

HW 3-4 – Chemical Equations & Stoichiometry

Problem A; Problems pg. 106 #3.60; pg. 107 #3.61, 3.66, 3.68, 3.72, 3.74, 3.76, 3.78, 3.106, 3.144

A. For the following reactions please write out all chemical formulas and balance equations:

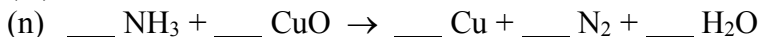
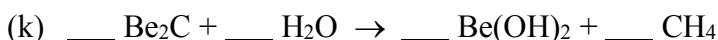
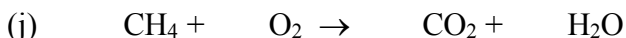
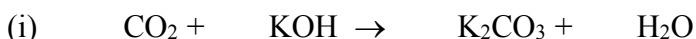
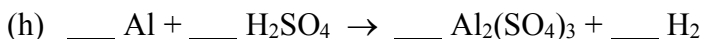
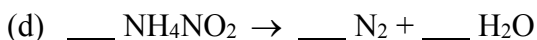
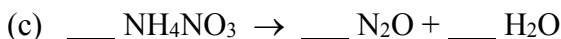
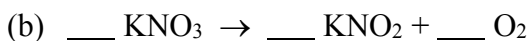
a) Dicarbon dihydride (ethyne) + Oxygen → Carbon dioxide + Water

b) Iron (III) chloride + Ammonium hydroxide → Iron(III) hydroxide + Ammonium chloride

c) Phosphorus pentachloride + water → Hydrochloric acid + Phosphoric acid

d) Lead(II) nitrate → Lead(II) oxide + Nitrogen dioxide + Oxygen

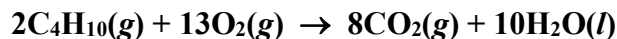
3.60 Balance the following equations



3.61 On what law is stoichiometry based? Why is it essential to use balanced equations in solving stoichiometric problems?

3.66 In one reaction, 0.507 mol of SiCl_4 is produced. How many moles of molecular chlorine were used in the reaction, $\text{Si}(s) + 2\text{Cl}_2(g) \rightarrow \text{SiCl}_4(l)$

3.68 5.0 moles of C_4H_{10} is reacted with an excess of O_2 . Calculate the number of moles of CO_2 formed?



- 3.72 Starting with 500.5 g of glucose, what is the maximum amount of ethanol in grams and in liters that can be obtained by fermentation? (Density of ethanol = 0.789 g/mL)
- $$\begin{array}{ccc} \text{C}_6\text{H}_{12}\text{O}_6 & \longrightarrow & 2 \text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2 \\ \text{glucose} & & \text{ethanol} \end{array}$$
- 3.74 What is the minimum amount of KCN in moles needed to extract 29.0 g of gold?
- $$4 \text{Au} + 8 \text{KCN} + \text{O}_2 \rightarrow 4 \text{KAu}(\text{CN})_2 + 4\text{KOH}$$
- 3.76 (a) Write the balanced equation for the preparation of laughing gas, dinitrogen monoxide from the decomposition of ammonium nitrate. (The other product is water.)
- (b) How many grams of N_2O are formed if 0.46 mole of NH_4NO_3 is used in the reaction?
- 3.78 Calculate the number of grams of O_2 gas that can be obtained from the decomposition of 46.0 g of KClO_3 . (The products are KCl and O_2). (write the balance equation first)
- 3.106 A certain metal oxide has the formula MO where M denotes the metal. A 39.46 g sample of the compound is strongly heated in an atmosphere of hydrogen to remove oxygen as water molecules. At the end, 31.70 g of the metal is left over. Knowing that O has an atomic mass of 16.00 amu, calculate the atomic mass of M and identify the element.

3.144 Industrially, hydrogen gas can be prepared by reacting propane gas (C₃H₈) with steam at about 400°C. The products are carbon monoxide and hydrogen gas.

(a) Write a balanced equation for the reaction.

(b) How many kilograms of hydrogen gas can be obtained from 2.84×10^3 kg?
[hint: use kg-mol to avoid converting to g and back to kg.]

Answers: (Aa) 2, 5, 4, 2; (Ab) 1, 3, 1, 3; (Ac) 1, 4, 5, 1; (Ad) 2, 2, 4, 1; (Ae) 2, 2, 1; (Af) 3, 60c) 1, 1, 2; (Ag) 1, 1, 1; (Ah) 2, 3, 1, 3; (Ai) 1, 2, 1, 1; (Aj) 1, 2, 1, 2; (Ak) 1, 4, 2, 1; (Al) 3, 60j) 3, 60k) 3, 60l) 3, 60m) 1, 6, 1, 6, 2; (An) 2, 3, 3, 1, 3; (Ao) 1.01 mol Cl₂; 3.68) 2.0 × 10⁴ mol CO₂; 3.72) 255.9 g C₂H₅OH; (Ap) 0.294 mol KCN; 3.76a) 1, 1, 2; 3.76b) 2.0 × 10⁴ g N₂O; 3.78) 18.0 g O₂; 3.106) 65.4 amu; 3.144a) 1, 3, 3, 7; 3.144b) 9.09 × 10² kg H₂