

Solution Stoichiometry

Chem Worksheet 15-6

Answer Key

Name _____

$C \cdot V = n$

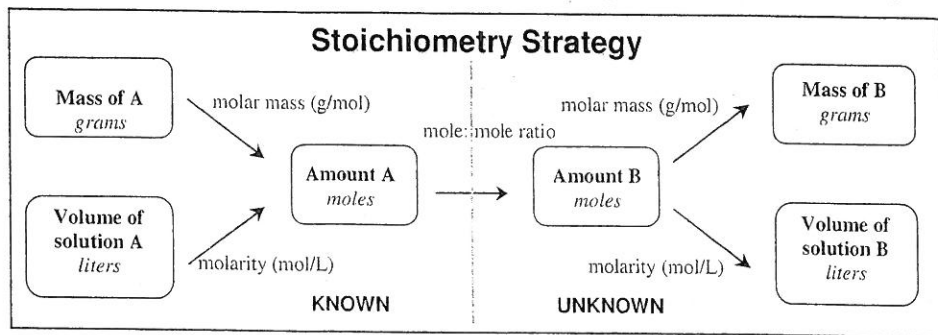
$\text{concentration (mol/L)} \times \text{volume (L)} =$

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.

USEFUL EQUATIONS

molarity = $\frac{\text{mol solute}}{\text{L solution}}$ 1 L = 1000 mL

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.



mole box!

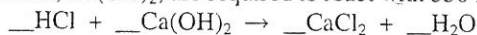
moles!

* g → moles using mm

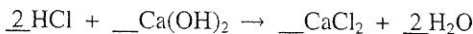
* C · V → moles if you have a soln & not a solid!

Example

How many grams of solid calcium hydroxide, Ca(OH)₂, are required to react with 350 mL of 0.40 M HCl?



- balance the equation:



- convert mL to L:

$$\frac{350 \text{ mL HCl}}{1} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 0.350 \text{ L HCl}$$

- write the 'given' and 'unknown' units:

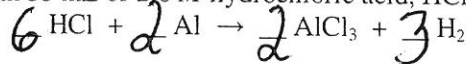
$$\frac{350 \text{ L HCl}}{1} \times \text{---} \times \text{---} \times \text{---} = \text{grams Ca(OH)}_2$$

- fill in factors and solve:

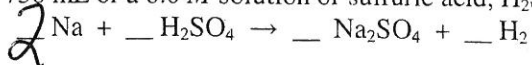
$$\frac{0.350 \text{ L HCl}}{1} \times \frac{0.40 \text{ mol HCl}}{1 \text{ L HCl}} \times \frac{1 \text{ mol Ca(OH)}_2}{2 \text{ mol HCl}} \times \frac{74.10 \text{ g Ca(OH)}_2}{1 \text{ mol Ca(OH)}_2} = 5.19 \text{ grams Ca(OH)}_2$$

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

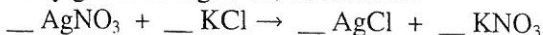
1. How many grams of aluminum are required to react with 35 mL of 2.0 M hydrochloric acid, HCl?



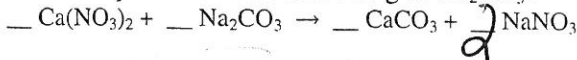
2. How many grams of sodium can be reacted with 750 mL of a 6.0 M solution of sulfuric acid, H₂SO₄?



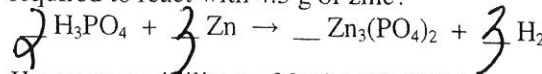
3. If 45 mL of a 1.5 M AgNO₃ is added to KCl how many grams of AgCl can be formed?



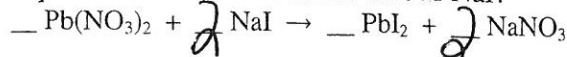
4. How many liters of a 0.75 M solution of Ca(NO₃)₂ will be required to react with 148 g of Na₂CO₃?



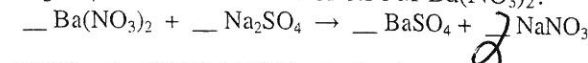
5. How many liters of a 3.0 M H₃PO₄ solution are required to react with 4.5 g of zinc?



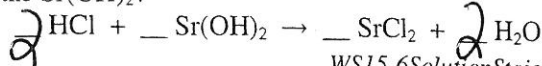
6. How many milliliters of 0.10 M Pb(NO₃)₂ are required to react with 75 mL of 0.20 M NaI?



7. How many grams of solid BaSO₄ will form when Na₂SO₄ reacts with 25 mL of 0.50 M Ba(NO₃)₂?



8. If 525 mL of 0.80 M HCl solution is neutralized with 315 mL of Sr(OH)₂ solution what is the molarity of the Sr(OH)₂?



Answer Key

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1) $35\text{ mL} \times \frac{1\text{ L}}{1000\text{ mL}} \times \frac{2.0\text{ mol HCl}}{1\text{ L}} \times \frac{2\text{ mol Al}}{6\text{ mol HCl}} \times \frac{27\text{ g Al}}{1\text{ mol Al}} = 0.63\text{ g Al}$

2) $750\text{ mL} \times \frac{1\text{ L}}{1000\text{ mL}} \times \frac{6.0\text{ mol H}_2\text{SO}_4}{1\text{ L}} \times \frac{2\text{ mol Na}}{1\text{ mol H}_2\text{SO}_4} \times \frac{23\text{ g Na}}{1\text{ mol Na}} = 207\text{ g Na}$ (210g)

3) $45\text{ mL} \times \frac{1\text{ L}}{1000\text{ mL}} \times \frac{1.5\text{ mol AgNO}_3}{1\text{ L}} \times \frac{1\text{ mol AgCl}}{1\text{ mol AgNO}_3} \times \frac{142.5\text{ g}}{1\text{ mol AgCl}} = 9.6\text{ g AgCl}$
107.35.5 } 142.5 g/mol

4) $148\text{ g Na}_2\text{CO}_3 \times \frac{1\text{ mol Na}_2\text{CO}_3}{106\text{ g}} \times \frac{1\text{ mol Ca(NO}_3)_2}{1\text{ mol Na}_2\text{CO}_3} \times \frac{1\text{ L Ca(NO}_3)_2}{0.75\text{ mol}} = 1.9\text{ L Ca(NO}_3)_2$

5) $4.5\text{ g Zn} \times \frac{1\text{ mol Zn}}{63.55\text{ g}} \times \frac{2\text{ mol H}_3\text{PO}_4}{3\text{ mol Zn}} \times \frac{1\text{ L H}_3\text{PO}_4}{3.0\text{ mol}} = 0.016\text{ L H}_3\text{PO}_4$

6) $75\text{ mL} \times \frac{1\text{ L}}{1000\text{ mL}} \times \frac{0.20\text{ mol NaI}}{1\text{ L}} \times \frac{1\text{ mol Pb(NO}_3)_2}{2\text{ mol NaI}} \times \frac{1\text{ L Pb(NO}_3)_2}{0.10\text{ mol}} = 0.075\text{ L Pb(NO}_3)_2$

7) $25\text{ mL} \times \frac{1\text{ L}}{1000\text{ mL}} \times \frac{0.50\text{ mol Ba(NO}_3)_2}{1\text{ L}} \times \frac{1\text{ mol BaSO}_4}{1\text{ mol Ba(NO}_3)_2} \times \frac{229\text{ g}}{1\text{ mol BaSO}_4} = 2.9\text{ g BaSO}_4$
137.32 } 16 x 4 = 64

8)

looking for molarity
looking for $\frac{\text{mol}}{\text{L}}$!

volume but
nothing with
it

$$\frac{1\cancel{\text{L}}}{1000\cancel{\text{mL}}} \times 525\cancel{\text{mL}} \times \frac{0.80\cancel{\text{mol HCl}}}{1\cancel{\text{L}}} \times \frac{1\cancel{\text{mol Sr(OH)}_2}}{2\cancel{\text{mol HCl}}} \times \frac{1}{315\cancel{\text{mL}}} \times \frac{1000\cancel{\text{mL}}}{1\cancel{\text{L}}} =$$

Sr(OH)_2

only units
left over = $\frac{\text{mol}}{\text{L}}$

$$= 0.67 \frac{\text{mol}}{\text{L}}$$

Sr(OH)_2 .

make sure to write down the units
of what is wanted!

