Gas laws

THE GAS LAWS STATE HOW GASES RESPOND TO CHANGE.

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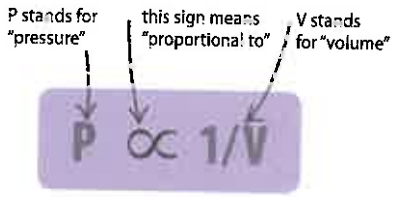
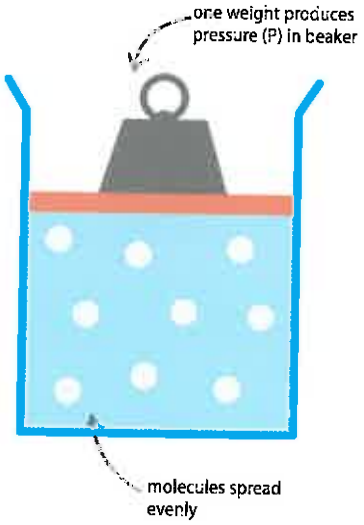
The three laws relate the movements of molecules in a gas to its volume, pressure, and temperature, and state how each measure responds when the others change. Each gas law is named after its discoverer.

Boyle's law

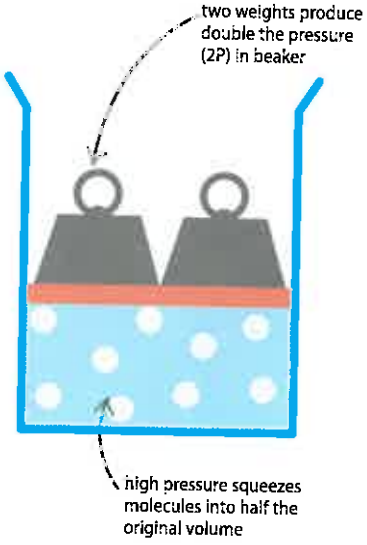
This law is named after Robert Boyle, who lived in Britain and Ireland in the 17th century and was one of the world's first chemists. His law states that if the temperature of a gas stays the same, then its volume is inversely proportional to its pressure. In other words, forcing a gas into a smaller volume results in it exerting a higher pressure.



△ **Equation for Boyle's law**
This equation shows the relationship between a gas's pressure and its volume. Increasing the pressure decreases the volume.



△ **Diffusion**
The molecules in the gas spread out evenly to fill any container. This is called diffusion and means that molecules tend to move away from places where they are highly concentrated.



△ **Pressure**
The force exerted on an area (its pressure) is caused by molecules in the gas hitting the inside of the container. Reducing the volume gives the molecules less room to move. They hit the sides more frequently, increasing the pressure.

REAL WORLD

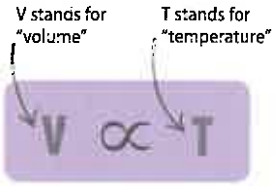
Avogadro's law

There is a fourth gas law, which, although unrelated to the other three, was set out by the Italian Amedeo Avogadro (right) in 1811. It states that equal volumes of all gases at the same temperature and pressure contain the same number of molecules. Therefore a flask of hydrogen can contain the same number of molecules as an identical flask of oxygen, despite weighing a lot (16 times) less.

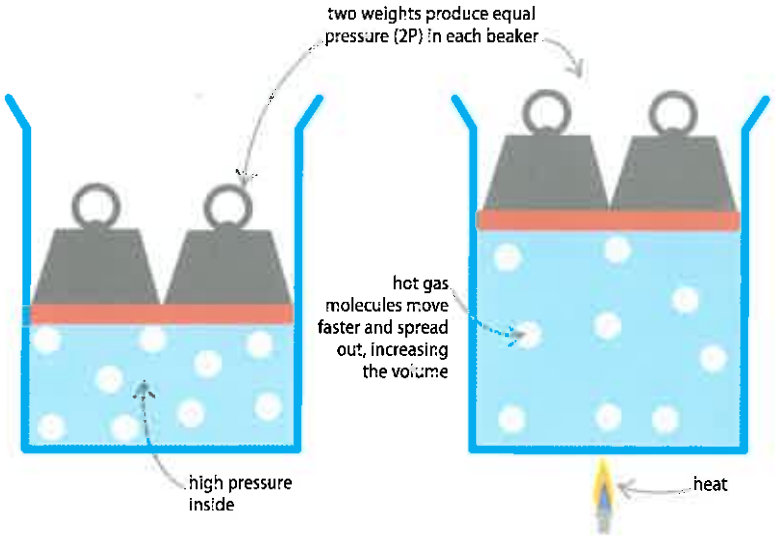
Robert Boyle was an alchemist and discovered his law while he was searching for a way to turn lead into gold.

Charles's law

This gas law, which is attributed to the French scientist Jacques Charles, states that the temperature of a gas is proportional to its volume. So if the gas is held in a container with an adjustable volume—a gas syringe, for example—increasing the temperature of the gas results in an increase in its volume.



△ **Equation for Charles's law**
This equation shows the relationship between a gas's volume and its temperature. Increasing the temperature increases the volume.

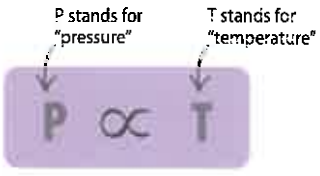


△ **Temperature**
Temperature is a measure of heat energy: the motion of a gas's molecules. Increasing the temperature of the gas increases the rate at which its molecules move.

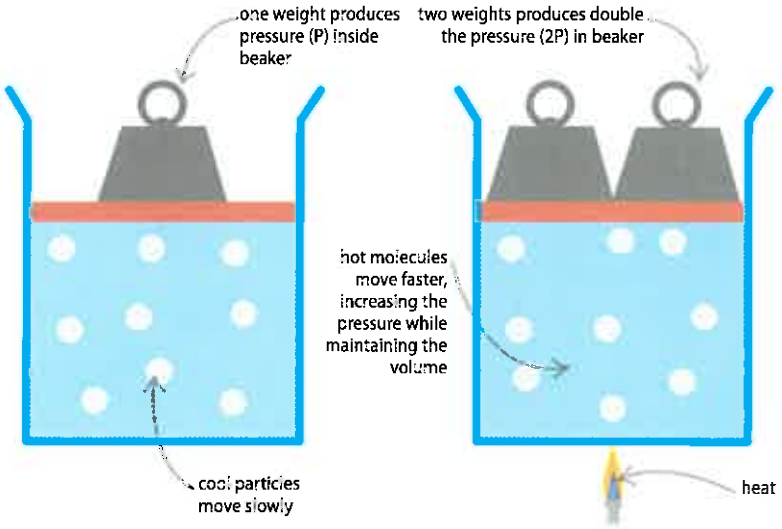
△ **More motion**
Faster molecules hit each other and the container walls more often. If one wall is moveable, these impacts will push it outward, increasing the volume of the container.

Gay-Lussac's law

Named after French scientist Joseph Louis Gay-Lussac in 1808, this was the last of the three main gas laws to be formulated. It states that for a fixed volume of gas, the pressure is proportional to its temperature. In other words, when the temperature of a gas is increased, it also exerts a higher pressure. Similarly, squeezing a gas into a smaller volume increases its pressure (as per Boyle's law) and also raises the gas's temperature.



△ **Equation for Gay-Lussac's law**
This equation shows the relationship between the pressure of a gas and its temperature. Increasing the temperature increases the pressure.



△ **Fewer collisions**
The molecules in the cool gas move slowly and they hit the sides of the container infrequently. These few, weak collisions combine to create a low gas pressure, overall.

△ **More collisions**
As the gas is heated, the molecules move around faster and hit the sides of the container more often and with greater force. Thus the pressure goes up.