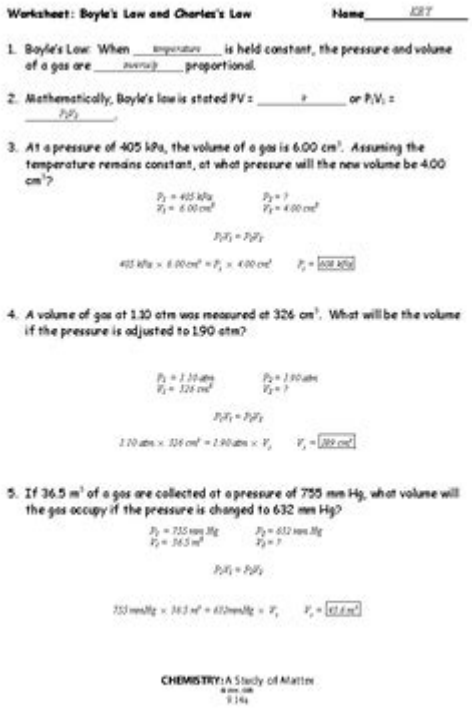
Boyles Law And Charles Law Answer Key



Worksheet: Boyle's Law and Charles's Law **Name** KEY

1. Boyle's Law: When ___temperature___ is held constant, the pressure and volume of a gas are ___inversely___ proportional.

2. Mathematically, Boyle's law is stated PV = ___k___ or $P_1V_1 =$ ___P_2V_2___.

3. At a pressure of 405 kPa, the volume of a gas is 6.00 cm^3. Assuming the temperature remains constant, at what pressure will the new volume be 4.00 cm^3?

$P_1 = 405\ kPa$ $P_2 = ?$
$V_1 = 6.00\ cm^3$ $V_2 = 4.00\ cm^3$

$P_1V_1 = P_2V_2$

$405\ kPa \times 6.00\ cm^3 = P_2 \times 4.00\ cm^3$ $P_2 = \boxed{608\ kPa}$

4. A volume of gas at 1.10 atm was measured at 326 cm^3. What will be the volume if the pressure is adjusted to 1.90 atm?

$P_1 = 1.10\ atm$ $P_2 = 1.90\ atm$
$V_1 = 326\ cm^3$ $V_2 = ?$

$P_1V_1 = P_2V_2$

$1.10\ atm \times 326\ cm^3 = 1.90\ atm \times V_2$ $V_2 = \boxed{189\ cm^3}$

5. If 36.5 m^3 of a gas are collected at a pressure of 755 mm Hg, what volume will the gas occupy if the pressure is changed to 632 mm Hg?

$P_1 = 755\ mm\ Hg$ $P_2 = 632\ mm\ Hg$
$V_1 = 36.5\ m^3$ $V_2 = ?$

$P_1V_1 = P_2V_2$

$755\ mmHg \times 36.5\ m^3 = 632 mmHg \times V_2$ $V_2 = \boxed{43.6\ m^3}$

CHEMISTRY: A Study of Matter
9.14a

Understanding Boyle's Law and Charles' Law

Boyle's Law and Charles' Law are fundamental principles in the field of thermodynamics, specifically concerning the behavior of gases. These laws describe how gases respond to changes in pressure, volume, and temperature, and are essential for understanding various scientific and engineering applications. This article will delve into the definitions, formulas, applications, and interrelation of these two important gas laws.

Boyle's Law

Definition

Boyle's Law states that the pressure of a given mass of gas is inversely proportional to its volume when the temperature remains constant. This relationship can be expressed mathematically as:

$$ P \times V = k $$

where:

- P is the pressure of the gas,
- V is the volume of the gas,
- k is a constant.

In simpler terms, if the volume of a gas decreases, its pressure increases, provided the temperature remains unchanged.

Graphical Representation

The relationship can be illustrated on a graph with pressure (P) on the y-axis and volume (V) on the x-axis. The graph will show a hyperbolic curve, indicating that as one variable increases, the other decreases.

Applications of Boyle's Law

Boyle's Law has various practical applications, including:

- **Medical Applications:** Understanding how the lungs expand and contract during breathing.
- **Aerospace Engineering:** Calculating how altitudes affect pressure in aircraft.
- **Scuba Diving:** Explaining how pressure changes affect gas volume in divers' lungs.

Charles' Law

Definition

Charles' Law states that the volume of a given mass of gas is directly proportional to its absolute temperature when the pressure is held constant. The mathematical expression is:

$$\frac{V}{T} = k$$

where:
- V is the volume of the gas,
- T is the absolute temperature (measured in Kelvin),
- k is a constant.

In other words, as the temperature of a gas increases, its volume also increases, assuming pressure is constant.

Graphical Representation

On a graph of volume (V) versus temperature (T), Charles' Law is represented by a straight line, indicating a linear relationship between the two variables.

Applications of Charles' Law

Charles' Law also finds numerous applications across various fields, such as:

- **Hot Air Balloons:** Explaining how heating air inside a balloon increases its volume, allowing it to rise.
- **Weather Balloons:** Understanding how temperature changes with altitude affect gas volume.
- **Thermal Expansion:** Applications in engineering where materials expand when heated.

Comparison of Boyle's Law and Charles' Law

While both Boyle's Law and Charles' Law describe the properties of gases, they focus on different aspects:

1. **Pressure vs. Volume:** Boyle's Law deals with the relationship between pressure and volume at constant temperature.
2. **Volume vs. Temperature:** Charles' Law examines the relationship between volume and temperature at constant pressure.
3. **Constants:** In Boyle's Law, the product of pressure and volume remains constant, while in Charles' Law, the ratio of volume to temperature remains constant.

Real-World Examples

Understanding these laws can help in various real-world scenarios:

Boyle's Law Example

Consider a syringe filled with air. If the plunger of the syringe is pushed down, the volume of air inside decreases. According to Boyle's Law, this reduction in volume will lead to an increase in pressure. This principle is utilized in medical practices, such as injecting medication into a patient, where the pressure change allows for the medication to be effectively delivered.

Charles' Law Example

A practical example of Charles' Law can be observed when a balloon is placed in a warm environment. As the temperature rises, the air inside the balloon expands, causing the balloon to inflate. Conversely, if the balloon is placed in a cold environment, the temperature drops, leading to a decrease in the volume of air and causing the balloon to shrink.

Limitations and Exceptions

Both laws hold true under ideal conditions, but there are limitations:

Boyle's Law Limitations

- Non-Ideal Gases: At high pressures or low temperatures, gases do not behave ideally; intermolecular forces can affect the results.
- Real Gases: Real gases deviate from Boyle's Law at very high pressures and low temperatures, where the volume occupied by gas molecules becomes significant.

Charles' Law Limitations

- High-Pressure Scenarios: At high pressures, gases may not expand linearly with temperature.
- Phase Changes: When a gas undergoes a phase change (e.g., from gas to liquid), it no longer follows Charles' Law.

Conclusion

Boyle's Law and Charles' Law are two cornerstone principles of gas behavior that provide valuable insights into the physical world. Understanding these laws not only aids in scientific explorations but also enhances practical applications in medicine, engineering, and everyday life. Whether you're inflating a balloon, using a syringe, or launching a hot air balloon, the principles of gas behavior are at work, illustrating the importance of these

laws in both theoretical and practical contexts. By grasping the concepts of pressure, volume, and temperature, one gains a deeper appreciation for the complexities of gases and their interactions in our universe.

Frequently Asked Questions

What is Boyle's Law and how does it relate to gas behavior?

Boyle's Law states that the pressure of a gas is inversely proportional to its volume when temperature is held constant. This means that as the volume of a gas decreases, its pressure increases, provided the temperature remains unchanged.

How is Charles's Law different from Boyle's Law?

Charles's Law states that the volume of a gas is directly proportional to its temperature (in Kelvin) when pressure is held constant. This contrasts with Boyle's Law, which focuses on the relationship between pressure and volume at constant temperature.

Can Boyle's Law and Charles's Law be combined to solve gas problems?

Yes, Boyle's Law and Charles's Law can be combined using the ideal gas law, PV = nRT, which relates pressure (P), volume (V), and temperature (T) of a gas, allowing for the calculation of gas behavior under varying conditions.

What are some real-life applications of Boyle's Law?

Real-life applications of Boyle's Law include syringes, where pulling back on the plunger increases volume and decreases pressure, causing fluid to be drawn in, and scuba diving, where changes in pressure affect gas volume in diver's lungs.

What units are typically used when applying Charles's Law in calculations?

When applying Charles's Law, the volume is often measured in liters and the temperature must be in Kelvin. This ensures that the direct relationship between volume and temperature is accurately represented.

How do Boyle's Law and Charles's Law help explain the behavior of balloons?

Boyle's Law explains that when a balloon is squeezed (decreasing volume), the pressure inside increases, causing it to resist the squeeze. Charles's Law explains that when a balloon is heated, the air inside expands, increasing

the volume of the balloon.

Find other PDF article:
https://soc.up.edu.ph/65-proof/pdf?dataid=JVN34-5564&title=west-b-writing-practice-test.pdf

Boyles Law And Charles Law Answer Key

YouTube Help - Google Help
Learn more about YouTube YouTube help videos Browse our video library for helpful tips, feature overviews, and step-by-step tutorials. YouTube Known Issues Get information on reported …

Download the YouTube app
Check device requirements The YouTube app is available on a wide range of devices, but there are some minimum system requirements and device-specific limitations: Android: Requires …

Utiliser YouTube Studio - Ordinateur - Aide YouTube
Utiliser YouTube Studio YouTube Studio est la plate-forme des créateurs. Elle rassemble tous les outils nécessaires pour gérer votre présence en ligne, développer votre chaîne, interagir avec …

Create an account on YouTube - Computer - YouTube Help
Once you've signed in to YouTube with your Google Account, you can create a YouTube channel on your account. YouTube channels let you upload videos, leave comments, and create playlists.

[illegible] - [illegible]
[illegible] 2011 [illegible] 1 [illegible] …

Get help signing in to YouTube - YouTube Help - Google Help
To make sure you’re getting the directions for your account, select from the options below.

Sign in and out of YouTube - Computer - YouTube Help
Signing in to YouTube allows you to access features like subscriptions, playlists and purchases, and history.

YouTube Partner Program overview & eligibility
The YouTube Partner Program (YPP) gives creators greater access to YouTube resources and monetization features, and access to our Creator Support teams. It also allows revenue …

[illegible] YouTube - [illegible] Android - [illegible] YouTube
[illegible] YouTube [illegible] YouTube [illegible].

[illegible] YouTube [illegible]
[illegible] YouTube [illegible] YouTube [illegible]

Xerxes' pontoon bridges - Wikipedia
New bridges were constructed by lashing penteconters and triremes together. 360 ships were used to construct the northeasterly bridge and 314 ships were used for the southwesterly bridge.

Darius Disposes of His Great Bridge – History Moments
Aug 11, 2015 · O king, seeing that thou art about to march upon a land where no cultivated ground will be seen nor any inhabited town, do thou therefore let this bridge remain where it is, leaving to guard it those same men who constructed it.

Pontoon Bridge - 480 BC - Golden Age Project
Xeres' engineers, in short, built a combination suspension and pontoon bridge. The cables took some of the weight and provided more consistent stability than the separate vessels, and the ships kept the lengthy, heavy cables from sagging into the water.

Blogging ancient epigram: Darius' bridge across the Bosporus
When Darius the Great set out to crush the nomadic Scythians he took his great army across the Hellespont on a pontoon bridge built by one Mandrocles, an engineer from the island of Samos.

The Hellespont bridge and Xerxes | AncientPedia
Jul 16, 2024 · The bridge was essentially a highway for Xerxes’ army. Thousands of Persian soldiers marched across its sturdy planks, while countless horses and supply wagons trundled …

The Most Cowardly Free Men?: Darius' Bridge Across the Danube …
pisode at the bridge over the Danub position about Classical Ionia. Recent seen a renewed interest in the problem of sources. Some scholars have claimed to excavate material from the Alcmeonids (Murray 2001 and Thomas 1989), Chios (Federico 2017), merchants from Naucratis (Murray 2001), as well as the ancient biographical tradition that

Darius The Great's ancient bridge in Turkey's Bosphorus
Great engineering & military skills of ancient Persia. This fild is made by History TV Channel, uploaded by Emad Jafaripour

Xerxes' Crossing of Hellespont in 480 BC - World History Edu
Dec 12, 2024 · To ensure the success of the endeavor, Xerxes ordered the construction of two massive pontoon bridges across the Hellespont (modern-day Dardanelles in Turkiye), the narrow strait separating Asia from Europe.

Xerxes and the Hellespont | The Engines of Our Ingenuity
It's the rare bridge that goes nowhere. Most go somewhere -- occasionally, they even span worlds. So it seemed in 480 BC when the Persians, under Xerxes, invaded Greece. The Hellespont, now known as the Dardanelles, is a narrow body of water, only a …

Darius the Great - Wikipedia
Darius crossed the Black Sea at the Bosphorus Straits using a bridge of boats. Darius conquered large portions of Eastern Europe, even crossing the Danube to wage war on the Scythians.

Back to Home