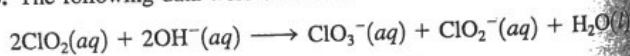


# Kinetics Practice #1

29. The rate of the reaction between hemoglobin (Hb) and carbon monoxide (CO) was studied at 20°C. The following data were collected with all concentration units in  $\mu\text{mol/L}$ . (A hemoglobin concentration of  $2.21 \mu\text{mol/L}$  is equal to  $2.21 \times 10^{-6} \text{ mol/L}$ .)

[Hb] <sub>0</sub> ( $\mu\text{mol/L}$ )	[CO] <sub>0</sub> ( $\mu\text{mol/L}$ )	Initial Rate ( $\mu\text{mol/L} \cdot \text{s}$ )
2.21	1.00	0.619
4.42	1.00	1.24
4.42	3.00	3.71

- Determine the orders of this reaction with respect to Hb and CO.
  - Determine the rate law.
  - Calculate the value of the rate constant.
  - What would be the initial rate for an experiment with [Hb]<sub>0</sub> =  $3.36 \mu\text{mol/L}$  and [CO]<sub>0</sub> =  $2.40 \mu\text{mol/L}$ ?
30. The following data were obtained for the reaction



where 
$$\text{Rate} = -\frac{\Delta[\text{ClO}_2]}{\Delta t}$$

[ClO <sub>2</sub> ] <sub>0</sub> (mol/L)	[OH <sup>-</sup> ] <sub>0</sub> (mol/L)	Initial Rate (mol/L · s)
0.0500	0.100	$5.75 \times 10^{-2}$
0.100	0.100	$2.30 \times 10^{-1}$
0.100	0.0500	$1.15 \times 10^{-1}$

- Determine the rate law and the value of the rate constant.
- What would be the initial rate for an experiment with [ClO<sub>2</sub>]<sub>0</sub> =  $0.175 \text{ mol/L}$  and [OH<sup>-</sup>]<sub>0</sub> =  $0.0844 \text{ mol/L}$ ?

43. A first-order reaction is 75.0% complete in 320. s.
- What are the first and second half-lives for this reaction?
  - How long does it take for 90.0% completion?

42. The radioactive isotope <sup>32</sup>P decays by first-order kinetics and has a half-life of 14.3 days. How long does it take for 95.0% of a sample of <sup>32</sup>P to decay?

46. The rate law for the reaction

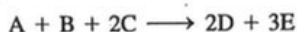


at some temperature is

$$\text{Rate} = -\frac{\Delta[\text{NOBr}]}{\Delta t} = k[\text{NOBr}]^2$$

- If the half-life for this reaction is 2.00 s when  $[\text{NOBr}]_0 = 0.900 \text{ M}$ , calculate the value of  $k$  for this reaction.
- How much time is required for the concentration of NOBr to decrease to 0.100 M?

48. Consider the hypothetical reaction



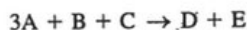
where the rate law is

$$\text{Rate} = -\frac{\Delta[\text{A}]}{\Delta t} = k[\text{A}][\text{B}]^2$$

An experiment is carried out where  $[\text{A}]_0 = 1.0 \times 10^{-2} \text{ M}$ ,  $[\text{B}]_0 = 3.0 \text{ M}$ , and  $[\text{C}]_0 = 2.0 \text{ M}$ . The reaction is started, and after 8.0 seconds, the concentration of A is  $3.8 \times 10^{-3} \text{ M}$ .

- Calculate  $k$  for this reaction.
- Calculate the half-life for this experiment.
- Calculate the concentration of A after 13.0 seconds.
- Calculate the concentration of C after 13.0 seconds.

77. Consider the reaction



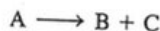
where the rate law is defined as

$$-\frac{\Delta[\text{A}]}{\Delta t} = k[\text{A}]^2[\text{B}][\text{C}]$$

An experiment is carried out where  $[\text{B}]_0 = [\text{C}]_0 = 1.00 \text{ M}$  and  $[\text{A}]_0 = 1.00 \times 10^{-4} \text{ M}$ .

- If after 3.00 min,  $[\text{A}] = 3.26 \times 10^{-5} \text{ M}$ , calculate the value of  $k$ .
- Calculate the half-life for this experiment.
- Calculate the concentration of B and the concentration of A after 10.0 min.

41. The reaction



is known to be zero order in A and to have a rate constant of  $5.0 \times 10^{-2} \text{ mol/L} \cdot \text{s}$  at  $25^\circ\text{C}$ . An experiment was run at  $25^\circ\text{C}$  where  $[\text{A}]_0 = 1.0 \times 10^{-3} \text{ M}$ .

- Write the integrated rate law for this reaction.
- Calculate the half-life for the reaction.
- Calculate the concentration of B after  $5.0 \times 10^{-3} \text{ s}$  has elapsed.