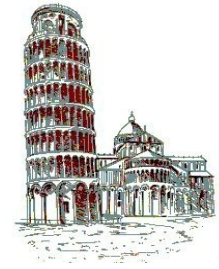


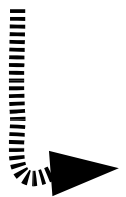
# ***Termodinamica***

*Equazione di stato*

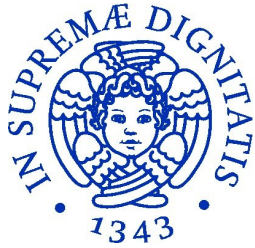


**V,P,T = variabili**

$\Phi = \Phi(V,P,T)$  equazione di stato



**V,P,T non sono indipendenti**



# Termodinamica

## Legge dei gas



□ Legge di Boyle: *Se la temperatura di un gas "perfetto" viene mantenuta costante, il volume del gas varia in proporzione inversa alla pressione.*

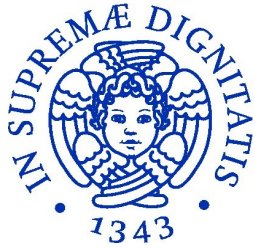
$$\implies PV = \text{Costante}$$

e Gay\_Lussac  $V = V_0(1 + aC)$  dove  $C$  sta per gradi Celsius.  
Se si passa ad esprimere la stessa legge in gradi Kelvin

(  $C = T - T_0$  con  $T_0 = 273.15\text{K}$  e  $a = 1/T_0$  ) segue:

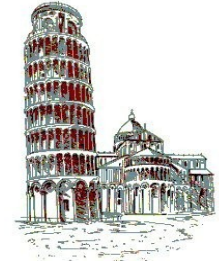
$$V = V_0(1 + aC) = V_0\left(1 + \frac{T - T_0}{T_0}\right) = V_0 \frac{T}{T_0}$$

$$\frac{V}{V_0} = \frac{T}{T_0}$$



# Termodinamica

Legge dei gas

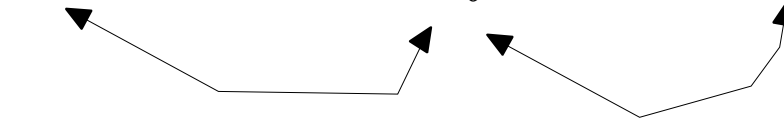


$PV = \text{Costante} \dots \text{Boyle}$

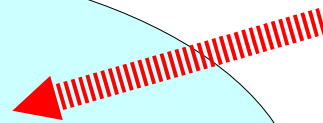
$V \propto T \text{ Gay-Lussac}$

**due + due fa quattro!!**

$$V_0, P_0, T_0 \implies P, V_0', T_0 \implies P, V, T$$



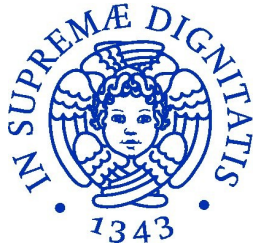
$$P_0 V_0 = P V_0' = P V \frac{T_0}{T}$$



$$VP = \frac{V_0 P_0}{T_0} T = BT$$

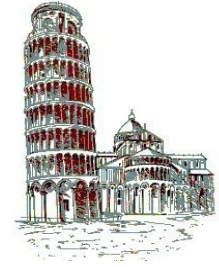
E' una legge di stato!!

**Ma B che cosa e'???????**



# Termodinamica

Legge di Avogadro



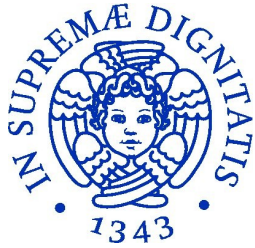
*Volumi uguali di gas diversi, alla stessa temperatura e pressione, contengono lo stesso numero di molecole.*

$m_p = 1.6604 \cdot 10^{-27} \text{ kg}$ ,  $A = \text{numero Atomico}$

$N = m / A \quad 1.6604 \cdot 10^{-27} = 6.0221 \cdot 10^{26} \text{ m/A}$

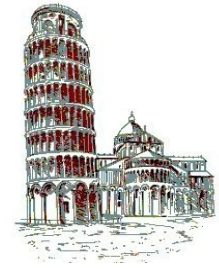
$N_A = 6.0221 \cdot 10^{26} = \text{chilomole}$

- 1 chilo di atomi di H quanti protoni contiene?
- 2 chili di molecole  $\text{H}_2$  di idrogeno quanti protoni?
- quanti atomi? quante molecole?
- Quanto vale un volume molare a STP.



# Termodinamica

*B e gas ideali*



$$\Rightarrow \Rightarrow \Rightarrow B = Nk$$

$$k = 1.38 \cdot 10^{-23} \text{ JT}^{-1}$$

$$VP = NkT$$

*k = costante di Boltzmann*

$$VP = nRT$$

*R = N<sub>a</sub>k = e' detta costante dei gas ideali.*

$$R = 6.0221 \cdot 10^{26} \times 1.380710^{-23} = 8314 \text{ [ J Kmol}^{-1} \text{ T}^{-1} \text{ ]} = 8.314 \text{ [ J mol}^{-1} \text{ T}^{-1} \text{ ]}$$