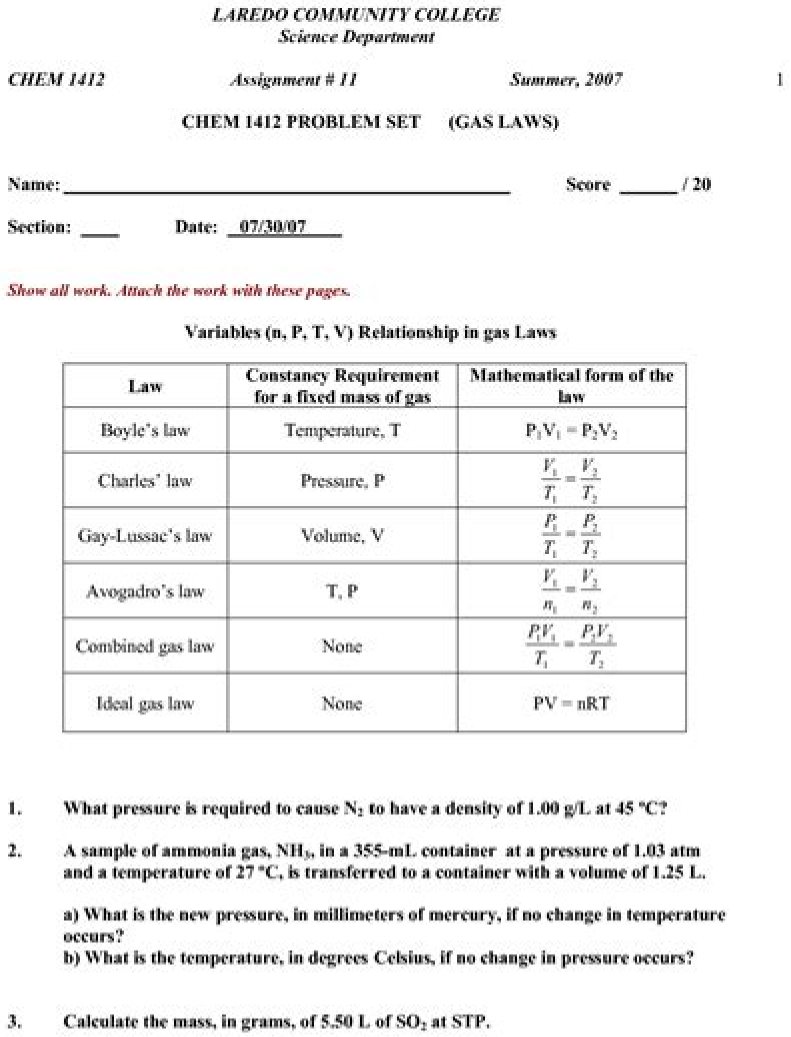
Gas Variables Worksheet Answers



LAREDO COMMUNITY COLLEGE
Science Department

CHEM 1412 *Assignment # 11* *Summer, 2007* 1

CHEM 1412 PROBLEM SET (GAS LAWS)

Name: ______________________________ **Score** ______ **/ 20**

Section: ____ **Date:** 07/30/07

Show all work. Attach the work with these pages.

Variables (n, P, T, V) Relationship in gas Laws

Law	Constancy Requirement for a fixed mass of gas	Mathematical form of the law
Boyle's law	Temperature, T	$P_1V_1 = P_2V_2$
Charles' law	Pressure, P	$\frac{V_1}{T_1} = \frac{V_2}{T_2}$
Gay-Lussac's law	Volume, V	$\frac{P_1}{T_1} = \frac{P_2}{T_2}$
Avogadro's law	T, P	$\frac{V_1}{n_1} = \frac{V_2}{n_2}$
Combined gas law	None	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
Ideal gas law	None	PV = nRT

1. **What pressure is required to cause N_2 to have a density of 1.00 g/L at 45 °C?**
2. **A sample of ammonia gas, NH_3, in a 355-mL container at a pressure of 1.03 atm and a temperature of 27 °C, is transferred to a container with a volume of 1.25 L.**

   a) What is the new pressure, in millimeters of mercury, if no change in temperature occurs?
   b) What is the temperature, in degrees Celsius, if no change in pressure occurs?

3. **Calculate the mass, in grams, of 5.50 L of SO_2 at STP.**

Gas variables worksheet answers are essential for students and professionals who study the behavior of gases under various conditions. Understanding these answers not only reinforces theoretical concepts but also helps in solving practical problems encountered in fields such as chemistry, physics, and engineering. This article will delve into the fundamental gas laws, provide context on gas variables, and explore the answers typically found in gas variables worksheets.

Understanding Gas Laws

Gas laws describe the relationships between pressure, volume, temperature, and the number of moles of a gas. These laws are the foundation for solving problems related to gas behavior and can be summarized in several key equations.

The Ideal Gas Law

The Ideal Gas Law combines several gas laws into one equation:

$$PV = nRT$$

Where:
- P = pressure of the gas (in atmospheres or pascals)
- V = volume of the gas (in liters or cubic meters)
- n = number of moles of the gas
- R = ideal gas constant (0.0821 L·atm/(K·mol) or 8.314 J/(K·mol))
- T = temperature of the gas (in Kelvin)

This equation is useful for calculations involving ideal gases, which behave predictably under a variety of conditions.

Boyle's Law

Boyle's Law states that the pressure of a gas is inversely proportional to its volume when temperature and the number of moles are held constant. The mathematical representation is:

$$P_1V_1 = P_2V_2$$

This means that if the volume decreases, the pressure increases, and vice versa.

Charles's Law

Charles's Law indicates that the volume of a gas is directly proportional to its temperature when pressure and the number of moles are constant. The equation is:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

This suggests that as temperature rises, volume also increases.

Avogadro's Law

Avogadro's Law states that the volume of a gas is directly proportional to the number of moles when pressure and temperature are constant. It can be represented as:

$$\frac{V_1}{n_1} = \frac{V_2}{n_2}$$

This law allows for the calculation of gas volumes based on the amount of substance present.

Common Gas Variables

Understanding the various gas variables is critical for interpreting gas behavior and solving worksheet problems.

Pressure (P)

Pressure is the force exerted by gas molecules colliding with the walls of their container. It can be measured in different units, including:

- Atmospheres (atm)
- Pascals (Pa)
- Millimeters of mercury (mmHg)
- Torr

Volume (V)

Volume is the amount of space that a gas occupies, typically measured in liters (L) or cubic meters (m^3).

Temperature (T)

Temperature is a measure of the average kinetic energy of gas molecules. It is essential to convert temperatures to Kelvin when using gas laws, as the Kelvin scale begins at absolute zero.

Number of Moles (n)

The number of moles refers to the quantity of gas, which can be calculated from the mass and molar mass of the substance. One mole of any gas occupies 22.4 liters at standard temperature and pressure (STP).

Solving Gas Variables Worksheets

Gas variables worksheets typically present problems that require the application of the gas laws mentioned above. Here are some common types of questions and how to approach them.

Example Problems

1. Boyle's Law Problem
Given: A gas occupies 4.0 L at 2.0 atm. What will be its volume at 1.0 atm?
Solution:
- Use Boyle’s Law: $P_1V_1 = P_2V_2$
- Rearranging gives $V_2 = \frac{P_1V_1}{P_2}$
- Substitute values:

$$V_2 = \frac{2.0 \, \text{atm} \times 4.0 \, \text{L}}{1.0 \, \text{atm}} = 8.0 \, \text{L}$$

2. Charles's Law Problem
Given: A gas at 300 K occupies 5.0 L. What will be its volume at 400 K?
Solution:
- Use Charles’s Law: $\frac{V_1}{T_1} = \frac{V_2}{T_2}$
- Rearranging gives $V_2 = V_1 \times \frac{T_2}{T_1}$
- Substitute values:

$$V_2 = 5.0 \, \text{L} \times \frac{400 \, \text{K}}{300 \, \text{K}} = \frac{2000}{300} \approx 6.67 \, \text{L}$$

3. Ideal Gas Law Problem
Given: A gas has a pressure of 1.5 atm, a volume of 10.0 L, and a temperature of 300 K. Calculate the number of moles.
Solution:
- Use the Ideal Gas Law: $PV = nRT$
- Rearranging gives $n = \frac{PV}{RT}$
- Substitute values:

$$n = \frac{(1.5 \, \text{atm}) \times (10.0 \, \text{L})}{(0.0821 \, \text{L·atm/(K·mol)}) \times (300 \, \text{K})} \approx 0.61 \, \text{mol}$$

Tips for Success

- Understand the Laws: Familiarize yourself with Boyle's, Charles's, and Avogadro's Laws as they form the basis of most problems.
- Keep Units Consistent: Always make sure your units are consistent, particularly when using the Ideal Gas Law.
- Practice: The more problems you solve, the more comfortable you will become with the concepts.

Conclusion

In conclusion, gas variables worksheet answers are invaluable tools for mastering the concepts of gas behavior. By understanding the various gas laws and how to apply them, students can effectively tackle problems they encounter in their academic and professional pursuits. Whether working with the Ideal Gas Law, Boyle's Law, or Charles's Law, the ability to manipulate these equations and interpret the results is essential for anyone studying the science of gases. Through practice and a solid grasp of the fundamental principles, success in solving gas variable problems becomes attainable.

Frequently Asked Questions

What is a gas variables worksheet?

A gas variables worksheet typically contains problems and exercises related to the behavior of gases, focusing on variables such as pressure, volume, temperature, and the number of moles, often applying the ideal gas law.

How do you calculate pressure using a gas variables worksheet?

To calculate pressure, you can use the ideal gas law formula PV = nRT, where P is pressure, V is volume, n is the number of moles, R is the ideal gas constant, and T is temperature in Kelvin. Rearranging the formula allows you to solve for pressure.

What is the ideal gas law?

The ideal gas law is a fundamental equation in chemistry represented as PV = nRT, which relates the pressure, volume, temperature, and amount of gas in a closed system. It assumes ideal behavior of gases.

What types of problems can be found on a gas variables worksheet?

Problems may include calculating unknown variables using the ideal gas law, transformations between different states of gas, and applying gas laws such as Boyle's Law, Charles's Law, and Avogadro's Law.

How do you find the volume of a gas using a gas variables worksheet?

To find the volume of a gas, you can rearrange the ideal gas law to V = nRT/P, where you substitute the values for the number of moles (n), the ideal gas constant (R), temperature (T), and pressure (P).

Are there practice worksheets available for gas variables?

Yes, many educational resources and websites provide free printable practice worksheets on gas variables that include problems and answer keys for self-assessment.

What skills can be improved by completing a gas variables worksheet?

Completing a gas variables worksheet can improve problem-solving skills, understanding of gas laws, mathematical calculations related to chemistry, and the ability to apply theoretical concepts to practical scenarios.

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