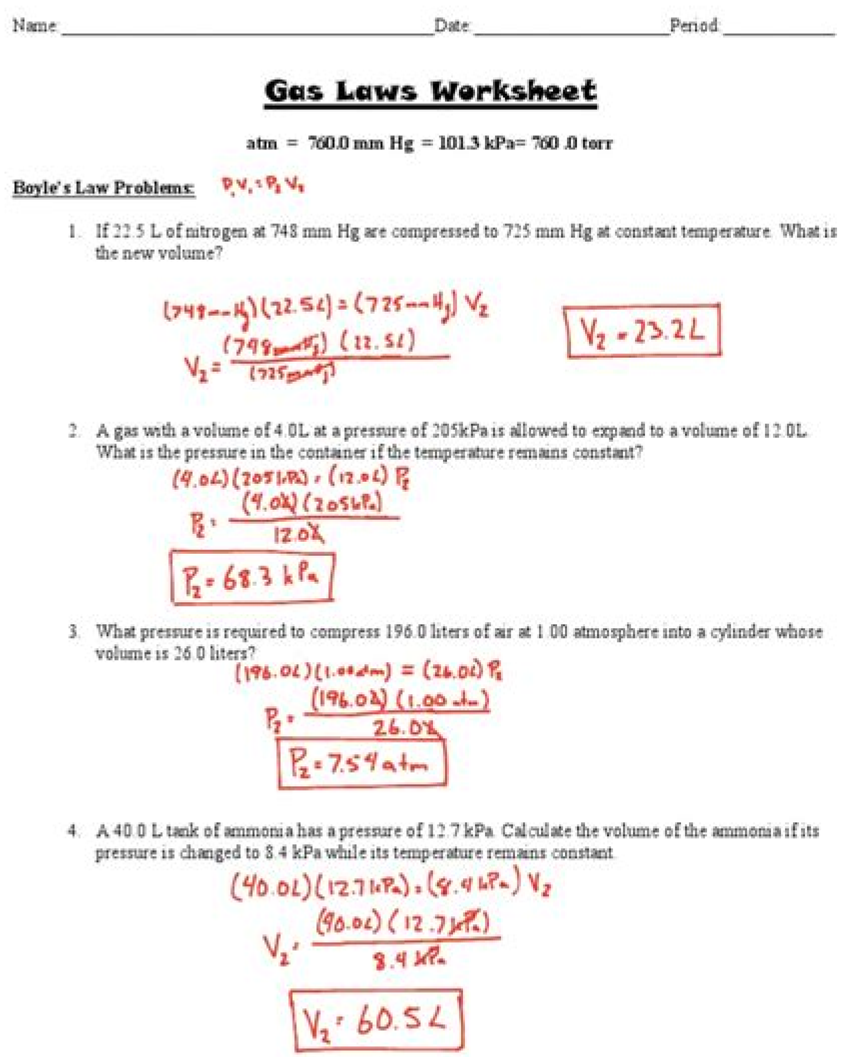
Gas Laws Worksheet Answer Key



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Gas Laws Worksheet

atm = 760.0 mm Hg = 101.3 kPa= 760 .0 torr

Boyle's Law Problems: $P_1V_1 = P_2V_2$

1. If 22.5 L of nitrogen at 748 mm Hg are compressed to 725 mm Hg at constant temperature. What is the new volume?

$(748\,mmHg)(22.5L) = (725\,mmHg)\,V_2$

$V_2 = \frac{(748\,\cancel{mmHg})\,(22.5L)}{(725\,\cancel{mmHg})}$

$\boxed{V_2 = 23.2L}$

2. A gas with a volume of 4.0L at a pressure of 205kPa is allowed to expand to a volume of 12.0L. What is the pressure in the container if the temperature remains constant?

$(4.0L)(205kPa) = (12.0L)\,P_2$

$P_2 = \frac{(4.0\cancel{L})(205kPa)}{12.0\cancel{L}}$

$\boxed{P_2 = 68.3\ kPa}$

3. What pressure is required to compress 196.0 liters of air at 1.00 atmosphere into a cylinder whose volume is 26.0 liters?

$(196.0L)(1.00atm) = (26.0L)\,P_2$

$P_2 = \frac{(196.0\cancel{L})\,(1.00\,atm)}{26.0\cancel{L}}$

$\boxed{P_2 = 7.54\,atm}$

4. A 40.0 L tank of ammonia has a pressure of 12.7 kPa. Calculate the volume of the ammonia if its pressure is changed to 8.4 kPa while its temperature remains constant.

$(40.0L)(12.7kPa) = (8.4kPa)\,V_2$

$V_2 = \frac{(40.0L)\,(12.7\cancel{kPa})}{8.4\,\cancel{kPa}}$

$\boxed{V_2 = 60.5L}$

Gas laws worksheet answer key is an essential resource for students and teachers alike, particularly in the realm of chemistry. Understanding gas laws is crucial for grasping the behavior of gases under various conditions, which has significant implications in both theoretical and practical applications. This article will explore the key concepts of gas laws, provide a detailed overview of common worksheets used in educational settings, and present an answer key for typical problems found in these worksheets. By the end, readers will have a comprehensive understanding of gas laws and how to approach related problems effectively.

Understanding Gas Laws

Gas laws describe the relationships between pressure, volume, temperature, and the number of moles of gas. These laws are fundamental to the study of gases and are based on empirical observations. The primary gas laws include:

1. Boyle’s Law

Boyle's Law states that the pressure of a gas is inversely proportional to its volume when the temperature remains constant. Mathematically, it can be expressed as:

$$P_1 V_1 = P_2 V_2$$

Where:
- P_1 and P_2 are the initial and final pressures,
- V_1 and V_2 are the initial and final volumes.

2. Charles’s Law

Charles's Law states that the volume of a gas is directly proportional to its temperature (in Kelvin) when the pressure is held constant. The law can be expressed as:

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

Where:
- T_1 and T_2 are the initial and final temperatures.

3. Avogadro’s Law

Avogadro’s Law states that the volume of a gas at constant temperature and pressure is directly proportional to the number of moles of gas. It can be expressed as:

$$V_1/n_1 = V_2/n_2$$

Where:
- n_1 and n_2 are the initial and final number of moles.

4. Ideal Gas Law

The Ideal Gas Law combines the three previous laws and can be expressed as:

$$PV = nRT$$

Where:
- P is pressure,
- V is volume,

- \(n \) is the number of moles,
- \(R \) is the ideal gas constant,
- \(T \) is temperature in Kelvin.

This equation allows for calculations involving all four variables and is fundamental in gas behavior analysis.

Common Gas Laws Worksheets

Gas laws worksheets are often used in educational settings to help students practice and apply their knowledge of gas laws. These worksheets typically contain a variety of problems, including calculations, graphing, and theoretical questions.

Types of Problems Found in Worksheets

1. Calculating Pressure, Volume, and Temperature
- Problems may require students to solve for an unknown variable using the appropriate gas law formula.

2. Graphical Representation
- Some worksheets may include graphs that illustrate the relationships described by the gas laws, with questions pertaining to interpreting these graphs.

3. Real-World Applications
- Worksheets may present real-world scenarios where students must apply gas laws to solve practical problems (e.g., calculating the pressure of air in a balloon at different temperatures).

4. Comparative Analysis
- Problems may require students to compare different conditions of gases and determine how changes in one variable affect others.

Sample Problems and Answer Key

To provide practical insight, let’s look at some sample problems commonly found in gas laws worksheets along with their answer key.

Sample Problem 1: Boyle’s Law

Problem: A gas occupies a volume of 4.0 L at a pressure of 2.0 atm. What will be the volume of the gas if the pressure is increased to 4.0 atm?

Solution Steps:
Using Boyle's Law:

$$ P_1 V_1 = P_2 V_2 $$

Where:
- $P_1 = 2.0$ atm,
- $V_1 = 4.0$ L,
- $P_2 = 4.0$ atm.

Plugging in the values:

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

Calculating V_2:

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

Answer: 2.0 L

Sample Problem 2: Charles’s Law

Problem: A gas has a volume of 3.0 L at 300 K. What will be its volume at 600 K if the pressure remains constant?

Solution Steps:
Using Charles's Law:

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

Where:
- $V_1 = 3.0$ L,
- $T_1 = 300$ K,
- $T_2 = 600$ K.

Plugging in the values:

$$ \frac{3.0}{300} = \frac{V_2}{600} $$

Calculating V_2:

$$ V_2 = \frac{3.0 \times 600}{300} = 6.0 \, \text{L} $$

Answer: 6.0 L

Sample Problem 3: Ideal Gas Law

Problem: Calculate the pressure exerted by 2 moles of gas occupying a volume of 5.0 L at a temperature of 300 K. (Use R = 0.0821 L·atm/(mol·K))

Solution Steps:
Using the Ideal Gas Law:

\[PV = nRT \]

Where:
- \(n = 2 \) moles,
- \(V = 5.0 \) L,
- \(T = 300 \) K,
- \(R = 0.0821 \, L·atm/(mol·K) \).

Rearranging for \(P \):

\[P = \frac{nRT}{V} \]

Plugging in the values:

\[P = \frac{2 \times 0.0821 \times 300}{5.0} \]

Calculating \(P \):

\[P = \frac{49.26}{5.0} = 9.852 \, \text{atm} \]

Answer: 9.85 atm

Conclusion

Understanding and applying gas laws is a fundamental part of chemistry that aids in predicting gas behavior under various conditions. The gas laws worksheet answer key serves as a valuable tool for students and educators, facilitating learning and comprehension of these essential principles. By mastering gas laws, students can gain a deeper insight into the physical world around them, equipping them with knowledge applicable in various scientific and real-world contexts. Whether through calculations, graphical analysis, or real-world applications, the significance of gas laws cannot be overstated in the journey of scientific discovery.

Frequently Asked Questions

What are gas laws?

Gas laws are scientific laws that describe the behavior of gases in relation to pressure, volume, temperature, and the number of moles.

What is the ideal gas law?

The ideal gas law is expressed as PV = nRT, where P is pressure, V is volume, n is the number of moles, R is the gas constant, and T is temperature in Kelvin.

What is the purpose of a gas laws worksheet?

A gas laws worksheet is designed to help students practice calculations and understand the relationships between pressure, volume, temperature, and number of moles in gases.

How can I check my answers on a gas laws worksheet?

You can check your answers using an answer key provided by your instructor or textbook, which typically includes correct calculations and explanations for each question.

What is 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 (P1V1 = P2V2).

What is Charles's Law?

Charles's Law states that the volume of a gas is directly proportional to its temperature in Kelvin when pressure and the number of moles are held constant (V1/T1 = V2/T2).

What units are commonly used in gas law calculations?

Common units include pressure in atmospheres (atm) or Pascals (Pa), volume in liters (L), temperature in Kelvin (K), and amount in moles (mol).

How does the gas constant R vary?

The gas constant R can be expressed in different units depending on the context, such as 0.0821 L·atm/(K·mol) or 8.314 J/(K·mol).

What should I do if I get the wrong answer on a gas laws worksheet?

If you get a wrong answer, review your calculations and the applicable gas law to identify any mistakes, and consult the answer key for guidance.

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