Calorimetría

$$\sum_i Q_i = 0 \quad \text{con}$$

Variación de Temp

$$Q_i = m_i \cdot c_i \cdot \Delta T_i$$

$$Q_i = m_i \cdot L^{(i)}$$

Cambio de fase

$$\Delta S_{univ} = \sum_i \Delta S_i \quad \text{con}$$

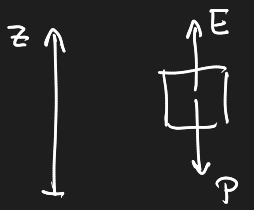
Variación de Temp

$$\Delta S_i = \int \frac{dQ_i}{T} = \int_{273\,K}^{333\,K} \frac{m_i \cdot c_i}{T} \cdot dT$$

$$\Delta S_i = \frac{m_i \cdot L^{(i)}}{T}$$

Cambio de fase

Fluidos



$$E - P = m_c \cdot \ddot{z}$$

datos del Cubo

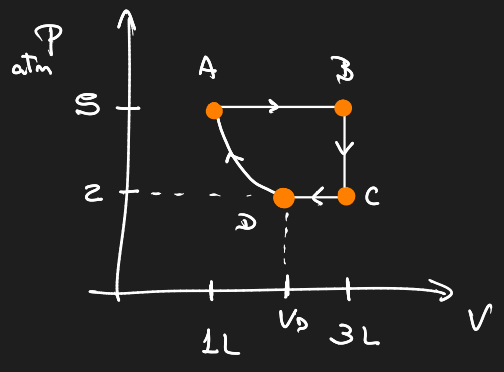
$$E - P = \underbrace{\rho_L \cdot V_L}_{\text{m del líquido desplazado}} \cdot g - \underbrace{\rho_c \cdot V_c}_{m_c} \cdot g$$

$$\text{Bernoulli}: \quad E = p_{Atm} + \frac{1}{2} \cdot \rho \cdot v^2 + \rho \cdot g \cdot h$$

$$\text{Caudal} \quad Q = \text{Area} \cdot v$$

Ciclos (ejercicios)

$P \cdot V = n \cdot R \cdot T$



	P_{atm}	V_L	T
A	5	1	
B	5	3	
C	2	3	
D	2	V_D	

$T_A = \frac{P_A \cdot V_A}{n \cdot R}$

isoterma

$T_D = \frac{P_D \cdot V_D}{n \cdot R}$

$$\Rightarrow \quad \frac{P_A \cdot V_A}{n \cdot R} = \frac{P_D \cdot V_D}{n \cdot R}$$

$$P_A \cdot V_A = P_D \cdot V_D$$

$$V_D = \frac{P_A \cdot V_A}{P_D} = \frac{5 atm \cdot 1L}{2 atm} = 2{,}5 L$$

1° Principio:

$$\Delta U = Q - W$$

	ΔU	Q	W
A → B			10
B → C			
C → D			
D → A			

A → B: P cte $\Rightarrow$ $W = \int P \cdot dV = P_A \cdot (V_B - V_A)$

$= 5 atm \cdot 2L = 10 atm \cdot L$

gas ideal

$\Delta U \overset{\downarrow}{=} n \cdot C_v \cdot \Delta T$ $\qquad T_A = \frac{P_A \cdot V_A}{n \cdot R}$ $\qquad T_B = \frac{P_B \cdot V_B}{n \cdot R}$

$$= n \cdot C_v \cdot \left(\frac{P_B \cdot V_B}{n \cdot R} - \frac{P_A \cdot V_A}{n \cdot R} \right)$$

$$\Delta U = \cancel{n} \cdot \frac{3}{2} \cdot \cancel{R} \cdot \left(\frac{5.3 - 5.1}{\cancel{n R}} \right) \text{ atm.L}$$

$$\Delta U = \frac{3}{2} \cdot 10 = 15 \text{ atm.L}$$

$$\Rightarrow 15 \text{ atm L} = Q - 10 \text{ atm.L}$$

$$Q = 25 \text{ atm L}$$

	ΔU	Q	W
$A \to B$	15	25	10
$B \to C$			
$C \to D$			
$D \to A$			

$B \to C$: Vcte $\Rightarrow$ $W = \int p \cdot dV = 0$

$\Rightarrow \Delta U = Q$

gaz idéal

$\Delta U = n \cdot C_v \cdot \Delta T$

$P \cdot V = n \cdot R \cdot T$

$$= n \cdot \frac{3}{2} R \cdot \left(\frac{P_C \cdot V_C}{n \cdot R} - \frac{P_B \cdot V_B}{n R} \right)$$

$$= \frac{3}{2} \cdot \left(2.3 - 5.3 \right) \text{ atm L}$$

$$= -\frac{27}{2} \text{ atm.L}$$

	ΔU	Q	W
$A \to B$	15	25	10
$B \to C$	$-\frac{27}{2}$	$-\frac{27}{2}$	0
$C \to D$			
$D \to A$			

$C \to D$: p cte $\Rightarrow W = P_C \cdot (V_D - V_C)$

$= 2\,atm\,(2{,}5\,L - 3\,L)$

$= -1\ atm.L$

$\Delta U = n \cdot C_v \cdot (T_D - T_C)$

$= n \cdot \frac{3}{2} R \cdot \left(\frac{P_D V_D}{nR} - \frac{P_C V_C}{nR} \right)$

$= \frac{3}{2} \cdot \underbrace{(2 \cdot 2{,}5 - 2 \cdot 3)}_{-1}\ atm.L$

$= -\frac{3}{2}\ atm.L$

	ΔU	Q	W
$A \to B$	15	25	10
$B \to C$	$-\frac{27}{2}$	$-\frac{27}{2}$	0
$C \to D$	$-\frac{3}{2}$	$-\frac{5}{2}$	-1
$D \to A$			

$-\frac{3}{2}\ atm.L = Q + 1\ atm.L$

$\Rightarrow Q = -\frac{5}{2}\ atm\,L$

$D \to A$: Isoterma : $\Delta U = 0$

$W = \int P \cdot dV = n \cdot R \cdot T_A \cdot \int_{2{,}5}^{1} \frac{1}{V}\, dV$

$= \underbrace{n \cdot R \cdot T_A}_{} \cdot \ln\left(\frac{1}{2{,}5}\right)$ $\quad P \cdot V = n \cdot R \cdot T$

$= P_A \cdot V_A \cdot \ln(0{,}4)$

$$= 5\,atm \cdot 1\,L \cdot \ln(0{,}4)$$

$$W = 5\ln(0{,}4)\,atm\,L = -4{,}58\,atm\,L$$

$$\Rightarrow Q = -4{,}58\,atm\,L$$

	ΔU	Q	W
$A \to B$	15	25	10
$B \to C$	$-\frac{27}{2}$	$-\frac{27}{2}$	0
$C \to D$	$-\frac{3}{2}$	$-\frac{5}{2}$	-1
$D \to A$	0	$-4{,}58$	$-4{,}58$

b) Eficiencia:

Recordar: como $W_{tot} > 0$ es una Expansión!

$$\varepsilon = \frac{W_{Tot}}{Q_{Abs}} = \frac{4{,}42}{25}$$

⇒ es máquina Térmica.

Recordar!

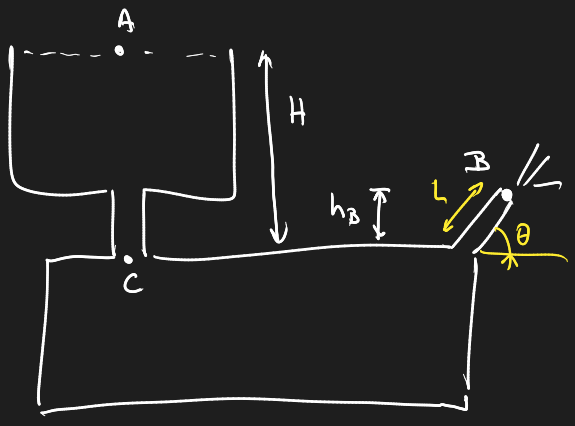
Absorve $Q > 0$

Pierde $Q < 0$

$$\varepsilon = 0{,}18$$

c) ΔU es función de Estado ∴ siempre vale cero para un ciclo cerrado, no importa si es rev. ó irrev.

Recordar



$E_A = E_C$

$1\,atm + \rho \cdot g \cdot H = 1\,atm + \frac{1}{2}\rho \cdot v_c^2 + 0$

$\rho \cdot g \cdot H = \frac{1}{2}\rho \cdot v_c^2$

$v_c^2 = 2gH$

$v_c = \sqrt{2gH}$

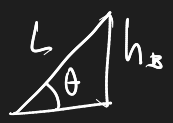
$E_A = E_B$

$1\,atm + \rho \cdot g \cdot H = 1\,atm + \frac{1}{2}\rho \cdot v_B^2 + \rho \cdot g \cdot h_B$

$g \cdot H = \frac{1}{2} \cdot v_B^2 + g h_B$

$g \cdot (H - h_B) = \frac{1}{2} \cdot v_B^2$

$v_B = \sqrt{2\,g\,(H - h_B)}$



SOH CAH

$\sin\theta = \frac{h_B}{L}$

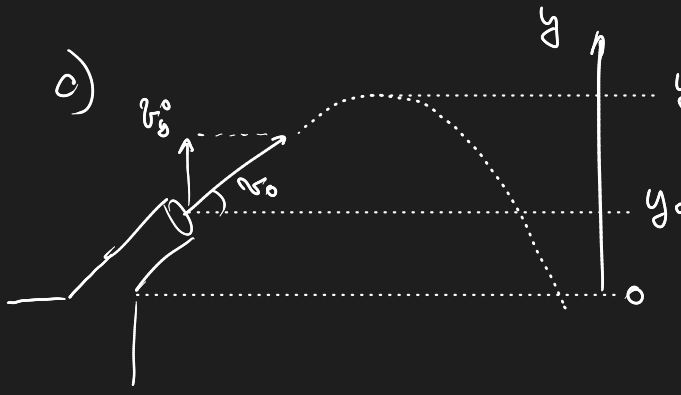
$v_B = \sqrt{2\,g\,(H - L \cdot \sin\theta)}$

$\begin{cases} H = 10\,m \\ L = 2\,m \\ \theta = 30° \end{cases}$

$v_B = \sqrt{180\ \frac{m^2}{s^2}}$

$v_B = 13{,}42\ \frac{m}{s}$

a)



$v_0 := v_B$

$$\begin{cases} v(t) = v_y^\circ - g \cdot t \\ y(t) = y_0 + v_y^\circ \cdot t - \frac{1}{2} g \cdot t^2 \end{cases}$$

$$v(t) = v_y^\circ - g \cdot t$$

SOH

$$\sin 30^\circ = \frac{v_y^\circ}{v_0}$$

$$0\,\frac{m}{s} = \frac{1}{2} \cdot 13.42\,\frac{m}{s} - 10\,\frac{m}{s^2} \cdot t$$

$$t_{max} = 0{,}671\,s$$

$$\Rightarrow y_{max} = y(t_{max})$$

$$= 1\,m + \frac{1}{2} \cdot 13.42\,\frac{m}{s} \cdot 0{,}671\,s - \frac{1}{2} \cdot 10\,\frac{m}{s^2} \cdot (0{,}671\,s)^2$$

$$\boxed{y_{max} = 3{,}25\,m}$$