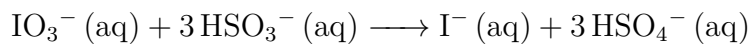
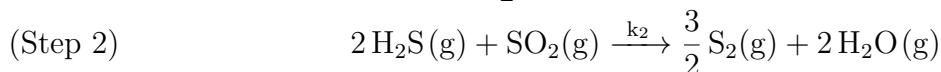
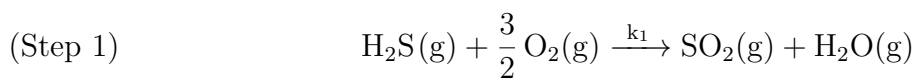


1. Is this a valid elementary step? Explain your reasoning.

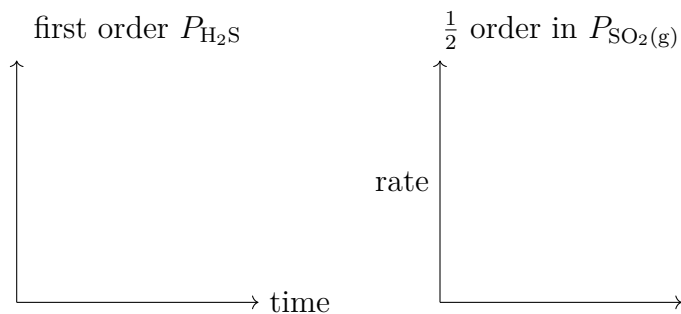


2. (**Chemical Engineering Science**, 55, 21, 2000, 5141.)

A proposed two-step mechanism for the Claus reaction is shown below.

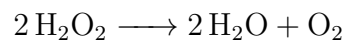


- (a) Write the overall reaction.
- (b) List all intermediates.
- (c) List all catalysts.
- (d) The study found the rate law for the second step to be first order in  $\text{H}_2\text{S}(\text{g})$  and one-half order in  $\text{SO}_2(\text{g})$ . Is step 2 an elementary step or not? Explain.
- (e) Sketch the straight line plots and provide labels for any missing axes to confirm orders.



- (f) In the study of step 2,  $\ln k_2$  vs.  $1/T$  was plotted producing a line with slope =  $-25,114 \text{ K}$ . What is the activation energy for step 2?

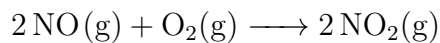
3. In General Chemistry, we study the decomposition of hydrogen peroxide catalyzed by iodine. Propose a two-step mechanism, including labeling slow/fast steps, for:



where the experimentally determined rate law is:

$$v(t) = k[\text{H}_2\text{O}_2][\text{I}^-]$$

4. Propose a two-step mechanism, including labeling slow/fast steps, for:

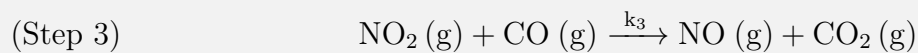
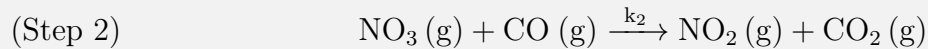


where the experimentally determined rate law is:

$$v(t) = k \frac{[\text{NO}]^2[\text{O}_2]}{[\text{NO}_2]}$$

**Homework Problem 35**

1. Consider the following mechanism.



(a) Write the overall reaction.

(b) List all catalysts.

(c) List all intermediates.

(d) Write out the rate law assuming that step 1 is slow and the others are fast.

(e) Write out the rate law assuming that step 2 is slow and the others are fast.

(f) Experimentally it is determined the overall order is 3. Between step 1 and step 2, which one could be the rate determining step?