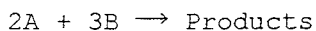


ANSWERS AT END

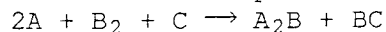
- The gas phase reaction  $A + B \rightarrow C$  has a reaction rate which is experimentally observed to follow the relationship  $\text{Rate} = k[A]^2[B]$ . The overall order of the reaction
- The units of the rate constant for a second order reaction can be \_\_\_\_\_.
- A reaction is first order in X and second order in Y. Tripling the initial concentration of X and cutting the initial concentration of Y to three-fourths of its previous concentration at constant temperature causes the initial rate to \_\_\_\_\_ by a factor of \_\_\_\_\_.
- Consider the following rate data for the reaction below at a particular temperature.



Experiment	Initial [A]	Initial [B]	Initial Rate of Loss of A
1	0.10 M	0.30 M	$7.20 \times 10^{-5} \text{ M}\cdot\text{s}^{-1}$
2	0.10 M	0.60 M	$1.44 \times 10^{-4} \text{ M}\cdot\text{s}^{-1}$
3	0.20 M	0.90 M	$8.64 \times 10^{-4} \text{ M}\cdot\text{s}^{-1}$

The reaction is \_\_\_\_\_ order in A and \_\_\_\_\_ order in B.

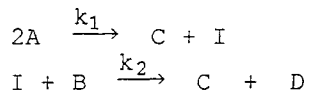
- Determine the rate-law expression for the reaction below.



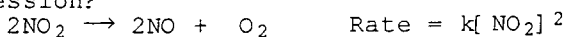
Trial	Initial [A]	Initial [B <sub>2</sub> ]	Initial [C]	Initial Rate of Formation of BC
1	0.20 M	0.20 M	0.20 M	$2.4 \times 10^{-6} \text{ M}\cdot\text{min}^{-1}$
2	0.40 M	0.30 M	0.20 M	$9.6 \times 10^{-6} \text{ M}\cdot\text{min}^{-1}$
3	0.20 M	0.30 M	0.20 M	$2.4 \times 10^{-6} \text{ M}\cdot\text{min}^{-1}$
4	0.20 M	0.40 M	0.40 M	$4.8 \times 10^{-6} \text{ M}\cdot\text{min}^{-1}$

- The decomposition of dimethylether at  $504^\circ\text{C}$  is first order with a half-life of 1570 seconds. What fraction of an initial amount of dimethylether remains after 4710 seconds?
- The gas phase reaction  $3C + 2D \rightarrow E + F$  obeys the rate-law expression  $\text{Rate} = k[D]$  and has a half-life of  $0.860 \text{ s}^{-1}$ . If 2.00 mole of D is injected into a 1.00-L container with excess C, what concentration of D remains after 1.50 seconds?
- The decomposition of dinitrogen pentoxide obeys the rate-law expression  $\text{Rate} = 0.080 \text{ min}^{-1} [\text{N}_2\text{O}_5]$ . If the initial concentration of  $\text{N}_2\text{O}_5$  is 0.30 M, what is the concentration after 2.6 minutes?

9. Consider the following proposed mechanism. If this mechanism for the overall reaction were correct, and if  $k_1$  were much less than  $k_2$ , then the observed rate law would be



10. Consider the reaction below and its observed rate law expression. Which proposed mechanisms are consistent with the rate law expression?



- I.  $NO_2 + NO_2 \rightarrow N_2O_4$  slow  
 $N_2O_4 \rightarrow N_2 + 2O_2$  fast  
 $N_2 + O_2 \rightarrow 2NO$  fast  


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 $2NO_2 \rightarrow 2NO + O_2$  overall
- II.  $NO_2 \rightarrow N + O_2$  slow  
 $NO_2 + N \rightarrow N_2O_2$  fast  
 $N_2O_2 \rightarrow 2NO$  fast  


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 $2NO_2 \rightarrow 2NO + O_2$  overall
- III.  $NO_2 \rightarrow NO + O$  slow  
 $O + NO_2 \rightarrow NO + O_2$  fast  


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 $2NO_2 \rightarrow 2NO + O_2$  overall

11. Calculate the activation energy of a reaction if the rate constant is  $0.75 \text{ s}^{-1}$  at  $25^\circ\text{C}$  and  $11.5 \text{ s}^{-1}$  at  $75^\circ\text{C}$ .
12. The specific rate constant,  $k$ , for a reaction is  $2.64 \times 10^{-2} \text{ s}^{-1}$  at  $25^\circ\text{C}$ , and the activation energy is  $74.0 \text{ kJ/mol}$ . Calculate  $k$  at  $50^\circ\text{C}$ .

ANSWERS:

- |  |   |
|--|---|
| 1. is third                                | 2. $\text{M}^{-1}\text{s}^{-1}$                 |
| 3. increase, 1.69                          | 4. second, first                                |
| 5. rate = $k[A]^2[C]$                      | 6. $1/8$  |
| 7. $0.60 \text{ M}$                        | 8. $0.24 \text{ M}$                             |
| 9. rate = $k_1[A]^2$                       | 10. I   |
| 11. <u>d) <math>47.1 \text{ kJ}</math></u> | 12. <u>c) <math>0.266 \text{ s}^{-1}</math></u> |

$$\ln \frac{k_2}{k_1} = \frac{E_a}{R} \left( \frac{1}{T_1} - \frac{1}{T_2} \right)$$