



Exercises on the outcome of chemical reactions

Data: $M(\text{O})=16.0 \text{ g}\cdot\text{mol}^{-1}$; $M(\text{H})=1.00\text{g}\cdot\text{mol}^{-1}$; $M(\text{Ca})=40.0 \text{ g}\cdot\text{mol}^{-1}$; $M(\text{C})=12.0 \text{ g}\cdot\text{mol}^{-1}$;
 $M(\text{Al})=27.0 \text{ g}\cdot\text{mol}^{-1}$; $M(\text{Cl}) = 35.5 \text{ g}\cdot\text{mol}^{-1}$; $M(\text{Cu})=63.5 \text{ g}\cdot\text{mol}^{-1}$.
 $V_M = 24.0 \text{ L}\cdot\text{mol}^{-1}$.

CuC!

We mix a mass $m = 4.77 \text{ g}$ of copper oxide (CuO) with carbon. Metallic copper and carbon dioxide are formed.

1. Determine the initial quantity of copper oxide.
2. Write the equation associated to the chemical reaction.
3. Determine the exact mass of carbon needed to consume all the copper oxide.

Ceramics class

Aluminum oxide ($\text{Al}_2\text{O}_{3(s)}$) can react with carbon ($\text{C}_{(s)}$), in presence of chlorine gas ($\text{Cl}_{2(g)}$), to form aluminum chloride ($\text{AlCl}_{3(s)}$) and carbon monoxide ($\text{CO}_{(g)}$).

1. Write the equation associated to the chemical reaction.

Initially, we have: $m(\text{Al}_2\text{O}_3)_i = 1.53 \text{ kg}$; $V(\text{Cl}_2)_i = 806 \text{ L}$; $m(\text{C})_i = 324 \text{ g}$.

2. Determine the volume of carbon monoxide formed in these conditions.

Chlorine gas is toxic. To avoid its propagation in the environment, the excess of chlorine gas can be trapped by dissolving it in 1.0 L of water.

3. What is the quantity of chlorine gas left at the end of the reaction?
4. What is the molar concentration of chlorine in the solution obtained after dissolution?

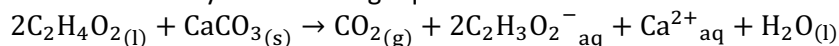
This solution should be diluted to obtain a daughter solution of a volume $V' = 100 \text{ mL}$ and a molar concentration $C' = 1.0 \text{ mol}\cdot\text{L}^{-1}$.

5. Write the method for preparing this solution. Justify the volume of stock solution needed.

Bubbling chalk

Ethanoic acid ($\text{C}_2\text{H}_4\text{O}_2$) acts on chalk (CaCO_3) to produce carbon dioxide, ethanoate ions ($\text{C}_2\text{H}_3\text{O}_2^-$), calcium ions and water.

This reaction can be summarised by the following equation:



Initially, there are 1.4 g of chalk and n_0 moles of ethanoic acid. Chalk is the limiting reagent.

1. What is the mass of water obtained at the end of the reaction?

A mixture is considered stoichiometric when all reagents are disappearing simultaneously: none is left at the end of the reaction.

2. What should the value of $n_0(\text{C}_2\text{H}_4\text{O}_2)$ be for this mixture to be considered stoichiometric?