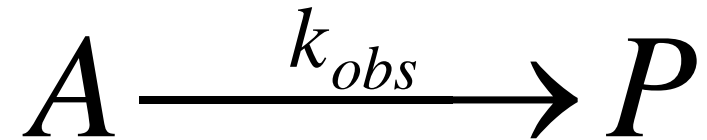


Chapter 29: Reaction Mechanisms



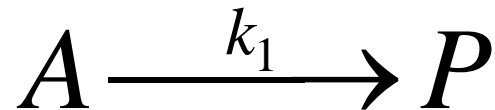
- One can never prove a reaction mechanism, although evidence may disprove a mechanism.
- Verifying proposed mechanisms requires extensive experimental verification of each proposed step!



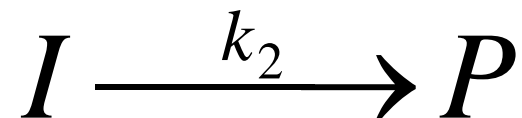
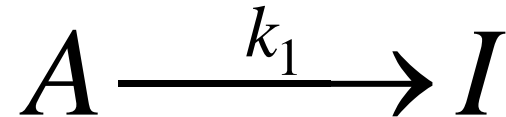


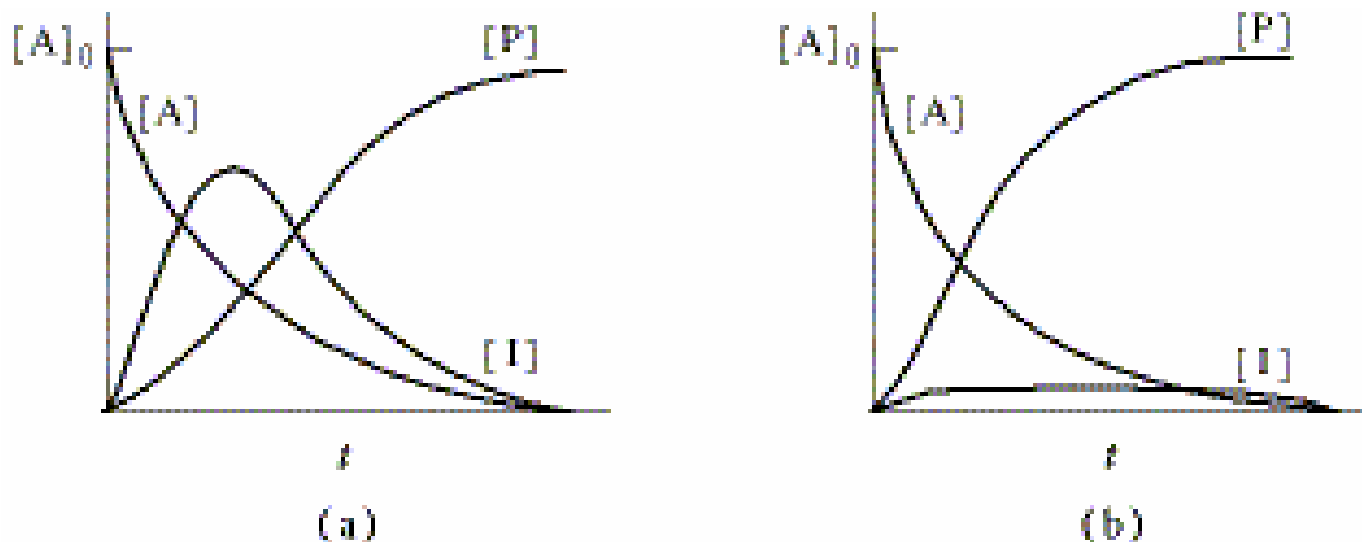
Reaction could progress in multiple ways... How can we distinguish?

Case 1: One elementary step



Case 2: Two step reaction





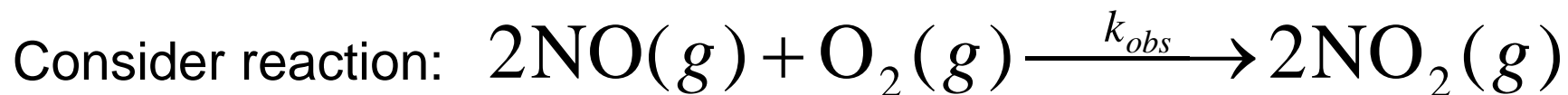
How do k_1 and k_2 relate in case a? in case b?

(a) I forms quickly but decays slowly...

(b) I builds up to a constant, nearly negligible, concentration until near end of reaction. ...



An empirically determined rate law does not imply a unique reaction mechanism!



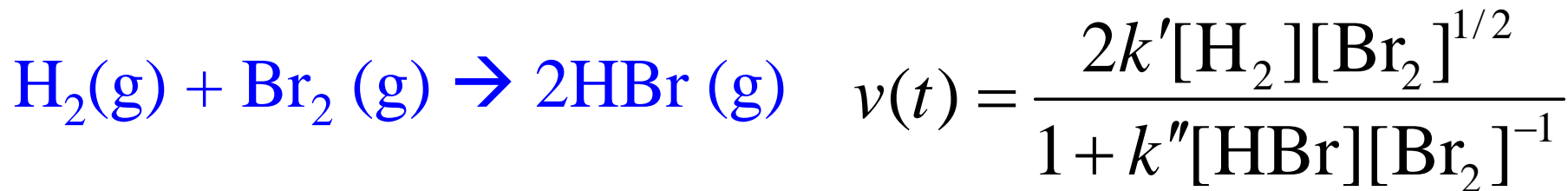
Experimentally, it was determined that the rate is given by:

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

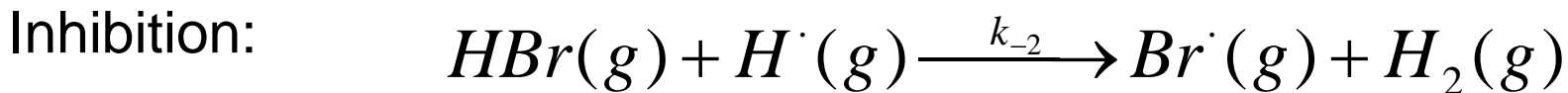
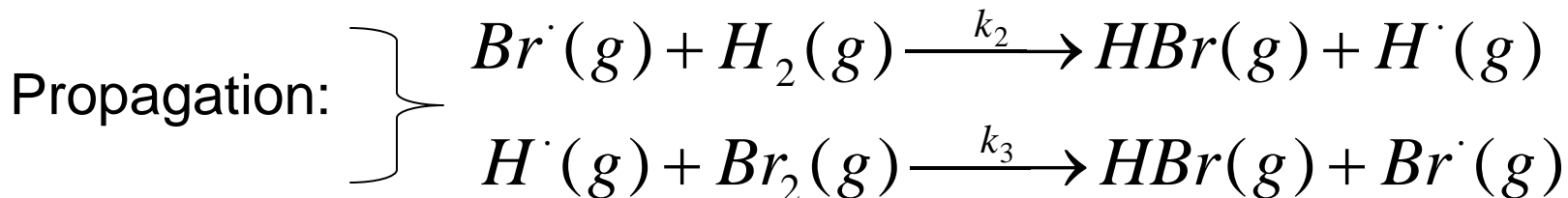
Researchers proposed two possible mechanisms. They need to determine if one of them is correct.

So how would researchers distinguish between the mechanisms?





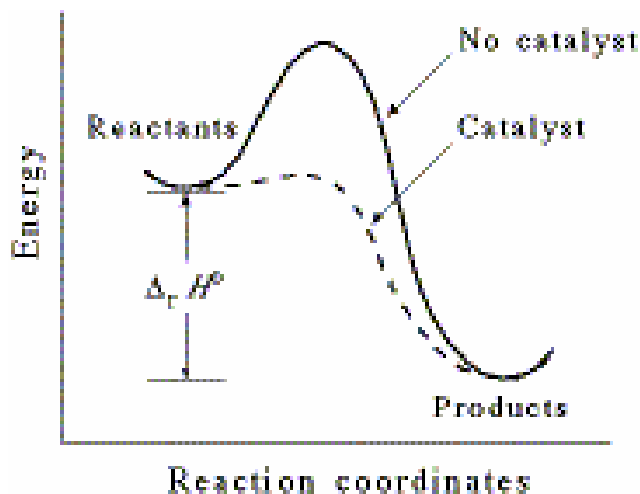
Proposed Mechanism



- Now that we've explored reaction mechanisms and rate laws, let's try to derive the rate laws from the solution kinetics lab...



Catalyst: A substance that participates in the chemical reaction but is not consumed. Provides a new mechanism for reaction and can cause reaction to occur faster.



In an experiment involving a catalyst, there are two competing reactions:



If both reactions are elementary, overall rate is given by:

$$-\frac{d[A]}{dt} = k[A] + k_{cat}[A][catalyst]$$

