STATI DI AGGREGAZIONE

SOLIDO → HA FORMA E VOLUME PROPRIO

LIQUIDO → NON HA FORMA PROPRIA
HA VOLUME PROPRIO

GAS → NON HA NE' FORMA NE' VOLUME PROPRI

FORZE INTERMOLECOLARI

Solidi > liquidi >> gas ≈ 0

Gas reali> gas ideali =0

STATO GASSOSO

- BASSA DENSITA' (ELEVATO VOLUME MOLARE)

↓

- ASSENZA DI FORZE INTERMOLECOLARI

- COMPRIMIBILITA'
- MISCIBILITA' TOTALE
- ESERCITA UNA PRESSIONE

Parametri che definiscono lo stato di un gas:

- Volume V m^3, litri = dm^3

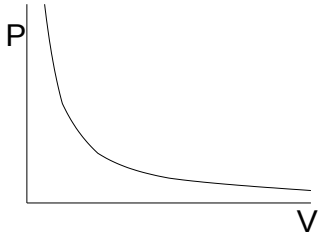
-Numero di moli n

- Pressione P= F/s Pa =N/m^2
atmosfere 1atm = 101,3 KPa
torr (mmHg) 1 atm = 760 torr

-Temperatura T °C 1°C = 1K
K $T_K = T_{°C} + 273,15$

LEGGI DEI GAS

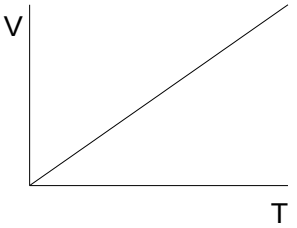
Legge di Boyle
T= costante (isoterma)
PV = costante $P_0V_0=P_1V_1$



Leggi di Gay-Lussac
P= costante (isobara)

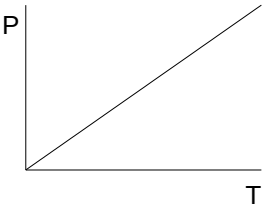
$$\frac{V_1}{V_0}=\frac{T_1}{T_0} \qquad \frac{V_0}{T_0}=\frac{V_1}{T_1}$$

T(K) = T(°C)+273,15



V = costante (isocora)

$$\frac{P_1}{P_0}=\frac{T_1}{T_0} \qquad \frac{P_0}{T_0}=\frac{P_1}{T_1}$$



R= 0,0821 atm·l·K^{-1}
R =8,31J·K^{-1}

$$\frac{P_0V_0}{T_0}=\frac{P_1V_1}{T_1}=R$$

Per 1 mole

PV°=RT
V°=volume di 1 mole

PRINCIPIO DI AVOGADRO

V=nV° ⟹ PV=nRT ⟸ Equazione di stato dei gas ideali

Bassa P alta T

PV = nRT R= 0,0821 atm x l/K

V=? P= 1,0 atm T= 25°C = 298K n= 1 mol

$$V = \frac{nRT}{P} = \frac{1 \times 0{,}0821 \times 298}{1} = 24{,}4\,L$$

$$PV = nRT = \frac{g}{PM}RT \quad \Rightarrow \quad PM = \frac{g}{V}\frac{RT}{P}$$

$$PV = nRT \Rightarrow \frac{n}{V} = \frac{P}{RT} \qquad d = \frac{g}{V} = \frac{n \times PM}{V} = PM\frac{n}{V} = PM\frac{P}{RT}$$

H_2 d = 2/24,4 = 0,0817 g/l

N_2 d = 28/24,4 = 1,14 g/l

$$PM = \frac{g}{V}\frac{RT}{P} = d\frac{RT}{P}$$

$$d_A = PM_A\frac{P}{RT} \qquad d_B = PM_B\frac{P}{RT} \quad \Rightarrow \quad \frac{d_A}{d_B} = \frac{PM_A}{PM_B}$$

MISCELE DI GAS

$P_{tot} = P_A + P_B + P_C + \ldots = \Sigma_i P_i$

↑ pressione totale ↑ pressioni parziali

$P_A = n_A RT/V$

$P_B = n_B RT/V$

$P_{tot} = n_{tot} RT/V \qquad n_{tot} = \sum_i n_i$

$$\frac{P_A}{P_{tot}} = \frac{n_A RT/V}{n_{tot} RT/V} = \frac{n_A}{n_{tot}} = x_A$$ ← frazione molare $\qquad 0 \leq x \leq 1$

$P_A = x_A \cdot P_{tot}$

$x_A + x_B + x_C + \ldots = \Sigma_i x_i = \Sigma_i (n_i/n_{tot}) = 1$

$V_{tot} = V_A + V_B + V_C + \ldots = \Sigma_i V_i$

↑ volumi parziali

$V_A = n_A RT/P$

$V_{tot} = n_{tot} RT/P$

$V_A/V_{tot} = n_A/n_{tot} = x_A$

$V_A = x_A \cdot V_{tot}$

GAS IDEALE
(alta T, bassa P)
-Elevato volume molare
-Assenza di interazioni

TEORIA CINETICA DEI GAS
-Moto caotico
-Urti elastici
-Energia cinetica = energia termica

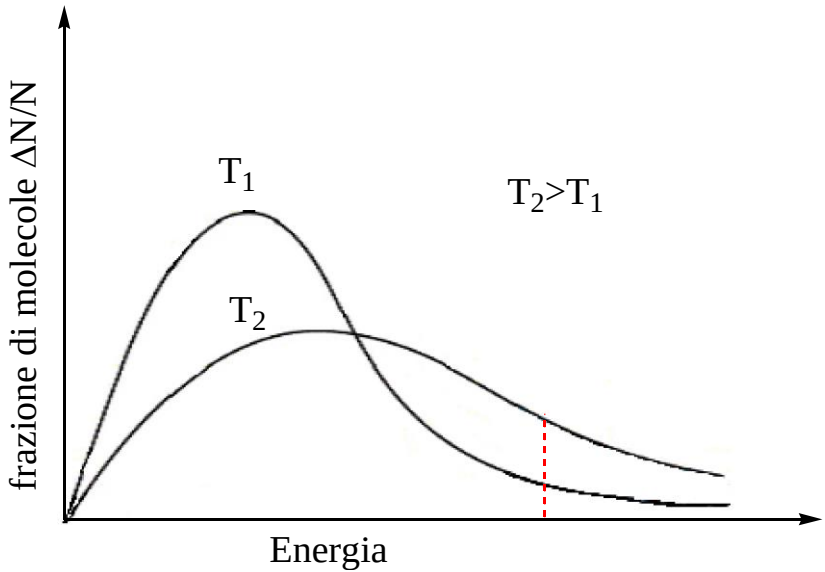
$E_K = ½\ mv^2$

$\overline{E}_K = ½\ m\overline{v^2} = 3/2\ kT$

$\overline{E}_K$ = Energia cinetica media

$\overline{v}$ = velocità media

k = costante di Boltzmann
$k=R/N_A = 1{,}38 \times 10^{-23}$ J/K



STATO SOLIDO

-FORMA PROPRIA E VOLUME PROPRIO

-ORDINE A CORTO E A LUNGO RAGGIO

-RIPETIZIONE IN 3D DI UNA STESSA UNITA'
→ CELLA ELEMENTARE
↓STRUTTURA PERIODICA → RETICOLO CRISTALLINO
↓ENERGIA RETICOLARE

AMORFI → VETRI

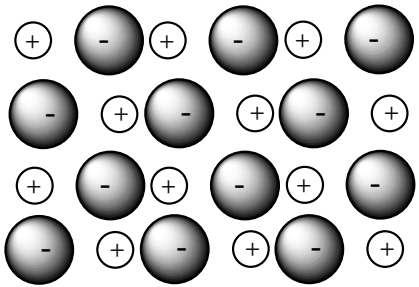
SOLIDI	IONICI
	MOLECOLARI (Van der Waals)
	COVALENTI
	METALLICI

SOLIDI IONICI

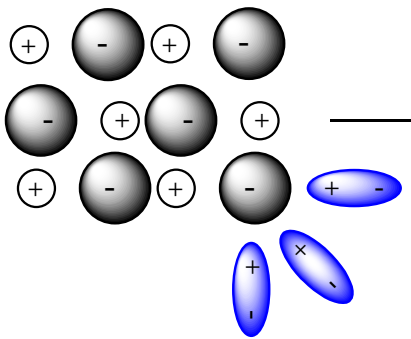
IONI + e – tenuti insieme da INTERAZIONI COULOMBIANE
→ ENERGIA RETICOLARE

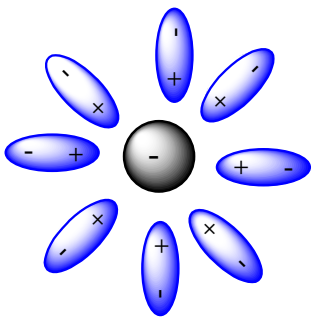
LEGAME IONICO

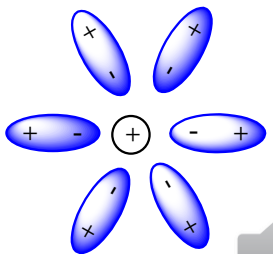
Ioni positivi (cationi) → elementi aventi basso I (metalli)
Ioni negativi (anioni) → elementi aventi alta A_e (non metalli)



- Alto p.f.
- Fragilità
- Isolanti
- Conduttori se fusi
- Solubili in H_2O → soluzioni conduttrici



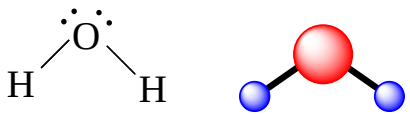


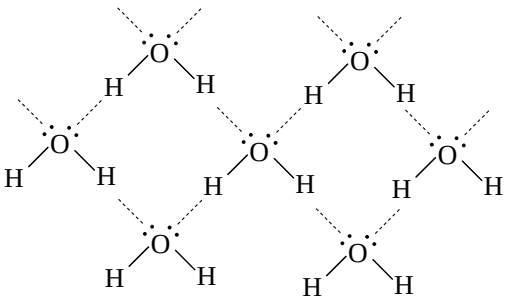


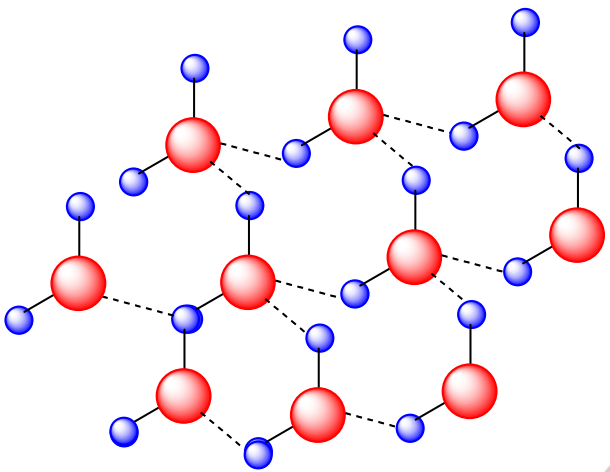
SOLIDI MOLECOLARI

MOLECOLE TENUTE INSIEME DA:
- FORZE DI VAN DER WAALS
- LEGAME IDROGENO
- Es. H_2O, I_2, CO_2,
composti organici etc.

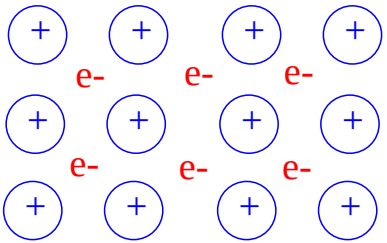
Basso pf
isolanti







SOLIDI METALLICI → LEGAME METALLICO



RETICOLO CRISTALLINO
→ IONI METALLICI

ELETTRONI DI VALENZA
→ MARE DI FERMI

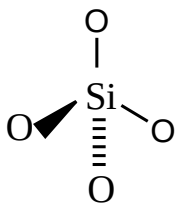
CONDUCIBILITA’
-ELETTRICA
-TERMICA
Alto pf
MALLEABILITA’,
DUTTILITA’

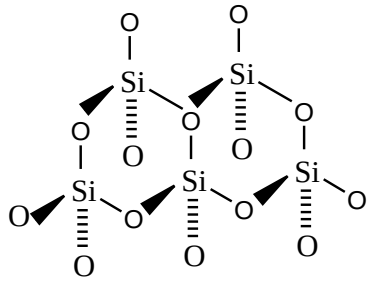
SOLIDI COVALENTI

IL SOLIDO E' COME UN'UNICA GRANDE MOLECOLA TENUTA INSIEME DA INTERAZIONI COVALENTI

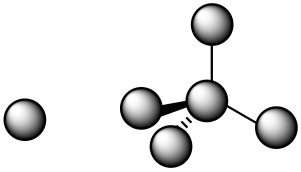
Es. C, SiO_2 Alto pf, durezza, isolanti

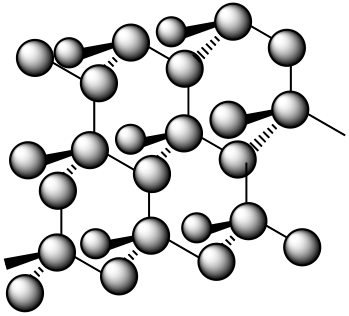
SiO_2
Ibridazione sp^3

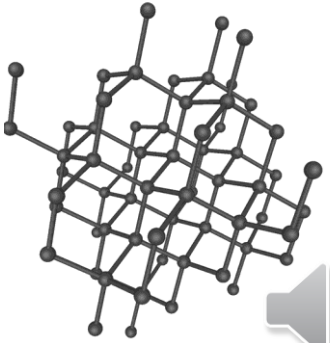




C: diamante
Ibridazione sp^3

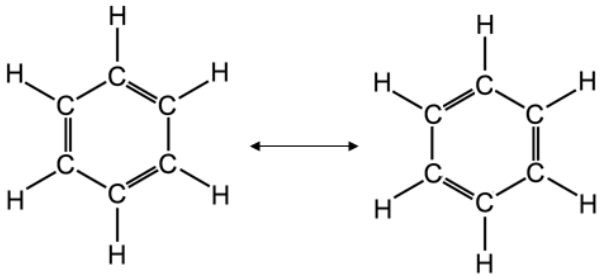


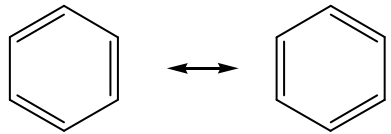




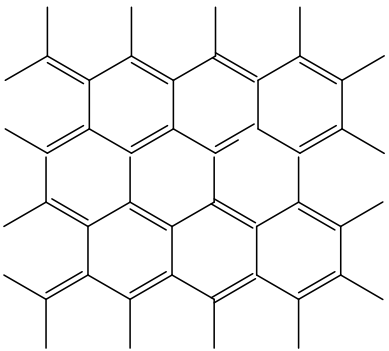
C: grafite
Ibridazione sp^2

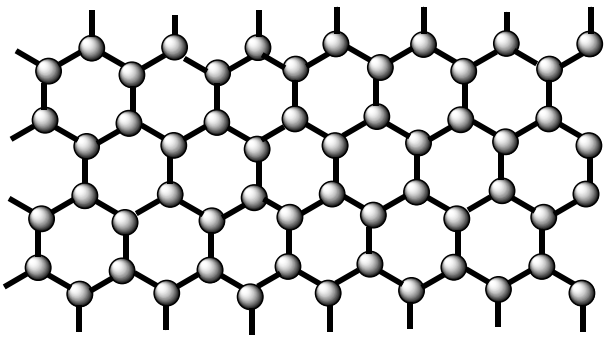
Forme allotropiche

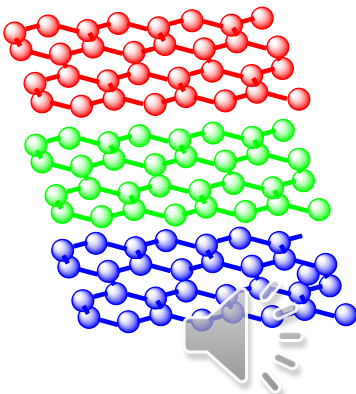




anisotropia





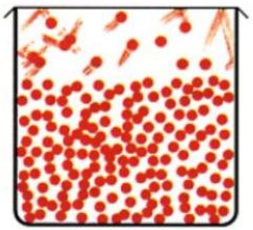


LIQUIDI

- Volume proprio, non forma propria

- Ordine a corto raggio
- Disordine a lungo raggio

- Poco comprimibili
- Isotropia

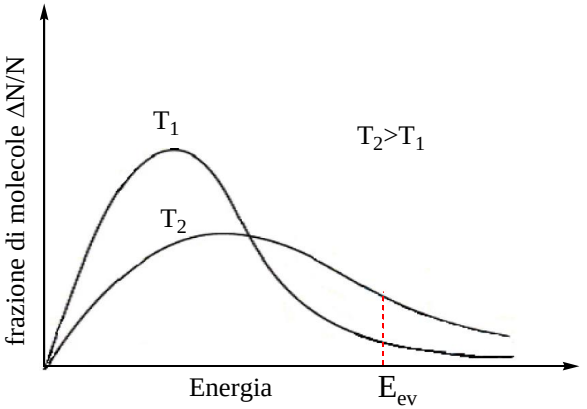


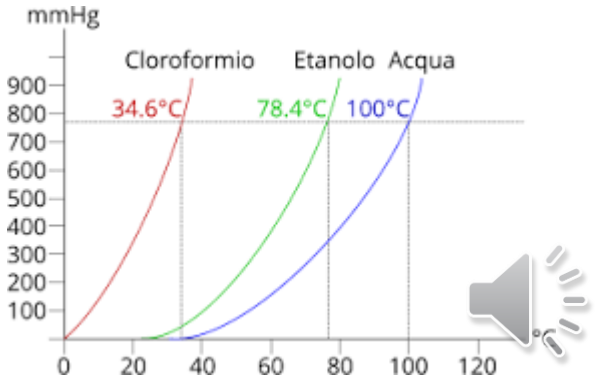
Tensione di vapore

$$P = P^{\circ} e^{-\frac{\Delta H_{ev}}{RT}}$$

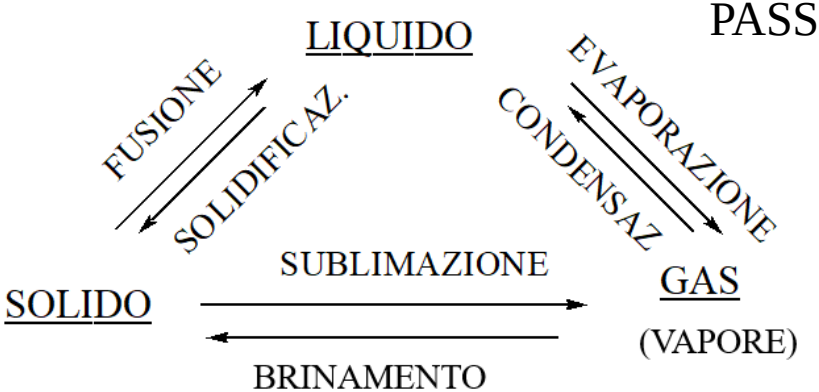
Liquido-vapore → evaporazione
ΔH_{ev} → entalpia
(calore latente) di evaporazione

Volume liquidi < Volume gas
- Molecole libere di muoversi
- Forze intermolecolari ≠0





PASSAGGI DI STATO

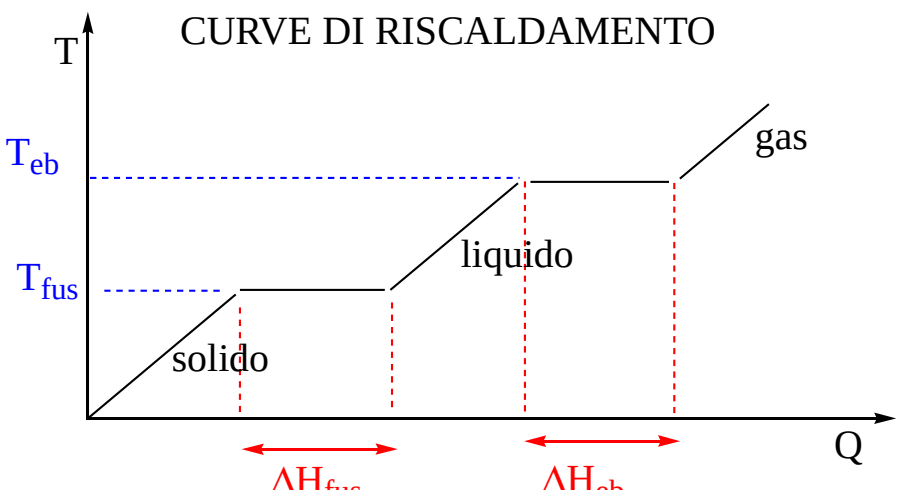


$\Delta H_{sol} = - \Delta H_{fus}$

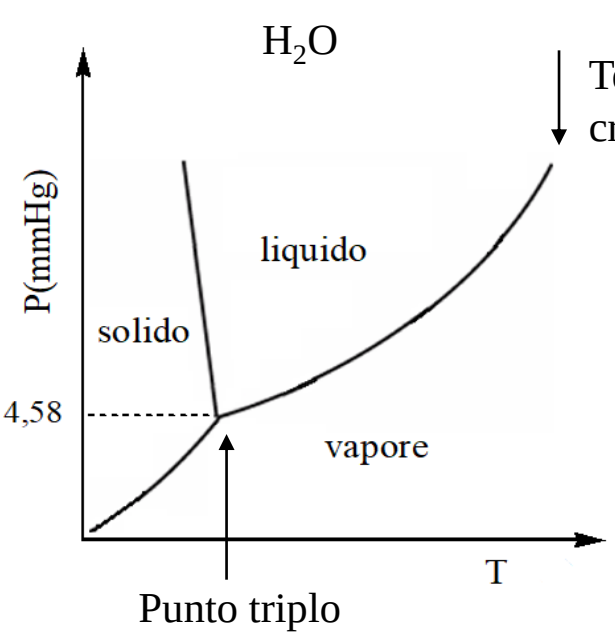
$\Delta H_{cond} = - \Delta H_{ev}$

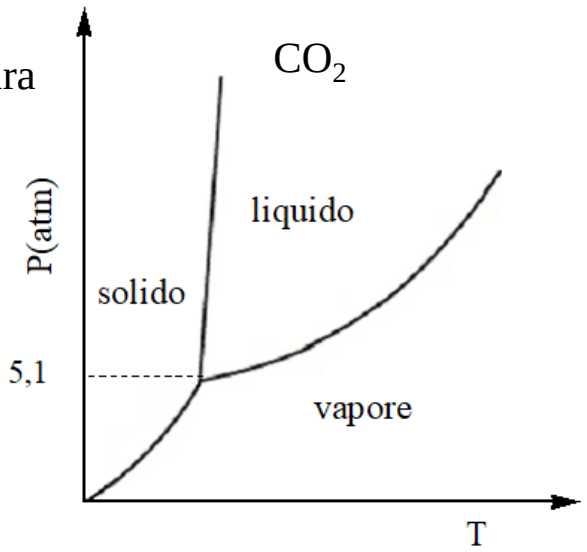
$\Delta H_{sub} = \Delta H_{fus} + \Delta H_{ev}$

CURVE DI RISCALDAMENTO



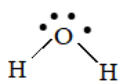
DIAGRAMMI DI STATO

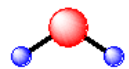


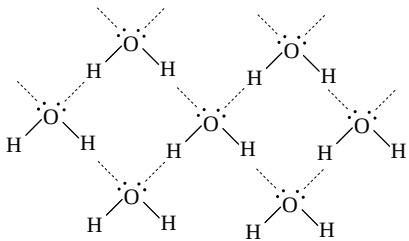


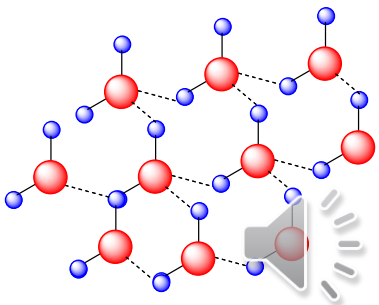
$$P = P^{\circ} e^{-\frac{\Delta H_{ev}}{RT}}$$

$$P = P^{\circ} e^{-\frac{\Delta H_{sub}}{RT}}$$









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