The Man Who Had a Law Named After Him

Almost from his birth in County Waterford, Ireland, in 1627, Robert Boyle seemed destined to achieve great things. When he was just eight years old, he entered the equivalent of high school for his era, having already learned Greek and Latin. At the age of 14, he journeyed to Italy where he studied the achievements of the Italian astronomer and physicist Galileo Galilei, better known simply as Galileo.

What impressed and influenced Boyle about Galileo was not only what the great man had discovered, but the methods he had used to make his discoveries. Galileo had not simply accepted scientific ideas that had long been held by others; he challenged them with careful observations and experiments.

This approach led Boyle to join a group of scholars who met from time to time to discuss the results and meanings of their experiments. Boyle was then 27 years old. The group would later become the famed Royal Society, whose Latin motto was "*Nullius in verba*." The English translation of this phrase is "Nothing by mere authority." In other words, the members of the Royal Society believed that established ideas could be questioned and overturned by experimental evidence.

With this attitude firmly implanted in Boyle's mind, he attempted to improve on experiments performed by the German physicist Otto von Guericke. In 1650, von Guericke had built an air pump that had produced a vacuum. This defied the long-held notion that a vacuum was impossible. Boyle built a device that was even more efficient than von Guericke's vacuum pump. Perhaps more importantly, this success prompted Boyle to perform experiments with gases that would lead him to discover a law of nature that bears his name today.

Pressure-Volume Relationship

Typical PV Relationships Obtained by Boyle

P (mmHg)	V (Arbitrary Units)	PV
724	1.50	1.09×10^3
869	1.33	1.16×10^3
951	1.22	1.16×10^3
998	1.16	1.16×10^3
1230	0.94	1.2×10^3
1893	0.61	1.2×10^3
2250	0.51	1.1×10^3

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Graph these data to see the relationship Boyle observed between pressure and volume in a gas.

On the way to that momentous discovery, Boyle made other discoveries. For example, Boyle demonstrated that objects of different masses fell at the same velocity in a vacuum. He also showed that sound could be transmitted only through a medium such as a solid, liquid, or gas. Sound could not pass through empty space—that is, a vacuum.

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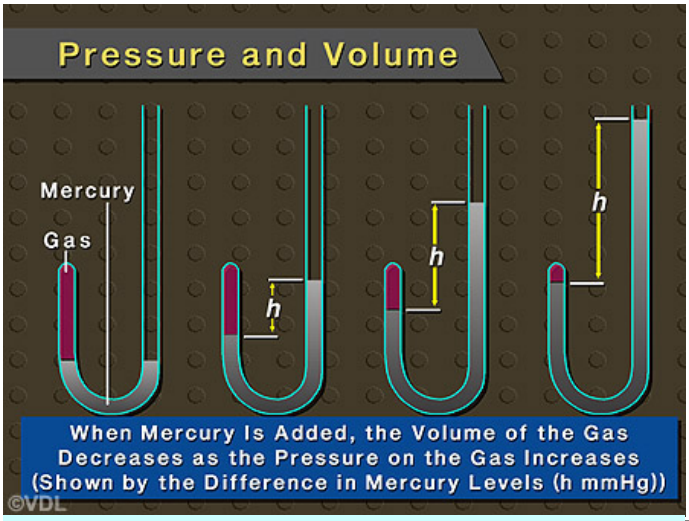
In 1662, Boyle discovered something startling about the compressibility of air. When squeezed, or placed under pressure, a given volume of air would shrink. But Boyle was not satisfied with this simple observation. He was determined to find out whether there was a mathematical relationship between the pressure exerted on a volume of air and the consequent change in its volume.

To find the answer, Boyle enclosed a volume of air in a closed tube. By adding mercury to the tube, Boyle was able to double the pressure on the gas. He then measured the volume of the gas. The volume of the gas was half what it had been at the start of the experiment. Doubling the pressure had reduced the volume by half. Although this was a fascinating result, Boyle needed more evidence to confirm the relationship that was crystallizing in his mind. So he tripled the pressure on the gas. To his delight, Boyle observed that the gas was now one-third of its original volume.



When Boyle added mercury to a closed tube containing a gas, the gas's volume decreased at a proportional rate.

Boyle performed additional experiments. Each experiment confirmed a consistent relationship between the pressure and volume of a gas. Boyle had demonstrated that the volume of a gas varies inversely with the pressure on it. That is, as pressure increases, volume decreases proportionally. Conversely, as pressure decreases, volume increases proportionally. Today, this relationship is called Boyle's Law.

