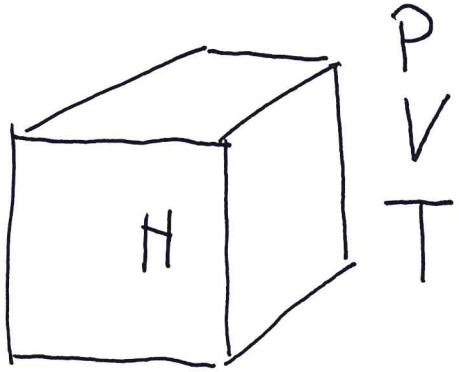
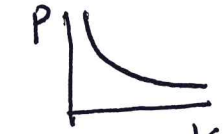


$$PV = NkT$$

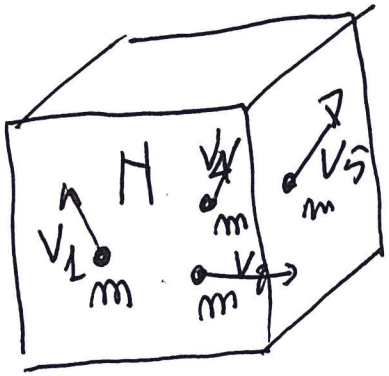
Boyle $P \cdot V = \text{cost}$ (1)



Gay Lussac $V \propto T$

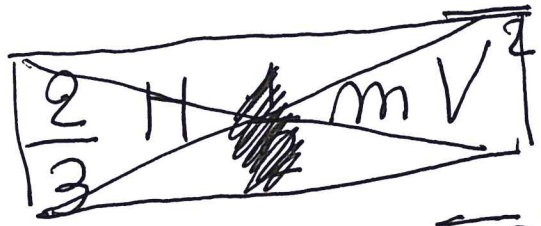
Charles $P \propto T$

TEORIA CINETICA GAS



$$\sum_{1}^{N} i \left(\frac{1}{2} m v_i^2\right) = U \quad \text{ENERGIA INTERNA}$$

$$PV = \frac{2N}{3} \bar{E} = \frac{2}{3} N \left(\frac{1}{2} m \overline{v^2}\right) = \frac{2}{3} N \cdot \bar{E}_c$$



Prop. Valor medio

$\bar{x}$ è la media n numero di oggetti

$n \cdot \bar{x} = \Sigma_n x$

$$PV = NkT \qquad PV = \frac{2}{3} N \cdot \overline{E_c}$$

$$PV = N \cdot \overline{E_c} \frac{2}{3} \qquad = \frac{2}{3} U$$

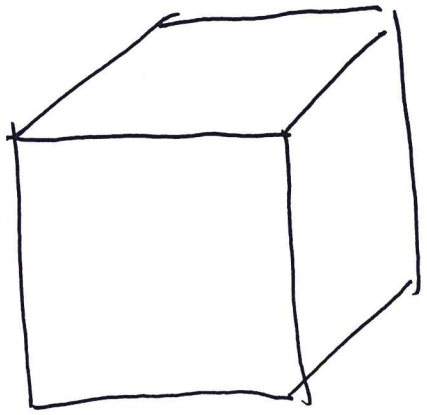
$$U = \frac{3}{2} PV$$

$$\cancel{N}kT = \frac{2}{3} \cancel{N} \overline{E_c}$$

$$\frac{3}{2} kT = \overline{E_c}$$

$T \Longrightarrow$ Varia l'energia cinetico medio delle particelle

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



P
T
V
N numero di molecole
di atomi (monoatomico)

$$\begin{cases} U = \frac{3}{2} N k T \\ PV = N k T \end{cases}$$

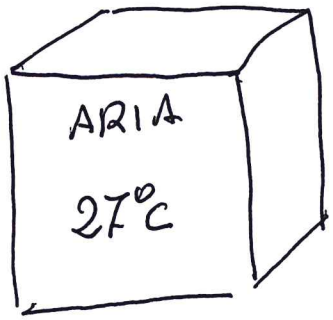
CH_4 O_2 N_2

He

$$\begin{cases} U = \frac{3}{2} n R T \\ P.V = n R T \end{cases}$$

n = numero di moli

Determinazione di $\bar{E}_c$ di una molecola di O_2 nell'aria a 27°C (3 bis)
e velocità quadratica media della molecola di O_2 $\underline{\underline{v_{qm}}}$



O_2 molecola Ossigeno

H_2 molecola Azoto

$$U = N \cdot \bar{E}_c = \frac{3}{2} N K T \quad \text{dove:}$$

$$N\bar{E}_c = \frac{3}{2} N K T \Rightarrow \bar{E}_c = \frac{3}{2} K T = \frac{3}{2} \cdot 1.38 \cdot 10^{-23} \cdot (27+273)$$ (Kelvin)

$$\bar{E}_c = 1{,}5 \times 1{,}38 \cdot 10^{-23} \cdot 300 = 6{,}21 \cdot 10^{-21}\ J$$

Per calcolare la v_{qm} ricordiamo che $\bar{E}_c = \frac{1}{2} m v^2$

$$\bar{E}_c = \frac{1}{2} m \bar{v}^2 = \frac{1}{2} m v_{qm}^2$$ v_{qm} = Velocità quadratica media

$$\frac{1}{2} m_0 v_{qm}^2 = 6{,}21 \cdot 10^{-21}\ J \qquad v_{qm} = \sqrt{\frac{2 \cdot 6.21 \cdot 10^{-21}}{m_0}} = \sqrt{\frac{2 \times 6{,}21 \cdot 10^{21}}{5.31 \cdot 10^{-26}}} = \sqrt{\frac{12.42}{5.31} \cdot 10^{5}}$$ → Next Page

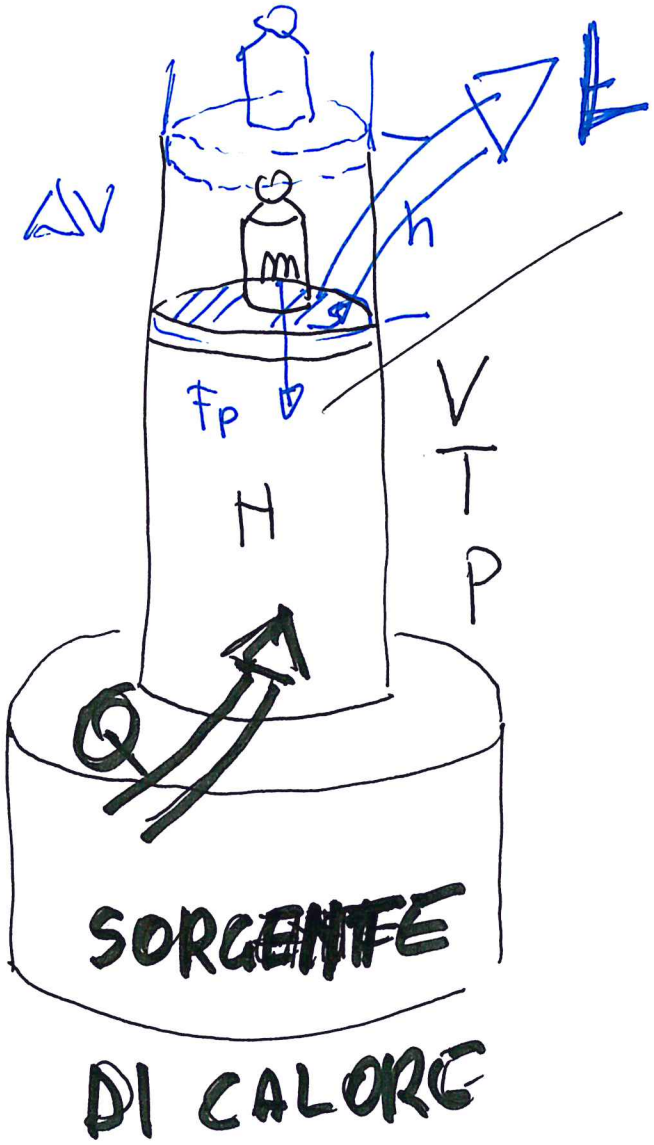
m_0 = massa molecola O_2 $= \frac{16\,g \cdot 10^{-3}}{6.02 \cdot 10^{23}} = \frac{\text{mol} \cdot 1\,\text{mole}}{Na} = 5.31 \cdot 10^{-26}\ Kg$

$$v_{qm} = \sqrt{\frac{12,42 \cdot 10^{+5}}{5.31}} = \sqrt{\frac{124,2}{5.21} \cdot 10^{+4}} = \sqrt{\frac{124,2}{5.21}} \cdot 10^{2} =$$

$$= \sqrt{23.8} \cdot 10^{2} = 4.88 \cdot 10^{2} \text{ m/s} \rightleftharpoons 488 \text{ m/s}$$

circa $\frac{1}{2}$ km (mezzo chilometro al secondo!!)

TRASFORMAZIONI TERMODINAMICHE



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

$$P = \frac{mg}{S}$$

$$\Delta V = S \cdot h$$

$$P \cdot \Delta V = \frac{mg}{S} \cdot S \cdot h =$$

$$\text{Lavoro} = P \cdot \Delta V = L$$

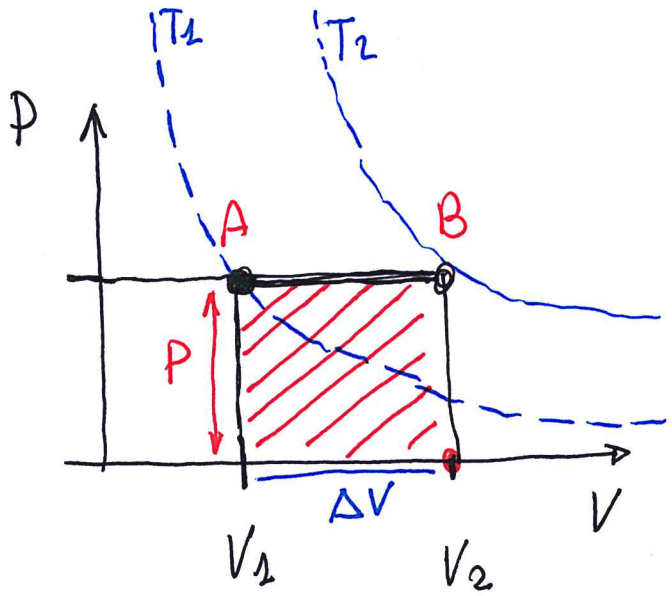
$$\boxed{\Delta U = Q - L}$$

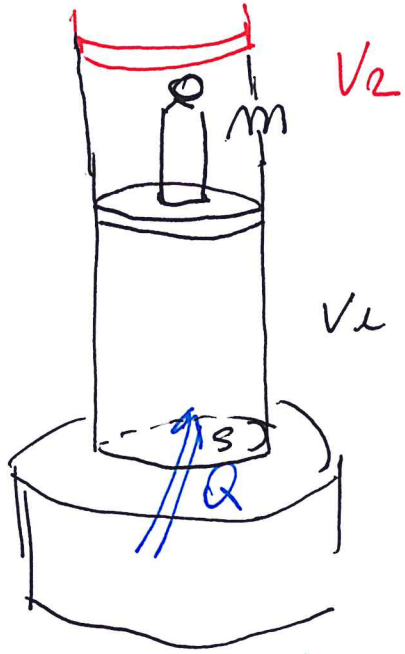
1° Principio della Termodinamica

PRINCIPIO DI CONSERVAZIONE DELL'ENERGIA

TRSFORMAZIONE ISOBARA A PRESSIONE COSTANTE

$P = \frac{mg}{S}$





$P.\Delta V = L$

$\Delta U = Q - L$

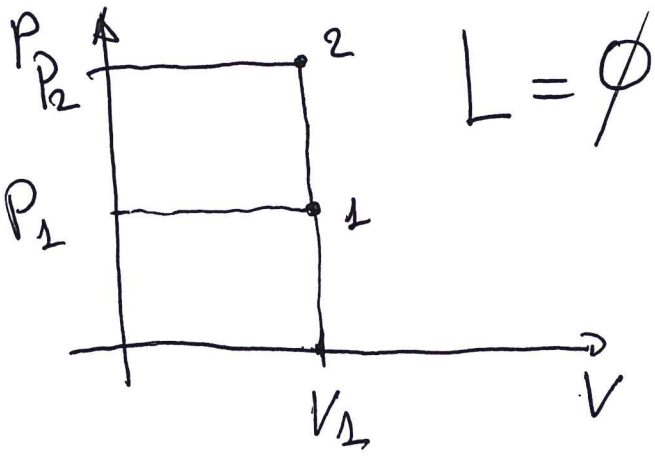
$\Delta U = Q - L$

$Q = -\Delta U - L$

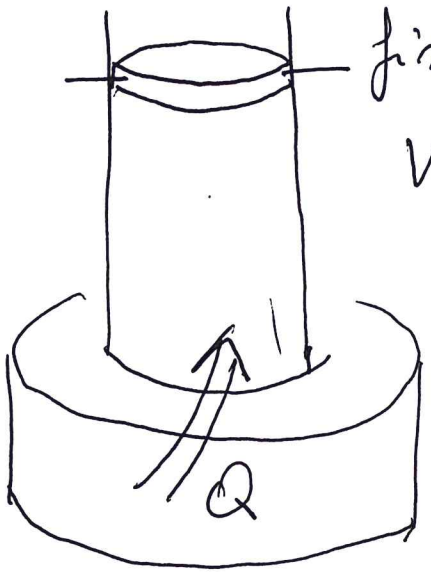
TRASFORMAZIONE ISOCORA

~~P~~R

VOLUME COSTANTE



$L = \emptyset$!!!



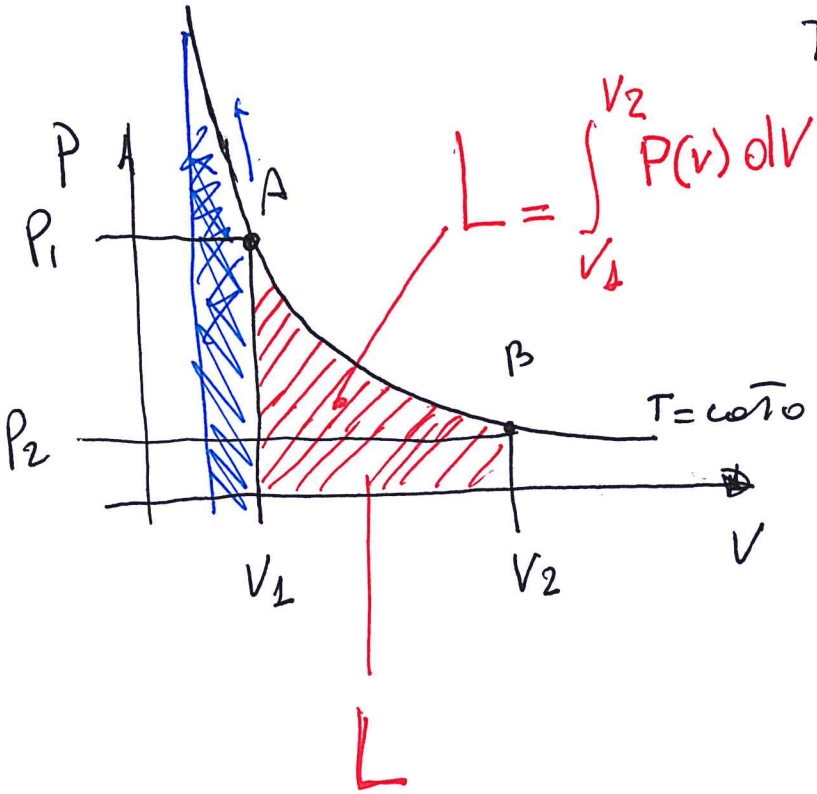
$U_1 + Q = U_2$

$$\Delta U = Q - L$$

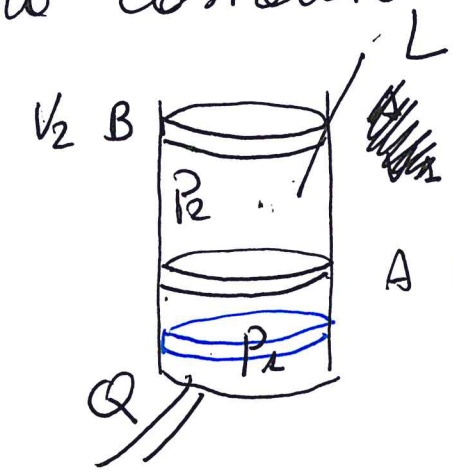
$$\boxed{\Delta U = Q}$$

TRASFORMAZIONE ISOTERMA

Temperatura costante



$$L = \int_{V_1}^{V_2} P(v)\, dV$$



Tuo è combiato

$T = K$

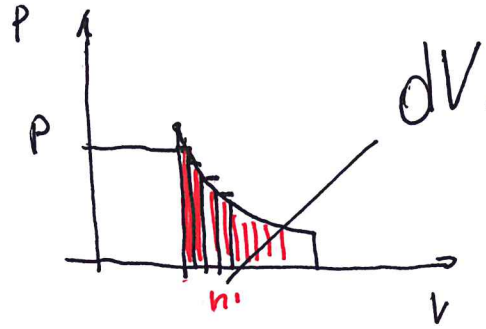
$$\Delta U = Q - L \qquad U = N \frac{3}{2} kT$$

$$\| \qquad \|$$

$$0 = Q - L$$

$$Q = L$$

ISOBARA $L = P \cdot \Delta V$



$$dV \cdot P_1 + dV P_2 + dV P_3$$

$$L = \sum_{i=1}^{n} P_i\, dV = \int_{V_1}^{V_2} P(V)\, dV \qquad n \to \infty$$

$$L = \int_{V_1}^{V} P(V)\,dV$$

$$PV = NkT$$

$$P = \frac{NkT}{V} = NkT \cdot \frac{1}{V}$$

$$L = \int_{V_1}^{V_2} NkT \frac{1}{V}\,dV$$

$$= NkT \int_{V_1}^{V_2} \frac{dV}{V} = NkT \int_{V_1}^{V_2} \frac{1}{V}\,dV$$

$$\frac{d}{dV}(\ln V) = \frac{1}{V}$$

$$\ln V = \frac{dV}{V}$$

$$= NkT \Big|_{V_1}^{V_2} \ln V \Big| = NkT (\ln V_2 - \ln V_1)$$

$$L = NkT \ln\left(\frac{V_2}{V_1}\right)$$

$$L = nRT \ln\left(\frac{V_2}{V_1}\right)$$

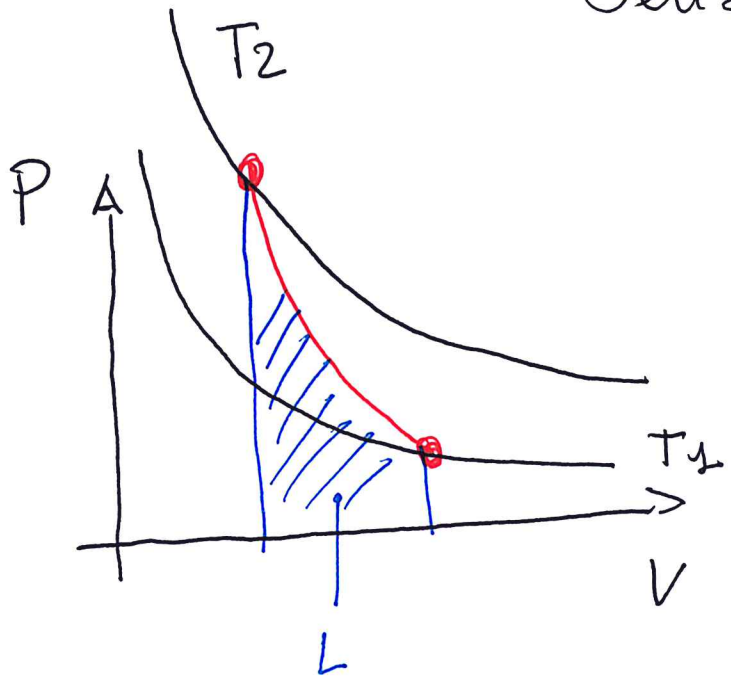
TRASFORMAZIONE ADIABATICA

$$Q = 0$$

Senza scambio di calore

$$\Delta U = Q - L$$

$$\Delta U = -L$$



1 mole di Benzina

1500 k CH_H

~~4~~ 300k GPL

$$-L = U_2 - U_1$$

$$+L = +14.958\ J$$

$$U_1 = \frac{3}{2} nRT = \frac{3}{2} 1 \cdot 8{,}31 \cdot 1500 = 18.697{,}5\ J$$

$$U_2 = \frac{3}{2} nRT = \frac{3}{2} 1 \cdot 8.31 \cdot 300 = 3.739{,}5\ J$$