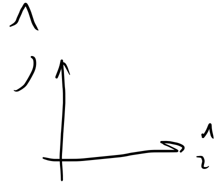
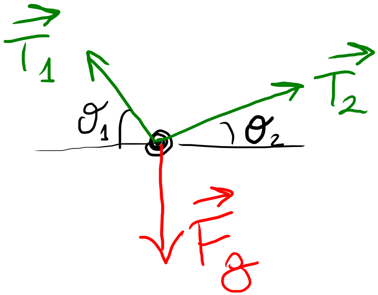
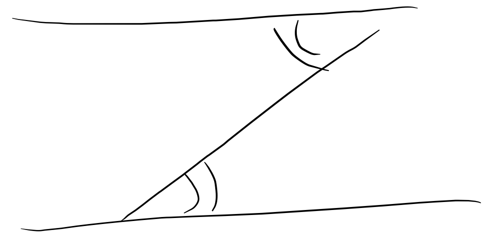
Appello 22/6/2016 - Problema A







Il sistema è in equilibrio

$$\vec{F}_g + \vec{T}_1 + \vec{T}_2 = 0$$

Componente lungo versore $\hat{i}$

$$-T_1\cos\theta_1 + T_2\cos\theta_2 = 0 \qquad (1)$$

Componente lungo versore $\hat{j}$

$$-F_g + T_1\sin\theta_1 + T_2\sin\theta_2 = 0 \qquad (2)$$

2 equazioni in 2 incognite → OK

$$\vec{F}_g = -F_g\,\hat{j}$$

F_g è un modulo

$$\vec{T}_1 = T_{1i}\,\hat{i} + T_{2j}\,\hat{j} = -T_1\cos\theta_1\,\hat{i} + T_1\sin\theta_1\,\hat{j}$$

$$\vec{T}_2 = T_{2i}\,\hat{i} + T_{2j}\,\hat{j} = T_2\cos\theta_2\,\hat{i} + T_2\sin\theta_2\,\hat{j}$$

Isolo T_2 in (1)

$$T_2 = T_1 \frac{\cos\theta_1}{\cos\theta_2} \quad (1a)$$

Sostituisco (1a) in (2)

$$\cos\theta_2 \cdot \left(-F_g + T_1 \sin\theta_1 + T_1 \frac{\cos\theta_1}{\cos\theta_2} \sin\theta_2\right) = (0) \cdot \cos\theta_2$$

Isolo T_1

$$-F_g \cos\theta_2 + T_1 \cos\theta_2 \sin\theta_1 + T_1 \cos\theta_1 \sin\theta_2 = 0$$

$$-F_g \cos\theta_2 + T_1 (\cos\theta_2 \sin\theta_1 + \cos\theta_1 \sin\theta_2) = 0$$

$$T_1 = \frac{F_g \cos\theta_2}{[\cos\theta_2 \sin\theta_1 + \cos\theta_1 \sin\theta_2]} = \frac{F_g \cos\theta_2}{\sin(\theta_1 + \theta_2)}$$

Per trovare T_2 sostituisco T_1 in (1a)

$$T_2 = T_1 \frac{\cos\theta_1}{\cos\theta_2} = \frac{F_g \cos\theta_1}{\sin(\theta_1+\theta_2)}$$

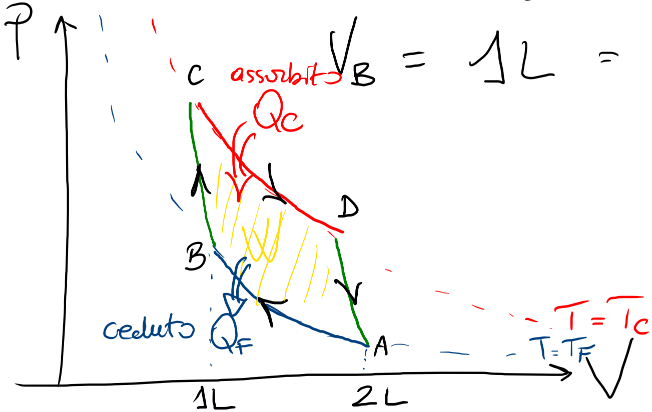
Appello 02/09/2016 – Problema C

$\Delta U = n C_V \Delta T$

$n = 1\,mol$ $\quad T_F = 27°C \quad T_C = 327°C$

$V_A = 2L = 2 \cdot 10^{-3} m^3$

$V_B = 1L = 1 \cdot 10^{-3} m^3$ $\quad \frac{V_i}{V_f} = 2$



ADIABATICA $Q = 0$

$\Delta U = -W$

ISOTERMA "CALDA"

ISOTERMA "FREDDA"

È una macchina termica

$W_{ciclo} > 0$

Appello 26/01/2017 – Problema D

$$P = \frac{\#\ \text{successi}}{\#\ \text{possibilità}}$$

a) 5 dadi $\to$ 1 dado 4 $\quad P_{singolo} = \frac{1}{6}$

$\to$ 4 dado $\neq 4$ $\quad P_{singolo} = \frac{5}{6}$

$$P = \frac{1}{6} \cdot \left(\frac{5}{6}\right)^4 = \dots$$

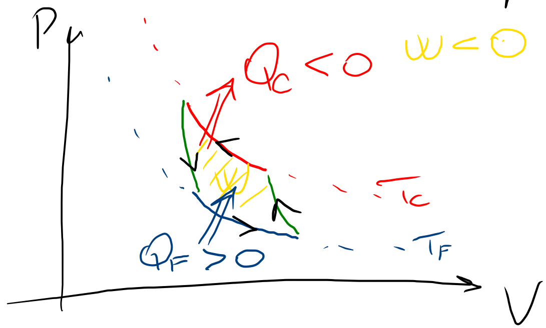
c) 5 dadi $\to$ 2 dadi 4

$\to$ 3 dati $\neq 4$

$$P = \left(\frac{1}{6}\right)^2 \left(\frac{5}{6}\right)^3$$

b)

In una macchina frigorifera



Trovo Q_F e Q_C

I° principio $\Delta U = Q - W$

Nelle isoterme $0 = Q - W \Rightarrow W = Q$

N.B. Usare temperature in Kelvin

$$W = \int p\,dV = nRT \int_{V_i}^{V_f} \frac{dV}{V} = nRT \ln\left(\frac{V_f}{V_i}\right) = Q$$

$$Q_F = nRT_F \ln\left(\frac{V_B}{V_A}\right) = nRT_F \ln\left(\frac{1}{2}\right) = -nRT_F \ln(2) < 0 \quad (= W_{A \to B})$$

$$Q_C = nRT_C \ln\left(\frac{V_D}{V_C}\right)$$

Devo trovare V_c e V_D .....

Uso $T V^{\gamma-1} = cost$

$$T_F V_B^{\gamma-1} = T_C V_C^{\gamma-1}$$

$$V_C^{\gamma-1} = \frac{T_F}{T_C} V_B^{\gamma-1} \Longrightarrow V_C = V_B \left(\frac{T_F}{T_C}\right)^{\frac{1}{\gamma-1}}$$

$$T_C V_D^{\gamma-1} = T_F V_A^{\gamma-1} \Longrightarrow V_D = V_A \left(\frac{T_F}{T_C}\right)^{\frac{1}{\gamma-1}}$$

$$\frac{V_D}{V_C} = \frac{V_A \cancel{\left(\frac{T_F}{T_C}\right)^{\frac{1}{\gamma-1}}}}{V_B \cancel{\left(\frac{T_F}{T_C}\right)^{\frac{1}{\gamma-1}}}} = 2$$

$$Q_C = nRT_C \ln(2) > 0 \Longrightarrow = W_{C\to D}$$

$W_{ciclo} = ?$ In un ciclo $\Delta U = 0$ $W_{ciclo} = Q_{ciclo}$

$$W_{ciclo} = \underbrace{Q_F}_{<0} + Q_C = nR\ln(2)\left[T_C - T_F\right]$$

GAS PERFETTO $\gamma = \frac{C_P}{C_V}$

MONOATOMICO

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

$C_P = \frac{5}{2}R$

$\gamma = \frac{5}{3}$

BIATOMICO

$C_V = \frac{5}{2}R$

$C_P = \frac{7}{2}R$

$\gamma = \frac{7}{5}$