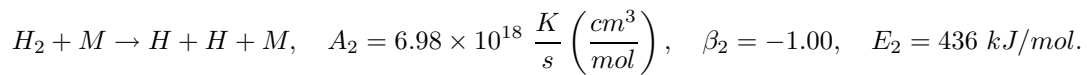
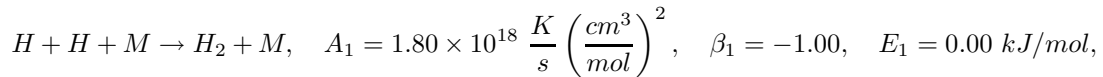


ME 456
Examination 1
Prof. J. M. Powers
19 February 1999

1. At $t = 0$ s, a stoichiometric mixture of H_2 and O_2 exists in a fixed volume of 10000 cm^3 at $P = 1 \text{ MPa}$, $T = 2000 \text{ K}$. The universal gas constant is $\mathfrak{R} = 8.31 \times 10^7 \text{ erg/mol/K}$.
 - (a) Calculate the total mass of gas in the volume.
 - (b) Determine the equilibrium concentrations which exist after an isothermal, isochoric combustion process.
 - (c) Using the eight species, thirty-seven reaction mechanism, developed in homework, generate a plot of $[H_2O](t)$. Make sure your plot elucidates all relevant time scales. Compare your the long time value of $[H_2O]$ with that obtained from the equilibrium calculation.
2. At $t = 0$, H_2 only is present in a fixed 1000 cm^3 , isothermal $T = 5000 \text{ K}$ volume. The initial pressure is 10^6 dyne/cm^2 . Model the system as an ideal gas which obeys the law of mass action with Arrhenius kinetics, where the reaction is given as



- (a) Calculate the equilibrium concentrations.
- (b) Using a linearization technique, find the time scale of reaction near the equilibrium point.
- (c) Why is atomic hydrogen preferred over diatomic hydrogen at this temperature?