Gay-Lussac's law (Amonton's law).

(1) In 1802, French chemist **Joseph Gay-Lussac** studied the variation of pressure with temperature and extended the Charle's law so, this law is also called Charle's-Gay Lussac's law.

(2) It states that, "The pressure of a given mass of a gas is directly proportional to the absolute temperature $(= {}^oC + 273)$ at constant volume."

Thus, $P \propto T$ at constant volume and mass

or $P = KT = K(t({}^oC) + 273.15)$ (where K is constant)

$$\frac{P}{T} = K$$

For two or more gases at constant volume and mass

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} = ... = K$$

(3) If $t = 0^o C$, then $P = P_0$

Hence, $P_0 = K \times 273.15$

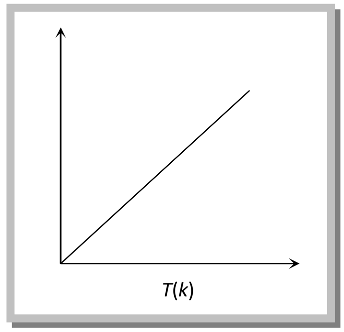
$$\therefore \quad K = \frac{P_0}{273.15}$$

$$P = \frac{P_0}{273.15}[t + 273.15] = P_0\left[1 + \frac{t}{273.15}\right] = P_0[1 + \alpha t]$$

Where α_P is the pressure coefficient, $\boxed{\alpha_P = \frac{P - P_0}{tP_0} = \frac{1}{273.15} = 3.661 \times 10^{-3}\ {}^oC^{-1}}$

Thus, for every 1^o change in temperature, the pressure of a gas changes by $\frac{1}{273.15}\left(\approx \frac{1}{273}\right)$ of the pressure at $0^o C$.

(4) **Graphical representation of Gay-Lussac's law:** A graph between P and T at constant V is called **isochore**.



Note: This law fails at low temperatures, because the volume of the gas molecules become significant.