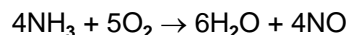


Stoichiometry

- Consider: $4\text{NH}_3 + 5\text{O}_2 \rightarrow 6\text{H}_2\text{O} + 4\text{NO}$
- Recall that many conversion factors exist: 4 mol NH_3 /5 mol O_2 , 6 mol H_2O /4 mol NH_3 , etc
- In words, this tells us that for every 4 moles of NH_3 , 5 moles of O_2 are required, etc.
- “Stoichiometry” refers to the relative quantities of moles. It also refers to calculations that make use of mole ratios.
- Recall also that molar masses provide factors:
- 1 mol NH_3 / 17 g NH_3 , 32 g O_2 / 1 mol O_2
- Is 4 g NH_3 / 5 g O_2 a conversion factor?

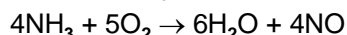
Stoichiometry questions (1)



- How many moles of H_2O are produced if 0.176 mol of O_2 are used?
- How many moles of NO are produced in the reaction if 17 mol of H_2O are also produced?

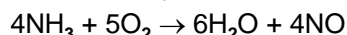
Notice that a correctly balanced equation is essential to get the right answer

Stoichiometry questions (2)



- How many grams of H_2O are produced if 1.9 mol of NH_3 are combined with excess oxygen?
- How many grams of O_2 are required to produce 0.3 mol of H_2O ?

Stoichiometry questions (3)



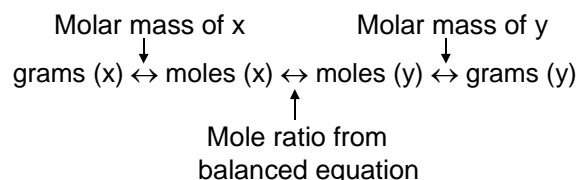
- How many grams of NO is produced if 12 g of O_2 is combined with excess ammonia?

Converting grams to grams

- Notice that we cannot directly convert from grams of one compound to grams of another. Instead we have to go through moles.
 - Many stoichiometry problems follow a pattern: $\text{grams}(x) \leftrightarrow \text{moles}(x) \leftrightarrow \text{moles}(y) \leftrightarrow \text{grams}(y)$
 - We can start anywhere along this path depending on the question we want to answer
- Q- for the reaction $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ what is the path we would take for the following
- Given 2 moles H_2O , calculate grams H_2O ?
 - Moles O_2 required for 36 g H_2 ?
 - Grams of H_2O produced from 6 grams O_2 ?

Moving along the stoichiometry path

- We always use the same type of information to make the jumps between steps:



Given: $4\text{NH}_3 + 5\text{O}_2 \rightarrow 6\text{H}_2\text{O} + 4\text{NO}$

- How many moles of H_2O can be made using 0.5 mol NH_3 ?
- what mass of NH_3 is needed to make 1.5 mol NO ?
- how many grams of NO can be made from 120 g of NH_3 ?

More Stoichiometry Questions

Follow the rules for significant digits. Show all calculations.

- $2\text{C}_4\text{H}_{10} + 13\text{O}_2 \rightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$
 - what mass of O_2 will react with 400 g C_4H_{10} ?
 - how many moles of water are formed in a)?
- $3\text{HCl} + \text{Al}(\text{OH})_3 \rightarrow 3\text{H}_2\text{O} + \text{AlCl}_3$

How many grams of aluminum hydroxide will react with 5.3 moles of HCl ?
- $\text{Ca}(\text{ClO}_3)_2 \rightarrow \text{CaCl}_2 + 3\text{O}_2$

What mass of O_2 results from the decomposition of 1.00 kg of calcium chlorate?
- The reaction of Ca with water can be predicted using the activity series. What mass of water is needed to completely react with 2.35 g of Ca ?



- How many moles of carbon monoxide are required to react with 163.0 g of iron(III) oxide?
- How many grams of CO_2 are produced from a reaction that also produces 23.9 grams of Fe ?



- how many moles of copper(II) nitrate can be prepared from 17.0 moles of Cu ?
- how many grams of copper(II) nitrate can be prepared using 3.8 moles of HNO_3 ?
- what mass of water results from the reaction of 8.50 kg of copper metal?