this essential concept.

Understanding Molarity

Molarity (M) is a quantitative measure of concentration. It is expressed in moles of solute per liter of solution. The formula to calculate molarity is:

$$ M = \frac{n}{V} $$

Where:
- M = molarity (moles per liter, mol/L)
- n = number of moles of solute
- V = volume of solution in liters

This definition implies that to find the molarity of a solution, one must know both the amount of solute present and the total volume of the solution.

Key Concepts Related to Molarity

1. Moles of Solute: A mole is a unit in chemistry that denotes 6.022×10^{23} entities (atoms, molecules, ions, etc.). To convert grams of a substance to moles, the formula is:

$$ n = \frac{mass\ (g)}{molar\ mass\ (g/mol)} $$

2. Volume of Solution: The volume must be in liters for the molarity calculation. If the volume is given in milliliters, it can be converted by:

$$ V\ (L) = \frac{V\ (mL)}{1000} $$

3. Dilution: When a solution is diluted, the number of moles of solute remains constant. The relationship is defined by the formula:

$$ M_1V_1 = M_2V_2 $$

Where M_1 and V_1 are the molarity and volume of the initial solution, and M_2 and V_2 are those of the diluted solution.

Sample Molarity Problems

To practice calculating molarity, consider the following sample problems that can be included in a worksheet. Each problem will require the student to find the molarity of a given solution.

1. Problem 1: What is the molarity of a solution that contains 5.0 grams of sodium chloride (NaCl) dissolved in enough water to make a total volume of 250 mL?

2. Problem 2: How many liters of a 0.5 M hydrochloric acid (HCl) solution can be made from 3 moles of HCl?

3. Problem 3: If 10 mL of a 2 M glucose (C6H12O6) solution is diluted to a final volume of 100 mL, what is the new molarity of the glucose solution?

4. Problem 4: Calculate the molarity of a solution prepared by dissolving 15 grams of potassium nitrate (KNO3) in 500 mL of water.

5. Problem 5: How many grams of calcium chloride (CaCl2) are needed to prepare 2 liters of a 1.5 M solution?

Answer Key for Calculating Molarity Worksheet

Now, let's provide the answers to the above problems, along with the step-by-step calculations.

Answer 1

- Given: Mass of NaCl = 5.0 g; Volume = 250 mL = 0.250 L
- Molar Mass of NaCl: 22.99 (Na) + 35.45 (Cl) = 58.44 g/mol

$$ n = \frac{5.0\ g}{58.44\ g/mol} = 0.0856\ mol $$

$$ M = \frac{0.0856\ mol}{0.250\ L} = 0.3424\ M $$

Answer: The molarity of the solution is 0.3424 M.

Answer 2

- Given: Moles of HCl = 3 moles; Molarity = 0.5 M

Using the formula $M = \frac{n}{V}$:

$$ V = \frac{n}{M} = \frac{3\ moles}{0.5\ M} = 6\ L $$

Answer: 6 liters of a 0.5 M hydrochloric acid solution can be made.

Answer 3

- Given: Initial Volume = 10 mL = 0.010 L; Initial Molarity = 2 M; Final Volume = 100 mL = 0.100 L

Using the dilution formula $M_1V_1 = M_2V_2$:

$$ 2\ M \times 0.010\ L = M_2 \times 0.100\ L $$

$$ M_2 = \frac{0.020}{0.100} = 0.20\ M $$

Answer: The new molarity of the glucose solution is 0.20 M.

Answer 4

- Given: Mass of KNO3 = 15 g; Volume = 500 mL = 0.500 L
- Molar Mass of KNO3: 39.10 (K) + 14.01 (N) + 3 × 16.00 (O) = 101.11 g/mol

$$ n = \frac{15\ g}{101.11\ g/mol} = 0.1486\ mol $$

$$ M = \frac{0.1486\ mol}{0.500\ L} = 0.2972\ M $$

Answer: The molarity of the solution is 0.2972 M.

Answer 5

- Given: Desired Molarity = 1.5 M; Volume = 2 L; Molar Mass of CaCl2 = 40.08 (Ca) + 2 × 35.45 (Cl) = 110.98 g/mol

Using the formula $n = M \times V$:

$$ n = 1.5\ M \times 2\ L = 3\ mol $$

To find grams needed:

$$ mass = n \times molar\ mass = 3\ mol \times 110.98\ g/mol = 332.94\ g $$

Answer: To prepare 2 liters of a 1.5 M solution, 332.94 grams of calcium chloride are needed.

Conclusion

Calculating molarity worksheet answer key serves as a valuable educational resource for students learning about solution concentrations in chemistry. Understanding how to calculate molarity and utilize it accurately in various chemical contexts is foundational for further studies in chemistry and related sciences. Practicing with worksheets and reviewing answer keys helps reinforce these concepts and prepares students for more advanced topics in chemistry. Through examples, exercises, and solutions, learners can build their confidence and competence in handling molarity-related problems effectively.

Frequently Asked Questions

What is molarity and how is it calculated?

Molarity is a measure of concentration defined as the number of moles of solute per liter of solution. It is calculated using the formula: Molarity (M) = moles of solute / liters of solution.

What information do I need to complete a molarity worksheet?

To complete a molarity worksheet, you need the number of moles of solute, the volume of the solution in liters, and possibly the molar mass of the solute for conversions.

How do I convert grams of solute to moles for molarity calculations?

To convert grams of solute to moles, divide the mass of the solute (in grams) by its molar mass (in g/mol). Use the formula: moles = grams / molar mass.

What is a common mistake when calculating molarity?

A common mistake is using milliliters instead of liters when calculating molarity. Always convert the volume to liters before using it in the molarity formula.

How do I find the molarity of a solution if I know the mass of solute and the volume of solution?

First, convert the mass of the solute to moles, then divide the number of moles by the volume of the solution in liters using the formula: M = moles of solute / liters of solution.

Can I find the molarity of a diluted solution using a worksheet?

Yes, you can find the molarity of a diluted solution using the dilution formula: M1V1 = M2V2, where M1 and V1 are the molarity and volume of the concentrated solution, and M2 and V2 are the molarity and volume of the diluted solution.

What are some typical examples of molarity calculations in a worksheet?

Typical examples include calculating the molarity of a salt solution, determining how much solute to add to achieve a desired molarity, and performing dilutions from a stock solution.

Where can I find answer keys for molarity worksheets?

Answer keys for molarity worksheets can often be found in educational resources, textbooks, or online educational platforms that provide worksheets and their solutions.

Calculating Molarity Worksheet Answer Key

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