

Formaldehyde, HCHO, once used as a preservative in biology laboratories, is prepared commercially by the reaction $\text{CH}_3\text{OH} + \text{O}_2 \rightarrow \text{HCHO} + \text{H}_2\text{O}$. The percent yield is 84.9% in a manufacturing plant. How much formaldehyde can be expected from processing 7.50×10^2 kg of methanol.

A researcher dissolved 1.832 g of impure copper in nitric acid to produce a solution of copper(II) nitrate. The solution went through a series of steps in which copper(II) nitrate was changed to copper(II) hydroxide, then to copper(II) oxide, and then to a solution of copper(II) chloride. This solution was treated with an excess of a soluble phosphate salt, precipitating all the copper in the original sample as pure copper(II) phosphate. The precipitate was dried and weighed. Its mass was 2.637 grams. Find the percentage of copper in the original sample. Also, what assumptions must you make to be able to solve this problem with the given information?

Silver(I) oxide decomposes at temperatures in excess of 300 °C, yielding metallic silver and oxygen gas. A 3.13 g sample of impure silver oxide yields 0.187 g of oxygen gas. If one assumes that silver(I) oxide is the only source of oxygen gas, what is the percent silver(I) oxide, by mass, in the sample?

A 2.05 g sample of an iron-aluminum alloy (ferroaluminum) is dissolved in excess HCl(aq) to produce 0.105 g of hydrogen gas. What is the percent composition, by mass, of the ferroaluminum? Refer to your activity series table and write balanced equations for the reaction of HCl with aluminum and iron, separately. Hint: iron typically forms iron(II) compounds.

An organic liquid is either methanol (methyl alcohol), ethanol (ethyl alcohol), or a mixture of the two. A 0.220 g sample is burned in an excess of oxygen gas and yields 0.352 g of carbon dioxide. Is the liquid a pure substance or a mixture?

A $\text{KMnO}_4(\text{aq})$ solution is to be standardized by titration against $\text{As}_2\text{O}_3(\text{s})$. A 0.1078 g sample of As_2O_3 requires 22.15 mL of the $\text{KMnO}_4(\text{aq})$ for its titration. What is the molarity of the $\text{KMnO}_4(\text{aq})$? See unit S for the definition of molarity.



A sulfide of iron, containing 36.5% S, by mass, is heated in oxygen gas, and the products are sulfur dioxide and an oxide of iron containing 27.6% oxygen by mass. Write a balanced chemical equation for this reaction. What class of reaction is this?