



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.
12. A chemical reaction that is first-order in A is observed to have a rate constant of  $1.2 \times 10^{-2} \text{ s}^{-1}$ . If the initial concentration of A is 2.0 M, what is the concentration of A after 200 s?  
a) 0.18 M                      d)  $6.0 \times 10^{-3} \text{ M}$   
b) 0.55 M                      e) 1.7 M  
c) 1.0 M
13. A first-order reaction is observed to have a rate constant of  $0.0154 \text{ min}^{-1}$ . What is the half-life of this reaction?  
a) 4.87 min                      d) 64.9 min  
b) 2.11 min                      e) 19.5 min  
c) 45.0 min
14. Suppose that the reaction  $\text{A} \rightarrow \text{products}$  obeys first-order kinetics. If the half-life of this reaction is 30.0 minutes, how long does it take for 62.5% of A to react?  
a) 37.5 min                      d) 20.3 min  
b) 47.5 min                      e) 42.5 min  
c) 45.0 min
15. 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
16. What are the units of the rate constant for a second-order reaction?  
a)  $\text{M}\cdot\text{s}^{-1}$                       d)  $\text{M}^2\text{s}^{-1}$   
b)  $\text{s}^{-1}$                       e)  $\text{M}^{1/2}\text{s}^{-1}$   
c)  $\text{M}^{-1}\text{s}^{-1}$
17. A certain first-order reaction has a rate constant  $k = 2.1 \times 10^5 \text{ s}^{-1}$  at 355 K. If the activation energy for this reaction is 135 kJ/mol, calculate the rate constant at 550 K.  
a)  $3.3 \times 10^5$                       d)  $4.9 \times 10^5$   
b)  $2.3 \times 10^{12}$                       e)  $7.2 \times 10^5$   
c)  $2.1 \times 10^5$
18. 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)  $\text{rate} = k [\text{H}_2\text{O}_2]$
19. 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 reactive intermediate, and  $\text{I}^-$  is the catalyst.  
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  $\text{H}_2\text{O}_2$  is the reactive intermediate.
20. 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                      d) I and IV  
b) I, II, and IV                      e) I, II, III, and IV  
c) II, III, and IV
21. The density of a 3.54 M solution of  $\text{NH}_4\text{Cl}$  in water is 1.0512 g/mL. What is the molality of the solution? (The molar mass of  $\text{NH}_4\text{Cl}$  is 53.45 g/mol.)  
a) 18.7 m                      d) 6.29 m  
b) 3.37 m                      e) 2.98 m  
c) 4.11 m
22. Which is more likely to be soluble in water,  $\text{CCl}_4$  or  $\text{CaCl}_2$ ?  
a)  $\text{CCl}_4$     c) Neither is likely to be soluble in water.  
b)  $\text{CaCl}_2$     d) Both are likely to be very soluble in water.

#### Answers

- |      |       |       |       |       |
|------|-------|-------|-------|-------|
| 1. E | 6. B  | 11. D | 16. C | 21. C |
| 2. C | 7. C  | 12. A | 17. B | 22. B |
| 3. A | 8. B  | 13. C | 18. B |       |
| 4. A | 9. C  | 14. E | 19. A |       |
| 5. A | 10. D | 15. E | 20. D |       |

#### Questions 18 and 19 refer to the information below:

Consider the reaction



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

