

"TRY YOURSELF" PROBLEMS FROM STUDY SECTION 4.4

Example 4.4 a

A 1.00 g coal sample containing some sulphur was treated with a reduction reagent to reduce all the sulphur in the sample to H_2S . The H_2S was isolated and found to weigh 0.0130 g. Calculate the % S in the 1.00 g coal sample.

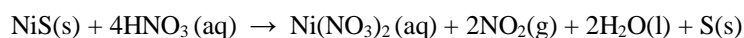
Try yourself 4.4b

A mixture of anhydrous CuSO_4 and $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ has a mass of 1.245 g, but after heating to drive off all the water, the mass is only 0.832 g. What is the weight percent of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ in the mixture?

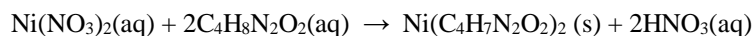
(Given: $M_{\text{CuSO}_4} = 159.5 \text{ g.mol}^{-1}$; $M_{\text{CuSO}_4 \cdot 5\text{H}_2\text{O}} = 249.6 \text{ g.mol}^{-1}$; $M_{\text{H}_2\text{O}} = 18.02 \text{ g.mol}^{-1}$)

Try yourself 4.4c

Nickel(II) sulphide, NiS , occurs naturally as the relatively rare mineral millerite. One of its occurrences is in meteorites. To analyse a mineral sample for the quantity of NiS , the sample is dissolved in nitric acid (HNO_3) to form a solution of $\text{Ni}(\text{NO}_3)_2$ according to the following balanced reaction equation:



The aqueous solution of $\text{Ni}(\text{NO}_3)_2$ is then reacted with the organic compound dimethylglyoxime ($\text{C}_4\text{H}_8\text{N}_2\text{O}_2$) to give the red solid $\text{Ni}(\text{C}_4\text{H}_7\text{N}_2\text{O}_2)_2$ according to the following balanced reaction equation:

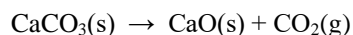


Suppose a 0.468 g sample containing millerite produces 0.206 g of the red solid $\text{Ni}(\text{C}_4\text{H}_7\text{N}_2\text{O}_2)_2$. Calculate the mass % NiS in the original sample.

(Given: $M_{\text{NiS}} = 90.8 \text{ g.mol}^{-1}$; $M_{\text{HNO}_3} = 63.01 \text{ g.mol}^{-1}$; $M_{\text{Ni}(\text{C}_4\text{H}_7\text{N}_2\text{O}_2)_2} = 288.84 \text{ g.mol}^{-1}$; $M_{\text{C}_4\text{H}_8\text{N}_2\text{O}_2} = 116.08 \text{ g.mol}^{-1}$; $M_{\text{Ni}} = 58.7 \text{ g.mol}^{-1}$; $M_{\text{Ni}(\text{NO}_3)_2} = 182.7 \text{ g.mol}^{-1}$; $M_{\text{NO}_2} = 46 \text{ g.mol}^{-1}$; $M_{\text{H}_2\text{O}} = 18.02 \text{ g.mol}^{-1}$; $M_{\text{S}} = 32.1 \text{ g.mol}^{-1}$)

Try yourself 4.4d

A sample of limestone and other soil materials were heated, and the limestone decomposed to give calcium oxide and carbon dioxide according to the following balanced reaction equation:



A 1.506 g sample of limestone-containing material gave 0.558 g of CO_2 , in addition to CaO , after being heated at a high temperature. Calculate the mass % of CaCO_3 in the original sample.

(Given: $M_{\text{CaCO}_3} = 100.1 \text{ g.mol}^{-1}$; $M_{\text{CaO}} = 56.1 \text{ g.mol}^{-1}$; $M_{\text{CO}_2} = 44 \text{ g.mol}^{-1}$)