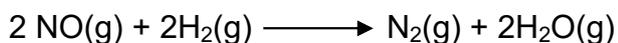


Exercise n°1

Experiments were conducted to study the rate of the reaction represented by this equation.

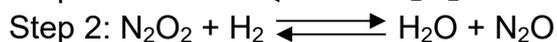


Initial concentrations and rates of reaction are given here.

Experiment	Initial Concentration [NO] (mol L ⁻¹)	Initial Concentration, [H ₂] (mol L ⁻¹)	Initial Rate of Formation of N ₂ (mol L ⁻¹ min ⁻¹)
1	0.006	0.001	1.8×10^{-4}
2	0.006	0.002	3.6×10^{-4}
3	0.001	0.006	0.30×10^{-4}
4	0.002	0.006	1.2×10^{-4}

Consider the following questions:

- Determine the order for each of the reactants, NO and H₂, from the data given and show your reasoning.
- Write the overall rate law for the reaction.
- Calculate the value of the rate constant, k, for the reaction. Include units.
- For experiment 2, calculate the concentration of H₂ remaining when exactly one-half of the original amount of NO had been consumed.
- The following sequence of elementary steps is a proposed mechanism for the reaction.



Based on the data presented, which of these is the rate determining step (all the steps are presented as equilibria: note that the rate determining step must be drawn as an irreversible reaction)? Show that the mechanism is consistent with the observed rate law for the reaction.

Exercise n°2

Hydrogen iodide, HI, decomposes in the gas phase to produce H₂ and I₂. The value of the rate constant, *k*, for the reaction was measured at several different temperatures and the data are shown here:

Temperature (K)	<i>k</i> (M ⁻¹ s ⁻¹)
555	6.23 × 10 ⁻⁷
575	2.42 × 10 ⁻⁶
645	1.44 × 10 ⁻⁴
700	2.01 × 10 ⁻³

What is the value of the activation energy (in kJ mol⁻¹) and of the pre-exponential factor (in M⁻¹ s⁻¹) for this reaction? (Note: use a regression line method).