CURSO DE TRANSFERENCIA DE MASA

(1649)

DGAPA / PAPIME / PEI 103325

CONCEPTOS DE FLUJO, FLUX Y VELOCIDAD

REFERENCIAS CURSO TRANSFERENCIA DE MASA

1) **Introductory Transport Phenomena.**
   R. Byron Bird, Warren E. Stewart, Edwin N. Lightfoot, Daniel J. Klingenberg.
   JohnWiley & Sons, Inc., 2015.
2) **Diffusion. Mass Transfer In Fluid Systems.**
   E. L. Cussler
   Cambridge University Press, UK, 2009, 3rd ed.
3) **Mass Transfer In Multicomponent Mixtures.**
   J. A. Wesselingh, R. Krishna.
   Delft University Press, Netherlands, 2000.
4) **Multicomponent Mass Transfer.**
   R. Taylor, R. Krishna.
   John Wiley & Sons, Inc., USA, 1993.
5) **Principles Of Mass Transfer And Separation Processes.**
   B. K. Dutta.
   PHI Learning Private Limited, New Delhi India, 2007.
6) **Diffusion And Mass Tranfer.**
   J. S. Vrentas, C. M. Vrentas.
   Taylor and Francis, USA, 2013.
7) **Estimation of Diffusivities**
   Dr. K. Wegner.
   ETH Zürich, Lecture 8, 08.11.2017.
8) **Fenómenos De Transporte. Aplicaciones Con Métodos Numéricos.**
   Luis Carrasco Venegas.
   Empresa Editora Macro, 2011.
9) **Mass Transfer. Principles And Applications.**
   D. Basmadjian.
   CRC Press, 2013.
10) **Absorption And Stripping.**
    P. Chattopadhyay.
    Asian Books Private Limited, New Delhi, India, 2007.
11) **Packed Towers In Processing And Environmental Technology.**
    R. Billet.
    VCH Verlagsgesellschaft mbH, Weinheim, Federal Republic of Germany, 1995.
12) **The Properties of Gases and Liquids.**
    B. E. Poling, J. M. Prausnitz, John P. O'Connell.
    The McGraw-Hill Companies, Inc., 2001.
13) **Introducción A La Mecánica Del Medio Continuo.**
    A. Ortiz Prado, J. A. Ortiz Valera, Osvaldo Ruiz Cervantes.
    UNAM, Facultad de Ingeniería, 2013.
14) **Separation Process Engineering. Includes Mass Transfer Analysis.**
    P. C. Wankat.
    Pearson Education, Inc., USA, 2012, third edition.
15) **Mass Transfer Operations for the Practicing Engineer.**

Louis Theodore, Francesco Ricci.
John Wiley and Sons, USA, 2010.

16) **Packed Tower Design an Applications. Random and Structured Packings.**
Ralph F. Strigle Jr.
Gulf Publishing Co., 1994, 2nd edition.

17) **Mass Transfer In Chemical Engineering Processes.**
Jozef Markos
InTech, 2011.

18) **Mass Transfer. From Fundamentals To Modern Industrial Applications.**
Koichi Asano.
Wiley-VCH, 2006.

19) **Mass Transfer in Multiphase Systems And Its Applications.**
Mohamed El-Amin.
InTech, 2011

20) **Mass Transfer Operations.**
Robert E. Treybal.
McGraw-Hill, 3rd Edition, 1980.

AGRADECIMIENTOS:

PROGRAMA DE APOYO A PROYECTOS PARA INNOVAR Y MEJORAR LA EDUCACIÓN 2023.

DGAPA / PAPIME / PE103523

INCORPORACION DE TIC'S PARA LA ENSEÑANZA Y EVALUACION DEL DESEMPEÑO DE LOS ALUMNOS EN ASIGNATURAS COMPARTIDAS DE DOS CARRERAS DE LA FACULTAD DE QUIMICA.

https://drive.google.com/file/d/19arMA-sKxuq_Gui0Rzhcuhi2OtfA5620/view?usp=drive_link

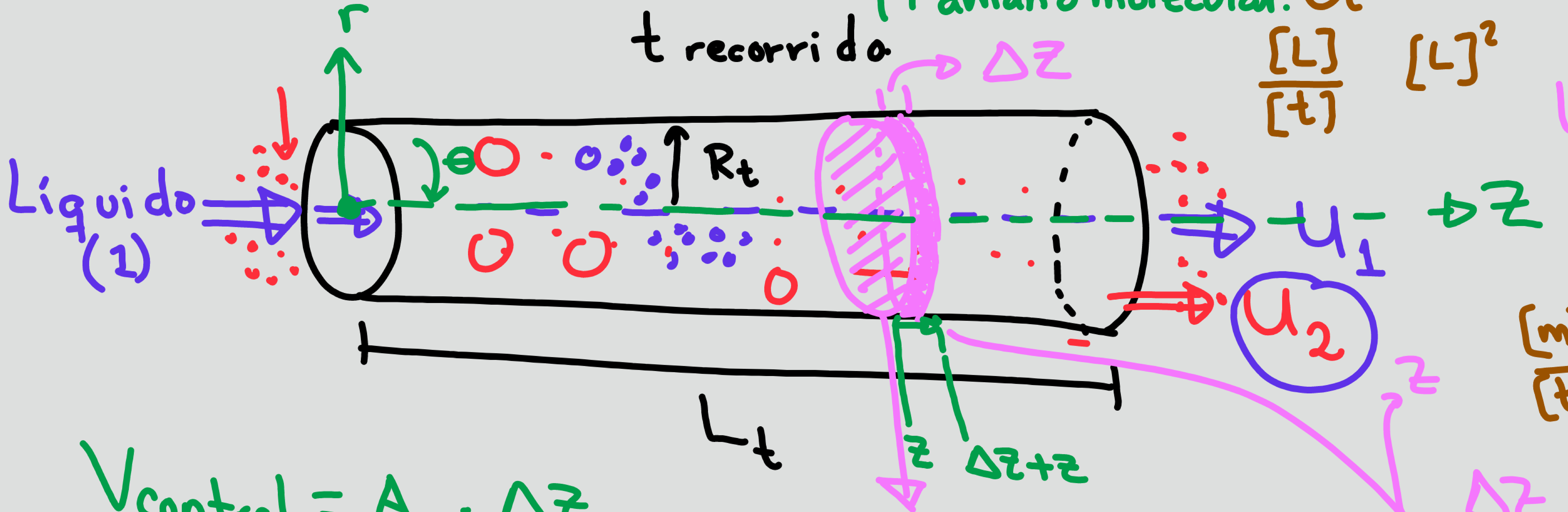
Flujo, Flux, Velocidad.

Convectivo $\begin{cases} \text{velocidad fluidos.} \\ \text{Tamaño molecular.} \end{cases}$

$$U \cdot A = Q$$

$$\frac{[L]}{[t]} \quad [L]^2 \quad [L]^3/[t]$$

$$U_1 \neq U_2$$



$$F_m \cdot \frac{1}{M_M} = F$$

$$\frac{[m]}{[t]} \quad \frac{[mol]}{[m]} = \frac{[mol]}{[t]}$$

$$V_{control} = A_s \cdot \Delta Z$$

$$V_{control} = \pi (R_t)^2 \cdot \Delta Z$$

$$A_s = \pi (R_t)^2$$

$$Q \cdot \rho = F_m$$

$$\frac{[\cancel{L}]^3}{[t]} \cdot \frac{[m]}{[\cancel{L}]^3} \quad \frac{[m]}{[t]}$$

$$\frac{\cancel{L}}{t} \cdot \frac{\cancel{m}}{[L]^2} \cdot \frac{mol}{\cancel{m}}$$

$$\frac{[mol]}{[t][L]^2} = J = \frac{F}{A} = U \cdot \rho \cdot \frac{1}{M_M}$$

[másico]

$$u_i = \frac{n_i}{\rho_i}$$

n_i → $\frac{[\text{masa}]}{[L]^2[t]}$ → flux másico

ρ_i → densidad del componente "i"

u_i → velocidad en términos másicos del componente "i"

$$v = \sum_{i=1}^{N.C.} (w_i u_i)$$

w_i → fracción masa de "i"

v → velocidad total del fluido en términos másicos

[molar]

$$u_i = \frac{n_i}{\rho_i} \cdot \frac{M_i}{M_i} = \frac{N_i}{C_i}$$

N_i → Flux molar

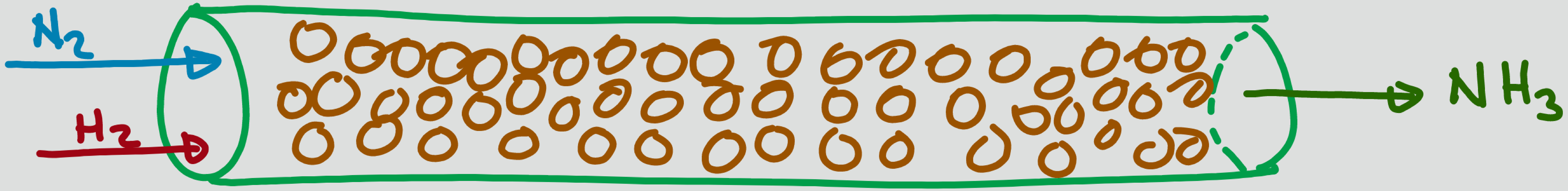
C_i → Conc. del comp. "i"

u_i → velocidad total del fluido molar

$$u = \sum_{i=1}^{N.C.} (x_i u_i)$$

$$r = -\boxed{k_c'}\, C_{N_2} \boxed{C_{H_2}^3} = -k_c''\, C_{N_2}$$

↳ pseudo constante



$\psi_i = C_i$

(lim) (exc)

$$N_2 + 3H_2 \longrightarrow 2NH_3$$

$$\cancelto{0}{\frac{\partial C_{H_2}}{\partial t}} + \nabla\cdot(\underline{v}\cdot C_{H_2}) = \nabla\cdot\cancelto{0}{\left(D\,\nabla C_{H_2}\right)} + 3\left(-k_c''\, C_{N_2}\right)$$

$$\cancelto{0}{\frac{\partial C_{N_2}}{\partial t}} + \nabla\cdot(\underline{v}\cdot C_{N_2}) = \nabla\cdot\cancelto{0}{\left(D\,\nabla C_{N_2}\right)} + \left(-k_c''\, C_{N_2}\right)$$

[másico]	[molar]
$$n_M = \sum_{i=1}^{N.C.} n_i$$	$$N_M = \sum_{i=1}^{N.C.} N_i$$
$$n_M = \sum_{i=1}^{N.C.} \frac{\overset{\text{flujo másico de "i"}}{F_{m_i}}}{A}$$	$$N_M = \sum_{i=1}^{N.C.} \frac{F_i}{A}$$
$$\underset{\text{Flux másico total.}}{n_M} = \frac{1}{A} \sum_{i=1}^{N.C.} F_{m_i}$$	$$\underset{\text{Flux molar total.}}{N_M} = \frac{1}{A} \sum_{i=1}^{N.C.} \overset{\text{Flux molar de "i"}}{F_i}$$

[másico]

$$n_M = \sum_{i=1}^{N.C.} (\rho_i\, u_i)$$

densidad mezcla.

$$= \sum_{i=1}^{N.C.} (\rho_M \cdot w_i \cdot u_i)$$

$$= \rho_M \sum_{i=1}^{N.C} (w_i\, u_i)$$

$$= \rho_M v$$

[molar]

$$N_m = \sum_{i=1}^{N.C.} (C_i\, u_i)$$

Conc. total de la mezcla.

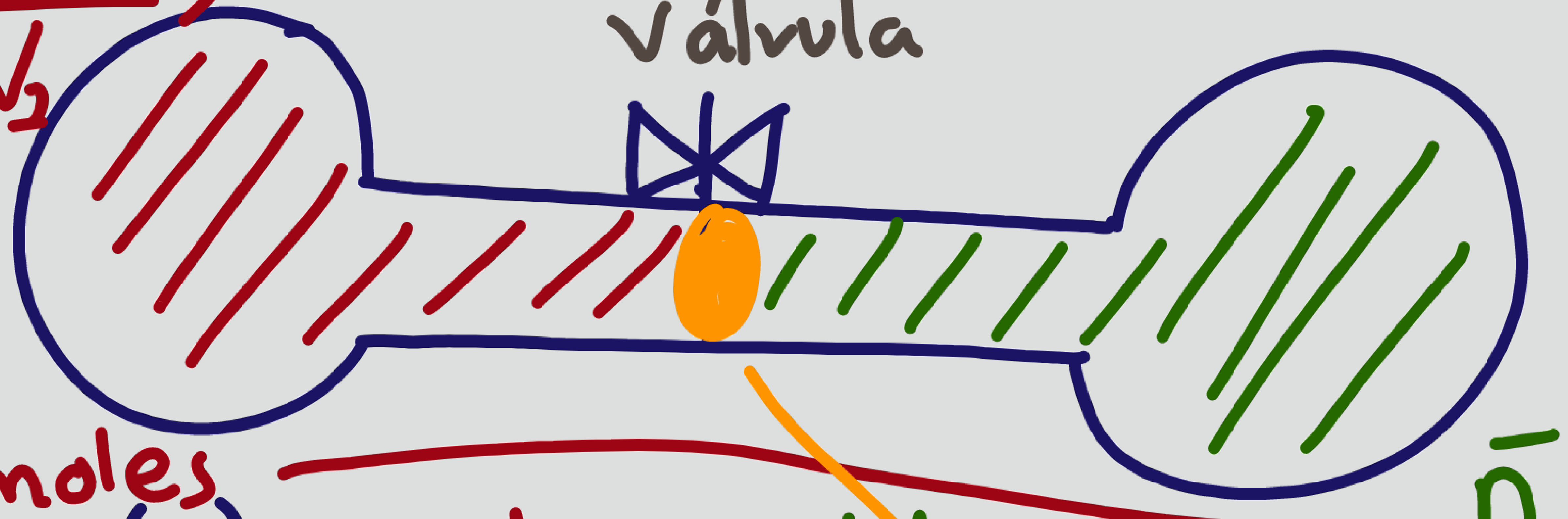
$$= \sum_{i=1}^{N.C.} (C_M x_i \cdot u_i)$$

$$= C_M \sum_{i=1}^{N.C.} (x_i \cdot u_i)$$

$$= C_M \cdot u$$

T=de Difusión

$C_1 = \frac{\tilde{n}_1}{V_1} > 0$



$\bar{n}_1$=moles

$C_2 = \frac{\bar{n}_2 \to 0}{V_1} = 0$

$M_1 \sim M_2$

$V_1 = V_2$

T

Gas1 Gas2

$P_1 \simeq P_2$

$C_1 = \frac{\bar{n}_1 \to 0}{V_2} = 0$

$t < 0$ gases separados

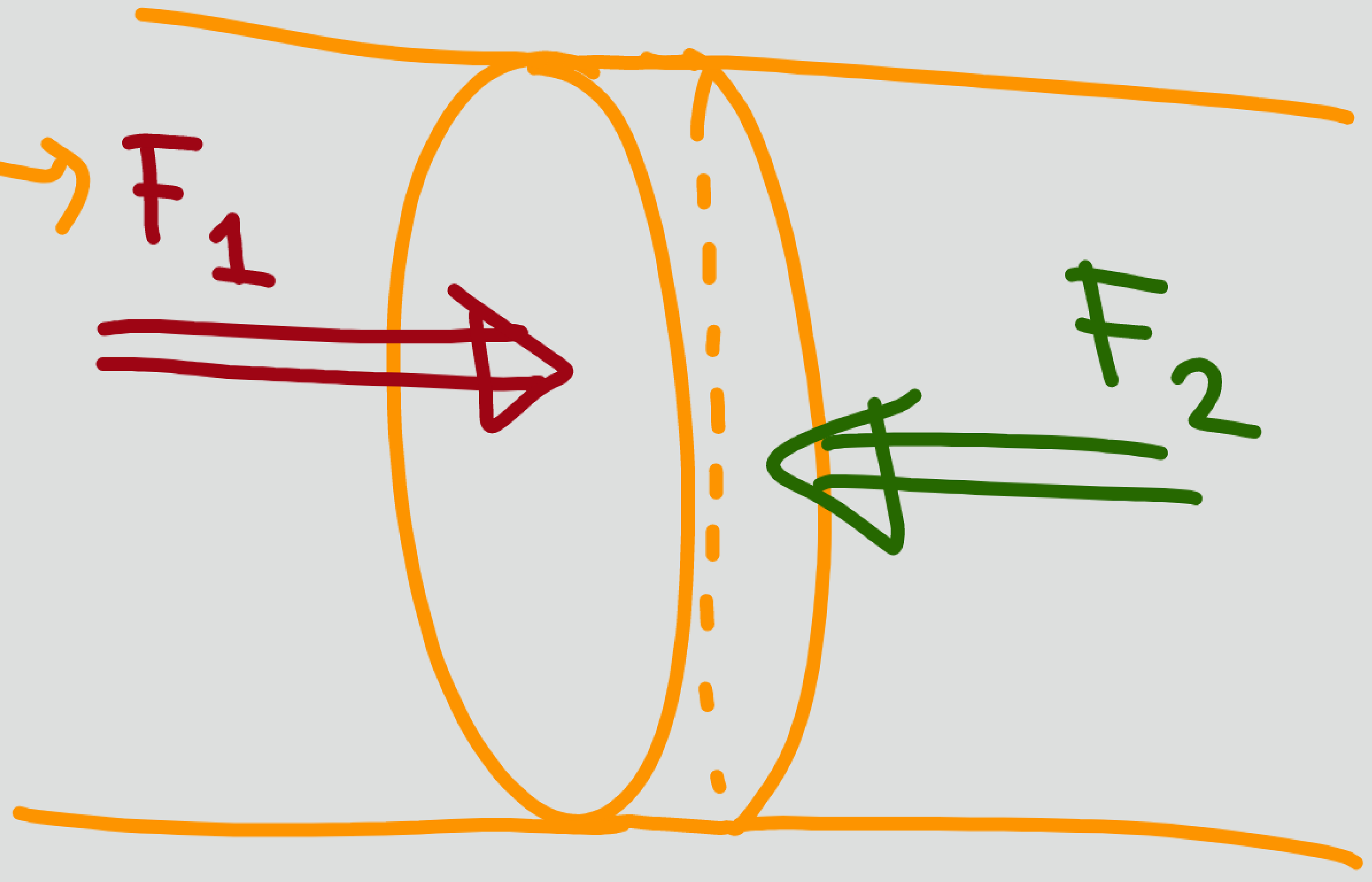
$t = 0$ abro laválvula.

$\bar{n}_2$=moles

$C_2 = \frac{\bar{n}_2}{V_2} > 0$

∇C_1

∇C_2



$$J_1 = \frac{F_1}{A}$$

Flux difusivo molar de "1"

$$J_2 = \frac{F_2}{A}$$

Flux molar difusivo de "2"

D_{ij} = coeficiente de difusión binario de "i" tratando de penetrar un campo de moléculas "j"

$$J_1 \propto \nabla C_1$$

$$J_2 \propto \nabla C_2$$

$$J_1 = -D_{1/2} \nabla C_1$$

$$J_2 = -D_{2/1} \nabla C_2$$