AP Chemistry

# Study Guide

## Chapter 14

Name: _____

Date: _____ Per: _____

1. Define:
   a. Homogeneous reaction: _____
   b. Heterogeneous reaction: _____
   c. Activated complex: _____
   d. Activation energy: _____
2. How is average rate of reaction calculated? _____
3. What is the relationship between Δ[product] and Δ[reactant] for a chemical reaction? _____
4. Describe an effective collision: _____
5. What are three factors that affect reaction rate? _____
6. Why is gas pressure directly related to gas concentration? _____
7. Describe the method of initial rates? _____
8. What are two methods of determining the order of a reactant using experimental data? _____
9. What is an integrated rate law used for? _____
10. Complete the following table for integrated rate law calculations:

| | Zero Order Reaction | First Order Reaction | Second Order Reaction |
|---|---|---|---|
| Rate Law Constant Unit: | | | |
| Integrated Rate Law: | | | |
| ½-life Formula: | | | |
| y-value for Straight-Line Plot: | | | |
| How does the ½-life change over time? | | | |

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11. What is the relationship between reaction rate and activation energy? _____

12. What is the Arhennius equation? How do the variables affect the value? _____

13. Describe a reaction mechanism: _____

14. Define:
    a. Molecularity: _____
    b. Rate-determining Step: _____
    c. Initial Step: _____

15. Complete the following table for elementary reactions:

| Molecularity | Sample Equation | Rate Law |
|---|---|---|
| | | |
| | | |
| | | |

16. How is the rate-law determined for a multi-step reaction mechanism with a slow-initial step? _____

17. How is determining the rate-law for a multi-step reaction mechanism with a fast-initial step different than for one with a slow-initial step? _____

18. How do catalysts affect reaction rate (& how do they change variables in the Arhennius equation)? _____

19. Define:
    a. Homogeneous catalyst: _____
    b. Heterogeneous catalyst: _____
    c. Adsorption: _____
    d. Absorption: _____

20. Compare & contrast acid catalysis & base catalysis: _____

21. Describe surface catalysis: _____

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22. Describe enzymatic catalysis: _____

_____

_____

Calculations

23. *The data in the table below were obtained for the reaction:*

$$2\ ClO_2\ (aq)\ +\ 2\ OH^-\ (aq)\ \rightarrow\ ClO_3^-\ (aq)\ +\ ClO_2^-\ (aq)\ +\ H_2O\ (l)$$

a. What is the order of the reaction with respect to $ClO_2$?

b. What is the order of the reaction with respect to $OH^-$?

c. What is the overall order of the reaction?

| Experiment Number | $[ClO_2]$ (M) | $[OH^-]$ (M) | Initial Rate (M/s) |
|---|---|---|---|
| 1 | 0.060 | 0.030 | 0.0248 |
| 2 | 0.020 | 0.030 | 0.00276 |
| 3 | 0.020 | 0.090 | 0.00828 |

d. What is the magnitude of the rate constant for the reaction?

24. *The rate law for a reaction is rate = k [A][B]$^2$:*

a. What is the overall reaction order? _____

b. How would the rate change if the [A] was tripled? _____

c. How would the rate change if the [B] was halved? _____

d. How would the rate change if the [A] was doubled and [B] was quartered? _____

25. The following reaction is second order in [A] and the rate constant is 0.025 $M^{-1}s^{-1}$:

$$A\ \rightarrow\ B$$

The concentration of A was 0.65 M at 33 s. Find the initial concentration of A.

26. A compound decomposes by a first-order process. If 25.0% of the compound decomposes in 60.0 minutes, the half-life of the compound is

27. For the elementary reaction; $NO_3\ +\ CO\ \rightarrow\ NO_2\ +\ CO_2$, the molecularity of the reaction is _____, and the rate law is rate = _____.

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28. A second-order reaction has a half-life of 18 s when the initial concentration of reactant is 0.71 M. The rate constant for this reaction is _____ $M^{-1}s^{-1}$.

29. The decomposition of $N_2O_5$ in solution in carbon tetrachloride proceeds via the reaction

$$2N_2O_5\ (soln) \rightarrow 4NO_2\ (soln) + O_2\ (soln)$$

The reaction is first order and has a rate constant of $4.82 \times 10^{-3}s^{-1}$ at 64°C. If the reaction is initiated with 0.058 mol in a 1.00-L vessel, how many moles remain after 151 s?

30. The reaction; $2NOBr\ (g) \rightarrow 2\ NO\ (g) + Br_2\ (g)$; is a second-order reaction with a rate constant of 0.80 $M^{-1}s^{-1}$ at 11°C. If the initial concentration of NOBr is 0.0440 M, what is the concentration of NOBr after 7.0 seconds?

31. What is the rate of appearance of $Br_2$ when the rate of disappearance of HBr in the gas phase reaction; $2HBr\ (g) \rightarrow H_2\ (g) + Br_2\ (g)$; is 0.301 $Ms^{-1}$ at 150°C.

32. *The peroxydisulfate ion* ($S_2O_8^{2-}$) *reacts with the iodide ion in aqueous solution via the reaction:*

$$S_2O_8^{2-}\ (aq) + 3I^- \rightarrow 2SO_4\ (aq) + I_3^-\ (aq)$$

*An aqueous solution containing* 0.050 M *of* $S_2O_8^{2-}$ *ion and* 0.072 M *of* $I^-$ *is prepared, and the progress of the reaction followed by measuring* $[I^-]$. *The data obtained is given in the table below.*

| Time (s) | 0.000 | 400.0 | 800.0 | 1200.0 | 1600.0 |
|---|---|---|---|---|---|
| $[I^-]$ (M) | 0.072 | 0.057 | 0.046 | 0.037 | 0.029 |

a. The average rate of disappearance of $I^-$ in the initial 400.0 s is _____ M/s.

b. The average rate of disappearance of $I^-$ between 400.0 s and 800.0 s is _____ M/s.

c. The concentration of $S_2O_8^{2-}$ remaining at 400 s is _____ M.