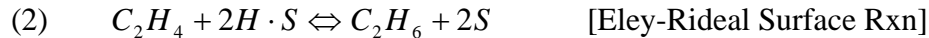


1. Hydrogenation of Ethylene over Palladium Metal

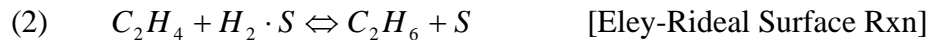
Assuming that hydrogen adsorbs dissociatively onto Palladium surface, and that ethylene reacts in the gas-phase with surface hydrogen, the following two-step Eley-Rideal mechanism is proposed:



- Derive the expression for the reaction rate, assuming that adsorption of hydrogen is the rate-limiting step.
- Derive the expression for the reaction rate, assuming that surface reaction is the rate-limiting step.
- Derive the expression for the reaction rate, assuming **no** rate limiting step.

2. Hydrogenation of Ethylene over Platinum Metal

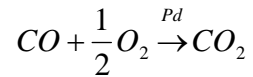
For the case of platinum metal, hydrogen may not dissociatively adsorb, and the following two-step Eley-Rideal mechanism can instead be proposed:



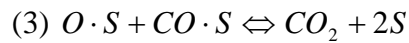
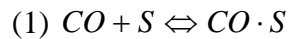
- Derive the expression for the reaction rate, assuming that adsorption of hydrogen is the rate-limiting step.
- Derive the expression for the reaction rate, assuming that surface reaction is the rate-limiting step.
- Derive the expression for the reaction rate, assuming **no** rate limiting step.

3. Langmuir-Hinshelwood Combustion Kinetics

Carbon monoxide is a common combustion by-product that is highly toxic (asphyxiant) and flammable. Palladium is highly active for combustion, and is often used in industry (e.g., automotive catalytic converters) to catalyze the following overall reaction:



The following Langmuir-Hinshelwood kinetics are proposed for this reaction:



- Derive the expression for the reaction rate, assuming that adsorption of carbon monoxide is the rate-limiting step.
- Derive the expression for the reaction rate, assuming that adsorption of oxygen is the rate-limiting step.
- Derive the expression for the reaction rate, assuming that surface reaction is the rate-limiting step.

4. Honors Supplement

Transition metals make for popular catalysts, and are employed for a wide variety of industrial applications. Each of you is assigned a specific transition metal (see below). Please prepare a 1-page summary of the uses for that metal (and/or its oxides) in industrial catalysis. The Kirk-Othmer Encyclopedia of Chemical Technology may prove useful.

<i>Student</i>	<i>Metal</i>
Cagnetta, Matthew John	Ag
Chen, Alison Tzy-Yn	Ni
Cobby, Michael Andrew	Cu
Cooper, Alexandra	Au
Cranford, Jeffrey P.	Pd
Crowley, Matthew Robert	Pt
Endicott, Christine Elizabeth	Ru
Goodell, Andrew John	Rh
Kellogg, Alexander Mclain	Ti
Martin, Jacob Thomas	Fe
Reitz, Eliot Thomas	Co
Ryan, Andrea Nicole	Re
White, Jason R.	W