

Advanced Chemistry
Half Life WS

NAME: _____ **PER:** _____

*Instructions: Complete the following problems. SHOW ALL WORK in the empty space below the questions.
Remember the units. Round to the correct number of significant digits.*

Equations

1st Order Half Life: $t_{1/2} = \frac{0.693}{k}$

2nd Order Half Life: $t_{1/2} = \frac{1}{k[A]_0}$

Zero Order Half Life: $t_{1/2} = \frac{[A]_0}{2k}$

First-Order Half Life Problems

1. The rate constant of a first-order process that has a half-life of 225 s is _____ s⁻¹.

2. The isomerization of methylisonitrile to acetonitrile: $\text{CH}_3\text{NC} (\text{g}) \rightarrow \text{CH}_3\text{CN} (\text{g})$ is first order in CH_3NC . The rate constant for the reaction is $9.45 \times 10^{-5} \text{ s}^{-1}$ at 478 K. The half-life of the reaction when the initial $[\text{CH}_3\text{NC}]$ is 0.0300 M is _____ s.

Second-Order Problems

3. A second-order reaction has a half-life of 21.0 s when the initial concentration of reactant is 0.830 M. The rate constant for this reaction is _____ M⁻¹s⁻¹.

4. The elementary reaction: $2\text{NO}_2 (\text{g}) \rightarrow 2\text{NO} (\text{g}) + \text{O}_2 (\text{g})$ is second order in NO_2 and the rate constant at 501 K is $5.44 \times 10^{-3} \text{ M}^{-1}\text{s}^{-1}$. The reaction half-life at this temperature when $[\text{NO}_2]_0 = 0.550 \text{ M}$ is _____ s.

Zero-Order Problems

5. If substance A in a zero order reaction has an original concentration of 3.20 M and a rate constant of 0.00988 M/s, what is the half life of substance A?

6. If substance A in a zero order reaction has a rate constant of 0.00642 M/s and a half life of 161 seconds, what was the original concentration of the substance?