Gas Stoichiometry

4 $NH_3(g)$ + 7 $O_2(g)$ --> 4 $NO_2(g)$ + 6 $H_2O(g)$

- **When the reactants and products are solids (s), liquids (l) or aqueous (aq), the coefficients represent:**
  - > the number of moles
- **When the reactants and products are gases (g) the coefficients represent:**
  - > the number of moles
  - > volumes of gases in liters

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Gas Stoichiometry Practice

Determine the volume of hydrogen gas needed to react completely with 5.00 L of oxygen gas to form water vapor. Conditions for the gases are STP. - $\frac{22.4\ L}{1\ mol}$

$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

X L 5.00 L

Why can we use the coefficients as volume ratio?

$5.00\ L\ O_2 \times \frac{1\ mol\ O_2}{22.4\ L} \times \frac{2\ mol\ H_2}{1\ mol\ O_2} \times \frac{22.4\ L\ H_2}{1\ mol\ H_2} = 10.0\ L\ H_2$

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Gas Stoichiometry Practice

If 5.0 L of N_2 reacts at STP, how many grams of NH_3 are produced? (Show all work)

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

5.0 L $\quad$ X g

$22.4\ L = 1\ mol$

$$5.0\ L\ N_2 \times \frac{1\ mol\ N_2}{22.4\ L\ N_2} \times \frac{2\ mol\ NH_3}{1\ mol\ N_2} \times \frac{17\ g\ NH_3}{1\ mol\ NH_3}$$

$$= 7.6\ g\ NH_3$$

Why did we use 22.4 L?

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Gas Stoichiometry Practice

Calculate the volume of oxygen gas at 300 K and 1.5 atm that is required to completely react wth 52.0 g of iron. (Show all work)

$$4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$$

52.0 g $\quad$ X L

$P = 1.5\ atm$

$V =$

$n = 0.696\ mol\ O_2$

$R = 0.0821\ \frac{L \cdot atm}{mol \cdot K}$

$T = 300\ K$

$$52.0\ g\ Fe \times \frac{1\ mol\ Fe}{56\ g\ Fe} \times \frac{3\ mol\ O_2}{4\ mol\ Fe}$$

$$= .696\ mol\ O_2$$

$$1.5 \cdot V = 0.696 \cdot 0.0821 \cdot 300$$

$$V = 11.4\ L$$

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Gas Stoichiometry Practice

Calculate the volume of oxygen gas at 300. K and 1.5 atm that is required to completely react wth 52.0 g of iron. (Show all work)

$$4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$$

Why did we use stoichiometry first in this problem? Fe is a solid

Why do we have to use the ideal gas law for this problem? not @ STP

Why couldn't we use the molar volume in this problem? not @ STP

When you aren't sure how to solve the problems, what will always work?

ideal gas law

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