

i (b) This mechanism starts with an equilibrium. If we assume it's fast, we can use it to find the rate law in terms of NO.

If step 2 is the rate determining step, we'd

$$\text{get rate} = k_2 [\text{N}_2\text{O}_2] [\text{H}_2]$$

Assuming fast equilibrium for step 1, we can find $[\text{N}_2\text{O}_2]$ in terms of NO:

$$\frac{k_1}{k_{-1}} = K = \frac{[\text{N}_2\text{O}_2]}{[\text{NO}]^2}$$

$$\text{So } [\text{N}_2\text{O}_2] = \frac{k_1}{k_{-1}} [\text{NO}]^2$$

Substituting this in to the rate law above,

$$\text{rate} = \frac{k_1 k_2}{k_{-1}} [\text{NO}]^2 [\text{H}_2] = k [\text{NO}]^2 [\text{H}_2]$$

This is consistent with step 2 being rate-determining.