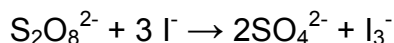


Practice Exam 1

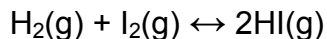
1. Consider the reaction



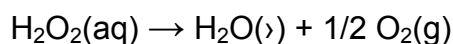
which one of the following rate expressions would give the same value as the rate of disappearance of $\text{S}_2\text{O}_8^{2-}$?

- rate = $-3 \Delta[\text{I}^-]/\Delta t$
 - rate = $-1/3(\Delta[\text{I}^-])/\Delta t$
 - rate = $-2(\Delta[\text{SO}_4^{2-}])/\Delta t$
 - rate = $-\Delta[\text{I}_3^-]/\Delta t$
 - rate = $-1/2(\Delta[\text{SO}_4^{2-}])/\Delta t$
2. The exponents (= orders) in a rate law are determined by
- the coefficients in the balance equation.
 - experiment.
 - the physical states of the reactants and products.
- 1 only
 - 2 only
 - 3 only
 - 1 and 2 only
 - 1, 2, and 3
3. After five half-life periods for a first-order reaction, what is the molarity of a reagent initially at 0.366 M?
- 1.14×10^{-2}
 - 3.12×10^{-2}
 - 6.57×10^{-3}
 - 3.12×10^3
 - 7.32×10^{-2}
4. If the half-life of a first-order process is 3.00 minutes, the rate constant for the process is
- 1.50/min.
 - 1.05/min.
 - 4.34/min.
 - 0.405/min.
 - 0.231/min.

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

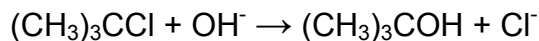


- changing the size of the container
 - Introducing more I_2 into the container
 - measuring the molar concentrations instead of pressures
 - changing the temperature
 - none of these, it is always constant
6. Hydrogen peroxide decays into water and oxygen in a first-order process.

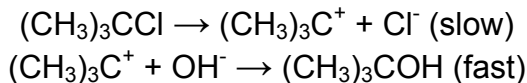


where the rate expression is $-\Delta[\text{H}_2\text{O}_2]/\Delta t = k[\text{H}_2\text{O}_2]$. If we begin with 0.100 M H_2O_2 and find that after 3200 seconds, the peroxide concentration falls to 0.0825 M, what is the rate constant, k , at the temperature at which the experiment is performed?

- $2.61 \times 10^{-5} \text{ s}^{-1}$
 - $6.01 \times 10^{-5} \text{ s}^{-1}$
 - $6.59 \times 10^{-5} \text{ s}^{-1}$
 - $3.79 \times 10^{-4} \text{ s}^{-1}$
 - $4.24 \times 10^{-3} \text{ s}^{-1}$
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?

- rate = $k[(\text{CH}_3)_3\text{C}^+][\text{OH}^-]$
- rate = $k[(\text{CH}_3)_3\text{C}^+][\text{OH}^-]$,
- rate = $k[\text{Cl}^-]$
- rate = $k[(\text{CH}_3)_3\text{CCl}]$
- rate = $k[(\text{CH}_3)_3\text{CCl}][\text{OH}^-]$

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}
- b. 4.35×10^{-16}
- c. 0.113
- d. 0.216
- e. 1.57×10^{31}

9. If $K_C = 0.44$ 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?



- a. 0.19
- b. 0.22
- c. 0.44
- d. 0.66
- e. 2.3

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 .



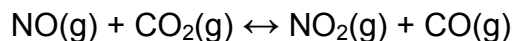
- a. 0.36
- b. 0.19
- c. 0.10
- d. 0.047
- e. 0.089

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 .

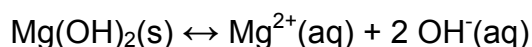


- a. 9.6×10^{-3}
- b. 1.1×10^{-2}
- c. 9.8×10^{-2}
- d. 1.4×10^{-1}
- e. 5.7×10^3

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.



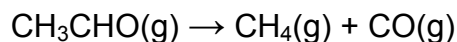
- a. 0.033
 - b. 0.05
 - c. 0.25
 - d. 1.1
 - e. 0.33
13. A flask contains the following system at equilibrium:



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

- a. NH₃
 - b. NaOH
 - c. HCl
 - d. H₂O
 - e. MgCl₂
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?
- a. The initial rates are equal.
 - b. The rate of disappearance of H₂ is 1/2 the rate of appearance of NH₃.
 - c. The rate of disappearance of H₂ is 3/2 the rate of appearance of NH₃.
 - d. The rate of disappearance of H₂ is 2/3 the rate of appearance of NH₃.
 - e. The rate of disappearance of H₂ is 1/3 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?

- a. zero-order
- b. first-order
- c. second-order
- d. third-order
- 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?

- a. 0.82 seconds
- b. 26 seconds
- c. 32 seconds
- d. 44 seconds
- e. 180 seconds

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



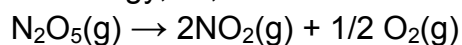
The half-life for the reaction at 550 °C is 81.3 seconds. How long does it take for the reaction to be 78.5% complete?

- a. 8.52 seconds
- b. 28.4 seconds
- c. 63.8 seconds
- d. 117 seconds
- e. 180 seconds

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

- a. 7.74 seconds
- b. 32 seconds
- c. 76.7 seconds
- d. 178 seconds
- e. 895 seconds

19. Calculate the activation energy, E^o, for



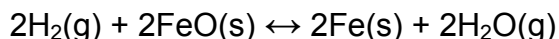
given k (at 25 °C) = 3.46 x 10⁻⁵/s and k (at 50 °C) = 1.10 x 10⁻³/s. R = 8.3145•10⁻³ kJ/mol•K).

- a. 231 kJ
- b. 111 kJ
- c. 99.3 kJ
- d. 76.2 kJ
- e. 56.5 kJ

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

- a. K = 10⁴
- b. K = 10³
- c. K = 1
- d. K = 10⁻³
- e. K = 10⁻⁵

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



- a. $K_C = [\text{Fe}]^2[\text{H}_2\text{O}]^2/[\text{H}_2]^2[\text{FeO}]^2$
- b. $K_C = [\text{H}_2\text{O}]^2/[\text{H}_2]^2[\text{FeO}]^2$
- c. $K_C = [\text{Fe}]^2/[\text{H}_2]^2[\text{FeO}]^2$
- d. $K_C = [\text{H}_2\text{O}]^2/[\text{H}_2]^2$
- e. $K_C = [2\text{Fe}]^2[2\text{H}_2\text{O}]^2/[2\text{H}_2]^2[2\text{FeO}]^2$

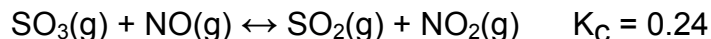
22. Consider the reaction $2\text{A}(\text{g}) \leftrightarrow \text{B}(\text{g})$ where $K_C = 0.5$ at the temperature of the reaction. If 2.0 moles of A and 2.0 moles of B are introduced into a 1.00 liter flask, what change in concentrations (if any) would occur in time?

- a. [A] increases and [B] increases
- b. [A] increases and [B] decreases
- c. [A] decreases and [B] increases
- d. [A] decreases and [B] decreases
- 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?

- a. [A] increases and [B] increases
- b. [A] increases and [B] decreases
- c. [A] decreases and [B] increases
- d. [A] decreases and [B] decreases
- e. [A] and [B] remain the same

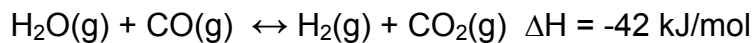
24. Exactly 0.50 mole of sulfur trioxide, 0.10 mole of sulfur dioxide, 0.20 mole of nitrogen monoxide and 0.30 mole nitrogen dioxide are sealed in a 1.0-L flask at 1500 °C. The equilibrium constant K_C is 0.24 for the following reaction.



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

- a. $[\text{SO}_3]$ increases; $[\text{NO}]$ increases
- b. $[\text{SO}_3]$ increases; $[\text{NO}]$ decreases
- c. $[\text{SO}_3]$ decreases; $[\text{NO}]$ decreases
- d. $[\text{SO}_3]$ decreases; $[\text{NO}]$ increases
- e. all concentrations remain the same

25. For the equilibrium system



K equals 0.62 at 1260 K. If 0.10 mol each of H₂O, CO, H₂ and CO₂ (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

- the temperature would decrease and the mass of CO would increase.
- the temperature would decrease and the mass of CO would decrease.
- the temperature would remain constant and the mass of CO would increase.
- the temperature would increase and the mass of CO would decrease.
- the temperature would increase and the mass of CO would increase.