

CH 123

General Chemistry

Exam 1

July 8, 2002

Name: _____
(please print)

SSN: * * * - * * - _____
(last 4 digits)

Each question is worth 1 point.

Circle your answer clearly, otherwise no credit will be given.

Circle only one answer. If you circle two or more, you will receive no credit.

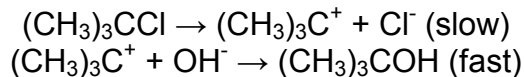
- What is the molality of a 5.45% by weight Na_2SO_4 (molar mass = 142.06 g/mol) solution?
 - 0.406 m
- What is the weight percent FeCl_3 (molar mass = 162.22 g/mol) in a solution which is 1.84 m?
 - 23.0%
- Which of the following solutions would have a freezing point closest to that of a 1 molal solution of CaCl_2 ?
 - 1 m Na_2SO_4
- Which of the following would have the highest freezing point?
 - pure H_2O
- You need a solution that is 0.15 m in ions. How many grams of MgCl_2 (molar mass = 95.2 g/mol) must you dissolve in 400. g of water? (Assume total dissociation of the ionic salt.)
 - 1.9 g
- The osmotic pressure of blood is 7.65 atm at 37 °C. How many grams of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$, molar mass = 180.2 g/mol) are needed to prepare 1.00 liter of a solution for intravenous injection that has the same osmotic pressure as blood?
 - 56.0 g
- For the gas phase reaction, $3\text{H}_2 + \text{N}_2 \rightarrow 2\text{NH}_3$, how does the rate of disappearance of H_2 compare to the rate of production of NH_3 ?
 - The rate of disappearance of H_2 is $3/2$ the rate of appearance of NH_3 .
- The reaction

$$\text{CH}_3\text{CHO}(\text{g}) \rightarrow \text{CH}_4(\text{g}) + \text{CO}(\text{g})$$
 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?
 - three-halves-order
- 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?
 - 32 seconds
- The decomposition of phosphine, PH_3 , follows first-order kinetics:

$$4\text{PH}_3(\text{g}) \rightarrow \text{P}_4(\text{g}) + 6\text{H}_2(\text{g})$$
 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?
 - 180 seconds
- What is the half-life of a first-order reaction which is 15% complete after 210 seconds?
 - 895 seconds

12. In basic solution, $(\text{CH}_3)_3\text{CCl}$ reacts according to the equation
 $(\text{CH}_3)_3\text{CCl} + \text{OH}^- \rightarrow (\text{CH}_3)_3\text{COH} + \text{Cl}^-$

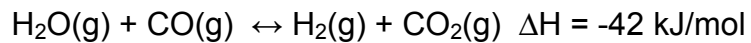
The accepted mechanism for the reaction is



What is the rate law expression for the reaction?

- d. $\text{rate} = k[(\text{CH}_3)_3\text{CCl}]$
13. Calculate the activation energy, E° , for
 $\text{N}_2\text{O}_5(\text{g}) \rightarrow 2\text{NO}_2(\text{g}) + 1/2 \text{O}_2(\text{g})$
given k (at 25°C) = $3.46 \times 10^{-5}/\text{s}$ and k (at 50°C) = $1.10 \times 10^{-3}/\text{s}$.
- b. 111 kJ
14. In which case does the reaction go farthest to completion?
- a. $K = 10^4$
15. For the reaction below, what is the expression for K_C ?
- $$2\text{H}_2(\text{g}) + 2\text{FeO}(\text{s}) \leftrightarrow 2\text{Fe}(\text{s}) + 2\text{H}_2\text{O}(\text{g})$$
- d. $K_C = [\text{H}_2\text{O}]^2/[\text{H}_2]^2$
16. 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
17. 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
18. 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.
- $$\text{SO}_3(\text{g}) + \text{NO}(\text{g}) \leftrightarrow \text{SO}_2(\text{g}) + \text{NO}_2(\text{g}) \quad K_C = 0.24$$
- When equilibrium is achieved, what changes in concentrations of SO_3 and NO will be observed?
- a. $[\text{SO}_3]$ increases; $[\text{NO}]$ increases
19. A flask contains the following system at equilibrium:
- $$\text{Mg}(\text{OH})_2(\text{s}) \leftrightarrow \text{Mg}^{2+}(\text{aq}) + 2 \text{OH}^-(\text{aq})$$
- Which of the following reagents could be added to increase the solubility of $\text{Mg}(\text{OH})_2$?
- c. HCl

20. 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

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