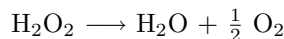


CHM 112.009

Additional Problems – Chapter 14

1. For the reaction



the initial concentration of H_2O_2 is 0.1108 M and 12 s later the concentration is 0.1060 M. What is the initial rate of this reaction expressed in M/sec and M/min?

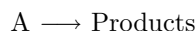
2. In the reaction



the rate of disappearance of A is $-2.2 \times 10^{-4} \text{ M}\cdot\text{s}^{-1}$. What is the:

- (a) rate of disappearance of B?
- (b) rate of formation of C?
- (c) the general rate of reaction?

3. What would be the units of k for a reaction



for which the order of the reaction was $\frac{1}{2}$?

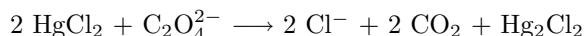
4. For the reaction



the rate law is $\text{RATE} = k[\text{A}][\text{B}]$. Which of the following statements is true – and why?

- (a) The value of k is independent of the initial concentrations $[\text{A}]_0$ and $[\text{B}]_0$.
- (b) The unit of the rate constant, k , can be determined to be either s^{-1} or min^{-1} .

5. The following rate data was collected for the reaction



Experiment	Initial [HgCl ₂] mol·L ⁻¹	Initial [C ₂ O ₄ ²⁻] mol·L ⁻¹	Initial Rate mol·L ⁻¹ ·s ⁻¹
1	0.105	0.15	1.8×10^{-5}
2	0.105	0.30	7.1×10^{-5}
3	0.052	0.30	3.5×10^{-5}
4	0.052	0.15	8.9×10^{-6}

- (a) Determine the **overall** order of the reaction
- (b) Determine the value of the rate constant k
- (c) What would be the initial rate of the reaction if $[\text{HgCl}_2]_0 = 0.094 \text{ M}$ and $[\text{C}_2\text{O}_4^{2-}]_0 = 0.19 \text{ M}$?
- (d) Are all four experiments needed to answer questions (a) – (c)?

6. In a reaction



the following data were obtained. What is the order of the reaction?

Experiment 1: $[\text{A}]_0 = 1.512 \text{ M}$, $[\text{A}]_{30\text{sec}} = 1.496 \text{ M}$

Experiment 2: $[\text{A}]_0 = 2.584 \text{ M}$, $[\text{A}]_{60\text{sec}} = 2.552 \text{ M}$

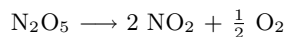
7. A first order reaction



has a rate of reaction of $0.00250 \text{ M}\cdot\text{s}^{-1}$ when $[A] = 0.484 \text{ M}$.

- (a) What is the rate constant k for this reaction?
- (b) Do $t_{\frac{3}{4}}$ and $t_{\frac{4}{5}}$ depend on the initial concentration?

8. In the first order decomposition of dinitrogen pentoxide at 335 K



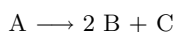
if one starts with a 2.50 g sample of N_2O_5 at 335 K and, after 109 seconds only 1.50 g remains:

- (a) What is the value of the rate constant?
- (b) What is $t_{\frac{1}{2}}$
- (c) What mass of N_2O_5 will remain after 5.0 minutes?

9. The decomposition of di-tert-butyl peroxide (DTBP) is a first order reaction with a half life of 320 minutes at 135°C and 100 minutes at 135°C . Calculate the activation energy, E_a , for this reaction.

10. A reaction has a first order rate constant of $4.82 \times 10^{-5} \text{ s}^{-1}$ at 25°C and 1.41×10^{-2} at 70°C . Calculate the value of the rate constant at 90°C .

11. For the reaction



the following data are obtained for $[A]$ as a function of time:

$$t = 0 \text{ min}, [A] = 0.80 \text{ M}$$

$$t = 8 \text{ min}, [A] = 0.60 \text{ M}$$

$$t = 24 \text{ min}, [A] = 0.35 \text{ M}$$

$$t = 40 \text{ min}, [A] = 0.20 \text{ M}$$

- (a) Establish the order of the reaction
- (b) What is the value of the rate constant, k
- (c) Calculate the rate of formation of B at 22 min

12. A reaction that is second order in reactant A has $[A]_0 = 0.200 \text{ M}$. The half life is 45.6 sec. What is $[A]$ after 3.00 min.

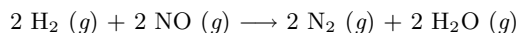
13. Explain why, for the following reaction



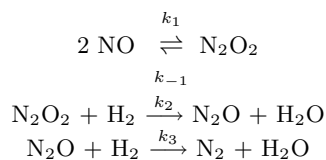
the mechanism shown below is inconsistent with the measured rate law of $\text{RATE} = k[\text{NO}_2]^2$.



14. Given that the proposed mechanism is consistent with the rate law $\text{RATE} = k[\text{H}_2][\text{NO}]^2$ for the reaction



PROPOSED MECHANISM:



Which step **must** be the rate determining step?