CHEM 132   Dr. Kutai   Name: _____
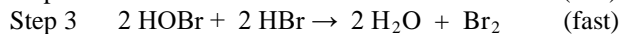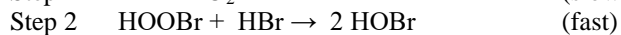Ch 12 Kinetics #4
Collision Theory, Catalysis, Mechanisms

1. Describe conditions required for a reaction to take place.

2. Draw an energy profile with for an endothermic reaction energy as a function of reaction progress. Label axes, reactants, products, activated complex (AKA transition state), and Ea (uncat). Use a broken line to indicate the profile for the catalyzed reaction. Indicate Ea (cat). Complete the inequality with < or >: Ea (cat)   Ea (uncat)

3. For the reaction $2 D + E + C \rightarrow W + Z$, the rate law is given by rate = k[D][C]. Indicate the effect on reaction rate (increase, decrease, no change) if the following change is made *and explain*:

    a. Temperature is decreased

    b. Concentration of E is increased

    c. A catalyst is added

4. The following mechanism has been proposed for the oxidation of HBr

Step 1	$HBr + O_2 \rightarrow HOOBr$	(slow)
Step 2	$HOOBr + HBr \rightarrow 2 HOBr$	(fast)
Step 3	$2 HOBr + 2 HBr \rightarrow 2 H_2O + Br_2$	(fast)

a. Write the overall balanced equation.

b. Identify any catalyst and/or intermediates.

c. What is the molecularity of the first step.

d. Which is the rate-determining step.

e. What is the rate law for step 3.

5. Why are termolecular elementary steps less likely than bimolecular steps?

6. The gas-phase decomposition of nitrous oxide is believed to occur via two elementary steps.

| Step 1 | $N_2O \rightarrow N_2 + O$ |
| Step 2 | $N_2O + O \rightarrow N_2 + O_2$ |
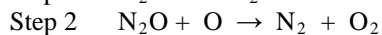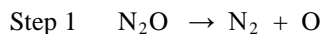
a. Write the overall balanced equation.

b. Experimentally, the rate law was found to be rate $= k[N_2O]$. This means the rate-determining step is
    _____.
    Expain.