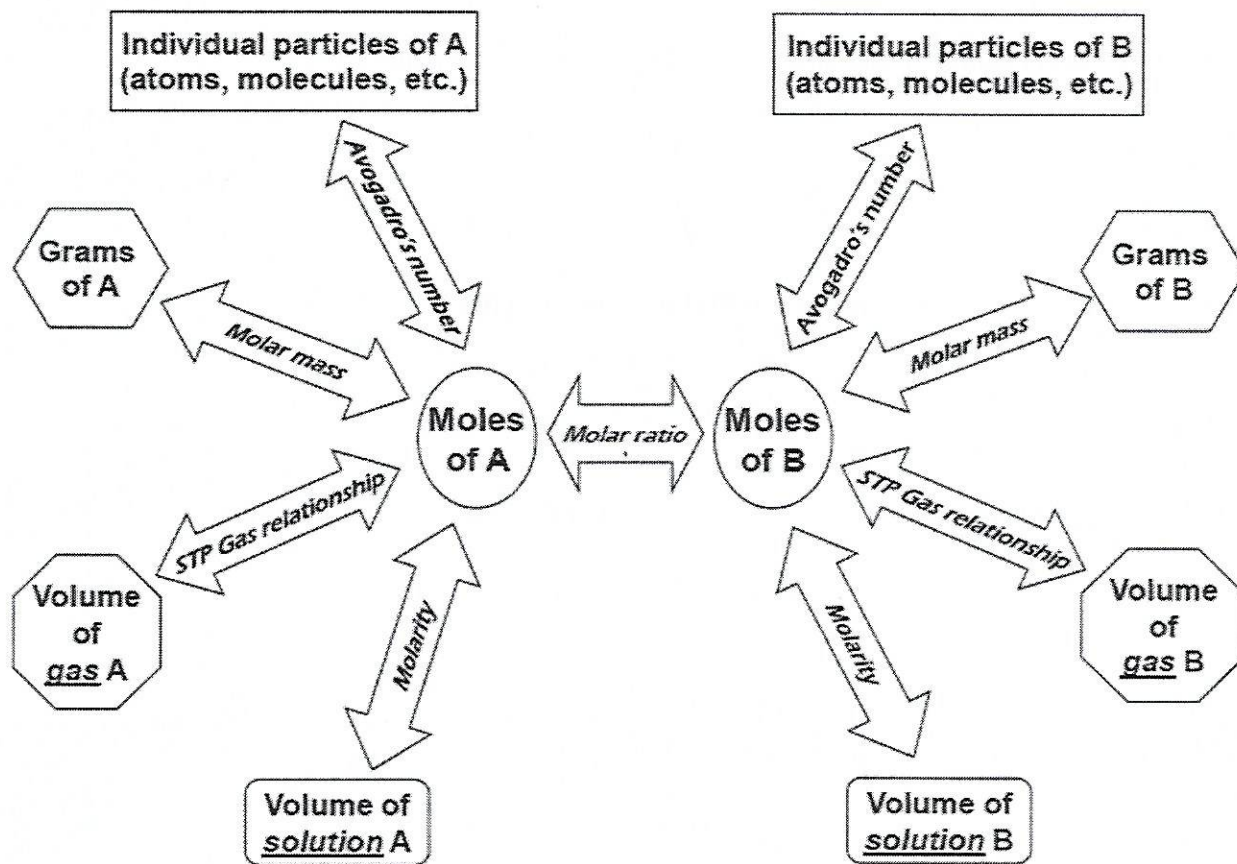


1. Stoichiometry → All Conversions

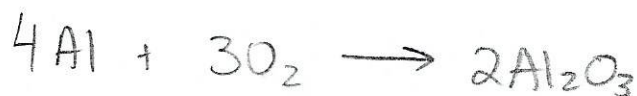
Stoichiometry → All Conversions

The Mole Wheel



Aluminum metal reacts with the oxygen gas in the air to produce aluminum oxide.

a) Write out the balanced equation below:



b) If 4.71 grams of aluminum reacted, how many liters of oxygen reacted at STP? (2.93 L O₂)

$$4.71\text{g Al} \times \frac{1\text{mol Al}}{26.98\text{g}} \times \frac{3\text{mol O}_2}{4\text{mol Al}} \times \frac{22.4\text{L}}{1\text{mol O}_2} = 2.93\text{L}$$

c) If 6.14 L of oxygen reacted at STP, how many molecules of the aluminum oxide were produced? (1.10x10²³ molecules Al₂O₃)

$$6.14\text{L O}_2 \times \frac{1\text{mol O}_2}{22.4\text{L}} \times \frac{2\text{mol Al}_2\text{O}_3}{3\text{mol O}_2} \times \frac{6.022 \times 10^{23}\text{ molecules}}{1\text{mol Al}_2\text{O}_3} = 1.10 \times 10^{23}\text{ molecules Al}_2\text{O}_3$$

Sodium metal reacts with the oxygen gas in the air to produce sodium oxide.

a) Write out the balanced equation below:



b) If 9.11 moles of sodium reacted, how many liters of oxygen reacted at STP? (51.0 L O₂)

$$9.11 \text{ mol Na} \times \frac{1 \text{ mol O}_2}{4 \text{ mol Na}} \times \frac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} = 51.0 \text{ L O}_2$$

c) If 1.38 grams of sodium reacted, how many grams of sodium oxide were produced? (1.86 g Na₂O)

$$1.38 \text{ g Na} \times \frac{1 \text{ mol Na}}{22.99 \text{ g}} \times \frac{2 \text{ mol Na}_2\text{O}}{4 \text{ mol Na}} \times \frac{61.98 \text{ g}}{1 \text{ mol Na}_2\text{O}} = 1.86 \text{ g Na}_2\text{O}$$

Chromium (II) oxide reacts with barium metal in a single replacement reaction.

a) Write out the balanced equation below:



b) If 1.11 grams of chromium (II) oxide reacted, how many atoms of barium reacted?
(9.83 × 10²¹ atoms Ba)

$$1.11 \text{ g CrO} \times \frac{1 \text{ mol}}{68.00 \text{ g}} \times \frac{1 \text{ mol Ba}}{1 \text{ mol CrO}} \times \frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mol Ba}} = 9.83 \times 10^{21} \text{ atoms Ba}$$

c) If 2.34 grams of chromium metal were produced, how many grams of the barium reacted?
(6.18 g Ba)

$$2.34 \text{ g Cr} \times \frac{1 \text{ mol Cr}}{52.00 \text{ g Cr}} \times \frac{1 \text{ mol Ba}}{1 \text{ mol Cr}} \times \frac{137.33 \text{ g}}{1 \text{ mol Ba}} = 6.18 \text{ g Ba}$$

Lead (III) oxide reacts with calcium metal in a single replacement reaction.

a) Write out the balanced equation below:



b) If 1.67 grams of lead (III) oxide reacted, how many grams of lead metal are produced? (1.50 g Pb)

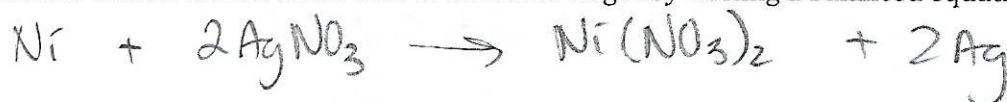
$$1.67 \text{ g Pb}_2\text{O}_3 \times \frac{1 \text{ mol Pb}_2\text{O}_3}{462.40 \text{ g}} \times \frac{2 \text{ mol Pb}}{1 \text{ mol Pb}_2\text{O}_3} \times \frac{207.20 \text{ g}}{1 \text{ mol Pb}} = 1.50 \text{ g Pb}$$

c) If 4.34 grams of CaO were produced, how many grams of calcium metal reacted? (3.10 g Ca)

$$4.34 \text{ g CaO} \times \frac{1 \text{ mol CaO}}{56.08 \text{ g}} \times \frac{3 \text{ mol Ca}}{3 \text{ mol CaO}} \times \frac{40.08 \text{ g}}{1 \text{ mol Ca}} = 3.10 \text{ g Ca}$$

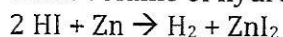
With a special focus on MOLAR CONCENTRATION...

Nickel reacts with silver nitrate to produce nickel (II) nitrate and silver metal. What mass of nickel reacts with silver nitrate in 1.25 L of a 0.15 M solution? Begin by writing a balanced equation. (5.5 g Ni)



$$1.25\text{L AgNO}_3 \times \frac{0.15\text{mol AgNO}_3}{1\text{L}} \times \frac{1\text{mol Ni}}{2\text{mol AgNO}_3} \times \frac{58.69\text{g}}{1\text{mol Ni}} \\ = 5.5\text{g Ni}$$

What volume of hydrogen gas is formed at STP with 150. mL of 0.185 M HI acid? (0.311 L H₂)



$$0.150\text{L HI} \times \frac{0.185\text{mol HI}}{1\text{L}} \times \frac{1\text{mol H}_2}{2\text{mol HI}} \times \frac{22.4\text{L}}{1\text{mol H}_2} \\ = 0.311\text{L H}_2$$

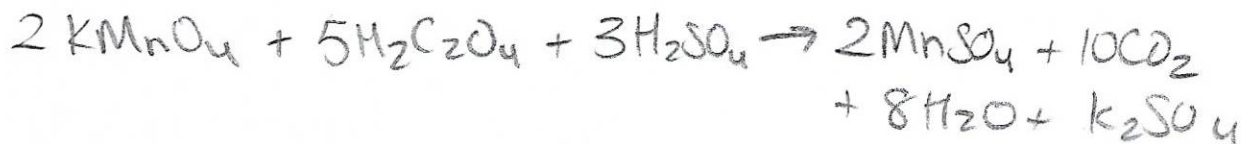
A flask containing 450. mL of 0.500 M HBr was accidentally knocked to the floor. How many grams of potassium chromate would you need to put on the spill to completely neutralize the acid? Begin by writing a balanced equation. (21.8 g K₂CrO₄)



$$450.\text{mL HBr} \times \frac{1\text{L}}{1000\text{mL}} \times \frac{0.500\text{mol HBr}}{1\text{L}} \times \frac{1\text{mol K}_2\text{CrO}_4}{2\text{mol HBr}} \times \frac{194.20\text{g}}{1\text{mol K}_2\text{CrO}_4} \\ = 21.8\text{g K}_2\text{CrO}_4$$

Potassium permanganate reacts with oxalic acid ($\text{H}_2\text{C}_2\text{O}_4$) in sulphuric acid (H_2SO_4) to produce manganese (II) sulphate, carbon dioxide, water and potassium sulphate.

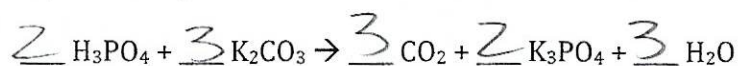
- Balanced Reaction:



- How many mL of 0.250 M KMnO_4 are needed to react with 3.225 g of oxalic acid? (57.3 mL KMnO_4)

$$3.225 \text{ g H}_2\text{C}_2\text{O}_4 \times \frac{1 \text{ mol H}_2\text{C}_2\text{O}_4}{90.04 \text{ g}} \times \frac{2 \text{ mol KMnO}_4}{5 \text{ mol H}_2\text{C}_2\text{O}_4} \times \frac{1 \text{ L}}{0.250 \text{ mol KMnO}_4} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 57.3 \text{ mL KMnO}_4$$

How many litres of CO_2 would be formed at STP if 1.500 L of 1.75 M phosphoric acid (H_3PO_4) were reacted with potassium carbonate? (88.2 L CO_2)



$$1.500 \text{ L H}_3\text{PO}_4 \times \frac{1.75 \text{ mol H}_3\text{PO}_4}{1 \text{ L}} \times \frac{3 \text{ mol CO}_2}{2 \text{ mol H}_3\text{PO}_4} \times \frac{22.4 \text{ L}}{1 \text{ mol CO}_2} = 88.2 \text{ L CO}_2$$