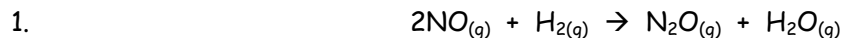


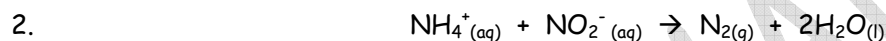
## Rates of Reactions Practice Questions

### Rate Laws:



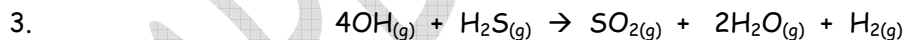
Initial Concentration (mol/L)		Initial Rate (mol/L.s)
$\text{NO}_{(g)}$	$\text{H}_{2(g)}$	
0.075	0.400	0.005
0.150	0.200	0.010
0.150	0.400	0.020

- Find the rate law.
- Determine the value of the rate constant.



Initial Concentration (mol/L)		Initial Rate (mol/L.s)
$\text{NO}_2^-_{(aq)}$	$\text{NH}_4^+_{(aq)}$	
0.010	0.020	$5.4 \times 10^{-7}$
0.020	0.020	$10.8 \times 10^{-7}$
0.040	0.020	$21.6 \times 10^{-7}$
0.020	0.0202	$10.8 \times 10^{-7}$
0.020	0.0404	$21.6 \times 10^{-7}$
0.020	0.0606	$32.4 \times 10^{-7}$

- Write the rate law.
- Calculate the rate constant.
- Calculate the initial rate if  $[\text{NO}_2^-_{(aq)}] = 0.10 \text{ M}$  and  $[\text{NH}_4^+_{(aq)}] = 0.10 \text{ M}$ .



Initial Concentration (mol/L)		Rate of Disappearance of $\text{H}_2\text{S}(\text{mol/L.s})$
$\text{OH}_{(g)}$	$\text{H}_2\text{S}_{(g)}$	
$1.3 \times 10^{-8}$	$2.1 \times 10^{-8}$	$1.4 \times 10^{-6}$
$3.9 \times 10^{-8}$	$2.1 \times 10^{-8}$	$4.2 \times 10^{-6}$
$3.9 \times 10^{-8}$	$4.2 \times 10^{-8}$	$8.4 \times 10^{-6}$

- Write the rate law.
- Calculate the rate constant.
- Calculate the rate of disappearance of  $\text{H}_2\text{S}$  when  $[\text{OH}_{(g)}] = 1.7 \times 10^{-8} \text{ M}$  and  $[\text{H}_2\text{S}_{(g)}] = 1.0 \times 10^{-8} \text{ M}$ . What is the rate of disappearance of  $\text{OH}$  at the same time?

4. The rate law for the reaction:  $A + B + 2C \rightarrow D + E$  is  $\text{rate} = k[A]^2[C]$ .

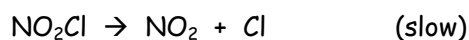
a) Complete the chart.

Experiment	[A] (mol/L)	[B] (mol/L)	[C] (mol/L)	Initial rate (mol/L.min)	K
1	1.0	4.0	2.0	8.0	
2	2.0	2.0	1.0		

b) How can the rate constant be increased?

### Mechanisms and Rate Laws:

5. The mechanism for a reaction is:



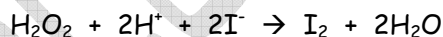
- What is the overall reaction?
- What is the reaction intermediate?
- What is the rate law?

6. If a mechanism for a reaction is:

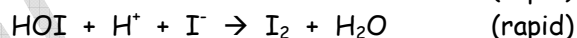
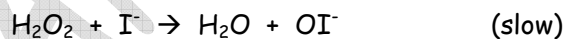


- If the first step is the rate-determining step, which step is the fast step?
- Write the rate law for the reaction.
- What is the overall reaction?

7. For the reaction of:

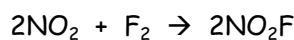


A proposed mechanism is:



For this mechanism to be consistent with the experimental data, what must the observed rate law be?

8. At low pressure, the reaction:



Follows the rate law:  $\text{Rate} = k[\text{NO}_2][\text{F}_2]$

Suggest a mechanism that is consistent with the rate law.

9. For the reaction:  $2A + B \rightarrow C$ , the rate of formation of  $C$  was measured for a number of different initial concentrations of  $A$  and  $B$ , with the following results:

Initial Concentration (mol/L)		Rate of Appearance of $C$ (mol/L.s)
$A$	$B$	
0.10	0.10	$2.0 \times 10^{-3}$
0.20	0.10	$8.0 \times 10^{-3}$
0.30	0.10	$1.8 \times 10^{-2}$
0.20	0.20	$8.0 \times 10^{-3}$
0.30	0.30	$1.8 \times 10^{-2}$

- Write the rate law.
- Calculate the rate constant.
- Suggest a two-step mechanism that is consistent with the experimental data.

10. For the reaction:  $I^- + OCl^- \rightarrow Cl^- + OI^-$ , the following data was collected:

Initial Concentration (mol/L)		Rate of Production of $Cl^-$ (mol/L.s)
$I^-$	$OCl^-$	
0.10	0.10	$1.0 \times 10^{-3}$
0.20	0.10	$2.0 \times 10^{-3}$
0.30	0.30	$9.0 \times 10^{-3}$
0.30	0.60	$1.8 \times 10^{-2}$

- Write the rate law.
- Calculate the rate constant.
- Suggest a two-step mechanism that is consistent with the experimental data.

11. The reaction:  $NO_2 + CO \rightarrow CO_2 + NO$  is known to be a one-step reaction at very high temperatures. At a much lower temperature, the following data was collected:

Initial Concentration (mol/L)		Rate of Production of $CO_2$ (mol/L.s)
$NO_2$	$CO$	
0.010	0.010	$2.1 \times 10^{-8}$
0.020	0.020	$8.4 \times 10^{-8}$
0.040	0.020	$3.36 \times 10^{-7}$
0.020	0.040	$8.4 \times 10^{-8}$

- Write the rate law.
- Calculate the rate constant.
- Suggest a two-step mechanism that is consistent with the experimental data.