

Réponses.

Exercice 1.

1.a) $N^*(x \neq 0, t=0) = 0$. 1.b) $N^*(x = -\infty, t) = N^*(x = +\infty, t) = 0$. 3) $L_t = \sqrt{4Dt \ln 2}$.

Exercice 2.

1) $L^2 = D\tau$. 2) $\tau = \frac{V^{2/3}}{D} = 11,2 \text{ jours}$.

Exercice 3.

1) $j(x) = j_0 \exp(-N_B^* \sigma x)$. 2) $\frac{j(0) - j(L)}{j(0)} = 1 - \exp(-N_B^* \sigma L) = 1,7\%$.

Exercice 4.

1.a) $\bar{l} = \frac{1}{N_c^* \sigma}$. 1.b) $\bar{l} = \frac{k_B T}{P \pi (r + r_c)^2}$. 2) $\bar{l} = 1,5 \cdot 10^{-7} \text{ m}$.

Exercice 5.

1.a) $D = \frac{\bar{l} \bar{v}}{3}$. 1.b) $D = \frac{k_B^{3/2} T^{3/2}}{P \pi (3 \text{ m})^{1/2} (r + r_c)^2}$. 2) $D = 2,5 \cdot 10^{-5} \text{ m}^2 \cdot \text{s}^{-1}$.

Exercice 6.

1) $\bar{\tau} = \frac{1}{N_c^* \sigma v}$; $\bar{\tau} = \frac{1}{\sqrt{2} N_c^* \sigma u}$. 2) $\bar{l} = \frac{1}{\sqrt{2} N_c^* \sigma}$.

Exercice 7.

1) $\rho(z) = \rho_0 \exp(-\frac{mgz}{k_B T})$. 2) $j_z(z) = + \frac{Dg}{k_B T} \rho_0 \exp(-\frac{mgz}{k_B T})$ et $u = \frac{Dgm}{k_B T} > 0$. 3) *moteur*: poids des molécules; $\alpha = \frac{k_B T}{D}$

A.N.: $u = \frac{DgM}{RT} = 2,2 \text{ nm} \cdot \text{s}^{-1}$ et $\alpha = 2,1 \cdot 10^{-16} \text{ N} \cdot \text{m}^{-1} \cdot \text{s}$.