ELEMENTS

OF THERMODYNAMICS

A work of ideal gases at the isoprocesses.

Polytrope equation:

$$PV^n = \text{const}$$

$$n = 0 \; \infty$$

$$A_{1,2} = \int_{V_1}^{V_2} P \, dV$$

ISOBARIC PROCESS

$P = \text{const}$ $\qquad dP = 0$ $\qquad n = 0$

$$V = \frac{RT}{P}$$

$$A_{1,2} = P\,(V_2 - V_1)$$

ISOTHERMAL PROCESS

$$T = \text{const} \qquad dT = 0 \qquad n = 1$$

$$PV = RT = \text{const}$$

$$A_{1,2} = \int_{V_1}^{V_2} P_1 V_1 \frac{dV}{V} = P_1 V_1 \ln \frac{V_2}{V_1} = RT \ln \frac{V_2}{V_1}$$

ISOCHORIC PROCESS

$$V = \text{const} \qquad dV = 0 \qquad n = \infty$$

$$P = \frac{RT}{V}$$

$$A_{1,2} = 0$$

ADIABATIC PROCESS

$$S = \text{const} \qquad dS = \frac{dQ}{T} = 0 \qquad n = \gamma$$

$$PV^{\gamma} = \text{const} \qquad PV^{\gamma} = \text{const}$$

$$PT^{\frac{\gamma}{\gamma-1}} = \text{const}$$

$$A_{1,2} = \frac{P_1 V_1}{\gamma - 1}\left(1 - \left(\frac{V_1}{V_2}\right)^{\gamma-1}\right)$$

FREE ENERGY
AND
CHEMICAL POTENTIAL

FREE ENERGY $F = U - TS$

U IS THE INTERNAL ENERGY

CHEMICAL POTENTIAL for N particles

$$\mu = \frac{F - PV}{N} = \frac{U - TS}{N}$$

TRANSFER PHENOMENA

1. DIFFUSION

Flux of mass transfer (Fick's law)

$$d I_m = \frac{d M}{d S \cdot d t} = -D \frac{d \rho}{d t}$$

Coefficient of diffusion

$$D = \frac{1}{3} v \cdot \lambda$$

2. INTERNAL FRICTION (VISCOSITY)

Flux of momentum transfer across the contact border

$$d I_p = \frac{d (mv)}{d S \cdot d t} = -\eta \cdot \text{grad } u$$

Coefficient of viscosity

$$\eta = \frac{1}{3} \rho \cdot v \cdot \lambda$$

TRANSFER PHENOMENA (2)

3. TRANSFER OF HEAT ENEGRY

A flux of the heat energy

$$d I_q = \frac{dQ}{dS \cdot dt} = \chi \cdot \text{grad}\, T$$

(Fourier's law)

Coefficient of heat conductivity

$$\chi = \frac{1}{3} \rho \cdot v \cdot \lambda \cdot C_v$$

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Mutual connection of transfer coefficients:

$\eta = \rho \cdot D$	$\chi = \eta \cdot C_v$	$\chi = \rho \cdot D \cdot C_v$