

Stoichiometry Dry Lab

A 32

1a $12.0112 + 4 \times 1.00797 = 16.0438 \text{ g/mol}$

1f $12.0112 + 3 \times 1.00797 + 15.9994 + 1.00797 = 32.04248 \text{ g/mol}$

1j $2 \times (14.0067 + 4 \times 1.00797) + 2 \times 51.996 + 7 \times 15.9994 = 252.065 \frac{\text{g}}{\text{mol}}$

A33

1a grams OK $\left[(2 \times 10.811) + (3 \times 15.9994) \right] \frac{\text{g}}{\text{mol}} \times 4.86 \text{ mol} = 338 \text{ grams}$

1d grams OK (use 1j from previous page)

$\rightarrow \times 19.2 \text{ mol} = 4840 \text{ grams}$

1e grams OK

A34 $\left[(6 \times 12.0112) + (12 \times 1.00797) + (6 \times 15.9994) \right] \frac{\text{g}}{\text{mol}} \times 0.136 \text{ mol} = 24.5 \text{ grams}$

2a $\text{Al(OH)}_3: 78.00361 \frac{\text{g}}{\text{mol}} \cdot 3.75 \text{ grams} \times \frac{1 \text{ mol}}{78.00361 \text{ g}} = 0.0481 \text{ mol}$

2b $\text{Mg}_2\text{N}_2: 100.9494 \frac{\text{g}}{\text{mol}} \left\{ 0.272 \text{ kg} \times \frac{10^3 \text{ g}}{1 \text{ kg}} \times \frac{1 \text{ mol}}{100.9494 \text{ g}} \right\} = 2.69 \text{ mol}$

2c $42.42 \text{ g} \times \frac{1 \text{ mol}}{39.948 \text{ g}} = 1.062 \text{ mol}$

3a $0.136 \text{ mol} \times \frac{6.022 \times 10^{23} \text{ molecules}}{\text{mol}} = 8.19 \times 10^{22} \text{ molecules}$

3c $7.85 \text{ g} \times \frac{1 \text{ mol}}{4.0026 \text{ g}} \times \frac{6.022 \times 10^{23} \text{ atoms}}{\text{mol}} = 1.18 \times 10^{24} \text{ atoms}$

3d (tricky) $229.6 \text{ mg} \times \frac{1 \text{ g}}{1000 \text{ mg}} \times \frac{1 \text{ mol I}_2}{126.904 \text{ g} \times 2} \times \frac{6.022 \times 10^{23} \text{ molecules I}_2}{1 \text{ mol I}_2} \times \frac{2 \text{ atoms I}}{1 \text{ molecule I}_2} = 1.09 \times 10^{21} \text{ atoms I}$

A35

2 $1.4 \text{ mol (NH}_4)_3\text{PO}_4 \times \frac{3 \text{ mol N}}{1 \text{ mol (NH}_4)_3\text{PO}_4} = 4.2 \text{ mol N} = 1.09 \times 10^{21} \text{ atoms I}$

3a $1.4 \text{ mol (NH}_4)_3\text{PO}_4 \times \frac{12 \text{ mol H}}{1 \text{ mol (NH}_4)_3\text{PO}_4} = 17 \text{ mol H}$

$12.7 \text{ g CO}_2 \times \frac{1 \text{ mol CO}_2}{44.01 \text{ g CO}_2} \times \frac{3 \text{ mol O}}{1 \text{ mol CO}_2} \times \frac{16.00 \text{ g}}{1 \text{ mol O}} = 9.23 \text{ g O}$

A36

2

answer this question for moles of O2 also

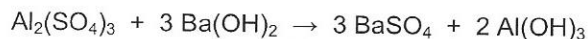
3

answer this question for mass of N2 in grams

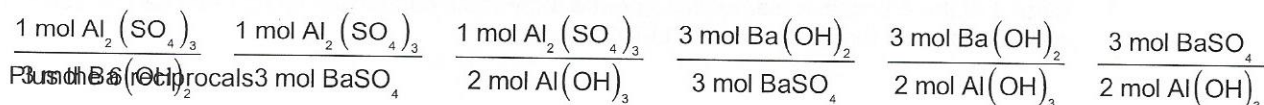
Stoichiometry

Just as the subscripts in the formula of a compound tell us how the quantities of atoms are related within a molecule, the stoichiometric coefficients in a balanced reaction tell us about how the quantities of reactant and product molecules (or formula units) are related to each other. These can also be setup as ratios or equalities to allow us to solve chemical calculations.

For example, in the reaction:



The following 12 mole-mole relationships can be established:



1. Determine at least 3 possible mole-mole relationships that can be derived from the following equation.



2. Given: $\underline{2} \text{KClO}_3(\text{s}) \rightarrow \underline{3} \text{O}_2(\text{g}) + \underline{2} \text{KCl}(\text{s})$ How many moles of KCl is produced when 12.5 mol KClO_3 is decomposed?

$$12.5 \text{ mol KClO}_3 \times \frac{2 \text{ mol KCl}}{2 \text{ mol KClO}_3} = 12.5 \text{ mol KCl}$$

$$12.5 \text{ mol KClO}_3 \times \frac{3 \text{ mol O}_2}{2 \text{ mol KClO}_3} = 18.8 \text{ mol O}_2$$

3. The reaction $\underline{\quad} \text{N}_2(\text{g}) + \underline{3} \text{H}_2(\text{g}) \rightarrow \underline{2} \text{NH}_3(\text{g})$ is used to produce NH_3 . How many moles of $\text{H}_2(\text{g})$ are required to produce 2.50 g of $\text{NH}_3(\text{g})$?

$$2.50 \text{ g NH}_3 \times \frac{1 \text{ mol NH}_3}{17.0306 \text{ g}} \times \frac{3 \text{ mol H}_2}{2 \text{ mol NH}_3} = 0.220 \text{ mol H}_2$$

$$2.50 \text{ g NH}_3 \times \frac{1 \text{ mol NH}_3}{17.0306 \text{ g}} \times \frac{1 \text{ mol N}_2}{2 \text{ mol NH}_3} \times \frac{2 \times 14.0067 \text{ g}}{1 \text{ mol N}_2} = 2.06 \text{ g N}_2$$

4. Given: $\text{MgCO}_3(\text{s}) \rightarrow \text{MgO}(\text{s}) + \text{CO}_2(\text{g})$ Calculate the grams of $\text{CO}_2(\text{g})$ produced from the decomposition of 17.2 g of $\text{MgCO}_3(\text{s})$.