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

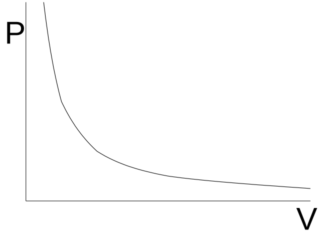
°C		1°C = 1K
K		$T_K = T_{°C} + 273{,}15$

LEGGI DEI GAS

Legge di Boyle

T= costante (isoterma)

PV = costante $P_0V_0=P_1V_1$



R= 0,0821 atm·l·K^{-1}

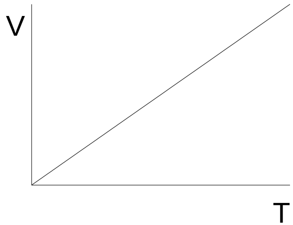
R =8,31J·K^{-1}

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

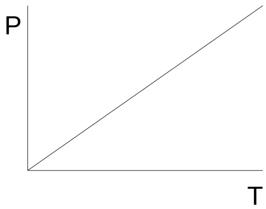


$$\frac{P_0V_0}{T_0}=\frac{P_1V_1}{T_1}=R$$

Per 1 mole

V = costante (isocora)

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



PV°=RT

V°=volume di 1 mole

PRINCIPIO DI AVOGADRO

V=nV° → PV=nRT ← Bassa P alta T

Equazione di stato dei gas ideali

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

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

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

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

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

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

$P_A = n_A RT/V$

$P_B = n_B RT/V$

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

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

$P_A = x_A \cdot P_{tot}$

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

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

↑ 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

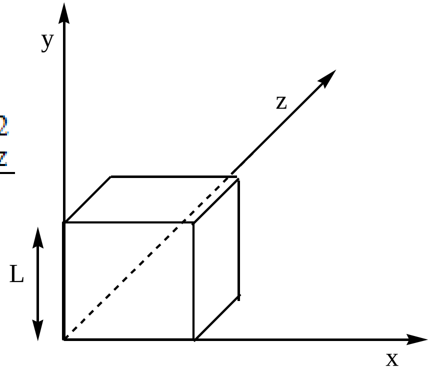
(alta T, bassa P)

- Molecole puntiformi
- Assenza di interazioni

TEORIA CINETICA DEI GAS

- Moto caotico
- Urti elastici
- Energia cinetica = energia termica

$$F_x = \frac{\Delta(mv_x)}{t} = \frac{2mv_x}{2L/v_x} = \frac{mv_x^2}{L}$$



$$P_x = \frac{F_x}{S} = \frac{mv_x^2}{L \times L^2} = \frac{mv_x^2}{V} \Rightarrow P_y = \frac{mv_y^2}{V} \Rightarrow P_z = \frac{mv_z^2}{V}$$

$$\bar{v}^2 = \bar{v}_x^2 + \bar{v}_y^2 + \bar{v}_z^2 \qquad \bar{v}_x^2 = \bar{v}_y^2 = \bar{v}_z^2 = \bar{v}^2/3$$

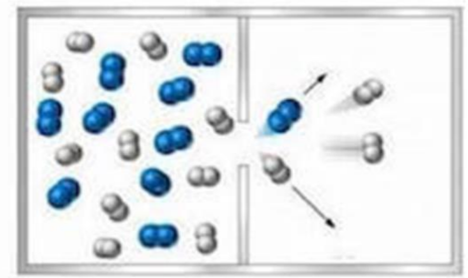
Per 1 mole $\quad P_x = N\frac{m\bar{v}_x^2}{V} = N\frac{m\bar{v}^2}{3V} = P_y = P_z = P$

$E_K = ½mv^2$ per 1 molecola $\quad \bar{E}_K = ½m\bar{v}^2$ $\quad$ Per 1 mole $\quad E_K = N½m\bar{v}^2$

$$PV = N\frac{m\bar{v}^2}{3} = \frac{2}{3}N\bar{E}_K = \frac{2}{3}E_K$$

$$\bar{E}_K = \frac{3}{2}\frac{R}{N}T = \frac{3}{2}kT \qquad E_K = \frac{3}{2}RT$$

LEGGE DI GRAHAM



T = cost   A, B m_A, m_B

$\overline{E}_{K\,A} = \overline{E}_{K\,B}$ $m_A \neq m_B$ $\overline{v}_A{}^2 \neq \overline{v}_B{}^2$

$$\frac{1}{2}\, m_A \overline{v}_A{}^2 = \frac{1}{2}\, m_B \overline{v}_B{}^2$$

$$m_A/m_B = \overline{v}_B{}^2/\overline{v}_A{}^2$$

$\overline{v}_B/\overline{v}_A{}^2 = \sqrt{m_A/m_B}$ ← legge di Graham

Distribuzione di Boltzmann

$E_K = ½\ mv^2$

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

$\overline{v} = \sqrt{<v^2>} = \sqrt{(3\ kT/m)}$

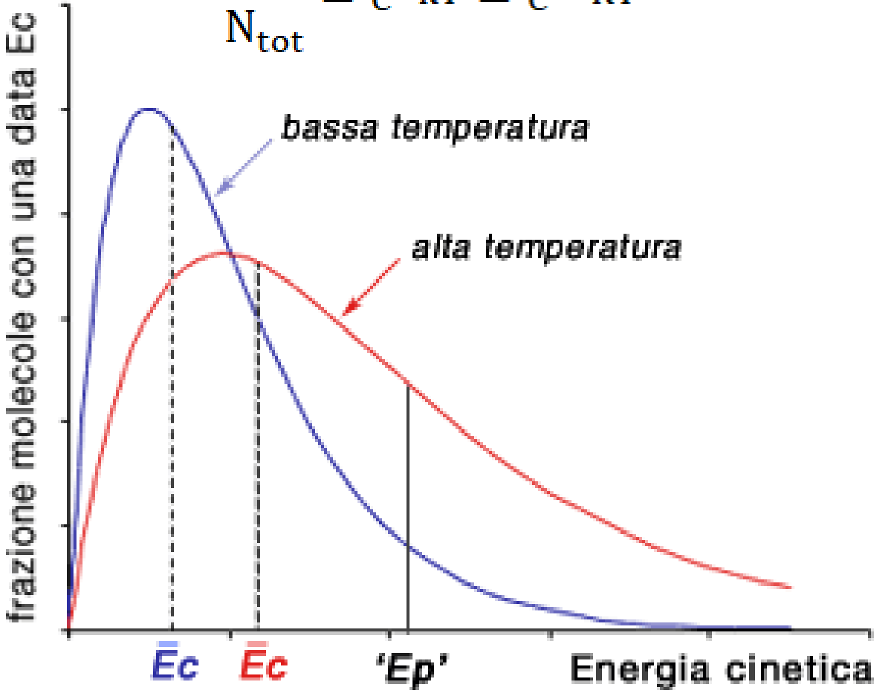
$\overline{E}_K$ = Energia cinetica media

$\overline{v}$ = velocità media

k = costante di Boltzmann

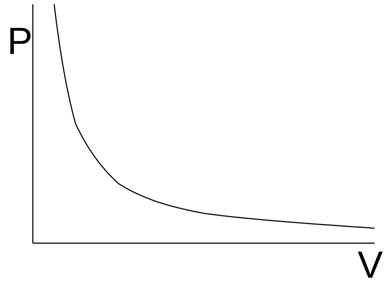
$k = R/N_A = 1{,}38\ x10^{-23}\ J/K$

$$\frac{N_E}{N_{tot}} = e^{-\frac{E}{kT}} = e^{-\frac{E_{mol}}{RT}}$$



GAS REALI

- Molecole non puntiformi $\rightarrow$ covolume
- Interazioni intermolecolari



Gas ideali PV=nRT

Per 1 mole PV =RT

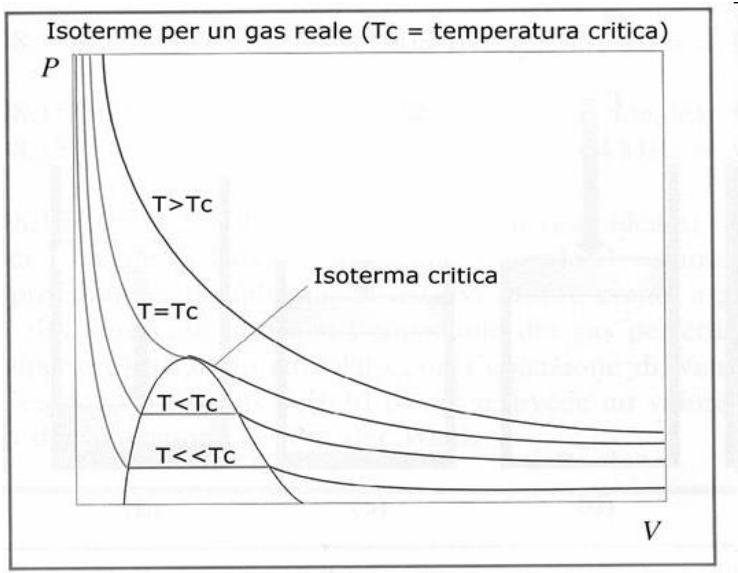
Gas reali

$(P+\frac{a}{V^2})(V-b) = RT$ per 1 mole

$(P+\frac{n^2a}{V^2})(V-nb) = nRT$ per n moli

$\frac{a}{V^2}$ = pressione interna

b =covolume



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