

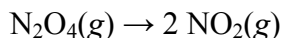
Worksheet 8

1. Butadiene (C_4H_6) reacts with itself to form a dimer with the formula C_8H_{12} . The reaction is second order in C_4H_6 . If the rate constant at a particular temperature is $4.0 \times 10^{-2} \text{ M}^{-1} \text{ s}^{-1}$ and the initial concentration of C_4H_6 is 0.0200 M .

- (a) What is its molarity after a reaction time of 1.00 hour?
 - (b) What is the time (in hours) when the C_4H_6 concentration reaches a value of 0.0020 M ?
 - (c) What is the half-life (in minutes) of the reaction when the initial C_4H_6 concentration is 0.0200 M ? How many minutes does it take for the concentration of C_4H_6 to drop from 0.0100 M to 0.0050 M ?
2. At 25°C , the half-life of a certain first-order reaction is 248 s . What is the value of the rate constant at this temperature?

3. A reaction of the type $\text{A} \rightarrow \text{B} + \text{C}$ has a rate constant $k = 3.6 \times 10^{-5} \text{ M/s}$.

- (a) What is the order of the reaction?
 - (b) What is the molarity of A after a reaction time of 30.0 min if the initial concentration of A is 0.096 M ?
 - (c) What is the half-life (in minutes) of the reaction in part (b)?
4. The half-life for the first-order decomposition of N_2O_4 is $1.3 \times 10^{-5} \text{ s}$.



If N_2O_4 is introduced into an evacuated flask at a pressure of 17.0 mm Hg , how many seconds are required for the pressure of NO_2 to reach 1.3 mm Hg ?

5. The rate constant for the decomposition of gaseous NO_2 to NO and O_2 is $4.7/(\text{M} \cdot \text{s})$ at 383°C . Consider the decomposition of a sample of pure NO_2 having an initial pressure of 746 mm Hg in a 5.00 L reaction vessel at 383°C .

- (a) What is the order of the reaction?
- (b) What is the initial rate of formation of O_2 in $\text{g}/(\text{L} \cdot \text{s})$?
- (c) What is the mass of O_2 in the vessel after a reaction time of 1.00 min ?