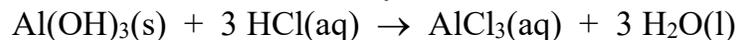


Stoichiometry Practice Problems

General Stoichiometry

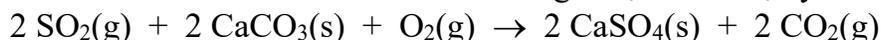
1. Several brands of antacid tablets use aluminum hydroxide to neutralize excess acid.



[Molar masses: 78.01 36.46 133.4 18.02]

What quantity of HCl, in grams, can a tablet with 0.750 g of Al(OH)_3 neutralize?

2. Burning coal and oil in a power plant produces pollutants such as sulfur dioxide, SO_2 . The sulfur-containing compound can be removed from other waste gases, however, by the following reaction:



[Molar masses: 64.07 100.1 32.00 136.2 44.01]

What mass of CaCO_3 is required to remove 155 g of SO_2 ?

3. Your body deals with excess nitrogen by excreting it in the form of urea, NH_2CONH_2 . The reaction producing it is the combination of arginine ($\text{C}_6\text{H}_{14}\text{N}_4\text{O}_2$) with water to give urea and ornithine ($\text{C}_5\text{H}_{12}\text{N}_2\text{O}_2$).



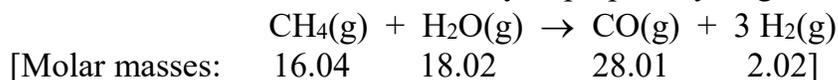
[Molar masses: 174.2 18.02 60.06 132.2]

(a) If you excrete 95 mg of urea, what quantity of arginine must have been used?

(b) What quantity of ornithine must have been produced?

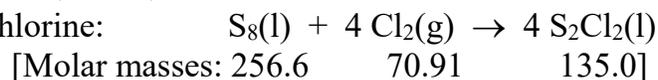
Limiting Reactant Stoichiometry Problems

4. The reaction of methane and water is one way to prepare hydrogen:



If you begin with 995 g of CH_4 and 2510 g of water, what is the maximum possible yield of H_2 ?

5. Disulfur dichloride, S_2Cl_2 , is used to vulcanize rubber. It can be made by treating molten sulfur with gaseous chlorine:

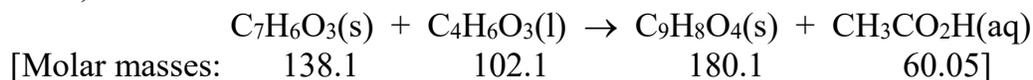


(a) Starting with a mixture of 32.0 g of sulfur and 71.0 g of Cl_2 , what mass of S_2Cl_2 can be produced?

(b) Identify the limiting and excess reactants.

(c) What mass of the excess reactant remains when the limiting reactant is completely consumed?

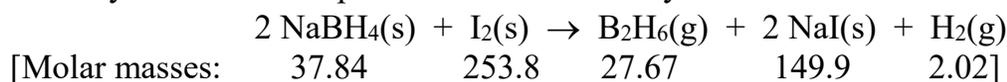
6. Aspirin ($\text{C}_9\text{H}_8\text{O}_4$) is produced by the reaction of salicylic acid ($\text{C}_7\text{H}_6\text{O}_3$) and acetic anhydride ($\text{C}_4\text{H}_6\text{O}_3$).



If you mix 100. g of each of the reactants, what is the maximum mass of aspirin that can be obtained?

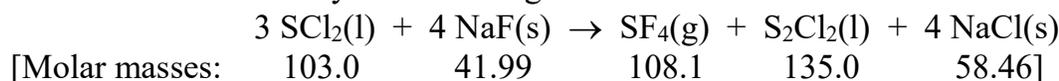
Theoretical & Percent Yield

7. Diborane, B_2H_6 , is a valuable compound in the synthesis of new organic compounds. One of several ways this boron compound can be made is by the reaction



Suppose you use 1.203 g of NaBH_4 with an excess of iodine and obtain 0.295 g of B_2H_6 . What is the percent yield of B_2H_6 ?

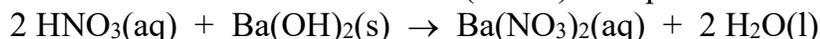
8. Disulfur dichloride, which has a revolting smell, can be prepared by directly combining S_8 and Cl_2 , but it can also be made by the following reaction:



Assume you begin with 5.23 g of SCl_2 and excess NaF . What is the theoretical yield of S_2Cl_2 ? If only 1.19 g of S_2Cl_2 is obtained, what is the percent yield of the compound?

Stoichiometry of Reactions in Solution

9. What volume of 0.125 M HNO_3 (in mL) is required to react completely with 1.30 g of $\text{Ba}(\text{OH})_2$?



10. In the photographic developing process, silver bromide is dissolved by adding sodium thiosulfate:



If you want to dissolve 0.250 g of AgBr , what volume of 0.0138 M $\text{Na}_2\text{S}_2\text{O}_3$ (in mL) should be used?

Determination of Empirical Formulas

11. Styrene, the building block of polystyrene, is a hydrocarbon, a compound consisting only of C and H. If 0.438 g of styrene is burned in oxygen and produces 1.481 g of CO_2 and 0.303 g of H_2O , what is the empirical formula of styrene?
12. Menthol, from the *oil of mint*, has a characteristic cool taste. The compound contains only C, H, and O. If 0.0956 g of menthol burns completely in O_2 , and gives 0.269 g of CO_2 and 0.110 g of H_2O , what is the empirical formula of menthol?
13. Silicon and hydrogen form a series of compounds with the general formula Si_xH_y . to find the formula of one of them, a 6.22-g sample of the compound is burned in oxygen. On doing so, all of the Si is converted to 11.64 g of SiO_2 and all of the H to 6.980 g of H_2O . What is the empirical formula of the silicon compound?