

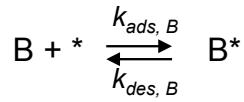
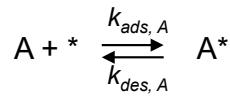
ChE-403 Problem Set 2.2

Week 6

Problem 1

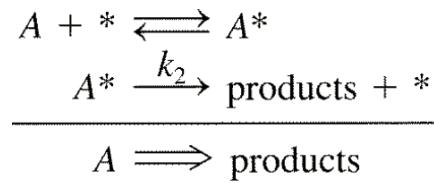
Can you solve the Langmuir isotherm (ϑ_A and ϑ_B) problem when 2 molecules are adsorbing on the surface simultaneously?

This occurs when these two reactions all happen at the same time:



Problem 2

For the mechanism below:



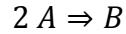
We had assumed that the first reversible reaction was quasi-equilibrated and that the second was the RDS to calculate the following rate:

$$r = k_2[A^*] = k_2[*]_0 \frac{K_{ads}[A]}{1 + K_{ads}[A]}$$

Can you derive this using the steady-state approximation (SSA)?

Problem 3

Reactant A dimerizes in the presence of Cr/SiO₂. The stoichiometric reaction is the following:



Experimentally, we observe that at a high concentration of A $\frac{d[A]}{dt} \approx -cst1 [A]$ whereas at low concentration of A $\frac{d[A]}{dt} \approx -cst2 [A]^2$.

Can you derive/propose a mechanism and a rate equation that would explain this behavior knowing that adsorbed A (i.e. A*) prefers to react directly with gaseous A instead of another adsorbed A?