

Gas Properties Review

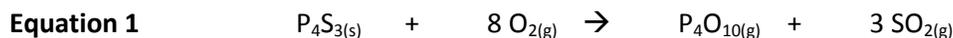
- A balloon filled with air has a volume of 580-mL at SATP. The balloon is placed in a deep freeze for 24 hours after which it has a volume of 525-mL.
 - Explain this observation using the kinetic molecular theory.
 - A student suggests, 'The intermolecular forces have become stronger.' Critique this student's reasoning.
 - Which of the gas laws is represented by this observation? Justify your choice.
 - Determine the temperature (in °C) within the deep freeze.
- A sample of an unknown gas is discovered inside a sealed chamber. Qualitative and quantitative analyses have been performed and the information is provided (see **Table 1**).

Table 1. Information on the unknown gas sample

Reactivity	Volume of gas collected (mL)	Measured pressure (atm)	Measured temperature (°C)	Mass of gas collected (g)
unreactive; highly dangerous to 'super-men'	8.00×10^2	1.017	78.0	2.366

The identity of the gas is suspected owing to its unusual 'reactivity' but this speculation must be confirmed.

- Calculate the number of moles of the unknown gas that was collected.
 - Calculate the molar mass of the unknown gas and confirm the likely identity of the gas.
- At 25°C, a 10.0-L scuba tank is filled with 64 mol of nitrogen gas, N_{2(g)}, and 16 mol of oxygen gas, O_{2(g)}.
 - What is the ratio of N_{2(g)} molecules: O_{2(g)} molecules in the mixture?
 - Determine the total gas pressure in the scuba tank.
 - What is the partial pressure of each gas? What is the ratio of p_{N₂}: p_{O₂}?
 - What does the ratio of gas molecules and the ratio of gas pressures indicate about the effect of gas identity on total pressure? Explain.
 - The chemical equation below describes what happens when a match is struck against a rough surface to produce light and heat (**Eq. 1**).



- If 0.015 mol of P₄S_{3(s)} is to be completely combusted at STP, what volume of oxygen gas will be required?
 - What volume of P₄O_{10(g)} will be produced in the complete combustion, assuming the temperature and pressure remain constant?
 - However, as the combustion proceeds, the temperature rises to 350°C. What volume will P₄O_{10(g)} occupy at this new temperature assuming the pressure remains constant?
- The atmosphere of planet Yaza, from the same star system as Xylo and Zeber, is made up entirely of phosphorus pentafluoride, PF_{5(g)}. The atmospheric pressure of this inhospitable planet is 125 kPa with a mean temperature of 335 K.

Calculate the density of the atmosphere on planet Yaza. (**HINT: 1 mol of ANY ideal gas takes up 24.8 L at SATP.**)