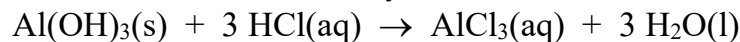


Stoichiometry Practice Problems

General Stoichiometry

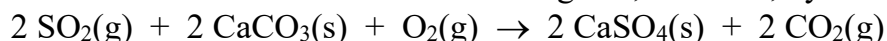
1. Several brands of antacid tablets use aluminum hydroxide to neutralize excess acid.



[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 ($\text{C}_5\text{H}_{12}\text{N}_2\text{O}_2$).



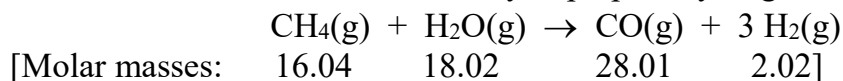
[Molar masses: 174.2 18.02 60.06 132.2]

(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?

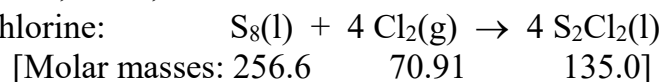
Limiting Reactant Stoichiometry Problems

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



If you begin with 995 g of CH₄ and 2510 g of water, what is the maximum possible yield of H₂?

5. Disulfur dichloride, S₂Cl₂, is used to vulcanize rubber. It can be made by treating molten sulfur with gaseous chlorine:

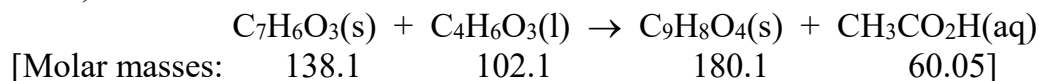


(a) Starting with a mixture of 32.0 g of sulfur and 71.0 g of Cl₂, what mass of S₂Cl₂ can be produced?

(b) Identify the limiting and excess reactants.

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

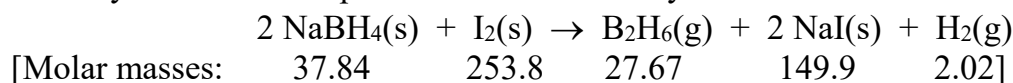
6. Aspirin (C₉H₈O₄) is produced by the reaction of salicylic acid (C₇H₆O₃) and acetic anhydride (C₄H₆O₃).



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

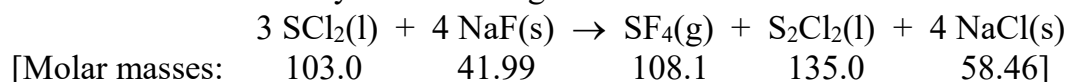
Theoretical & Percent Yield

7. Diborane, B₂H₆, 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 NaBH₄ with an excess of iodine and obtain 0.295 g of B₂H₆. What is the percent yield of B₂H₆?

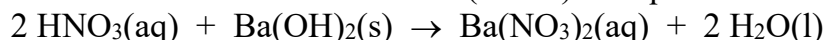
8. Disulfur dichloride, which has a revolting smell, can be prepared by directly combining S₈ and Cl₂, but it can also be made by the following reaction:



Assume you begin with 5.23 g of SCl₂ and excess NaF. What is the theoretical yield of S₂Cl₂? If only 1.19 g of S₂Cl₂ is obtained, what is the percent yield of the compound?

Stoichiometry of Reactions in Solution

9. What volume of 0.125 M HNO₃ (in mL) is required to react completely with 1.30 g of Ba(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 Na₂S₂O₃ (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?