ANSWER KEY.

ZornScience
zornscience.org

Molarity Calculations

Chemistry | ANSWER KEY

M = mol of solute ÷ L of solution. Convert mL to L (÷ 1000) first. Percent by mass = (g solute ÷ g solution) × 100; percent by volume = (mL solute ÷ mL solution) × 100; ppm = (g solute ÷ g solution) × 1,000,000. Molar masses: NaOH = 40.00, $CaCl_2$ = 110.98, $C_6H_{12}O_6$ = 180.18, KNO_3 = 101.11 g/mol. Round to the correct sig figs.

1. Molarity, moles, and volume. The first row is done for you.

Given	Find	Setup	Answer
0.750 mol KCl in 1.50 L of solution	M	0.750 mol ÷ 1.50 L	0.500 M
125 mL of 0.400 M HCl	mol HCl	**0.400 M × 0.125 L**	**0.0500 mol**
0.250 M NaCl that contains 0.100 mol	mL	**0.100 mol ÷ 0.250 M = 0.400 L**	**400. mL**

2. Starting from grams or finding grams. Show your setup in the Answer column. The first row is done for you.

Given	Find	Answer
20.0 g NaOH in 500. mL of solution	M	0.500 mol ÷ 0.500 L = 1.00 M
250. mL of 0.300 M $CaCl_2$	g $CaCl_2$	**0.0750 mol × 110.98 = 8.32 g**
2.00 L of 0.150 M glucose, $C_6H_{12}O_6$	g glucose	**0.300 mol × 180.18 = 54.1 g**
5.06 g KNO_3 in 100.0 mL of solution	M	**0.05004 mol ÷ 0.1000 L = 0.500 M**

Grams → moles (÷ molar mass) → ÷ L, or M × L → moles → × molar mass.

CC BY-NC-SA 4.0 | zornscience.org

3. Percent and parts per million. Show your setup in the Answer column. The first row is done for you.

Given	Find	Answer
12.0 g NaCl dissolved in 188.0 g water	percent by mass	12.0 ÷ 200.0 × 100 = 6.00%
25.0 mL ethanol in 200.0 mL of solution	percent by volume	**25.0 ÷ 200.0 × 100 = 12.5%**
250.0 g of 3.00% (by mass) hydrogen peroxide	g H_2O_2	**250.0 g × 0.0300 = 7.50 g**
0.0450 g Ca^{2+} in 500.0 g of solution	ppm Ca^{2+}	**0.0450 ÷ 500.0 × 10^6 = 90.0 ppm**

The bottom of each fraction is the whole solution: solute plus solvent.

4. A student dissolves 0.50 mol of NaCl to make 250 mL of solution and reports 0.0020 M. What went wrong? What is the right answer?

The student divided by 250 mL instead of 0.250 L. 0.50 mol ÷ 0.250 L = **2.0 M**

5. A student dissolves 10.0 g of salt in 90.0 g of water and says the solution is 11.1% salt by mass. Find the mistake and the right percent.

The student divided by the water (10.0 ÷ 90.0) instead of the whole solution. 10.0 ÷ 100.0 × 100 = **10.0%**

6. Adding 1.00 mol of NaCl to 1.00 L of water does not make a 1.00 M solution. Explain why, and describe the right way to make this **standard solution**.

Molarity uses liters of solution, and the dissolved NaCl adds volume, so the total is more than 1.00 L.

Dissolve the NaCl in some water in a 1.00 L volumetric flask, then add water up to the line, stopper, and invert to mix.

CC BY-NC-SA 4.0 | zornscience.org