

14.2

THE GAS LAWS

Section Review

Objectives

- Describe the relationship among the temperature, volume, and pressure of a gas
- Use the combined gas law to solve problems

Vocabulary

- Boyle's law
- Charles's law
- Gay-Lussac's law
- combined gas law

Key Equations

- Boyle's law: $P_1 \times V_1 = P_2 \times V_2$
- Charles's law: $\frac{V_1}{T_1} = \frac{V_2}{T_2}$
- Gay-Lussac's law: $\frac{P_1}{T_1} = \frac{P_2}{T_2}$
- combined gas law: $\frac{P_1 \times V_1}{T_1} = \frac{P_2 \times V_2}{T_2}$

Part A Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

- The pressure and volume of a fixed mass of gas are 1 **1.** _____
 related. If one decreases, the other 2. This relationship is **2.** _____
 known as 3 law. The volume of a fixed 4 of a gas is **3.** _____
 directly proportional to its 5 temperature. This relationship **4.** _____
 is known as 6 law. 7 law states that the pressure of a **5.** _____
 gas is 8 proportional to the Kelvin temperature if the **6.** _____
 volume remains constant. **7.** _____
- These three separate gas laws can be written as a single **8.** _____
 expression called the 9 gas law. It can be used in situations **9.** _____
 in which only the 10 of gas is constant. **10.** _____

Part B True-False

Classify each of these statements as *always true, AT*; *sometimes true, ST*; or *never true, NT*.

- _____ 11. According to Charles's law, $T_2 = \frac{V_1 \times V_2}{T_1}$.
- _____ 12. According to Boyle's law, when the volume of a gas at constant temperature increases, the pressure decreases.
- _____ 13. A balloon with a volume of 60 L at 100 kPa pressure will expand to a volume of 120 L at a pressure of 50 kPa.
- _____ 14. In an inverse relationship, the ratio of two variable quantities is constant.
- _____ 15. When using the combined gas law, pressure must always be in kilopascals but temperature can be in kelvins or degrees Celsius.
- _____ 16. When 20.0 L of O₂ is warmed from -30.0°C to 85.0°C at constant pressure, the new volume is 29.5 L.

Part C Matching

Match each description in Column B to the correct term in Column A.

Column A

Column B

- | | |
|----------------------------|--|
| _____ 17. Boyle's law | a. The volume of a fixed mass of gas is directly proportional to its Kelvin temperature if the pressure is kept constant |
| _____ 18. combined gas law | b. $\frac{P_1 \times V_1}{T_1} = \frac{P_2 \times V_2}{T_2}$ |
| _____ 19. absolute zero | c. For a fixed mass of gas at constant temperature, the volume of gas varies inversely with pressure. |
| _____ 20. Charles's law | d. The pressure of a gas is directly proportional to the Kelvin temperature if the volume remains constant. |
| _____ 21. Gay-Lussac's law | e. -273.15°C |

Part D Questions and Problems

Answer the following in the space provided.

22. A rigid container holds a gas at a pressure of 55 kPa and a temperature of -100.0°C . What will the pressure be when the temperature is increased to 200.0°C ?
23. What is the volume of a sample of CO₂ at STP that has a volume of 75.0 mL at 30.0°C and 91 kPa?