

## 8 • Why Do Hot Air Balloons Float?

### CHARLES' S LAW

Charles' Law states the volume of a gas varies directly with the Kelvin temperature, assuming the 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. Assume all numbers are 3 significant figures.*

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 2.30 Liters. To what temperature should it be raised to occupy a volume of 6.50 Liters?
3. Hydrogen gas was cooled from 150 °C to 50 °C. Its new volume is 75.0 mL. What was its original volume?
4. Chlorine gas occupies a volume of 25.0 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 2.50 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 3.80 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?