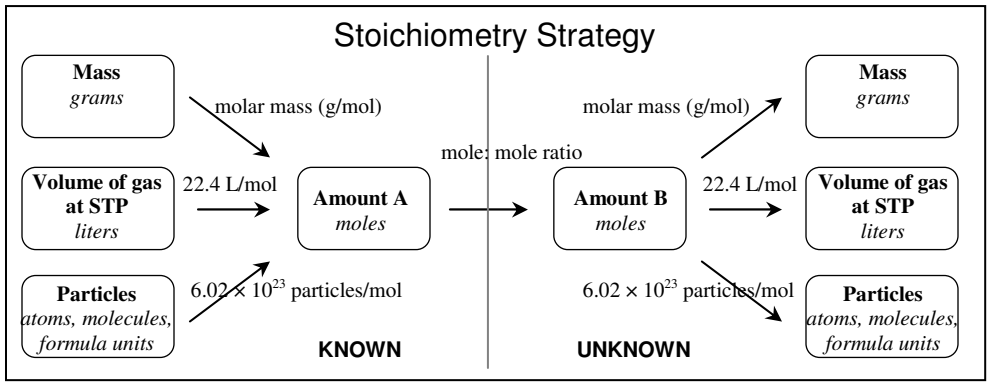
Stoichiometry Problems

Chem Worksheet 12-2

Name _____

With a balanced equation it is possible to calculate the amount of expected product or reactant for a reaction. The **products** are the substances formed in a chemical reaction and these are found on the right side of the reaction arrow. The **reactants** are the substances required in a chemical reaction and these are written on the left side of the arrow. Using the technique of unit cancellation and the strategy outlined to the left, given the mass, volume, or number of particles of a substance, it is possible to determine the mass, volume, or particles of another.



Example

What mass of aluminum is required to produce 25.8 L of hydrogen gas at STP in the reaction below?

$$\_\_Al + \_\_H_2SO_4 \rightarrow \_\_Al_2(SO_4)_3 + \_\_H_2$$

- balance the equation: $2\,Al + 3\,H_2SO_4 \rightarrow 1\,Al_2(SO_4)_3 + 3\,H_2$
- develop a strategy: liters H_2 → moles H_2 → moles Al → grams Al
- write 'given' and 'unknown' units: $\frac{25.8\ L\ H_2}{1} \times \frac{\quad}{\quad} \times \frac{\quad}{\quad} \times \frac{\quad}{\quad} =$ grams Al
- fill in conversion factors: $\frac{25.8\ \cancel{L\ H_2}}{1} \times \frac{1\ mol\ \cancel{H_2}}{22.4\ \cancel{L\ H_2}} \times \frac{2\ mol\ \cancel{Al}}{3\ mol\ \cancel{H_2}} \times \frac{26.98\ g\ Al}{1\ mol\ \cancel{Al}} =$ grams Al
- solve: $\frac{(25.8\ \cancel{L\ H_2})(1\ mol\ \cancel{H_2})(2\ mol\ \cancel{Al})(26.98\ g\ Al)}{(1)(22.4\ \cancel{L\ H_2})(3\ mol\ \cancel{H_2})(1\ mol\ \cancel{Al})} =$ 20.7 g Al

Balance the following equations. Solve the stoichiometric problems.

1. How many molecules of oxygen are required to react with 174 g of carbon monoxide?
   $\_\_ CO + \_\_ O_2 \rightarrow \_\_ CO_2$
2. How many liters of oxygen at STP are required for the combustion of 1.4 g of magnesium?
   $\_\_ Mg + \_\_ O_2 \rightarrow \_\_ MgO$
3. What mass of hydrogen peroxide must decompose to produce 48.64 g of water?
   $\_\_ H_2O_2 \rightarrow \_\_ O_2 + \_\_ H_2O$
4. How many liters of oxygen at STP are needed to react with 5.2×10^{22} molecules of hydrogen sulfide?
   $\_\_ H_2S + \_\_ O_2 \rightarrow \_\_ SO_2 + \_\_ H_2O$
5. What mass of chlorine gas is necessary to synthesize 258 L of hydrogen chloride at STP?
   $\_\_ H_2 + \_\_ Cl_2 \rightarrow \_\_ HCl$
6. If there are 6.2×10^{22} molecules of calcium carbide, CaC_2, what mass of acetylene (C_2H_2) can be formed?
   $\_\_ CaC_2 + \_\_ H_2O \rightarrow \_\_ Ca(OH)_2 + \_\_ C_2H_2$
7. What mass of sodium iodide (NaI) will react with 7.82 grams of chlorine?
   $\_\_ NaI + \_\_ Cl_2 \rightarrow \_\_ NaCl + \_\_ I_2$
8. If 8.2 L of hydrogen gas at STP are produced in this reaction, how many atoms of sodium react?
   $\_\_ Na + \_\_ H_2O \rightarrow \_\_ NaOH + \_\_ H_2$
9. What volume of nitrogen gas at STP is produced when 68.2 g of trinitrotoluene, $C_7H_5(NO_2)_3$ reacts?
   $\_\_ C_7H_5(NO_2)_3 \rightarrow \_\_ C + \_\_ CO + \_\_ H_2 + \_\_ N_2$
10. What mass of carbon dioxide is produced when 6.2 moles of propane, C_3H_8 is burned in oxygen?
    $\_\_ C_3H_8 + \_\_ O_2 \rightarrow \_\_ CO_2 + \_\_ H_2O$