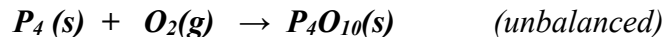
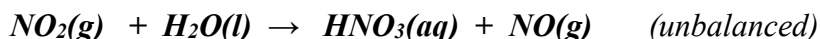


Worksheet 21 Gas law and reaction stoichiometry

1. How many grams of phosphorus react with 35.5 L of O₂ at STP to form tetraphosphorus decoxide?

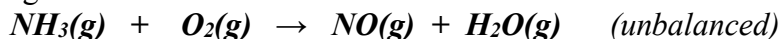


2. The industrial synthesis of nitric acid involves the reaction of nitrogen dioxide gas with water:



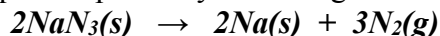
How many moles of nitric acid can be prepared using 450 L of NO₂ at a pressure of 5.00 atm and a temperature of 295 K?

3. In the first step in the industrial process of making nitric acid, ammonia reacts with oxygen at 850°C and 5.00 atm in the presence of a suitable catalyst. The following reaction occurs:



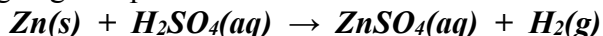
How many litres of NH₃(g) at 850°C and 5.00 atm are required to react with 1.00 mol of O₂(g) in this reaction?

4. Air bags are activated when a severe impact causes a steel ball to compress a spring and electrically ignite a detonator cap. This causes sodium azide (NaN₃) to decompose explosively according to the following reaction:



What mass of NaN₃(s) must be reacted to inflate an air bag to 70.0 L at STP?

5. Hydrogen gas is produced when zinc reacts with sulfuric acid:



If 159 mL of wet H₂ is collected over water at 25°C and a barometric pressure of 738 torr, how many grams of Zn have been consumed?

6. Small quantities of oxygen gas are sometimes generated in the laboratory by heating KClO₃ in the presence of MnO₂ as a catalyst:



What volume of O₂ is collected over water at 20°C by reaction of 0.3570 g of KClO₃ if the barometric pressure is 742 torr?

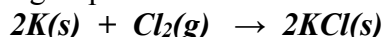
Worksheet 21 Gas law and reaction stoichiometry

7. How many grams of phosphine (PH₃) can form when 37.5 g of phosphorus and 83.0 L of hydrogen gas react at STP?

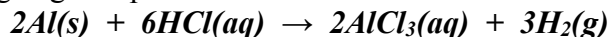


8. Consider the reaction between 60.0 mL of liquid methyl alcohol, CH₃OH (density = 0.850 g/mL), and 22.8 L of O₂ at 27°C and a pressure of 2.00 atm. The products of the reaction are CO₂ (g) and H₂O(g). Calculate the number of moles of H₂O formed if the reaction goes to completion.

9. The alkali metals react with the halogens to form ionic metal halides. What mass of potassium chloride forms when 5.25 L of chlorine gas at 0.950 atm and 293 K reacts with 17.0 g of potassium?



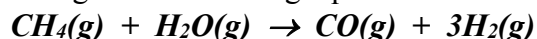
10. Hydrogen gas is produced when aluminum reacts with hydrochloric acid:



What volume of hydrogen gas is collected over water at 35°C by reaction of 0.6470 g of aluminum if the atmospheric pressure is 742 torr?

11. Consider the reaction between 75.0 mL of liquid ethanol, C₂H₅OH (density = 0.789 g/mL), and 32.5 L of O₂ at 27°C and a pressure of 2.50 atm. The products of the reaction are CO₂ (g) and H₂O (g). If the reaction produces 45.0 g of H₂O(g), what is the percent yield?

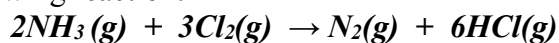
12. Hydrogen gas (a potential future fuel) can be formed by the reaction of methane with water according to the following equation:



In a particular reaction, 25.5 L of methane gas (measured at a pressure of 732 torr and a temperature of 25°C) is mixed with 22.8 L of water vapor (measured at a pressure of 702 torr and a temperature of 12.5 °C). The reaction produces 26.2 L of hydrogen gas measured at STP. What is the percent yield of the reaction?

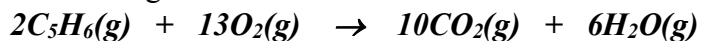
Worksheet 21 Gas law and reaction stoichiometry

13. Consider the following reaction:



19.8 L of NH_3 gas (measured at STP) is mixed with 26.8 L of wet Cl_2 (measured at a pressure of 722 torr and a temperature of 35.0°C). The reaction produces 6.81 g of N_2 . What is the percent yield of the reaction?

14. Consider the following reaction:



10.8 L of C_5H_6 gas (measured at STP) is mixed with 26.8 L of wet O_2 (measured at a pressure of 0.968 atm and a temperature of 45.0°C). The reaction produces 5.00 g of $\text{H}_2\text{O}(\text{g})$. What is the *percent yield* of the reaction?