International Master's Programs of Chemical Engineering in the Graduate School of Engineering, Kyushu University (Academic Year from October, 2025)

Subject： Chemical Reaction Engineering（1 sheet）

1. (25 points)

The liquid phase reaction, $\mathrm{A} \rightarrow \mathrm{P}$ ： $r = kC_{\mathrm{A}}$, proceeds at a steady state in a constant-temperature reactor system consisting of two identical continuously stirred tank reactors (CSTRs) connected in series. The space time of each reactor is τ. Only A is fed to the first reactor inlet. The molar concentration of A of the feed stream is C_{A0}. Express the molar concentration of A in the outlet stream of the second reactor of this reactor system in terms of $C_{\mathrm{A0}}, k, and\ \tau$.

2. (25 points)

The gas-phase reaction $\mathrm{C_6H_6} + 3\mathrm{H_2} \rightleftharpoons \mathrm{C_6H_{12}}$ proceeds steadily at a constant pressure in a flow reactor. Only benzene $(\mathrm{C_6H_6})$ and hydrogen $(\mathrm{H_2})$ are fed to the reactor inlet. The conversion of benzene is 94%, and its mole fraction at the reactor outlet is 2%. Calculate the mole fraction of benzene at the inlet of the reactor.