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Solution Stoichiometry
Chem Worksheet 15-6

Name _____

The molarity of a solution is a ratio of the moles of solute per liters of solution. The units for molarity are written as mol/L, or M. This measurement is used to perform stoichiometric calculations. The strategy used for solving these solution stoichiometry problems is to set up the problem so that the units cancel.

When the volume of a solution is multiplied by the molarity of a solution the resulting units are moles. A balanced equation allows us to convert from moles of a known substance to moles of an unknown. Finally, the moles of an unknown substance can be converted into grams, liters of solution, molarity, or other units.

Stoichiometry Strategy

Start with a given: **Volume of solution (L)** or **Mass of solute (g)** → **Molarity (mol/L)** or **Molar mass (g/mol)** → **Moles of solute (mol)** → **Stoichiometric ratio (mol/mol)** → **Moles of solute (mol)** → **Volume of solution (L)** or **Mass of solute (g)**

Example

How many grams of solid calcium hydroxide, Ca(OH)₂, are required to react with 250 mL of 0.10 M HCl?

Balance the equation: $Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$

convert mol. to L: $250 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 0.250 \text{ L}$

with the "given and unknown" units: $0.250 \text{ L} \times \frac{0.10 \text{ mol Ca(OH)}_2}{1 \text{ L}} \times \frac{2 \text{ mol HCl}}{1 \text{ mol Ca(OH)}_2} \times \frac{74.10 \text{ g Ca(OH)}_2}{1 \text{ mol Ca(OH)}_2} = 3.70 \text{ g Ca(OH)}_2$

Fill in factors and solve: $0.250 \text{ L} \times \frac{0.10 \text{ mol Ca(OH)}_2}{1 \text{ L}} \times \frac{2 \text{ mol HCl}}{1 \text{ mol Ca(OH)}_2} \times \frac{74.10 \text{ g Ca(OH)}_2}{1 \text{ mol Ca(OH)}_2} = 3.70 \text{ g Ca(OH)}_2$

Answer the following questions. Show all work and report answers with units.

- How many grams of aluminum are required to react with 25 mL of 2.0 M hydrochloric acid, HCl?
 $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$
- How many grams of sodium can be reacted with 750 mL of a 0.10 M solution of sodium acid, HNO₃?
 $Na + HNO_3 \rightarrow NaNO_3 + H_2$
- If 45 mL of a 1.0 M AgNO₃ is added to KCl how many grams of AgCl can be formed?
 $AgNO_3 + KCl \rightarrow AgCl + KNO_3$
- How many liters of a 0.50 M solution of Ca(NO₃)₂ will be required to react with 100 g of Na₂CO₃?
 $Ca(NO_3)_2 + Na_2CO_3 \rightarrow CaCO_3 + Na_2NO_3$
- How many liters of a 1.0 M H₂O₂ solution are required to react with 5.0 g of Fe?
 $H_2O_2 + Fe \rightarrow Fe_2O_3 + H_2O$
- How many milliliters of 0.10 M Pb(NO₃)₂ are required to react with 75 mL of 0.20 M NaCl?
 $Pb(NO_3)_2 + NaCl \rightarrow PbCl_2 + NaNO_3$
- How many grams of solid BaCl₂ will form when Na₂SO₄ reacts with 25 mL of 0.10 M Ba(NO₃)₂?
 $Ba(NO_3)_2 + Na_2SO_4 \rightarrow BaSO_4 + NaNO_3$
- If 125 mL of 0.80 M HCl solution is neutralized with 210 mL of 0.60 M KOH solution what is the molarity of the KOH?
 $HCl + KOH \rightarrow KCl + H_2O$

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