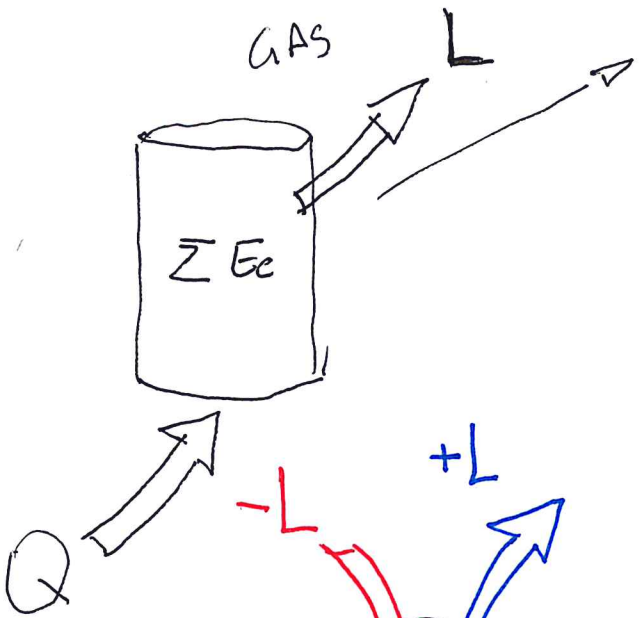
1° principio della Termodinamica

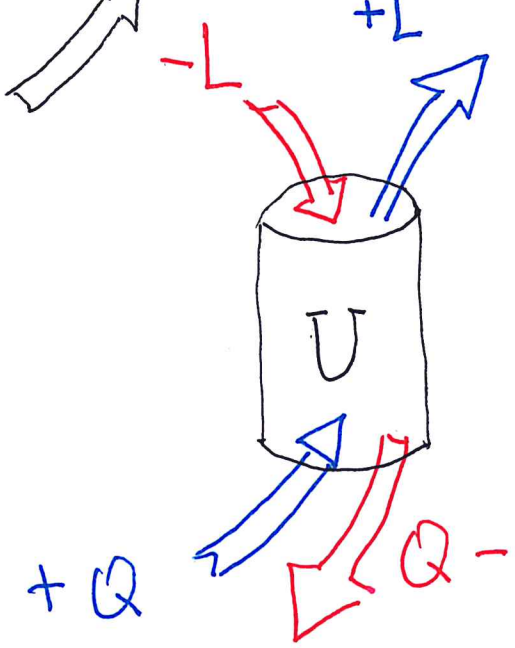


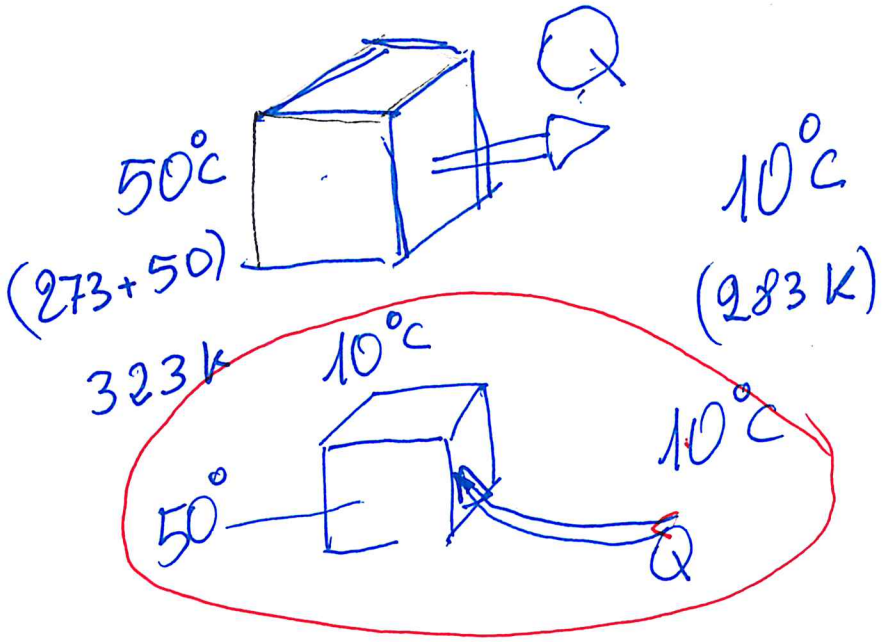
U energia interna → Temperatura

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

$$\Delta U = Q - L$$

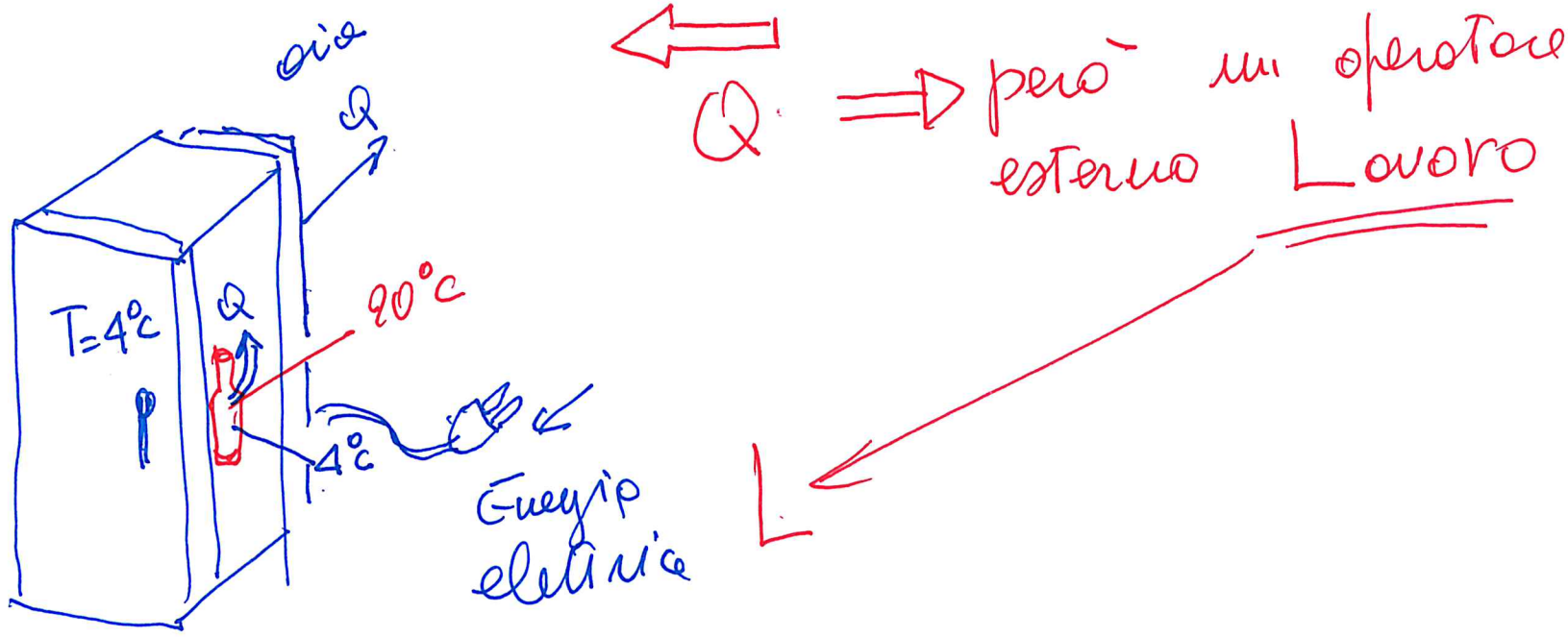
$$U_f - U_i = Q - L$$



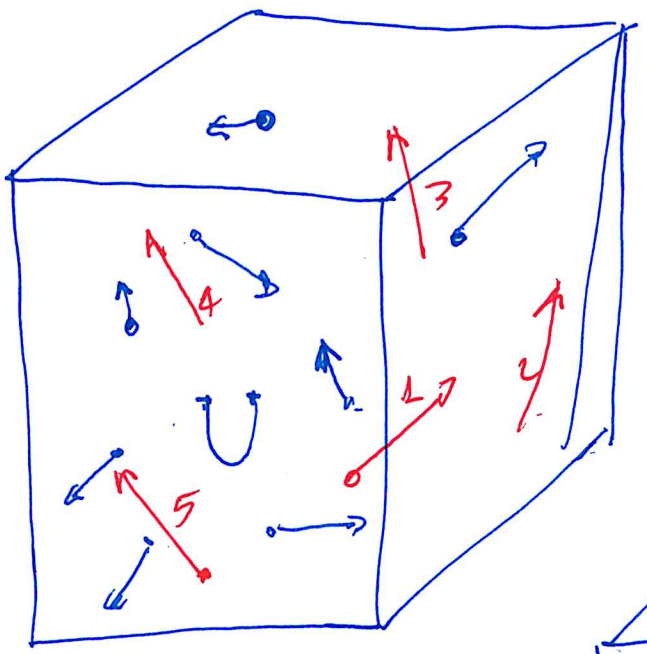


2° Principio T.D.

Q ⟶ Oggetto a Temp maggiore ⟶ Temp. inf.

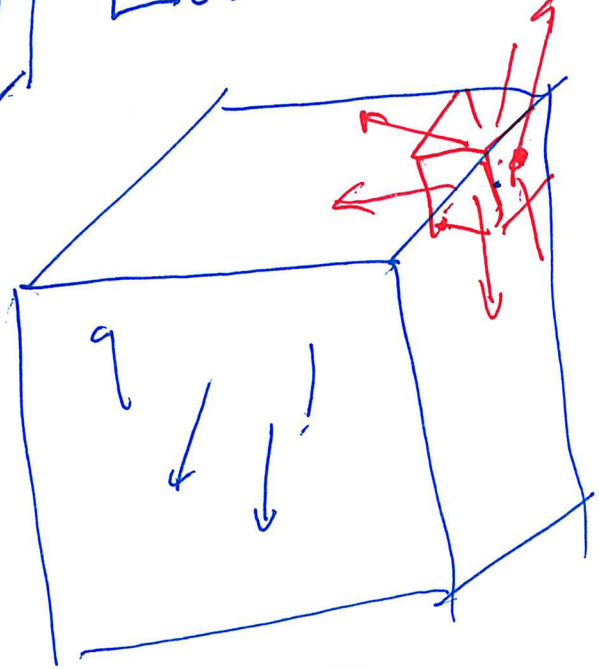


S >



Lavoro

T mgh

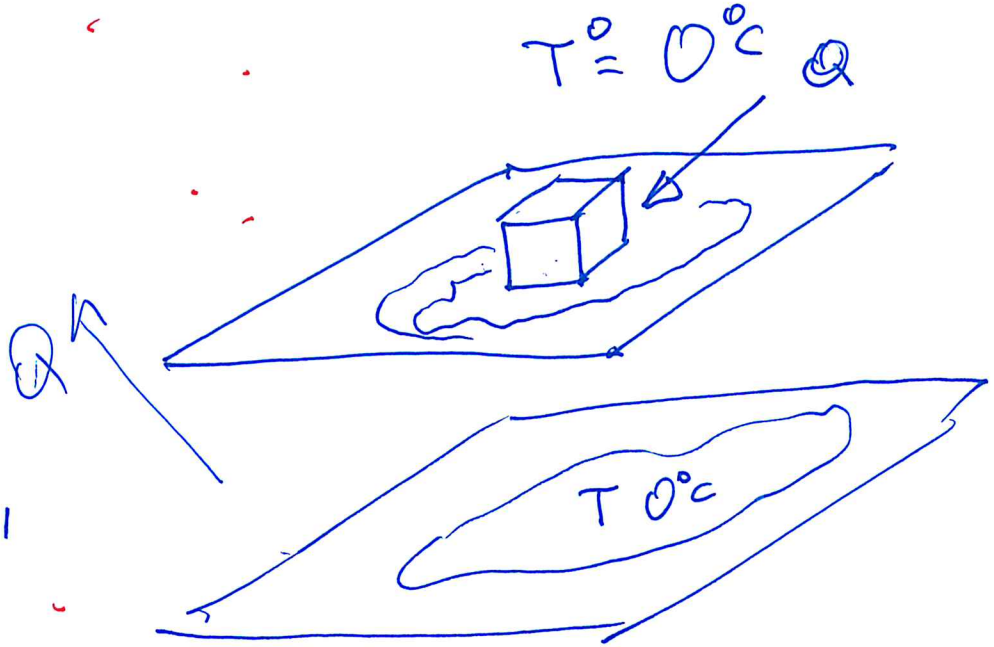


S

Entropia

|| livello di disordine di un sistema

S <



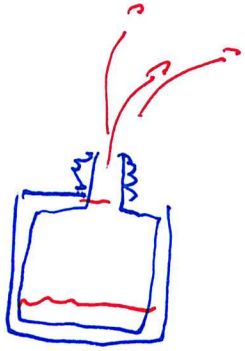
$$\Delta U = Q - L$$

$$\frac{\Delta Q}{T} = \frac{Q}{273} > 0$$

$$S = \frac{\Delta Q}{T} > 0$$

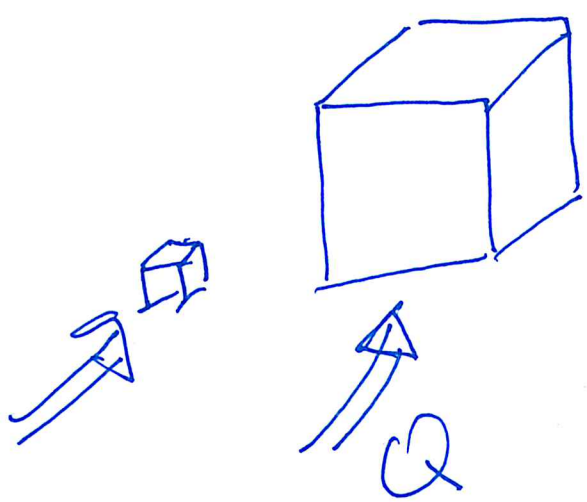
$$S = \frac{-\Delta Q}{T} < 0$$

impossibile



Spiccolo | S

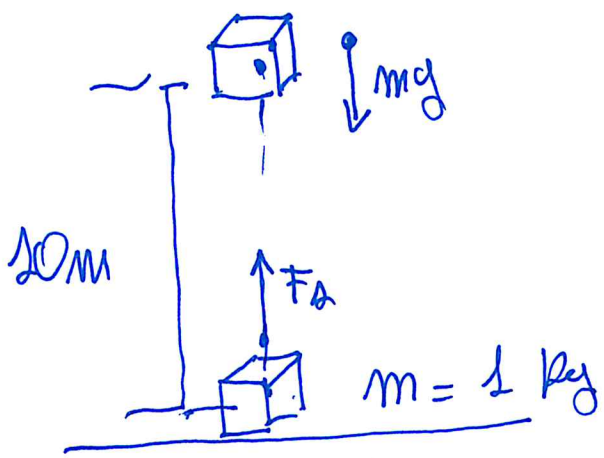
Calorimetria



$$Q = c_s \, m \, \Delta T \, (T_2 - T_1)$$

Calore specifico $\left[\frac{?}{K}\right]$ e processo

c_s = la quantità di energia per aumentare di $1\,^\circ C$ $1\,kg$ di materia $\left[\frac{J}{kg\,K}\right] = \left[\frac{J}{kg\,^\circ C}\right] [kg] \; [^\circ C]$



$L = mg \cdot h$

$= 1 \cdot 9{,}81 \cdot 10$

$L = 98{,}1\ J > 22\ cal$

$= 98{,}1\ J \approx 100\ J >> 22\ cal$

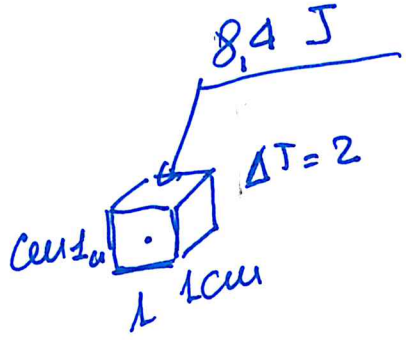
1 cal.

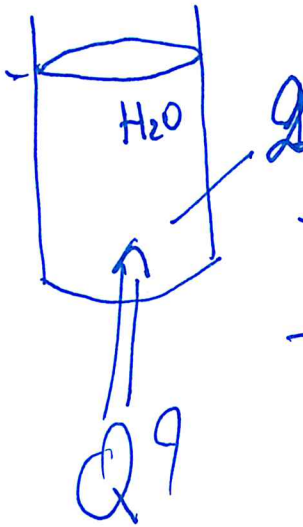
1 cal = 4,186 J

1 kcal = 4186 J

4186 cal → 1°C → 1 kg H_2O

4,186 cal → 1°C → 1 g H_2O





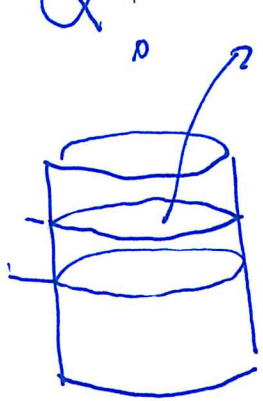
$$Q = c_{s_{H_2O}} \cdot m_{H_2O} \cdot \Delta T$$

$$= 4186 \cdot 2 \cdot (100°C - 20°C)$$

$$= 4186 \cdot 2 \cdot 80 =$$

$$= 4186 \cdot 160 = 669760\ J$$

$$\approx 670\ kJ$$

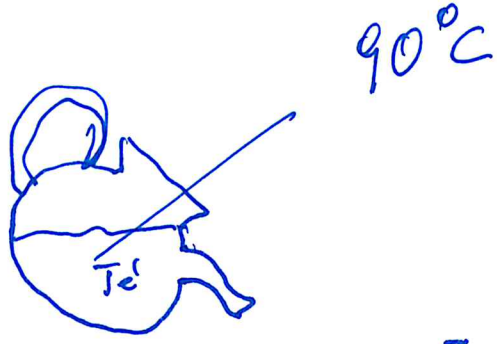


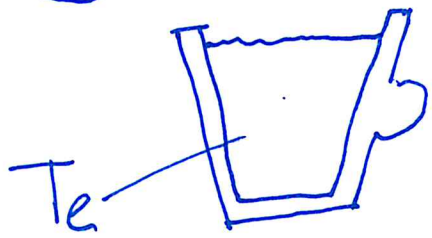
$c_{l\,ev.} = 2260\ kJ/kg$

$m_{evaporie} = 0.2kg$

$Q_{evapor} = 0.2 \cdot 2260 \cdot$ kJ

$= 452\ kJ$

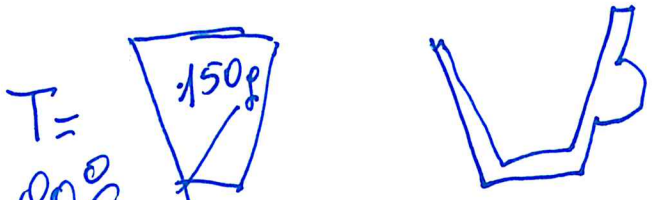


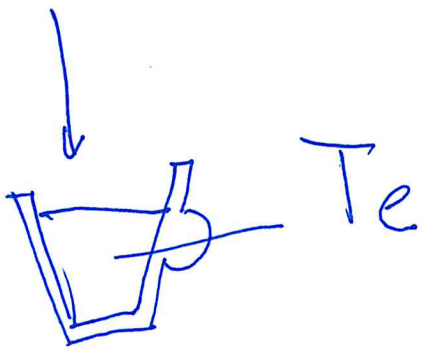


$m_{Te} = 150\,g$

$m_{Tazza} = 150\,g$

$T_{Tazza} = 20°C$





$T_e < 90°$

$T_e > 20°C$

Q perduto H_2O ↘

Q acquisito Tazza

$Q_{H_2O} = m_{H_2O} \, c_{S_{H_2O}} (T_e - T_i)$

$Q_{H_2O} < 0 \quad T_e - T_i < 0$

$Q_{Tazza} = m_{Tazza} \cdot c_{S_{vetro}} \cdot (T_e - T_i)$

$Q_{Tazza} = - Q_{H_2O}$

Entra nella Tazza

esce dalla H_2O

$$-Q_{H_2O} = -\, m_{H_2O} \cdot c_{s\,H_2O} \left(T_{ep} - T_{i\,H_2O}\right) = m_{H_2O} \cdot c_{s\,H_2O} \left(T_{i\,H_2O} - T_{ep}\right)$$

$$Q_{Tazza} = m_{Tazza} \cdot c_{s\,Tazza} \left(T_e - T_{i\,vetro}\right) = m_{Tazza} \cdot c_{s\,Tazza} \left(T_e - T_i\right.$$

$$0{,}150 \cdot 4186 \left(90^\circ - T_e\right) = 0{,}150 \cdot 840 \left(T_e - 20^\circ\right)$$

$$4186 \times 90 - 4186\, T_e = 840 \cdot T_e - 840 \times 20$$

$$4186 \times 90 + 840 \times 20 = 840 \times T_e + 4180 \times T_e$$

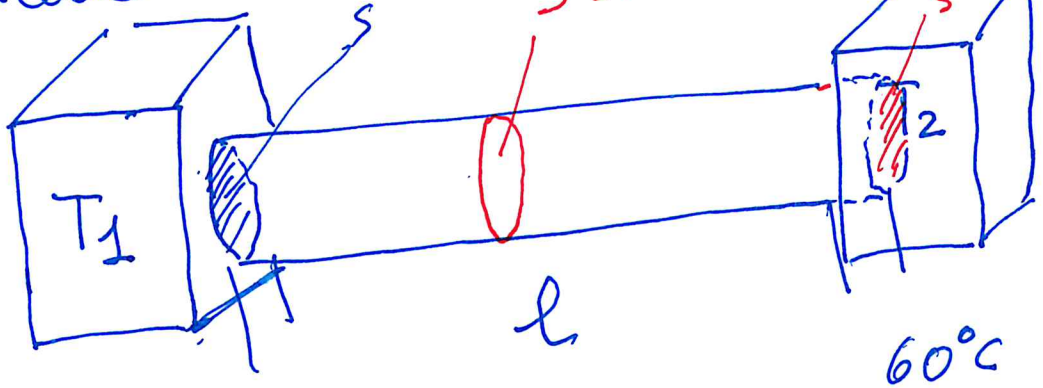
$$376200 + 16800 = T_e \left(840 + 4180\right) = T_e \cdot 5020$$

$$T_e = \frac{393.000}{5020} = \underline{\underline{78{,}2^\circ}}$$ Temperatura di equilibrio

PROPAGAZIONE DEL CALORE

1) Conduzione → Sorgente e utilizzatore a contatto
2) Convezione → (liquido o m. gas fluido)
3) ~~Irraggiamento~~ Irraggiamento → Vuoto

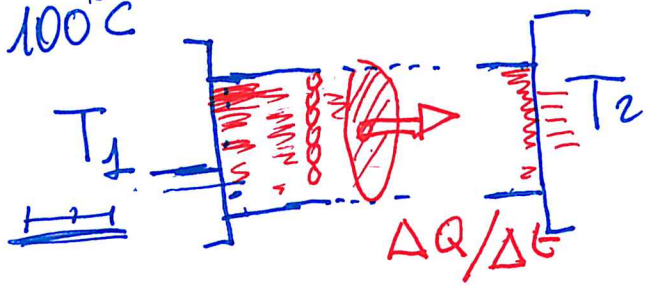
(1) Conduzione



$T_2 < T_1$

$60°C$

$$\left[\frac{J}{S}\right] = \left[\frac{J}{s\,m\,°C}\right]\frac{[m^2]\,[°C]}{[m]}$$



$$\frac{\Delta Q}{\Delta t} = K\,\frac{S\,\Delta T}{l}$$

K = conducibilità Termica

Coefficiente di Conduttività termica

$$k = \left[\frac{J}{s}\,\frac{1}{m\,^\circ C}\right] = \left[\frac{W}{m\,^\circ C}\right] = \left[\frac{W}{m\,^\circ C}\right]$$

RAME $k_{Cu} = 380 \; W/m\,^\circ C$

VETRO $k_{vetro} = 0{,}84 \; W/m\,^\circ C$

Buon Conduttore

Cattivo conduttore (isolante)