

MC 03 Practice

1. All of the following affect the rate of a reaction except
 - a. Concentration of reactants
 - b. Surface area of reactants
 - c. Temperature
 - d. The presence of a catalyst
 - e. None of the above
2. For the reaction $\text{N}_2 + 3 \text{H}_2 \rightarrow 2 \text{NH}_3$, the
 - a. rate of reaction = _____ rate of production of NH_3
 - b. rate of reaction = _____ rate of consumption of H_2

Use the following table for questions 3-4

Time (s)	[A] (M)
0	0.165
200	0.112
500	0.054
800	0.028
1200	0.015
1500	0.013

3. What is the average reaction rate between 0 and 1500 seconds?
4. What is the instantaneous reaction rate at 800 seconds?
5. At a certain time in a reaction, substance A is disappearing at a rate of $2.0 \times 10^{-2} \text{ M/s}$, substance B is appearing at a rate of $4.0 \times 10^{-2} \text{ M/s}$, and substance C is appearing at a rate of $8.0 \times 10^{-2} \text{ M/s}$. Propose a chemical equation relating the three substances.
6. Consider the reaction: $3\text{I}^- + \text{IO}_2^- + 4\text{H}^+ \rightarrow 2\text{I}_2 + 2\text{H}_2\text{O}$. The reaction is first order with respect to I^- , second order with respect to H^+ and fifth order overall. What is the rate law?
7. If the concentration of IO_2^- were doubled, what would happen to the reaction rate?
8. Considering the reaction $2 \text{UO}_2(+) + 4\text{H}(+) \rightarrow \text{U}(4+) + \text{UO}_2(2+) + 2\text{H}_2\text{O}$ and the initial rate data below, derive the rate law for the reaction and find the rate constant k with the correct units.

Experiment	Initial Concentration $\text{UO}_2(+)$	Initial Concentration $\text{H}(+)$	Initial Rate of Reaction
1	0.0012	0.22	4.12×10^{-5}
2	0.0012	0.35	6.55×10^{-5}
3	0.0030	0.35	4.10×10^{-4}

9. What are the units of the rate constant for $\text{Rate} = k[\text{CHCl}_3][\text{Cl}_2]^{3/2}$?

10. A certain reaction $X + Y \rightarrow Z$ is described as being second order in $[X]$ and fourth order overall. Which of the following statements are true?
- The rate law for the reaction is $\text{Rate} = k[X]^2[Y]$
 - If the concentration of X is increased by a factor of 1.5, the rate will increase by a factor of 2.25
 - If the concentration of Y is increased by a factor of 1.5, the rate will increase by a factor of 2.25

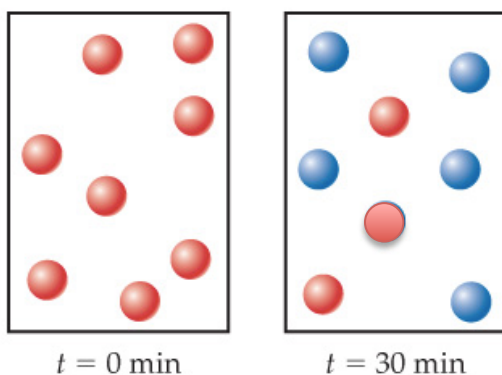
Part 2

Question 8 Extension: What is the rate of disappearance of UO_2^{2+} when $[\text{UO}_2^{2+}] = 4.5 \times 10^{-2} \text{ M}$ and $[\text{H}^+] = 0.18 \text{ M}$? Assume the rate of reaction relates to U^{4+} .

Time (min)	$[\text{X}](\text{M})$
0	0.467
1	0.267
2	0.187
3	0.144
4	0.117
5	0.099
6	0.085
7	0.075

- Using the table above how would you decide the order of the reaction with respect to $[\text{X}]$? What is the order?
 - 0
 - 1
 - 2
- Given that the rate constant for the decomposition of hypothetical compound X from part A is $1.15 \text{ M}^{-1} \cdot \text{min}^{-1}$, calculate the concentration of X after 25.0 min.
- What is the definition of half-life?
- Calculate the half-life of potassium-43 assuming it follows second-order kinetics with a rate constant of 8.634×10^{-6} and starting with 2 M potassium.
- Calculate the half-life of potassium-43 assuming it follows second-order kinetics with a rate constant of 8.634×10^{-6} and starting with 4 M potassium.
- Calculate the half-life of potassium-43 assuming it follows first-order kinetics with a rate constant of 8.634×10^{-6} and starting with 2 M potassium.

7. Calculate the half-life of potassium-43 assuming it follows first-order kinetics with a rate constant of 8.634×10^{-6} and starting with 4 M potassium.



8. Given the picture above, find the rate constant k assuming the reaction follows first-order kinetics.
9. At 25°C , the decomposition of dinitrogen pentoxide, $\text{N}_2\text{O}_5(\text{g})$, into $\text{NO}_2(\text{g})$ and $\text{O}_2(\text{g})$ follows first-order kinetics with $k = 4.3 \times 10^{-4} \text{ s}^{-1}$. A sample of N_2O_5 with an initial pressure of 760 torr decomposes at 25°C until its partial pressure is 450 torr. How much time (in s) has elapsed?