



Real-life Examples of Gay-Lussac's Law

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Physical Chemistry

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Some real-life examples of Gay-Lussac's law are the rupture of a pressure cooker, an aerosol can, and a tyre. All these substances explode when exposed to higher temperatures. The scientific reason behind the explosion is explained by Gay-Lussac's Law.

Gay-Lussac's law is the law that says the pressure of gas increases with its temperature, or vice versa. Gay-Lussac published his experimental results in c. 1808, which showed the direct relationship between the pressure and the temperature of a fixed amount of gas at constant volume.

Some real-life applications of the law are as follows:



Pressure cooker

The pressure cooker is a sealed utensil for cooking food under steam pressure. It is usually made up of steel or aluminium. When heat is supplied, the water inside the cooker vaporizes, and the steam is produced. The steam is periodically released through a valve to maintain the operating pressure inside the cooker.



Pressure cooker

If the valve malfunctions and the heat flow is not interrupted, the pressure inside the cooker escalates. The increase in the pressure is due to Gay-Lussac's law, i.e. the pressure of a fixed amount of gas increases with its temperature at constant volume. This high pressure may rupture the cooker and may lead to an unfortunate accident.

Aerosol can

Aerosol cans or sprays are devices which dispense an aerosol, a suspension of fine solid particles or liquid droplets in the air. When the valve of a metal can is opened, the gas is driven out to form a mist or an aerosol. One of the components in an aerosol can is a propellant. The propellant consists of high volatile compounds which are liquefied with high pressure. The propellant gives thrust to other components when the valve is opened.





Aerosol can

When an aerosol can is subjected to a hot environment, the propellant gets vaporize. These vaporized gases exert the pressures on the wall of the bottle. The pressure on the wall increases with the temperature as per Gay-Lussac's law. Finally, the can bursts when the pressure becomes intolerable. This is the reason why it is recommended to keep the aerosol cans away from heat.

Tyre

In hot summer days, the inflated tyres of vehicles may burst. The bursting of tyres is caused by Gay-Lussac's law. The inflated tyres are under high pressure. When the temperature of the air rises, the pressure of the gas in the tubes increases. After an unbearable point, the tyres fracture.



Tyre



Water heater

The electric water heater is similar to the pressure cooker. The cold water is heated by the heating filaments inside the heater. The hot water generated is released through the outlet nozzle. Modern electric heaters automatically regulate the temperature of water. When the system and pressure-relief valve malfunctions, the steam is generated by continuous power supply. This steam can damage the heater. If the pressure of the steam exceeds the tolerable limit, the heater may burst.



Electric water heater

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