

CH 302 Worksheet 16 More Kinetics Problems

[A]	[B]	[C]	rate
0.10 M	0.10 M	0.10 M	1.4×10^{-4} M/s
0.20 M	0.10 M	0.10 M	2.8×10^{-4} M/s
0.37 M	0.25 M	0.10 M	8.09×10^{-3} M/s
0.37 M	0.25 M	0.05 M	3.24×10^{-2} M/s

For the data given above, find the order of the reaction with respect to the indicated species.

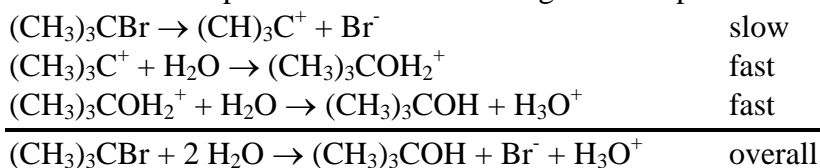
- A
- B
- C
- Assume the reaction does not depend on any other species besides A, B, and C. Write the expression for the rate of the reaction in terms of the rate constant k .
- Calculate the rate constant k .
- If $A = 10^8 \text{ M}^{-1}\text{s}^{-1}$ and $T = 298 \text{ K}$, what is E_a for this reaction?

You start out with 1.0 M A . Assume the rate of the reaction $2\text{A} \rightarrow \text{A}_2$ depends only on $[\text{A}]$. Assume that $A = 3.4 \times 10^8$ (units depend on the order), $E_a = 65 \text{ kJ/mol}$, and $T = 298 \text{ K}$. If the reaction is the given order in A, calculate the amount of A left after five minutes and the half-life of A.

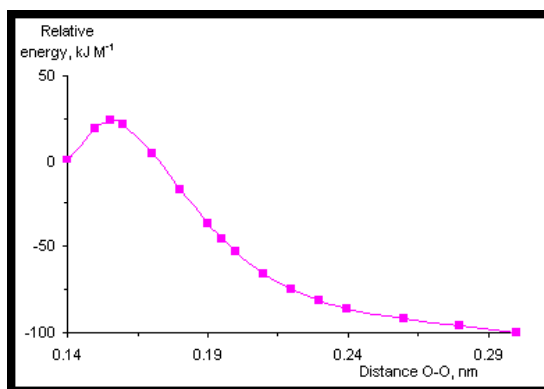
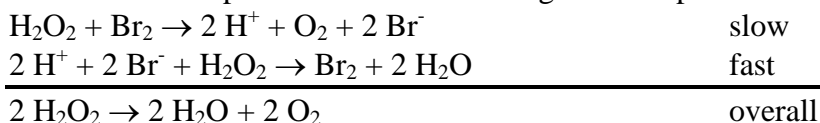
- Zeroth order
- First order
- Second Order
- For a (a) zeroth, (b) first, and (c) second order reaction, a plot of _____ vs. t is linear.
- The reaction $3\text{A} + 5/2 \text{ B} \rightarrow 2 \text{ C} + 4 \text{ D}$ has a rate constant k of $3.7 \times 10^{-6} \text{ M}^{-2}\text{s}^{-1}$ at 298 K and $6.80 \times 10^{-2} \text{ M}^{-2}\text{s}^{-1}$ at 600 K . Calculate the activation energy E_a for this reaction.
- Calculate the pre-exponential factor A for the reaction in #11.
- What would be k for the reaction in #11 at 0°C ?
- Write the rate expression for the following multi-step reaction.

$\text{O}_3 \rightarrow \text{O}_2 + \text{O}$	fast
$\text{O} + \text{O}_3 \rightarrow 2 \text{ O}_2$	slow
$2 \text{ O}_3 \rightarrow 3 \text{ O}_2$	overall

15. Write the rate expression for the following multi-step reaction.



16. Write the rate expression for the following multi-step reaction.



17. The above plot represents the energy profile of a reaction that involves breaking an O-O bond in terms of the O-O bond distance (treat this as a general “reaction coordinate”). Assume this is in 1 L of solution, so $1 \text{ kJ M}^{-1} = 1 \text{ kJ mol}^{-1}$. Approximately what is ΔG for this reaction? What is E_a ?

18. What is E_a for the reverse reaction?

19. Assume the reaction described by the plot is a simple reaction of the form $\text{A} \rightarrow \text{B} + \text{C}$ and is first order overall and first order in A. The reaction rate when $[\text{A}] = 0.235 \text{ M}$ is found to be $1.4 \times 10^{-3} \text{ M/s}$. What is k for this reaction?

20. What is the preexponential factor A for the above reaction?