

AP Chemistry Daily Videos

5.2 Introduction to Rate Law

Video #1

1. What is a rate law and how is it determined?
2. The exponent in a rate law is also known as the _____ of the reaction. The sum of the powers of the reactant concentrations in the rate law is the _____ of the reaction.
3. Identify the rate law, order of reactions, rate constant, and overall rate order from this generic equation. Which variable changes with temperature?



4. Pause the video at 3:11 and attempt the problem, then evaluate how you did and identify any errors.

$2 \text{NO}(g) + \text{O}_2(g) \rightarrow 2 \text{NO}_2(g)$

A rate study of the reaction yielded the data recorded in the table below.

Experiment	Initial Concentration of NO (mol L ⁻¹)	Initial Concentration of O ₂ (mol L ⁻¹)	Initial Rate of Formation of NO ₂ (mol L ⁻¹ s ⁻¹)
1	0.0200	0.0300	8.52×10^{-2}
2	0.0200	0.0900	2.56×10^{-1}
3	0.0600	0.0300	7.67×10^{-1}

(d) Determine the order of the reaction with respect to each of the following reactants.

- (i) NO
- (ii) O₂

(e) Write the expression for the rate law for the reaction as determined from the experimental data.

(f) Determine the value of the rate constant for the reaction, clearly indicating the units.

5. Pause the video at 6:27 and attempt the problem, then evaluate how you did and identify any errors.

Experiment	Initial [NO] (mol L ⁻¹)	Initial [O ₂] (mol L ⁻¹)	Initial Rate of Formation of NO ₂ (mol L ⁻¹ s ⁻¹)
1	0.10	0.10	2.5×10^{-4}
2	0.20	0.10	5.0×10^{-4}
3	0.20	0.40	8.0×10^{-3}

The initial-rate data in the table above were obtained for the reaction represented below. What is the experimental rate law for the reaction?

$2 \text{NO}(g) + \text{O}_2(g) \rightarrow 2 \text{NO}_2(g)$

A Rate = $k[\text{NO}][\text{O}_2]$
 B Rate = $k[\text{NO}][\text{O}_2]^2$
 C Rate = $k[\text{NO}]^2[\text{O}_2]$
 D Rate = $k[\text{NO}]^2[\text{O}_2]^2$
 E Rate = $k[\text{NO}]/[\text{O}_2]$