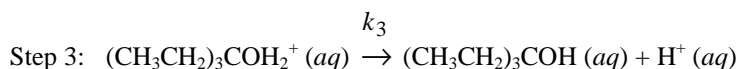
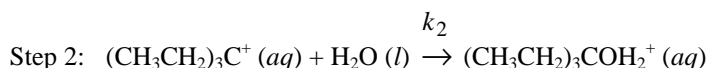
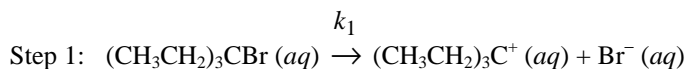


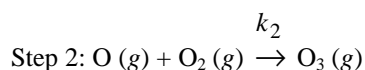
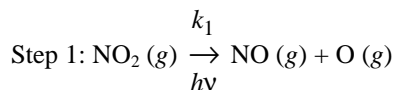
Chemical Kinetics: Reaction Mechanisms (covering Topic 4a)

Chemistry 126

- Provide the molecularity and rate law for each of the following elementary reaction steps.
 - $2\text{NO}_2(g) \rightarrow \text{NO}(g) + \text{NO}_3(g)$
 - $\text{ICl}(g) + \text{H}_2(g) \rightarrow \text{HI}(g) + \text{HCl}(g)$
 - $\text{Cl}_2(g) \rightarrow 2\text{Cl}(g)$
- The reaction between 3-bromo-3-ethylpentane, $(\text{CH}_3\text{CH}_2)_3\text{CBr}$, and water can be used to produce the alcohol 3-ethyl-3-pentanol, $(\text{CH}_3\text{CH}_2)_3\text{COH}$ and hydrobromic acid (HBr). Consider the proposed mechanism below.



- What is the overall equation for this reaction?
 - Identify the intermediates.
 - Write the individual rate laws for each of the three elementary reaction steps. Argue that, for the mechanism as written,
$$(\text{Reaction Rate})_1 = (\text{Reaction Rate})_2 = (\text{Reaction Rate})_3$$
 - What is the overall rate law for this reaction?
- Ozone (O_3) is a major component of photochemical smog formed by the reaction of nitric oxide (NO), which is from car exhaust, and atmospheric oxygen. Consider the following mechanism.



- What is the overall equation for this reaction?
- Identify the intermediate in this mechanism.
- Write the rate law for each elementary reaction step.
- Provide the overall rate law for this reaction assuming a steady state.
- Draw a graph depicting how the concentrations of NO_2 , NO , O , O_2 and O_3 change with time. (No need to be quantitative here, just relatively correct. Hint: Consider the steady state.)

CHALLENGE PROBLEM:* Based on the mechanism given in Problem 3 and given $k_1 = 0.002 \text{ s}^{-1}$ and $k_2 = 30,000 \text{ L/mol}\cdot\text{s}$, consider the following problem: At 11:00 AM on a hot summer morning (85 °F) in Los Angeles after much commuter travel, $[\text{NO}_2] = 10 \text{ ppm}$, and a state of smog emergency is called. Under these conditions, what must be the concentration of oxygen atoms, $\text{O}(g)$, in the air in ppm, assuming a steady state? (Consider the O_2 pressure to be approximately 0.23 atm.) If all the cars were instantly turned off (as in the movie *The Day the Earth Stood Still*), at what time could the state of emergency be called off, if that required $[\text{NO}_2]$ to be less than 0.5 ppm?

***One bonus point; all or none; must be done ON YOUR OWN (or with a group)—not at the problem session with the teaching assistant!—must be turned in on a separate sheet of paper directly to your professor.**