

Stoichiometry - Calculating Quantities in Chemical Reactions

Key

Example: Moles \longleftrightarrow Moles conversion.

- 1) Aluminum reacts with bromine to form aluminum bromide (used as an acid catalyst in organic synthesis).

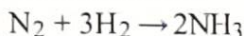


How many moles of Al are needed to form 2.43 mol of Al_2Br_6 ?

$$2.43 \text{ mol Al}_2\text{Br}_6 \times \frac{2 \text{ mol Al}}{1 \text{ mol Al}_2\text{Br}_6} = 4.86 \text{ mol Al}$$

Practice/Exploration: Check if you're already in moles, if not, a) find a way to convert to moles, then b) convert to moles of the other substance in the reaction using coefficients from the chemical equations, then c) convert to the information/unit requested for your answer.

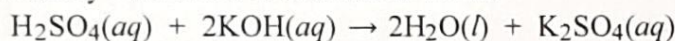
- 2) **Mass Stoichiometry**- What mass of nitrogen gas is required to react completely with 2.79 g of hydrogen gas to produce ammonia?



2) _____

$$2.79 \text{ g H}_2 \times \frac{1 \text{ mol H}_2}{2.016 \text{ g}} \times \frac{1 \text{ mol N}_2}{3 \text{ mol H}_2} \times \frac{28.014 \text{ g N}_2}{1 \text{ mol N}_2} = 12.923 \text{ g N}_2 = 12.9 \text{ g N}_2$$

- 3) **Solution Stoichiometry**- What volume (in Liters) of 0.200 M H_2SO_4 solution is required to react exactly with 0.050 L of 0.100 M KOH?



3) _____

$$0.05 \text{ L KOH} \times \frac{0.100 \text{ mol KOH}}{1 \text{ L KOH}} \times \frac{1 \text{ mol H}_2\text{SO}_4}{2 \text{ mol KOH}} \times \frac{1 \text{ L H}_2\text{SO}_4}{0.200 \text{ mol H}_2\text{SO}_4} = 0.0125 \text{ L H}_2\text{SO}_4$$

- 4) **Gas Stoichiometry**- What volume of CO_2 gas at STP could be produced by the decomposition of 45.0 g of CaCO_3 ?



4) _____

$$45.0 \text{ g CaCO}_3 \times \frac{1 \text{ mol CaCO}_3}{100.088 \text{ g}} \times \frac{1 \text{ mol CO}_2}{1 \text{ mol CaCO}_3} \times \frac{22.4 \text{ L CO}_2}{1 \text{ mol CO}_2} = 10.07 \text{ L}$$

↑
@ STP

$= 10.1 \text{ L CO}_2$

- 5) **Energy Stoichiometry**- Given that $\text{CaO}(s) + \text{H}_2\text{O}(l) \rightarrow \text{Ca(OH)}_2(s)$, heat of reaction = -64.8 kJ/mol, how many grams of CaO must react in order to liberate 525 kJ of heat?

5) _____

$$-525 \text{ kJ} \times \frac{1 \text{ mol CaO}}{-64.8 \text{ kJ}} \times \frac{56.079 \text{ g CaO}}{1 \text{ mol CaO}} = 454.34 \text{ g} = 454 \text{ g CaO}$$