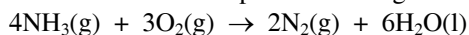


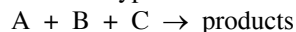
1. The oxidation of ammonia produces nitrogen and water via the reaction



If ammonia is being consumed at a rate of 0.72 M/s, how fast is oxygen being consumed?

- a) 0.24 M/s d) 0.63 M/s
b) 0.48 M/s e) 0.96 M/s
c) 0.54 M/s
2. The rate law for the reaction
 $5\text{Br}^-(\text{aq}) + \text{BrO}_3^-(\text{aq}) + \text{H}^+(\text{aq}) \rightarrow 3\text{Br}_2(\text{l}) + 3\text{H}_2\text{O}(\text{l})$
has been experimentally determined to be
 $\text{rate} = k[\text{Br}^-][\text{BrO}_3^-][\text{H}^+]^2$
What is the overall order for this reaction?
a) 1 c) 3
b) 2 d) 4
e) The order of the reaction cannot be determined from the information provided.
3. What are the units of the rate constant for a second-order reaction?
a) $\text{M}\cdot\text{s}^{-1}$ d) M^2s^{-1}
b) s^{-1} e) $\text{M}^{1/2}\text{s}^{-1}$
c) $\text{M}^{-1}\text{s}^{-1}$

4. Consider the hypothetical reaction:



The following initial concentrations and initial rates were obtained for the reaction at 25°C:

[A] ₀ (M)	[B] ₀ (M)	[C] ₀ (M)	Initial Rate (M/s)
0.100	0.200	0.300	4.20×10^{-3}
0.100	0.200	0.600	1.68×10^{-2}
0.100	0.400	0.300	4.20×10^{-3}
0.300	0.200	0.300	1.26×10^{-2}

What is the correct rate law for this reaction?

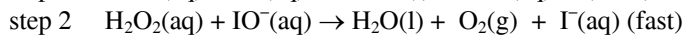
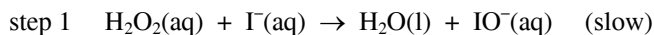
- a) $\text{rate} = k[\text{A}]^3[\text{B}][\text{C}]^4$
b) $\text{rate} = k[\text{A}][\text{B}][\text{C}]^2$
c) $\text{rate} = k[\text{A}][\text{B}][\text{C}]$
d) $\text{rate} = k[\text{A}][\text{C}]^2$
e) $\text{rate} = k[\text{A}]^3[\text{C}]^4$
5. The decomposition of ethylene oxide,
 $(\text{CH}_2)_2\text{O}(\text{g}) \rightarrow \text{CH}_4(\text{g}) + \text{O}_2(\text{g})$,
is first order with a half-life of 56.3 min at 415°C. How long (in min.) will it take for 90.0% of a sample of ethylene oxide to decompose at this temperature?
a. 11.3 b. 81.2 c. 282 d. 8.56 e. 187
6. Suppose that the reaction $\text{A} \rightarrow \text{products}$ is a second-order reaction. Which of the following, when drawn on a graph, would be a straight line?
a) [A] vs. time
b) $[\text{A}]^2$ vs. time
c) $[\text{A}]^{1/2}$ vs. time
d) $\ln[\text{A}]$ vs. time
e) $\frac{1}{[\text{A}]}$ vs. time

Questions 7 and 8 refer to the information below:

Consider the reaction



The mechanism for this reaction is believed to be the two-step mechanism below:



7. What rate law is consistent with this mechanism?

- a) $\text{rate} = k [\text{H}_2\text{O}_2]^2$
- b) $\text{rate} = k [\text{H}_2\text{O}_2] [\text{I}^-]$
- c) $\text{rate} = k [\text{H}_2\text{O}_2]^2 [\text{I}^-] [\text{IO}^-]$
- d) $\text{rate} = k [\text{H}_2\text{O}_2] [\text{IO}^-]$
- e) $\text{rate} = k [\text{H}_2\text{O}_2]$

8. What is the catalyst, and what is the reactive intermediate in the reaction above?

- a) $\text{I}^-(\text{aq})$ is the catalyst, and $\text{IO}^-(\text{aq})$ is the reactive intermediate.
- b) $\text{IO}^-(\text{aq})$ is the catalyst, and I^- is the reactive intermediate.
- c) $\text{I}^-(\text{aq})$ is the catalyst, and there is no reactive intermediate.
- d) $\text{IO}^-(\text{aq})$ is the catalyst, and there is no reactive intermediate.
- e) $\text{IO}^-(\text{aq})$ is the catalyst, and H_2O_2 is the reactive intermediate.

9. Which of the following statements below is/are true concerning the activation energy for a reaction?

- I. E_a is the difference in energy between reactants and activated complex.
- II. E_a decreases with increasing temperature.
- III. The greater the activation energy, the faster the reaction.
- IV. Catalysts generally work by lowering the E_a for a reaction.

- a) III and IV
- b) I, II, and IV
- c) II, III, and IV
- d) I and IV
- e) I, II, III, and IV

10. The rates of chemical reactions increase with increasing temperature. Which of the following statements best explains this observation?

- a) Increasing the temperature lowers the activation energy for a reaction.
- b) Increasing the temperature raises the activation energy for a reaction.
- c) Increasing the temperature allows more energy to be released in an exothermic reaction.
- d) At higher temperatures, more molecules collide with sufficient energy to react.
- e) Choices (a) and (d) are both correct.

11. Dinitrogen tetroxide, N_2O_4 , decomposes to nitrogen dioxide, NO_2 , in a first-order process. If $k = 2.5 \times 10^3 \text{ s}^{-1}$ at -5°C , and $k = 3.5 \times 10^4 \text{ s}^{-1}$ at 25°C , what is the activation energy for the decomposition?

- a) 0.73 kJ/mol
- b) 58 kJ/mol
- c) 140 kJ/mol
- d) 580 kJ/mol
- e) 93 kJ/mol

Answers

- 1. C 5. E 9. D
- 2. D 6. E 10. D
- 3. C 7. B 11. B
- 4. D 8. A