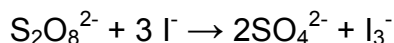


Solutions for Practice Exam 1

1. Consider the reaction



which one of the following rate expressions would give the same value as the rate of disappearance of $\text{S}_2\text{O}_8^{2-}$?

b. $\text{rate} = -1/3(\Delta[\text{I}^-]) / \Delta t$

2. The exponents (= orders) in a rate law are determined by

1. the coefficients in the balance equation.
2. experiment.
3. the physical states of the reactants and products.

b. 2 only

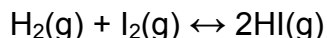
3. After five half-life periods for a first-order reaction, what is the molarity of a reagent initially at 0.366 M?

a. 1.14×10^{-2}

4. If the half-life of a first-order process is 3.00 minutes, the rate constant for the process is

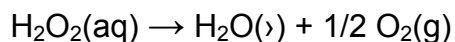
e. 0.231/min.

5. Under which of the following conditions does the equilibrium constant K change for the reaction



d. changing the temperature

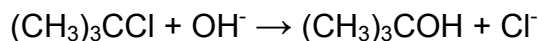
6. Hydrogen peroxide decays into water and oxygen in a first-order process.



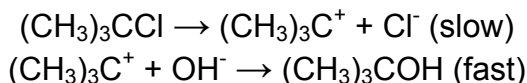
where the rate expression is $-\Delta[\text{H}_2\text{O}_2] / \Delta t = k[\text{H}_2\text{O}_2]$. If we begin with 0.100 M H_2O_2 and find that after 3200 seconds, the peroxide concentration falls to 0.0825 M, what is the rate constant, k, at the temperature at which the experiment is performed?

b. $6.01 \times 10^{-5} \text{ s}^{-1}$

7. In basic solution, $(\text{CH}_3)_3\text{CCl}$ reacts according to the equation



The accepted mechanism for the reaction is



What is the rate law expression for the reaction?

d. $\text{rate} = k[(\text{CH}_3)_3\text{CCl}]$

8. The activation energy for $2\text{N}_2\text{O}(\text{g}) \rightarrow 2\text{N}_2(\text{g}) + \text{O}_2(\text{g})$ is 250. kJ. If k for this reaction is $0.380 \text{ M}^{-1}\text{s}^{-1}$ at 1001 K, what will k be at room temperature, 298 K?

a. 6.36×10^{-32}

9. If $K_{\text{C}} = 0.44$ for the reaction $2\text{NOBr}(\text{g}) \leftrightarrow 2\text{NO}(\text{g}) + \text{Br}_2(\text{g})$ at a particular temperature, what is K_{C} for the following reaction?



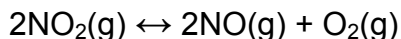
d. 0.66

10. A chemist prepared a sealed tube with 0.85 atm of PCl_5 at 500 K. The pressure increased as the following reaction occurred. When equilibrium was achieved, the pressure in the tube had increased to 1.25 atm. Calculate K_{p} .



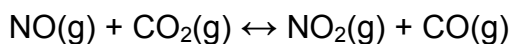
a. 0.36

11. A 1.00 liter flask contained 0.24 mol NO_2 at 700 K which decomposed according to the following equation. When equilibrium was achieved, 0.14 mol NO was present. Calculate K_{C} .



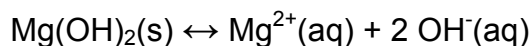
d. 1.4×10^{-1}

12. A mixture of 0.30 mol NO and 0.30 mole CO₂ is placed in a 2.00 L flask and allowed to reach equilibrium at a given temperature. Analysis of the equilibrium mixture indicated that 0.10 mol of CO was present. Calculate K_C for the reaction.



c. 0.25

13. A flask contains the following system at equilibrium:



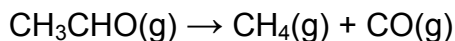
Which of the following reagents could be added to increase the solubility of Mg(OH)₂?

c. HCl

14. For the gas phase reaction, 3H₂ + N₂ → 2NH₃, how does the rate of disappearance of H₂ compare to the rate of production of NH₃?

c. The rate of disappearance of H₂ is 3/2 the rate of appearance of NH₃.

15. The reaction



proceeds via the rate expression $\Delta[\text{CO}]/\Delta t = [\text{CH}_3\text{CHO}]^{3/2}$. What is the overall order of the reaction?

e. three-halves-order

16. The half-life for a first-order reaction at 550 °C is 85 seconds. How long would it take for 23% of the reactant to decompose?

c. 32 seconds

17. The decomposition of phosphine, PH₃, follows first-order kinetics:



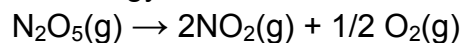
The half-life for the reaction at 550 °C is 81.3 seconds. How long does it take for the reaction to be 78.5% complete?

e. 180 seconds

18. What is the half-life of a first-order reaction which is 15% complete after 210 seconds?

e. 895 seconds

19. Calculate the activation energy, E° , for



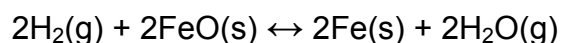
given k (at 25°C) = $3.46 \times 10^{-5}/\text{s}$ and k (at 50°C) = $1.10 \times 10^{-3}/\text{s}$. $R = 8.3145 \cdot 10^{-3} \text{ kJ/mol}\cdot\text{K}$.

b. 111 kJ

20. In which case does the reaction go farthest to completion (to the products)?

a. $K = 10^4$

21. For the reaction below, what is the expression for K_C ?



d. $K_C = [\text{H}_2\text{O}]^2/[\text{H}_2]^2$

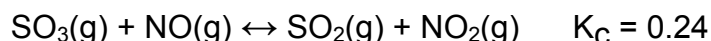
22. Consider the reaction $2\text{A}(\text{g}) \leftrightarrow \text{B}(\text{g})$ where $K_C = 0.5$ at the temperature of the reaction. If 2.0 moles of A and 2.0 moles of B are introduced into a 1.00 liter flask, what change in concentrations (if any) would occur in time?

e. [A] and [B] remain the same

23. Consider the reaction $\text{A}(\text{g}) \leftrightarrow 2\text{B}(\text{g})$ where $K_C = 1.5$ at the temperature of the reaction. If 3.0 moles of A and 3.0 moles of B are introduced into a 1.00 liter flask, what change in concentrations (if any) would occur in time?

b. [A] increases and [B] decreases

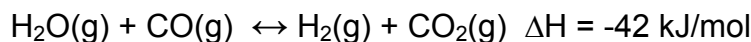
24. Exactly 0.50 mole of sulfur trioxide, 0.10 mole of sulfur dioxide, 0.20 mole of nitrogen monoxide and 0.30 mole nitrogen dioxide are sealed in a 1.0-L flask at 1500°C . The equilibrium constant K_C is 0.24 for the following reaction.



When equilibrium is achieved, what changes in concentrations of SO_3 and NO will be observed?

a. $[\text{SO}_3]$ increases; $[\text{NO}]$ increases

25. For the equilibrium system



K equals 0.62 at 1260 K. If 0.10 mol each of H_2O , CO , H_2 and CO_2 (all at 1260 K) were placed in a 1.0 L thermally insulated vessel which was also at 1260 K, then when the system came to equilibrium

a. the temperature would decrease and the mass of CO would increase.