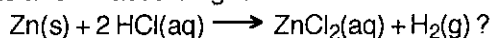


EXAMPLE 3: What mass of impure zinc metal having a purity of 89.5% is required to produce 975 mL of hydrogen gas at STP according to the reaction



First, find the mass of 100% pure zinc required.

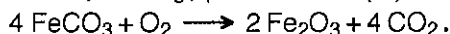
$$\text{mass of Zn} = 0.975 \text{ L H}_2 \times \frac{1 \text{ mol H}_2}{22.4 \text{ L H}_2} \times \frac{1 \text{ mol Zn}}{1 \text{ mol H}_2} \times \frac{65.4 \text{ g Zn}}{1 \text{ mol Zn}} = 2.847 \text{ g}$$

Since the zinc was impure, divide by 89.5% (actually, 0.895 as a decimal equivalent) so as to increase the calculated mass of metal used and compensate for the fact that not all the metal used was zinc.

$$\text{mass of impure Zn} = \frac{2.847 \text{ g}}{0.895} = 3.18 \text{ g}$$

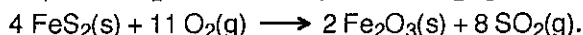
EXERCISES:

33. The roasting of siderite ore, FeCO_3 , produces iron(III) oxide:



- A 15.0 g FeCO_3 sample is 42.0% pure. What mass of Fe_2O_3 can the sample produce?
- A second sample of FeCO_3 , with a mass of 55.0 g, is roasted so as to produce 37.0 g of Fe_2O_3 . What is the percentage purity of the FeCO_3 ?
- A 35.0 g sample of pure FeCO_3 produces 22.5 g of Fe_2O_3 . What is the percentage yield of the reaction?
- What mass of siderite ore with a purity of 62.8% is needed to make 1.00 kg of Fe_2O_3 ?

34. A 100.0 g sample of impure FeS_2 is roasted to produce Fe_2O_3 and SO_2 :



If 4.50 L of SO_2 (g) is collected at STP, what percentage of FeS_2 is in the sample?

35. A student reacts 25.0 mL of benzene (C_6H_6 , density = 0.879 g/mL) with a "nitrating mixture" containing excess nitric acid to make 18.0 mL of nitrobenzene ($\text{C}_6\text{H}_5\text{NO}_2$, density = 1.204 g/mL) according to the equation



- What is the percentage yield of the reaction?
- What mass of C_6H_6 is left unreacted?

36. The reaction $\text{SiO}_2\text{(s)} + 4 \text{HF(g)} \longrightarrow \text{SiF}_4\text{(g)} + 2 \text{H}_2\text{O(g)}$ produces 2.50 g of H_2O when 12.20 g of SiO_2 is treated with a small excess of HF.

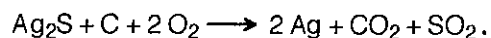
- What mass of SiF_4 is formed?
- What mass of SiO_2 is left unreacted?
- What is the percentage yield of the SiF_4 ?

37. When 5.000 kg of malachite ore containing 4.30% of malachite, $\text{Cu}_2\text{(OH)}_2\text{CO}_3$, is heated, the product is copper (II) oxide:



- If the reaction has an 84.0% yield, how many grams of CuO are produced?
- If the decomposition reaction has an 87.0% yield, what mass of ore containing 3.70% malachite is required to produce 100.0 g of CuO ?

38. A mine produces a silver ore named argentite, Ag_2S . The ore is smelted according to the overall reaction



- A 250.0 kg load of argentite ore contains 0.135% pure Ag_2S . What mass of silver metal can be produced from the load of ore?
- A 76.4 g test sample of ore from a new ore vein produces 0.261 g of pure silver. What is the percentage of pure argentite in the ore?
- A sample of pure Ag_2S has a mass of 152.6 g. When smelted, the sample produces 117.4 g of pure Ag. What is the percentage yield of the smelting process?
- What mass of ore containing 0.795% Ag_2S is required to produce a 50.0 kg ingot of silver metal?
- If 89.2% of the Ag_2S present is extracted from 3.50×10^4 kg of ore containing 1.86% Ag_2S , what mass of silver metal can be produced?