"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 $CuSO_4.5H_2O$ 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 $CuSO_4.5H_2O$ in the mixture?

(**Given:** $M_{CuSO4} = 159.5\ g.mol^{-1}$; $M_{CuSO4.5H2O} = 249.6\ g.mol^{-1}$; $M_{H2O} = 18.02\ g.mol^{-1}$)

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 $Ni(NO_3)_2$ according to the following balanced reaction equation:

$$NiS(s) + 4HNO_3(aq) \rightarrow Ni(NO_3)_2(aq) + 2NO_2(g) + 2H_2O(l) + S(s)$$

The aqueous solution of $Ni(NO_3)_2$ is then reacted with the organic compound dimethylglyoxime ($C_4H_8N_2O_2$) to give the red solid $Ni(C_4H_7N_2O_2)_2$ according to the following balanced reaction equation:

$$Ni(NO_3)_2(aq) + 2C_4H_8N_2O_2(aq) \rightarrow Ni(C_4H_7N_2O_2)_2(s) + 2HNO_3(aq)$$

Suppose a 0.468 g sample containing millirite produces 0.206 g of the red solid $Ni(C_4H_7N_2O_2)_2$. Calculate the mass % NiS in the original sample.

(**Given:** $M_{NiS} = 90.8\ g.mol^{-1}$; $M_{HNO3} = 63.01\ g.mol^{-1}$; $M_{Ni(C4H7N2O2)2} = 288.84\ g.mol^{-1}$; $M_{C4H8N2O2} = 116.08\ g.mol^{-1}$; $M_{Ni} = 58.7\ g.mol^{-1}$; $M_{Ni(NO3)2} = 182.7\ g.mol^{-1}$; $M_{NO2} = 46\ g.mol^{-1}$; $M_{H2O} = 18.02\ g.mol^{-1}$; $M_S = 32.1\ g.mol^{-1}$)

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:

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$

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:** $M_{CaCO3} = 100.1\ g.mol^{-1}$; $M_{CaO} = 56.1\ g.mol^{-1}$; $M_{CO2} = 44\ g.mol^{-1}$)