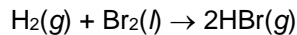


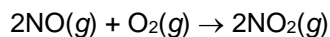
AP Worksheet 5a (Reaction Orders & Rate Constants)

1. The following data was collected for the reaction below.



Experiment	[H ₂]	[Br ₂]	Rate in M s ⁻¹
1	0.25 M	0.0012 M	1.20 × 10 ⁻⁴
2	0.50 M	0.0012 M	4.80 × 10 ⁻⁴
3	0.50 M	0.0048 M	4.80 × 10 ⁻⁴

- a. Write the rate equation and calculate the value of the rate constant, *k*. (Include units).
- b. What is the overall order of this reaction?
2. Nitrogen monoxide can be oxidized to nitrogen dioxide in the reaction below.



The following data was collected in a kinetics experiment.

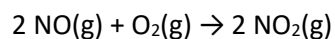
Experiment	Initial [O ₂] (M)	Initial [NO] (M)	Rate (M s ⁻¹)
1	0.20	0.10	1.0
2	0.80	0.10	4.0
3	0.80	0.30	36

- a. Write the rate law.
- b. Calculate the rate constant and give its units.
3. In each of the following cases where the rate law and units used are described, suggest units for the rate constant, *k*.
- a. A third order reaction overall, where the rate is measured in mol L⁻¹ s⁻¹ and the concentration of all reactants are measured in units of mol L⁻¹.
- b. A rate law that has the concentration of two reactants measured in M, each first order and a rate that is measured in mol L⁻¹ min⁻¹.
- c. A reaction where there are multiple products but only a single reactant that is found to be zero order. The rate is measured in units of g s⁻¹.

4. Describe how the orders with respect to two different reactants might be determined in a simple experiment where a gas is produced as a result of mixing two solutions together. Carefully describe the measurements that should be recorded and suggest a method of measuring the rate of the reaction.

AP style question

Nitrogen monoxide gas can react with oxygen to produce nitrogen dioxide gas, as represented below.



Experiment number	Initial concentration of NO (M)	Initial concentration of O ₂ (M)	Observed initial rate (M/s)
1	0.0100	0.0150	4.26×10^{-2}
2	0.0100	0.0450	1.28×10^{-1}
3	0.0300	0.0150	3.84×10^{-1}

- a. Determine the order of the reaction with respect to each of the following reactants. Give details of your reasoning, clearly explaining or showing how you arrived at your answers.
- NO
 - O₂
- b. Write the expression for the rate law for the reaction as determined from the experimental data.
- c. Determine the value of the rate constant for the reaction, clearly indicating the units.