

## Kinetics Practice Problems

For multiple-choice questions, show your work below the a-e choices for full credit AND circle your answer.

- Calculate the average speed of reaction if at 10.0 seconds the reactant concentration is 1.25M but at 55.0 seconds the concentration is 1.02M.  
a. 0.0051 M/s      b. -196 M/s      c. 239 M/s      d.  $-5.1 \times 10^{-3}$  M/s      e. 0.0042 M/s
  
- If the rate of disappearance of  $\text{H}_2$  is 3.00 M/s, calculate the rate of  $\text{NH}_3$  appearance.  
Given:  $\text{N}_2 + 3 \text{H}_2 \rightarrow 2 \text{NH}_3$   
a. 2.00 M/s      b. 1.00 M/s      c. 3.00 M/s      d. 4.50 M/s      e. 1.50 M/s
  
- If a hypothetical rate law is  $\text{rate} = k[\text{A}]^2[\text{B}]^2$  what is the overall reaction order? \_\_\_\_\_
  
- The rate law for the following reaction is found to be  $\text{rate} = k[\text{H}_2][\text{I}_2]$ .  $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightarrow 2 \text{HI}(\text{g})$   
If the rate =  $4.24 \times 10^{-3}$  M/s when  $[\text{H}_2] = 0.150$  M and  $[\text{I}_2] = 0.250$  M, calculate the rate when  $[\text{H}_2] = 0.300$  M and  $[\text{I}_2] = 0.200$  M. (*Hint: first find k*) Show all your work and units.
  
- If the rate of a reaction increases by a factor of 9 when the concentration of a reactant is tripled, then the reaction is \_\_\_\_\_ order with respect to that reactant.
  
- If 25% of a sample, which obeys first order kinetics, remains after 45 seconds, calculate the rate constant.  
a.  $0.031 \text{ s}^{-1}$       b.  $-0.031 \text{ s}^{-1}$       c.  $-62 \text{ s}^{-1}$       d.  $0.56 \text{ s}^{-1}$       e.  $-0.59 \text{ s}^{-1}$

7. If plutonium-246 decays with a first order half-life of 200.0 years, what percentage of a sample would remain after 600.0 years?
- a. 33.3%      b. 25.0%      c. 12.5%      d. 6.25%      e. 8.00%
8. The half-life for a radioactive element that follows first-order decay is 534 years. If an 8.5 M solution is buried at a waste site, how long will it take for the solution to reach a concentration of 0.50 M?
- a. 0.001298 years      b. 1298 years      c. 771 years      d. 0.00367 years      e. 2180 years
9. Given the following reaction:  $\text{CO (g)} + \text{Cl}_2 \text{(g)} \rightarrow \text{COCl}_2 \text{(g)}$  Determine the orders for CO and Cl<sub>2</sub> and then write the rate law for this reaction. Then calculate the rate constant, *k*, and include the proper units. Show all your work and units.

Experiment	[CO] (M)	[Cl <sub>2</sub> ] (M)	Rate (M/s)
1	$1.00 \times 10^{-2}$	$2.00 \times 10^{-2}$	$2.64 \times 10^4$
2	$3.00 \times 10^{-2}$	$2.00 \times 10^{-2}$	$7.92 \times 10^4$
3	$1.00 \times 10^{-2}$	$4.00 \times 10^{-2}$	$1.06 \times 10^5$