

1. a b c d

7. a b c d

2. a b c d

8. a b c d

3. a b c d

9. a b c d

4. a b c d

10. a b c d

5. a b c d

11. a b c d

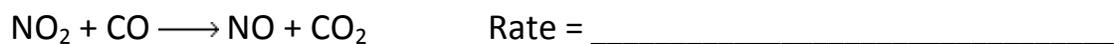
6. a b c d

12. a b c d

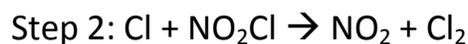
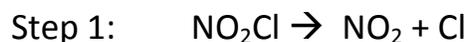
13. a b c d

Fill-in Questions

14. The following reaction is 2nd-order in NO₂ in and zero-order in CO. Write the rate law for the reaction.



15. The following mechanism is proposed for a reaction:



Write the overall reaction:

What is the molecularity of Step 2: _____

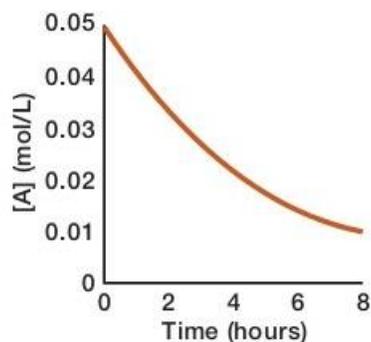
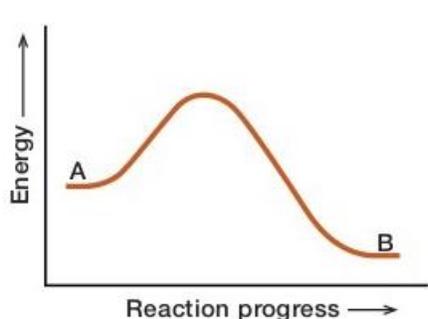
Give formulas of intermediates (if none, enter "none"): _____

Give formulas of catalysts (if none, enter "none"): _____

18. A metal carbonate undergoes decomposition: $\text{MCO}_3(\text{s}) \rightarrow \text{MO}(\text{s}) + \text{CO}_2(\text{g})$

The standard entropy of $\text{MCO}_3(\text{s})$ is 97.1 J/K. The free energy change of the reaction is +187 kJ at 270 K and +173.2 kJ at 350 K. What is the standard entropy of $\text{MO}(\text{s})$?

16. The reaction coordinate diagram for a reaction and its concentration-time curve are shown for the reaction run at 25 °C.



- draw a curve on the left plot that has a higher activation energy.
- draw a curve on the right plot for the reaction run if the activation energy were higher. Label it **B**.
- draw a curve on the right plot for the reaction run at higher temperature. Label it **C**.
- If the energy of the products were lower, the reaction rate would be:

faster slower the same

Long Answer Question:

17. A reaction has the following measured rate constants at two temperatures.

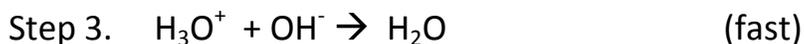
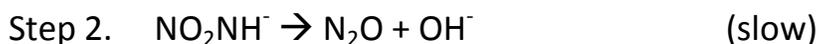
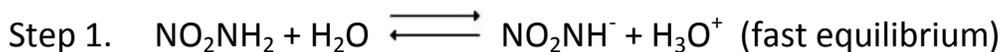
What is the activation energy?

$$k = 12.0 \text{ s}^{-1} \text{ at } 270 \text{ K}$$

$$k = 44.0 \text{ s}^{-1} \text{ at } 300 \text{ K}$$

$$E_a = \text{_____ kJ}$$

19. What is the expected rate law for the following mechanism? Add your own rate constant labels where needed.



Rate =