Stoichiometry

What is stoichiometry?

- stoichiometry- method of determining the amounts of reactants needed to create a certain amount of products.
- we will combine balancing equations with molar mass and add one more step.

How to do it

- the coefficients in a balanced equation are ratios of the molecules needed for the reaction.
- moles are just a number of molecules
- so $2\ H_2 + O_2 \rightarrow 2\ H_2O$
- How many moles of H_2O are made by completely reacting 1.4 mol of O_2

$$1.4\ \text{mol } O_2 \left| \frac{2\ \text{mol } H_2O}{1\ \text{mol } O_2} \right. = 2.8\ \text{mol } H_2O$$

Adding in molar mass

- How many grams of H_2 are needed to completely react with 24 g of O_2?
- $2\ H_2 + O_2 \rightarrow 2\ H_2O$
- convert to moles → convert to the desired molecule → convert to grams
- O_2 = 32.00 g/mol ; H_2 = 2.016 g/mol

$$24\ \text{g } O_2 \left| \frac{1\ \text{mol } O_2}{32\ \text{g } O_2} \right. \left| \frac{2\ \text{mol } H_2}{1\ \text{mol } O_2} \right. \left| \frac{2.016\ \text{g } H_2}{1\ \text{mol } H_2} \right.$$

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Practice

- How many grams of H_2O are produced from 15 g of H_2?
- $2\ H_2 + O_2 \rightarrow 2\ H_2O$

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$$15\ \text{g } H_2 \left| \frac{1\ \text{mol } H_2}{2.016\ \text{g } H_2} \right. \left| \frac{2\ \text{mol } H_2O}{2\ \text{mol } H_2} \right. \left| \frac{18.016\ \text{g } H_2O}{1\ \text{mol } H_2O} \right.$$

$$= 130\ \text{g } H_2O$$

practice

- How many grams of H_2O are produced by completely reacting 24 g of O_2?
- $2\ H_2 + O_2 \rightarrow 2\ H_2O$
- convert to moles → convert to the desired molecule → convert to grams
- O_2 = 32.00 g/mol ; H_2O = 18.016 g/mol

practice

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Another

- How many grams of H_2 are needed to form 34 g of H_2O?
- $2\ H_2 + O_2 \rightarrow 2\ H_2O$
- convert to moles → convert to the desired molecule → convert to grams
- H_2 = 2.016 g/mol ; H_2O = 18.016 g/mol

Another

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- $2\ H_2 + O_2 \rightarrow 2\ H_2O$
- convert to moles → convert to the desired molecule → convert to grams
- H_2 = 2.016 g/mol ; H_2O = 18.016 g/mol

34 g H_2O	1 mol H_2O	2 mol H_2	2.016 g H_2	= 3.8 g H_2
	18.016 g H_2O	2 mol H_2O	1 mol H_2	

Balance the equation 1st, then do the problem

- Na + Cl_2 → NaCl
- How many grams of chlorine are needed to react with 37 g of Na?

Balance the equation 1st, then do the problem

- 2 Na + Cl_2 → 2 NaCl
- How many grams of chlorine are needed to react with 37 g of Na?

37 g Na	1 mol Na	1 mol Cl_2	70.90 g Cl_2
	22.99 g Na	2 mol Na	1 mol Cl_2

=57 g Cl_2

More

- $CH_4 + O_2 \rightarrow H_2O + CO_2$
- How many grams of CH_4 are needed to make 120 g of H_2O?

More

- $CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$
- How many grams of CH_4 are needed to make 120 g of H_2O?

120 g H_2O	1 mol H_2O	1 mol CH_4	16.042 g CH_4
	18.016 g H_2O	2 mol H_2O	1 mol CH_4

= 53 g CH_4