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BL → P α1/V

Charles' Law (Temp.-Vol. Relationship)

Charles and Gay Lussac

For a fixed mass of a gas[m] at constant P, volume of a gas increases on increasing temperature and decreases on cooling.

$V \alpha T$
for a fixed mass of gas at constt. P
T incr and V incr
T decc and Vdecr

They found that for 1°C rise in temperature, volume of a gas increases by 1/273.15 [new volume , V_t] from the original volume [V_0] of the gas that is kept at 0 °C.

New Volume = $V_1 = V_0 + 1/273.15$ at increase of 1°C rise

Thus if the volumes of the gas at 0 °C is V_0 and at 1°C rise = t °C is V_t respectively, then

$$V_t = V_0 + \frac{t}{273.15} V_0$$

$$\Rightarrow V_t = V_0\left(1+\frac{t}{273.15}\right)$$

$$\Rightarrow V_t = V_0\left(\frac{273.15+t}{273.15}\right) \qquad (5.6)$$

If we write $T_t = 273.15 + t$ and $T_0 = 273.15$

$$V_t = V_0\left(\frac{T_t}{T_0}\right)$$

$$\Rightarrow \frac{V_t}{V_0} = \frac{T_t}{T_0} \qquad (5.7)$$

Note

0 °C = 273.15K =Kelvin temperature scale or Absolute temperature scale or Thermodynamic scale