

Using Balanced Equations

Use a calculator and a periodic table to answer the following questions.

1. Sulfur dioxide is produced as a by-product of the combustion of fossil fuels. Many manufacturing businesses use calcium carbonate to remove sulfur dioxide from flue gases.



One factory reports its annual emissions of sulfur dioxide to be 481 kg.

Calculate the mass of calcium carbonate, in kg, that would be required to prevent the emission of this amount of sulfur dioxide.

Give your answer to an appropriate number of significant figures.

mass = _____ kg

2. Sodium chlorate(I), NaClO, is a component of bleach and can be made in the reaction between sodium hydroxide and chlorine at room temperature and pressure.



Calculate the volume, in dm^3 , of chlorine that is required to produce 10.0 dm^3 of $0.671 \text{ mol dm}^{-3}$ sodium chlorate(I) solution.

Give your answer to an appropriate number of significant figures.

3. Magnesium carbonate reacts with nitric acid to produce magnesium nitrate solution, carbon dioxide and water.



75 cm³ of 1.5 mol dm⁻³ nitric acid was heated to a temperature of 40 °C.

Magnesium carbonate powder was added to the warm acid until it no longer dissolved, and the excess was then removed by filtration.

Calculate the maximum volume, in m³, of carbon dioxide that was produced at this temperature and a pressure of 100 kPa.

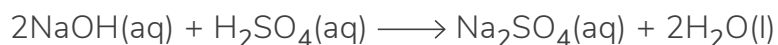
The gas constant, $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$.

Give your answer to an appropriate number of significant figures.

volume = _____ m³

4. A student dissolved an unknown mass of sodium hydroxide in water and made the solution up to 200 cm^3 .

The student then titrated a 20.0 cm^3 sample of the sodium hydroxide solution with 0.650 mol dm^{-3} sulfuric acid.



The student's results are shown in the table below.

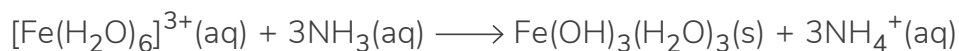
	Rough	Titre 1	Titre 2	Titre 3
Volume of Sulfuric Acid (cm^3)	36.05	35.70	35.75	35.80

Calculate the concentration of the sodium hydroxide solution.

Give your answer to an appropriate number of significant figures.

concentration = _____ mol dm^{-3}

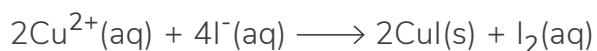
5. Calculate the volume, in cm^3 , of $0.500 \text{ mol dm}^{-3}$ ammonia solution that would be needed to produce 804 mg of the brown precipitate $\text{Fe}(\text{OH})_3(\text{H}_2\text{O})_3$ in the following reaction.



Give your answer to an appropriate number of significant figures.

volume = _____ cm^3

6. A tool, believed to date from the bronze age, was analysed to determine its percentage by mass of copper. A 0.850 g sample of the tool was dissolved in a small amount of concentrated nitric acid and made up to a 250 cm³ solution containing Cu²⁺ ions. An excess of potassium iodide solution was added to a 25 cm³ sample of the Cu²⁺ solution to produce iodine.



The reaction mixture was filtered to remove the copper iodide precipitate and then titrated with 0.150 mol dm⁻³ sodium thiosulfate, Na₂S₂O₃. 6.50 cm³ of sodium thiosulfate reacted completely with the resulting iodine solution.



Calculate the percentage by mass of copper in the bronze tool.

Give your answer to an appropriate number of significant figures.

percentage by mass of copper = _____ %