MEGA LECTURE

Topic 11 Exercise 3 – Reaction Mechanisms and Rate Determining Steps

1. Explain what is meant by the term "rate-determining step"

2. Explain why the orders of reaction in a rate equation to not always correspond to the coefficients in a chemical equation.

3. Consider the reaction: $BrO_3^- + 6H^+ + 6Br^- \rightarrow 3Br_2 + 3H_2O$

   The rate equation for this reaction is: rate = $k[BrO_3^-][Br^-][H^+]^2$

   Give two reasons why you can tell that this reaction involves more than one step.

4. Consider the following reaction: $NO_2 + CO \rightarrow NO + CO_2$
   The rate equation for the reaction is: rate = $k[NO_2]^2$

   Suggest a likely rate determining step for the reaction.

   Hence suggest a two-step mechanism for this reaction.

5. The reaction X + Y → W proceeds according to the following mechanism:
   Step 1: 2X → Z (slow)
   Step 2: Z + Y → W + X (fast)

   Show that these two steps are consistent with the overall equation and suggest a rate equation for this reaction.

6. The reaction $2NO + O_2 \rightarrow 2NO_2$ has the following rate equation: rate = $k[NO]^2$.
   Suggest a two-step mechanism for the reaction