Helio 6 ppm Helio.

$$v_{RMS} = \sqrt{\langle v^2 \rangle} \cong 1100 \text{ m/s.}$$

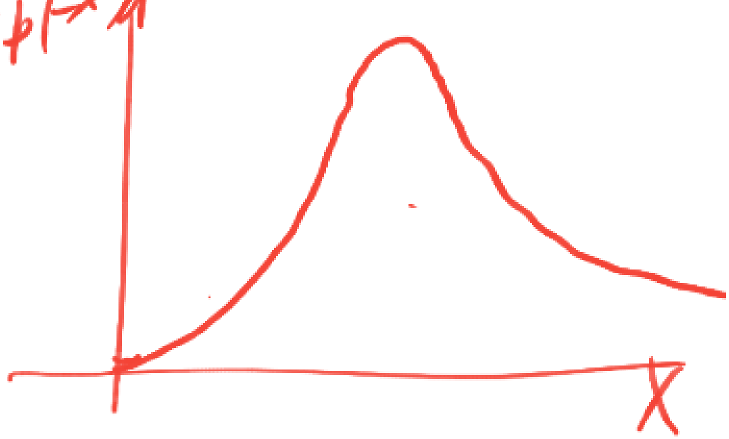
$$\langle v^2 \rangle = \frac{3RT}{M}$$

$$v_{e\oplus} = 11{,}4 \text{ km/s}$$

$$f(v) = \left(\left[\frac{M}{2\pi RT} \right]^{3/2} 4\pi \right) v^2 \, e^{-\frac{Mv^2}{2RT}} \quad E_K$$

Google Class → Excel.

exp(-x²)



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p, n, T, V — Estado.

$$\boxed{pV = nRT} \Rightarrow R = \frac{pV}{nT}$$

A, B, C, ..., Z

$T = \frac{PV}{nR}$

A: $p_A, V_A, T_A \rightarrow \underline{n_A}$

transformaciones $\rightarrow$ 1, 2, 3, ...

$p = cte$ isobárico

$T = cte$ isoterma

$V = cte$ isocora.

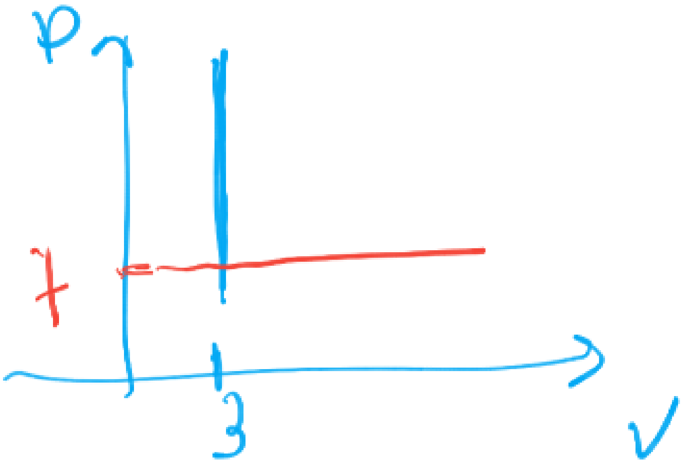
$n = cte$ isomásico

$pV = cte \Rightarrow pV = nRT\ cte$

ley de Boyle

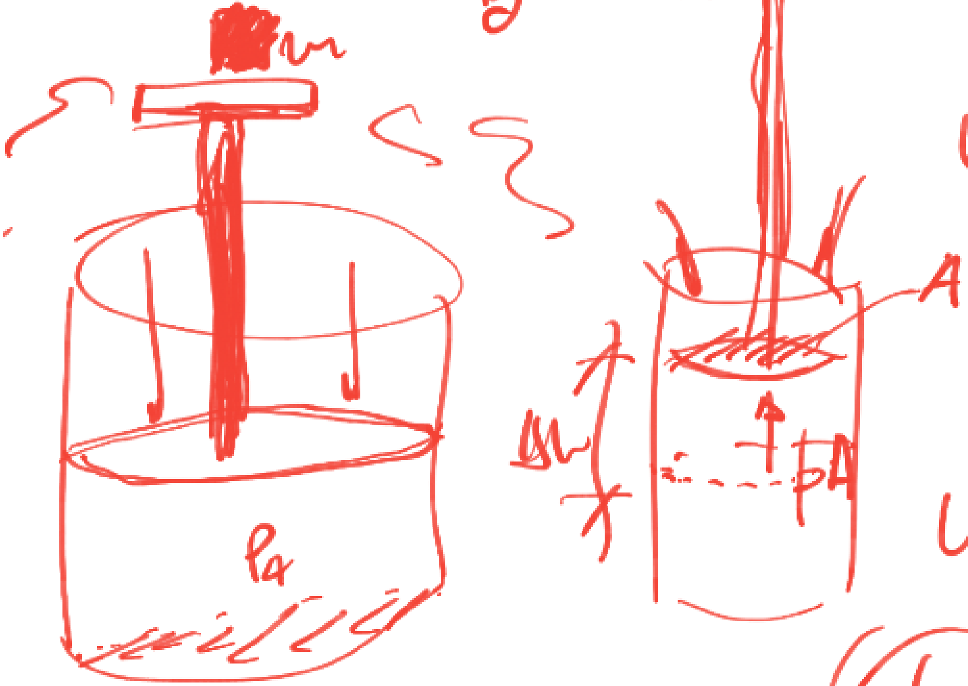
$p(v) \Rightarrow \underbrace{p(v) = \frac{nRT}{V}}_{\text{Hipérbola}}$

Isocora $V = cte$



Isobaro $\quad p = cte$

$$\Delta V = V_B - V_A > 0$$



$$W = F\,\Delta h$$

$$\uparrow$$

$$p \cdot A$$

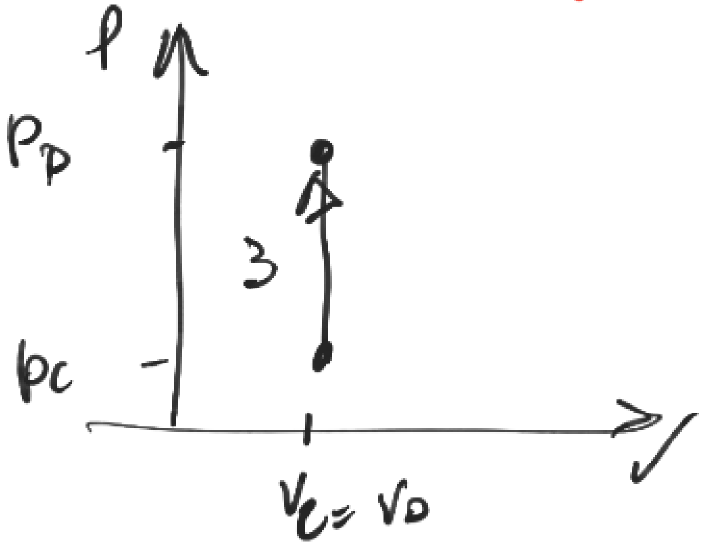
$$W = p \cdot \underbrace{A \cdot \Delta h}$$

$$W = p \cdot \Delta V$$

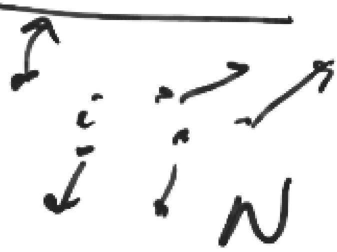
$$>0 \qquad\qquad >0$$

$W = p\,\Delta V$

$W = p\Delta V$



Energia



$$\langle E_k \rangle = \frac{1}{N} \sum_{i=1}^{N} E_{k i}$$

Energia total

$$N \langle E_k \rangle = \cancel{N} \frac{1}{\cancel{N}} \sum_{i=1}^{N} E_{k i}$$

$$\boxed{N \langle E_k \rangle \overset{def}{=} U}$$

$$T = \frac{2}{3}\,\frac{1}{k}\,\langle E_k\rangle$$

$$\langle E_k\rangle = \frac{3}{2}kT$$

$$\frac{3}{2}NkT = U$$

$$U = \frac{3}{2}\,\overbrace{N\,\frac{N_A}{N_A}}^{n}\,\overbrace{k}^{R}\,T$$

$$\boxed{U = \frac{3}{2}nRT}$$

$n = cte$

$$dU = \frac{3}{2}R\,d(nT)$$

$$dU = \frac{3}{2}R\left[dn\,T + n\,dT\right]$$

Si $n = cte$

$$\boxed{\Delta U = \frac{3}{2}Rn\,\Delta T}$$

$$Q = C\, n\, \Delta T$$

$$\boxed{C \overset{def}{=} \frac{Q}{n\, \Delta T}}$$ Calor específico

Gas ideal $V = cte$

$P = cte$

i) $V = cte$ $W = 0$

$$Q = C\, n\, \Delta T$$

$$Q = \Delta U = \frac{3}{2} n R \Delta T$$

$$C \cancel{n} \cancel{\Delta T} = \frac{3}{2} \cancel{n} R \cancel{\Delta T}$$

$$\boxed{C_V = \frac{3}{2} R}$$

Calor espe.
Gas ideal
Monoatómico

$\Delta V \neq 0 \quad p = cte \Rightarrow W \neq 0$

$$W = p \Delta V$$

$$PV = nRT \Rightarrow V = \frac{nR}{p} T$$

$$\Delta V = \left(\frac{nR}{p}\right) \Delta T$$

$$W = \cancel{p} \cdot \frac{nR}{\cancel{p}} \Delta T$$

$$W = nR\Delta T$$

$$\Delta U = \frac{3}{2} nR\Delta T$$

$$Q = \Delta U + W$$

$$Q = \frac{3}{2} n R \Delta T + n R \Delta T$$

$$Q = \left(\frac{3}{2} + 1\right) n R \Delta T$$

$$Q = \frac{5}{2} n R \Delta T$$

$$Q = C_p n \Delta T$$

$$C_p \cancel{n} \cancel{\Delta T} = \frac{5}{2} \cancel{n} R \cancel{\Delta T}$$

$$\boxed{C_p = \frac{5}{2} R}$$

Căld specif molară gazului ideal monoatomic $p = ct$

Ecuația transf. de un gaz ideal

de cambio de temperatura.

V=cte $\quad Q_v = \frac{3}{2} R\, n\, \Delta T$

p=cte $\quad Q_p = \frac{5}{2} R\, n\, \Delta T$

$$C_p = \frac{5}{2} R \Rightarrow C_p = \left(\frac{3}{2} + 1\right) R$$

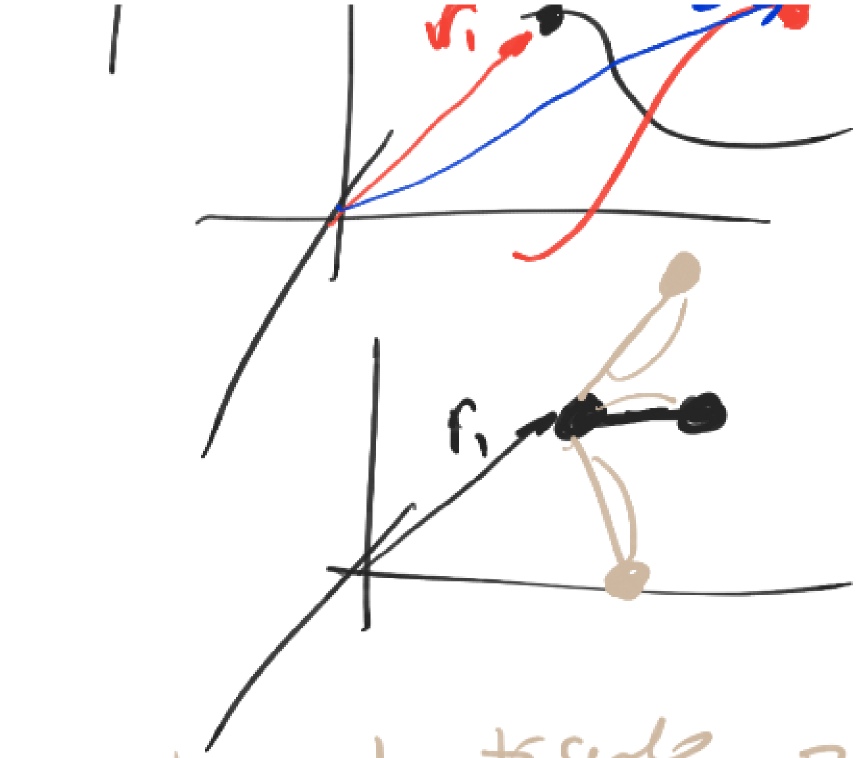
$$= \underbrace{\frac{3}{2} R}_{C_v} + R$$

$$\Rightarrow \boxed{C_p = C_v + R}$$

Ley Gral para todos los gases ideales.

He $\quad O=O \qquad O=C=O$

$\vec{r}_2$



Grados de Libertad

3 grados

6 grados de libertad para 2 part

$$\text{cte}: d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

biatómica 5 grados

mono	$z = 3$	$C_v = \frac{3}{2} R$
bi	$z = 5$	$C_v = \frac{5}{2} R$
tri	$z = 6$	$C_v = 3R$

fecha i,

Grados de libertad

$$C_v = \frac{3}{2} R$$

$$C_p = C_v + R$$

$$\gamma \stackrel{def}{=} C_p / C_v$$

mono: $\gamma_{mono} = \frac{5/\cancel{2}\,\cancel{R}}{3/\cancel{2}\,\cancel{R}} = \frac{5}{3}$

$$\gamma_{bi} = \frac{7}{5}$$

$$\gamma_{tri} = \frac{4}{3}$$

Monoatómica $C_v = \frac{3}{2} R$ $v = cte$

Biatómica $C_v = \frac{5}{2} R$ $v = cte$

$$Q = C_v \, n \, \Delta T$$

$$Q_v^{mono} = \frac{3}{2} R \, n \, \Delta T$$

$$Q_v^{bi} = \frac{5}{2} R \, n \, \Delta T$$