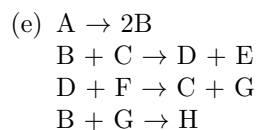
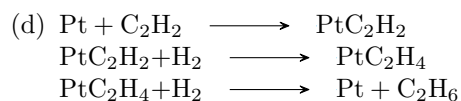
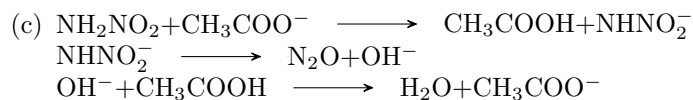
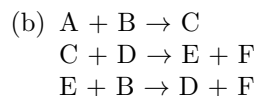
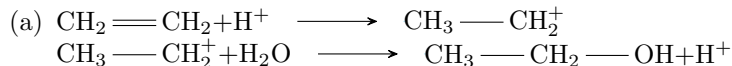


56. In the following reaction mechanisms identify (i) the catalyst (ii) the reaction intermediate(s) (iii) the overall reaction



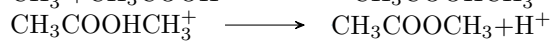
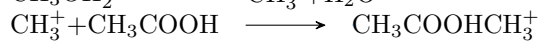
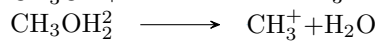
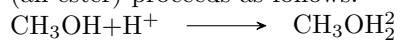
57. "All catalyzed reaction mechanisms have more than one step." Why must this statement be true?

58. Suppose a catalyzed reaction is occurring in a reaction container. If the catalyst is removed, will the reaction stop completely? Explain your answer.

59. Can a catalyst cause an exothermic reaction to become endothermic, or vice versa? Explain.

60. Consider the following reaction mechanism: $X+Y \rightarrow Z$ (very fast)
 $Z + Y \rightarrow P$ (very fast)
 $P + Y \rightarrow Q$ (slow)
 Suppose there was a catalyst that worked on step 1, and another catalyst that worked on step 3. Which catalyst would be ineffective in increasing the rate of the overall reaction?
61. If you have a slow reaction and add a substance that provides an alternate reaction mechanism having a higher activation energy, what will happen to the reaction rate? Why does this occur?
62. Chlorine atoms are present in the upper atmosphere as a result of emissions from volcanoes and man-made pollutants. The reaction between chlorine atoms and ozone is thought to proceed by a 2-step mechanism:
- $$\begin{array}{lcl} \text{O}_3 + \text{Cl} & \longrightarrow & \text{ClO} + \text{O}_2 \\ \text{O} + \text{ClO} & \longrightarrow & \text{O}_2 + \text{Cl} \end{array}$$
- (a) What is the overall reaction?
- (b) Identify any reaction intermediates or catalysts present.
- (c) Suggest a reason why chlorine atoms in the upper atmosphere are a threat to the environment.
- (d) Why does the presence of chlorine atoms in the upper atmosphere allow more UV light to reach the earth's surface?
Hint : look at reaction (3) on the previous page.

63. The catalyzed reaction between CH_3OH (an alcohol) and CH_3COOH (an organic acid) to make $\text{CH}_3\text{COOCH}_3$ (an ester) proceeds as follows.



(a) What is the overall reaction?

(b) Why is the reaction said to be "acid catalyzed"?

(c) If the H^+ used in the first step was radioactive, Would the $\text{CH}_3\text{COOCH}_3$ produced in the 4th step contain a radioactive hydrogen atom? Why?