

GAS STOICHIOMETRY

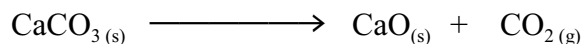
In dealing with the stoichiometry of reactions involving gases, it is useful to define the volume occupied by 1 mole of a gas at 0°C and 101.3 kPa, (Standard Temperature and Pressure STP) as Molar Volume, which equals 22.4 Liters. The following equations may be useful in finding the answers below:

$$PV = nRT \quad \text{number of moles} = \text{Volume in litres/Volume at STP.}$$

1. A sample of $\text{N}_2(\text{g})$ has a volume of 1.75 L at STP. How many moles of N_2 are present?
(7.81×10^{-2} mol)

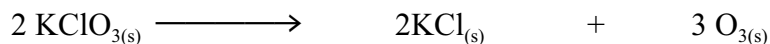
2. NH_3 is commonly used as a fertilizer to provide a source of N_2 for plants. A sample of NH_3 occupies 5.0 L at 25°C and 15.0 atm. What volume will this sample occupy at STP?
(68.8 L)

3. Quicklime, CaO , is produced by heating $\text{CaCO}_3(\text{s})$. Calculate the volume of $\text{CO}_2(\text{g})$ produced at STP from the decomposition of 152g of $\text{CaCO}_3(\text{s})$ according to the following equation...
(34.1 L)

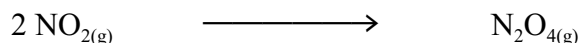


4. Consider the above reaction... What volume of $\text{CO}_2(\text{g})$ is produced at 25°C and a pressure of 1.02 atm when 10.0 g of $\text{CaCO}_3(\text{s})$ is decomposed?
(2.4 L)

5. Calculate the volume of $\text{O}_2(\text{g})$ produced at 25°C and 630 mm Hg when 50 g of KClO_3 is heated according to the following equation...
(18.1 L)

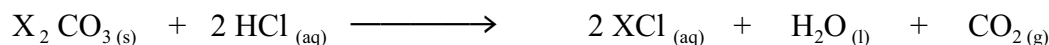


6. Consider the following equation...



If 25.0 mL of $\text{NO}_2(\text{g})$ is completely converted to $\text{N}_2\text{O}_4(\text{g})$ under the same conditions of temperature and pressure, what volume of $\text{N}_2\text{O}_4(\text{g})$ will be obtained?
(12.5 mL)

7. A 2.64 g sample of X_2CO_3 reacts with $\text{HCl}(\text{aq})$ according to the following equation:



The $\text{CO}_2(\text{g})$ which is collected at 27°C occupies 600 mL at 101.3 kPa, therefore, calculate the molar mass of X. (24 g/mol)

Clue: Determine the no. moles $\text{X}_2 \text{CO}_3 = \text{no. moles of CO}_2$ in 2.64 g from $PV = nRt$

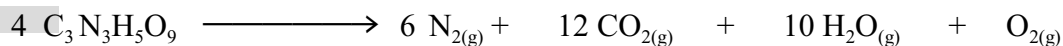
Find the molar mass of $\text{X}_2 \text{CO}_3 = \text{mass/ moles}$. Hence molar mass of X from total molar mass.

8. Standard marijuana cigarettes produce more carcinogenic chemicals than standard tobacco cigarettes. Many of these compounds are related to pyrene, an aromatic hydrocarbon. At 350°C and 80 kPa, 1.17 g of pyrene has a volume of 375 mL. Calculate the molar mass of pyrene, check your answer against the molecular formula of C₁₆H₁₀. (201.0 g/mol.)

9. Trichloroethylene, formerly used for coffee decaffeination, in high doses causes liver cancer. It has a mass of 2.75 g in a volume of 1.80 L at 38.8 kPa and at 127°C. Find its molar mass. (130.88 g/mol.)

10. Peroxyacetyl nitrate (PAN) produced in photo-chemical smog has a density of 1.85 g/L at 50.66 kPa and 125°C. Find its molar mass. (129.78 g/mol.)

11. Nitroglycerine C₃N₄H₅O₉ is used both as a heart drug to relieve severe heart pains and as a powerful explosive. The equation for the explosion of nitroglycerine is:



All of the products are gases. In an explosion, these gases are produced at high temperature in a very short time. The rapid expansion of these high pressure and high temperature gases constitute the explosion. Calculate the total volume of gases at 250°C and 300 kPa when 1.00 kg of liquid Nitroglycerine explodes.

(462.14 L)