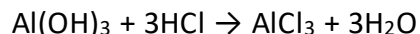


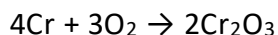
## Mixed Stoichiometry Practice:

1. Some antacid tablets contain aluminum hydroxide. The aluminum hydroxide reacts with stomach acid according to the equation:



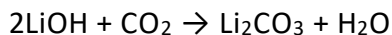
Determine the moles of acid that are neutralized if a tablet contains 0.200 mol  $\text{Al(OH)}_3$ .

2. Chromium reacts with oxygen according to the equation:



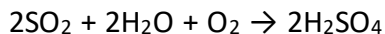
Determine the mass of chromium (III) oxide produced when 4.58 moles of chromium is allowed to react.

3. Space vehicles use solid lithium hydroxide to remove exhaled carbon dioxide according to the equation:



Determine the mass of carbon dioxide removed if the space vehicle carries 1.008 kg of  $\text{LiOH}$ .

4. Some of the sulfur dioxide released into the atmosphere is converted to sulfuric acid according to the equation:

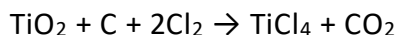


Determine the mass of sulfuric acid formed from 3.20 moles of sulfur dioxide.

5. How many grams of carbon dioxide are produced when 2.50 g of sodium bicarbonate react with excess citric acid according to the equation:



6. Titanium is a transition metal used in many alloys because it is extremely strong and lightweight. Titanium tetrachloride is extracted from titanium oxide using chlorine and carbon according to the equation:



If you begin with 1.25 mol  $\text{TiO}_2$ , what mass of  $\text{Cl}_2$  gas is needed?

7. Sodium chloride is decomposed into the elements sodium and chlorine by means of electrical energy. How many grams of chlorine gas can be obtained from 10.5 kg of sodium chloride?

8. An acid spill has occurred in a nearby lake. Specifically, 19.5 kg of  $\text{H}_2\text{SO}_4$  have been released into the lake. If local officials have 30 kg of baking soda ( $\text{NaHCO}_3$ ), will they have enough to completely neutralize the acid?

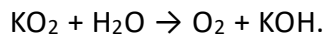


9. Rex the clown needs more hydrogen gas to fill his balloons! However, Rex has no tanks of hydrogen with him. He does have some zinc and 12L of hydrochloric acid (HCl gas). He decides to make hydrogen gas by reacting zinc with hydrochloric acid, in a reaction that also produces zinc chloride. How many liters of hydrogen gas (at STP) can Rex form?

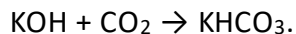
10. One mole of aspartame ( $C_{14}H_{18}N_2O_5$ ) reacts with two moles of water to produce one mole of aspartic acid ( $C_4H_7NO_4$ ), one mole of methanol ( $CH_3OH$ ) and one mole of phenylalanine.

- What is the molecular formula of phenylalanine? (hint\* conservation of mass)
- What mass of phenylalanine is produced from 378 g of aspartame?

11.  $KO_2$  is used in a closed-system breathing apparatus. It removes carbon dioxide and water from exhaled air. The reaction for the removal of water is:



The KOH produced is used to remove carbon dioxide by the following reaction:



- What mass of  $KO_2$  produces 235 g of  $O_2$ ?
- What mass of  $CO_2$  can be removed by 123 g of  $KO_2$ ?

12. What mass of aluminum can be produced from the decomposition of 200 kg of aluminum oxide?

13. 250 mL of **liquid** ethanol ( $\text{CH}_3\text{CH}_2\text{OH}$ , density = 0.789 g/mL) was allowed to completely combust in an excess of oxygen gas. Calculate the mass of water produced from the reaction.

14. Future astronauts on Mars could potentially produce oxygen gas through the decomposition of the perchlorate salts found in the Martian soil. The main salt found in the soil is calcium perchlorate which, when heated, can decompose into calcium chloride and oxygen gas.

a. How much oxygen gas could be produced (STP) from the decomposition of 400 g of calcium perchlorate.

b. In reality, this would not occur at standard temperature. The astronauts may need to heat the reaction to  $150^\circ\text{C}$ . At this temperature the molar volume of oxygen is 34.7 L/mol. Calculate the volume of oxygen produced at this temperature. How different is it from the standard value?

**Answers:**

1. 0.60 moles      2. 348.08 g      3. 926.14 g      4. 313.86 g      5. 1.31 g      6. 177.25 g  
7. 6369.35 g      8. No, 3.405 kg more      9. 6 L      10a.  $\text{C}_9\text{H}_{11}\text{NO}_2$       10b. 212.17 g      11a. 696.19 g      11b. 76.14g  
12. 105845.43 g      13. 231.41 g      14a. 107.12 g      14b. 116.17 L @  $150^\circ\text{C}$ , 74.99 L @  $0^\circ\text{C}$