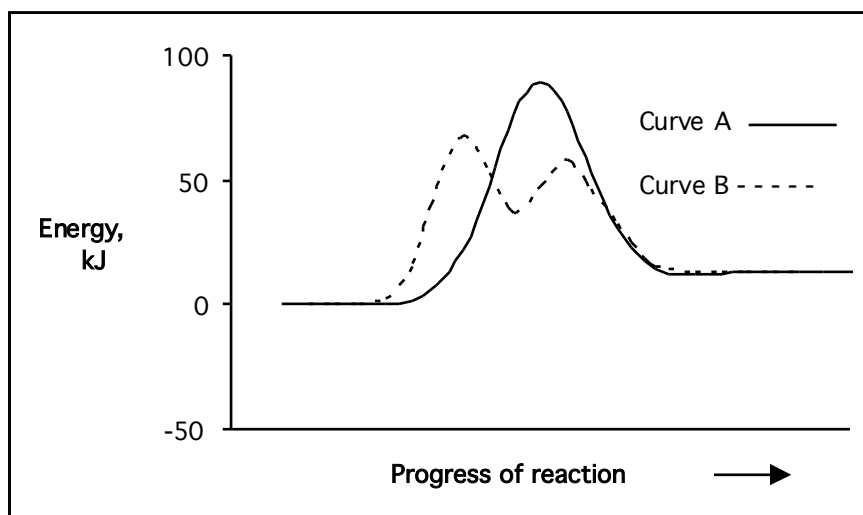CHEM 1F92 Assignment 16 Kinetics Part 2, Version # 34

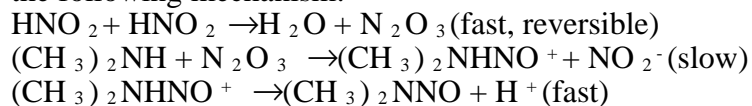1. The progress of a reaction from reactants to products is shown in the following diagram:

(a) Which curve (A or B) represents the catalyzed reaction?
(b) How many elementary steps are in the catalyzed reaction?
(c) How many elementary steps are in the uncatalyzed reaction?
(d) What is the activation energy Ea of the uncatalyzed reaction? (to the nearest kJ)
(e) What is the activation energy of the catalyzed reaction? (to the nearest kJ)
(f) What is Δ H for the reaction? (to the nearest kJ)
(g) What is the activation energy of the reverse uncatalyzed reaction? (to the nearest kJ)

2. A reaction proceeds with Δ H = -80 kJ/mol. The energy of activation of the uncatalyzed reaction is 80 kJ/mol, whereas it is 55 kJ/mol for the catalyzed reaction. How many times faster is the catalyzed reaction than the uncatalyzed reaction at 25°C? Express your answer in scientific notation to two significant figures.

3. A reaction has a rate constant of 3.41 x 10 $^{-8}$ L mol $^{-1}$ min $^{-1}$ at 25 °C, and a rate constant of 6.65 x 10 $^{-7}$ L mol $^{-1}$ min $^{-1}$ at 45 °C. What is the activation energy for the reaction? Give your answer to 3 significant figures.

4. At 29 °C, a reaction produces product at the rate of 0.710 mol L $^{-1}$ h $^{-1}$. If the activation energy is 5 8 kJ/mol, what will the reaction rate be at 47 °C?

5. Carcinogenic nitrosamines are produed from amines such as dimethylamine and nitrous acid according to the following mechanism:
$HNO_2 + HNO_2 \rightarrow H_2O + N_2O_3$ (fast, reversible)
$(CH_3)_2NH + N_2O_3 \rightarrow (CH_3)_2NHNO^+ + NO_2^-$ (slow)
$(CH_3)_2NHNO^+ \rightarrow (CH_3)_2NNO + H^+$ (fast)

(a) What is the overall reaction? (Hint: $H^+ + NO_2^- \rightarrow HNO_2$)
(b) What is the molecularity of each step?
(c) Write the rate equation for the rate-determining step.
(d) What are the intermediates in thi s reaction? (If none, write "none.")