

Gas Laws

Gas laws are a set of equations describing the relationships among the pressure, volume, and temperature of a gas. Gas is a substance that has constant volume and takes the shape of its container. The kinetic theory of gases stipulates that a gas is made up of very small particles in constant, rapid random motion. These particles are infrequent, low-energy collisions with each other and with the walls of the container.

Boyle's Law

Boyle's law, also referred to as the Boyle–Mariotte law, or Mariotte's law (especially in France), is an experimental gas law that describes how the pressure of a gas tends to decrease as the volume of the container increases. A modern statement of Boyle's law is, within an ideal gas at a given temperature, the absolute pressure exerted by a given mass of gas is directly proportional to the volume it occupies if the number of moles and the temperature are constant.

The equation asserts that for a given mass of confined gas, the product of pressure and volume is a constant, and this stays true as long as the temperature remains constant. The law can be advantageously phrased as follows when comparing the same material under two distinct sets of conditions:

$$P_1V_1=P_2V_2$$

This equation indicates that as the volume of the gas grows, the pressure of the gas drops proportionally. Similarly, when the volume of the gas diminishes, the pressure of the gas rises. The rule was named after chemist and physicist Robert Boyle, who published the first version of the concept in 1662.

Real-Life Application

When you fill your bike tires with air, you may see a real-world implementation of Boyle's Law. When you pump air into a tire, the gas molecules inside the tire compress and become more closely packed together. This raises the pressure of the gas, causing it to push against the tire's walls. You can feel as the tire tightens and becomes pressured.

A Coke bottle is another example. The entire bottle is frequently compressed with gas to get carbon dioxide gas into the liquid. It is extremely difficult to squeeze the bottle when it is closed because the gas is confined to limited space and pushes against the bottle's walls. When the cap is removed, the accessible volume rises and part of the gas escapes. Its pressure is decreasing at the same time.

Charles's Law

Charles' law (also known as the law of volumes) is a gas law that defines how gases expand when heated. When the pressure on a sample of a dry gas is maintained constant, the temperature and volume will be in direct proportion, according to a modern formulation of Charles' law.