Integrated Kinetics Equation Problems

1. The rate constant for the first-order reaction is $1.20 \times 10^{-2}\ s^{-1}$ at $45^{O}C$, and the initial concentration of N_2O_5 is 0.00500M.

   $N_2O_5 \longrightarrow 2NO_2 + \frac{1}{2}O_2$

   a. How long will it take for the concentration to decrease to 0.00110 M?
   b. How much longer will it take for a further decrease to 0.000900 M?

2. The first order rate constant for the radioactive decay of radium-223 is $0.0606\ day^{-1}$. What is the half-life of radium-223? Radioactive decay is first order, with the equation showing 1 mole of radium decomposing.

3. In the first order reaction A→ products, [A] = 0.724M initially and 0.586M after 16.0 min.
   a. What is the value of the rate constant, k?
   b. What is the half-life of this reaction?
   c. At what time will [A]= 0.185M?
   d. What will [A] be after 2.5 hours?

4. A certain temperature the reaction $2B \rightarrow C + D$ obeys the rate-law expression

   $$\text{Rate} = (1.14 \times 10^{-3}\ M^{-1}s^{-1})\,[B]^2.$$

   If 5.00 mol of B is initially present in a 1.00 L container at that temperature, how long would it take for <u>2.00 mol B to be consumed</u> at constant temperature?

5. At 300 K the reaction: $2\ NOCl \rightarrow 2\ NO + Cl_2$
   obeys the rate law: Rate = $k[NOCl]^2$ where $k = 2.8 \times 10^{-5}\ M^{-1} \cdot s^{-1}$.
   Suppose 1.0 mole of NOCl is introduced into a 2.0 liter container at 300 K. What is the half-life of the reaction?

6. If a first-order reaction (3A-->B) has a rate constant equal to $3.0\ min^{-1}$, what is the half-life for the reaction if 3 mol of A is introduced into a 1.0 L container at 298 K?

7. If a zero-order reaction (2A-->B) has a rate constant equal to $3.0\ min^{-1}$, what is the half-life for the reaction if 6 mol of A is introduced into a 2.0 L container at 298 K?

Integrated Kinetics Equation Problems Answers

1. **a. t = 126 s**
b. t= 16.9s more
2. **11.4 days**
3. **a. 0.0132 min^{-1},** $1/[A] = akt + 1/[A]_0$
b. 52.5 min, $[A]_0/(2ak) = t_{1/2}$
c. 103 min, $[A] = -akt + [A]_0$
d. 0.10M $\ln [A] = -akt + \ln [A]_0$
4. **58.5s** $0.693/ak = t_{1/2}$
5. **3.6×10^4 seconds** $1/ak[A]_0 = t_{1/2}$
6. **4.6 sec or .077 min**
7. **15 sec or 0.25 min**