解答例
Example Answers

令和 8 年度 (2026 年度)　大学院工学府修士課程外国人留学生特別選抜試験（化学工学専攻）
International Master's Programs of Chemical Engineering in the Graduate School of Engineering, Kyushu University (Academic Year from April, 2026)

科　目/Subject:　【化学工学Ⅱ】物質移動 / Chemical Engineering II: Mass transfer　(1 枚 /1 sheet)

1.

(1.1) $\frac{\partial C_A}{\partial t} = D\frac{\partial^2 C_A}{\partial z^2} - kC_A$

(1.2) kL^2/D (このべき乗でも可 / a power of this number is also acceptable)

(1.3) $kL^2/D \ll 1$ のとき, 拡散に比べて反応は無視できるほど遅いので，物質 A は拡散により液に吸収される．$kL^2/D \gg 1$ のとき, 拡散速度に比べて反応速度は著しく速いので，界面近傍で物質 A は消滅する．
When $kL^2/D \ll 1$, the reaction rate is negligibly small compared to the diffusion rate, and thus the substance A is absorbed into the liquid primarily by diffusion. When $kL^2/D \gg 1$, the reaction is significantly faster than the diffusion, causing the substance A to disappear near the interface.

2.

(2.1) $Sh = \frac{Lk}{D}$ であるが U_∞ の増加により拡散物質移動に対する対流物質移動の寄与が増加して k が増加するので Sh は増加する.
or
所与の相関式により，$Sh \propto Re^{1/2}Sc^{1/3} \propto U_\infty^{1/2}$ のように Sh は増加する.
The answer could be (i) An increase in U_∞ enhances the contribution of convective mass transfer relative to diffusive mass transfer, thereby increasing k and consequently $Sh = Lk/D$, or (ii) Based on the given correlation, $Sh \propto Re^{1/2}Sc^{1/3} \propto U_\infty^{1/2}$, indicating that Sh increases as U_∞ increases.

(2.2) 1.75×10^{-4} mol/(m^2·s)

(2.3) $\sqrt{3} \approx 1.73$ 倍