

Charles Law Worksheet With Answers

CHARLES' LAW

Name _____

Charles' Law states that the volume of a gas varies directly with the Kelvin temperature, assuming that pressure is constant. We use the following formulas:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \text{or} \quad V_1 \times T_2 = V_2 \times T_1$$
$$K = ^\circ C + 273$$

Solve the following problems assuming a constant pressure.

1. A sample of nitrogen occupies a volume of 250 mL at 25° C. What volume will it occupy at 95° C?

2. Oxygen gas is at a temperature of 40° C when it occupies a volume of 2.3 liters. To what temperature should it be raised to occupy a volume of 6.5 liters?

3. Hydrogen gas was cooled from 150° C to 50° C. Its new volume is 75 mL. What was its original volume?

4. Chlorine gas occupies a volume of 25 mL at 300 K. What volume will it occupy at 600 K?

5. A sample of neon gas at 50° C and a volume of 2.5 liters is cooled to 25° C. What is the new volume?

6. Fluorine gas at 300 K occupies a volume of 500 mL. To what temperature should it be lowered to bring the volume to 300 mL?

7. Helium occupies a volume of 3.8 liters at -45° C. What volume will it occupy at 45° C?

8. A sample of argon gas is cooled and its volume went from 380 mL to 250 mL. If its final temperature was -55° C, what was its original temperature?

Charles Law Worksheet with Answers: Mastering Gas Law Calculations

Are you struggling to grasp Charles's Law and its applications? Do you need practice problems to solidify your understanding before that big exam? Then you've come to the right place! This comprehensive blog post provides you with a Charles's Law worksheet complete with answers, designed to help you master this fundamental concept in chemistry. We'll cover the law itself, walk through example problems, and offer helpful tips for solving similar problems independently. Get ready to conquer Charles's Law!

Understanding Charles's Law

Charles's Law, a cornerstone of gas behavior, states that the volume of a given amount of gas is directly proportional to its absolute temperature, assuming the pressure remains constant. This means that as the temperature increases, the volume of the gas also increases, and vice versa. Mathematically, we express this relationship as:

$$V_1/T_1 = V_2/T_2$$

Where:

V_1 = Initial volume of the gas

T_1 = Initial absolute temperature of the gas (in Kelvin)

V_2 = Final volume of the gas

T_2 = Final absolute temperature of the gas (in Kelvin)

Remember: Always convert temperatures to Kelvin (K) by adding 273.15 to the Celsius temperature (°C). Using Celsius will lead to incorrect calculations.

Charles Law Worksheet: Practice Problems

Let's put your knowledge to the test with the following Charles's Law worksheet. Remember to show your work for each problem!

Problem 1: A balloon filled with helium gas has a volume of 2.5 L at 25°C. What will be its volume if the temperature is increased to 50°C, assuming the pressure remains constant?

Problem 2: A gas sample occupies 500 mL at 300 K. If the volume is reduced to 250 mL at constant pressure, what will be the new temperature in Kelvin and Celsius?

Problem 3: A weather balloon has a volume of 10 m³ at a temperature of 273 K. What will its volume be at a height where the temperature is 223 K, assuming constant pressure?

Problem 4: A sample of gas has a volume of 1.5 L at 20°C. To what temperature (in °C) must the gas be heated to increase its volume to 2.0 L at constant pressure?

Problem 5: A gas occupies 4.0 L at 27°C. If the temperature is decreased to -73°C while keeping the pressure constant, calculate the new volume.

Charles Law Worksheet: Answers and Explanations

Now let's look at the solutions. Understanding the process is just as important, if not more so, than getting the right answer.

Problem 1:

Convert temperatures to Kelvin: $T_1 = 25^{\circ}\text{C} + 273.15 = 298.15\text{ K}$; $T_2 = 50^{\circ}\text{C} + 273.15 = 323.15\text{ K}$

Apply Charles's Law: $2.5\text{ L} / 298.15\text{ K} = V_2 / 323.15\text{ K}$

Solve for V_2 : $V_2 = (2.5\text{ L } 323.15\text{ K}) / 298.15\text{ K} \approx 2.71\text{ L}$

Problem 2:

Apply Charles's Law: $500\text{ mL} / 300\text{ K} = 250\text{ mL} / T_2$

Solve for T_2 : $T_2 = (250\text{ mL } 300\text{ K}) / 500\text{ mL} = 150\text{ K}$

Convert to Celsius: $150\text{ K} - 273.15 = -123.15^{\circ}\text{C}$

Problem 3:

Apply Charles's Law: $10\text{ m}^3 / 273\text{ K} = V_2 / 223\text{ K}$

Solve for V_2 : $V_2 = (10\text{ m}^3 223\text{ K}) / 273\text{ K} \approx 8.17\text{ m}^3$

Problem 4:

Convert initial temperature: $T_1 = 20^{\circ}\text{C} + 273.15 = 293.15\text{ K}$

Apply Charles's Law: $1.5\text{ L} / 293.15\text{ K} = 2.0\text{ L} / T_2$

Solve for T_2 : $T_2 = (2.0\text{ L } 293.15\text{ K}) / 1.5\text{ L} \approx 390.87\text{ K}$

Convert to Celsius: $390.87\text{ K} - 273.15 = 117.72^{\circ}\text{C}$

Problem 5:

Convert temperatures to Kelvin: $T_1 = 27^{\circ}\text{C} + 273.15 = 300.15\text{ K}$; $T_2 = -73^{\circ}\text{C} + 273.15 = 200.15\text{ K}$

Apply Charles's Law: $4.0\text{ L} / 300.15\text{ K} = V_2 / 200.15\text{ K}$

Solve for V_2 : $V_2 = (4.0\text{ L } 200.15\text{ K}) / 300.15\text{ K} \approx 2.67\text{ L}$

Conclusion

By working through this Charles's Law worksheet and understanding the provided solutions, you've significantly improved your comprehension of this crucial gas law. Remember to practice regularly, focusing on accurate unit conversions and the correct application of the formula. Consistent practice will build your confidence and ensure success in your studies.

Frequently Asked Questions (FAQs)

1. Why is it essential to use Kelvin in Charles's Law calculations? Kelvin is an absolute temperature scale, meaning it starts at absolute zero. Charles's Law is directly proportional; using Celsius, which has negative values, would lead to inaccurate results.

2. What happens if the pressure isn't constant in a real-world scenario? If the pressure changes, you'll need to consider the combined gas law, which incorporates both pressure and temperature

changes.

3. Are there any limitations to Charles's Law? Charles's Law is an ideal gas law, meaning it works best for gases at low pressures and high temperatures. Real gases deviate from ideal behavior under extreme conditions.

4. How can I check my understanding beyond this worksheet? Search online for additional Charles's Law practice problems or consult your textbook for more examples and exercises.

5. What are some real-world applications of Charles's Law? Charles's Law is utilized in various applications, including hot air balloons (hot air expands, increasing buoyancy), weather forecasting (air temperature affects air volume), and tire pressure changes with temperature variations.

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Museum of Natural History. Home to one of the largest ornithological collections in the world, the Tring museum was full of rare bird specimens whose gorgeous feathers were worth staggering amounts of money to the men who shared Edwin's obsession: the Victorian art of salmon fly-tying. Once inside the museum, the champion fly-tier grabbed hundreds of bird skins—some collected 150 years earlier by a contemporary of Darwin's, Alfred Russel Wallace, who'd risked everything to gather them—and escaped into the darkness. Two years later, Kirk Wallace Johnson was waist high in a river in northern New Mexico when his fly-fishing guide told him about the heist. He was soon consumed by the strange case of the feather thief. What would possess a person to steal dead birds? Had Edwin paid the price for his crime? What became of the missing skins? In his search for answers, Johnson was catapulted into a years-long, worldwide investigation. The gripping story of a bizarre and shocking crime, and one man's relentless pursuit of justice, *The Feather Thief* is also a fascinating exploration of obsession, and man's destructive instinct to harvest the beauty of nature.

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Forensic Science in the United States: A Path Forward provides a detailed plan for addressing these needs and suggests the creation of a new government entity, the National Institute of Forensic Science, to establish and enforce standards within the forensic science community. The benefits of improving and regulating the forensic science disciplines are clear: assisting law enforcement officials, enhancing homeland security, and reducing the risk of wrongful conviction and exoneration. Strengthening Forensic Science in the United States gives a full account of what is needed to advance the forensic science disciplines, including upgrading of systems and organizational structures, better training, widespread adoption of uniform and enforceable best practices, and mandatory certification and accreditation programs. While this book provides an essential call-to-action for congress and policy makers, it also serves as a vital tool for law enforcement agencies, criminal prosecutors and attorneys, and forensic science educators.

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the poor and middleclass. - Climate-a hotter world will increase water, food, and health insecurity. - Technology-the emergence of new technologies could both solve and cause problems for human life. Students of trends, policymakers, entrepreneurs, academics, journalists and anyone eager for a glimpse into the next decades, will find this report, with colored graphs, essential reading.

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examined and reported on the collapse of major financial institutions that failed or would have failed if not for exceptional assistance from the government. News Dissector DANNY SCHECHTER is a journalist, blogger and filmmaker. He has been reporting on economic crises since the 1980's when he was with ABC News. His film *In Debt We Trust* warned of the economic meltdown in 2006. He has since written three books on the subject including *Plunder: Investigating Our Economic Calamity* (Cosimo Books, 2008), and *The Crime Of Our Time: Why Wall Street Is Not Too Big to Jail* (Disinfo Books, 2011), a companion to his latest film *Plunder The Crime Of Our Time*. He can be reached online at www.newsdissector.com.

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children's literature, inaugurating an era in which writing for children aimed to delight or entertain. The tale plays with logic, giving the story lasting popularity with adults as well as with children. The titular character Alice shares her name with Alice Liddell, a girl Carroll knew; scholars disagree about the extent to which the character was based upon her.

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