

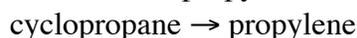
LECTURE 33

1. The Arrhenius factor A (pre-exponential factor) for the isomerization reaction of $\text{CH}_3\text{NC} \rightleftharpoons \text{CH}_3\text{CN}$ is $14.3 \times 10^{13} \text{ s}^{-1}$, and the reaction rate constant is 0.41 s^{-1} at 600.0 K .
- (a) Calculate the Activation Energy for this reaction in kJ/mol .
- (b) Calculate the temperature to one significant figure that is required for the rate constant to be $1 \times 10^5 \text{ s}^{-1}$.

(a) $E_a = 167.0 \text{ kJ mol}^{-1}$

(b) $T = 1000 \text{ K}$

2. Cyclopropane isomerizes to propylene according to a first-order reaction:



The activation energy is 272 kJ mol^{-1} .

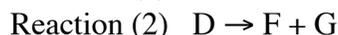
At 500.0°C , the reaction rate constant is $6.1 \times 10^{-4} \text{ s}^{-1}$.

- (a) Calculate the Arrhenius factor A (pre-exponential factor) for this reaction.
- (b) Calculate the rate constant for this reaction at 25.0°C .

(a) $A = 1. \times 10^{15} \text{ s}^{-1}$

- (b) $k_{298} = 2. \times 10^{-33} \text{ s}^{-1}$ or $3. \times 10^{-33} \text{ s}^{-1}$ (There are two ways to calculate this answer. One uses the answer from part (a) and the other does not. If the answer from part (a) is used to one significant figure, the answer in (b) is $2. \times 10^{-33}$. Other approaches yield an answer of $3. \times 10^{-33}$).**

3. For the reactions:



For reaction (1), the activation energy for the forward reaction ($E_{a,f}$) is 371 kJ mol^{-1} and the activation energy for the reverse reaction ($E_{a,r}$) is 139 kJ mol^{-1} . Based on this information, predict whether the reaction is endothermic or exothermic.

endothermic

MIT OpenCourseWare
<https://ocw.mit.edu>

5.111 Principles of Chemical Science
Fall 2014

For information about citing these materials or our Terms of Use, visit: <https://ocw.mit.edu/terms>.