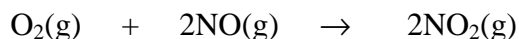


**Work through the ChemCAL modules “Reaction Rates and Chemical Kinetics 1”
and “Reaction Rates and Chemical Kinetics 2”**

1. One of the key reactions in the formation of acid rain and in the industrial production of nitric acid is the reaction of nitric oxide with oxygen:



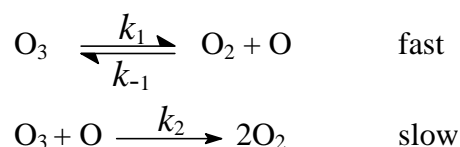
The following data were obtained at constant temperature.

experiment number	initial concentrations (mol L ⁻¹)		initial reaction rate (mol L ⁻¹ s ⁻¹)
	[O ₂]	[NO]	
1	1.10 × 10 ⁻²	1.30 × 10 ⁻²	3.20 × 10 ⁻³
2	2.20 × 10 ⁻²	1.30 × 10 ⁻²	6.40 × 10 ⁻³
3	1.10 × 10 ⁻²	2.60 × 10 ⁻²	12.8 × 10 ⁻³
4	3.30 × 10 ⁻²	1.30 × 10 ⁻²	9.60 × 10 ⁻³

- (a) Deduce the rate equation for this reaction and find the value of the rate constant.
- (b) If the initial rate of consumption of oxygen was 1 × 10⁻³ mol L⁻¹ s⁻¹, what is the initial rate of formation of NO₂(g)?
2. The half life at 20 °C for the first order decomposition of N₂O₅(g) is 6.00 × 10⁴ s. Calculate the rate constant at this temperature.
3. Using the data below for the hydrolysis of an antibiotic in a patient, calculate the activation energy, *E_a*, and the "A" factor for the hydrolysis of an antibiotic.

Temperature / °C	Rate constant, <i>k</i> / L mol ⁻¹ s ⁻¹
37	0.208
40	0.248

4. For the reaction 2O₃ → 3O₂ a suggested mechanism is:



- (a) On the basis of this mechanism, write the rate equation for this reaction
- (b) What is the molecularity of the rate determining step?