Chem Kinetics

Multiple Choice Questions (MCQs) on First-Order Rate Equation and Half-Life Period

Questions

1. **Which of the following is a characteristic of a first-order reaction?**
   - A. The rate is independent of the concentration of the reactant.
   - B. The rate is directly proportional to the concentration of the reactant.
   - C. The rate is inversely proportional to the concentration of the reactant.
   - D. The rate is proportional to the square of the concentration of the reactant.
2. **The rate constant for a first-order reaction is $0.693\,\mathrm{s}^{-1}$. What is the half-life of the reaction?**
   - A. 1 s
   - B. 0.693 s
   - C. 1.44 s
   - D. 2 s
3. **For a first-order reaction, the half-life period depends on:**
   - A. The initial concentration of the reactant.
   - B. The rate constant.
   - C. Both the initial concentration and the rate constant.
   - D. The temperature only.
4. **Which of the following plots represents a first-order reaction?**
   - A. $[A]$ vs. t gives a straight line.
   - B. $\ln[A]$ vs. t gives a straight line.
   - C. $\frac{1}{[A]}$ vs. t gives a straight line.
   - D. $\frac{1}{[A]^2}$ vs. t gives a straight line.
5. **The half-life of a first-order reaction is 20 minutes. How long will it take for the concentration of the reactant to reduce to one-fourth of its initial value?**
   - A. 10 minutes
   - B. 20 minutes
   - C. 30 minutes
   - D. 40 minutes
6. **In a first-order reaction, the rate constant k has units of:**
   - A. $\mathrm{mol\,L^{-1}s^{-1}}$
   - B. $\mathrm{L\,mol^{-1}s^{-1}}$
   - C. $\mathrm{s^{-1}}$
   - D. $\mathrm{L^2mol^{-2}s^{-1}}$
7. **The integrated rate law for a first-order reaction is:**
   - A. $[A] = [A]_0 - kt$
   - B. $[A] = [A]_0 e^{-kt}$
   - C. $\frac{1}{[A]} = \frac{1}{[A]_0} + kt$
   - D. $\ln[A] = \ln[A]_0 + kt$

8. **For a first-order reaction with a rate constant of $0.02\,\text{min}^{-1}$, what is the time required for the concentration of the reactant to decrease to 25% of its initial value?**
   - A. 17.32 minutes
   - B. 34.65 minutes
   - C. 69.3 minutes
   - D. 138.6 minutes
9. **A reaction has a rate constant k of $4.6 \times 10^{-3}\,\text{s}^{-1}$. What is its half-life?**
   - A. 100 s
   - B. 150 s
   - C. 200 s
   - D. 300 s
10. **If the concentration of a reactant in a first-order reaction is reduced to one-eighth of its initial value in 60 seconds, what is the rate constant k?**
    - A. $0.023\,\text{s}^{-1}$
    - B. $0.046\,\text{s}^{-1}$
    - C. $0.069\,\text{s}^{-1}$
    - D. $0.092\,\text{s}^{-1}$
11. **In a first-order reaction, the time required for 75% of the reactant to decompose is:**
    - A. $t_{1/2}$
    - B. $2t_{1/2}$
    - C. $3t_{1/2}$
    - D. $4t_{1/2}$
12. **Which of the following statements is true for a first-order reaction?**
    - A. The rate of reaction is constant.
    - B. The half-life increases with increasing concentration.
    - C. The half-life is independent of the initial concentration.
    - D. The rate of reaction decreases linearly with time.
13. **The half-life of a first-order reaction is 50 seconds. How long will it take for the reactant concentration to fall to 12.5% of its original value?**
    - A. 50 seconds
    - B. 100 seconds
    - C. 150 seconds
    - D. 200 seconds
14. **For a first-order reaction, the concentration of reactant decreases from 0.8 M to 0.4 M in 20 minutes. What is the rate constant k?**
    - A. $0.015\,\text{min}^{-1}$
    - B. $0.035\,\text{min}^{-1}$
    - C. $0.017\,\text{min}^{-1}$
    - D. $0.025\,\text{min}^{-1}$
15. **If a first-order reaction has a half-life of 60 seconds, what will be the concentration of the reactant after 120 seconds, if the initial concentration is 2 M?**
    - A. 1 M
    - B. 0.5 M
    - C. 0.25 M
    - D. 0.125 M

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1. B
2. A
3. B
4. B
5. D
6. C
7. B
8. B
9. A
10. B
11. C
12. C
13. C
14. C
15. C