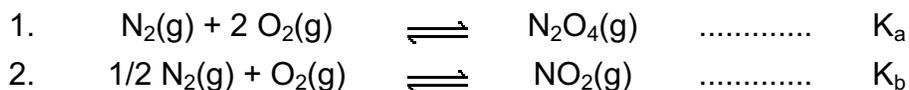
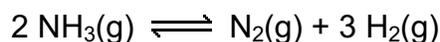


1. Consider the reaction: $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$
Write the equilibrium constant for this reaction in terms of the equilibrium constants, K_a and K_b , for reactions 1 and 2 below:

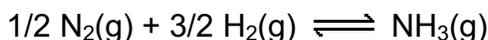


e. K_b^2/K_a

2. The equilibrium constant, K_c , for the following reaction is 16.4 at 768 K:

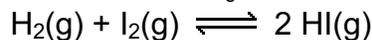


Calculate K_c at this temperature for:



c. 0.25

3. Consider the following reaction where $K_c = 55.6$ at 698 K:



A reaction mixture was found to contain $4.05 \cdot 10^{-2}$ moles of $\text{H}_2(\text{g})$, $4.21 \cdot 10^{-2}$ moles of $\text{I}_2(\text{g})$ and 0.269 moles of $\text{HI}(\text{g})$, in a 1.00 Liter container. Which of the following statements is true?

d. Q is less than K .

4. The pH of an aqueous solution of 0.159 M sodium cyanide, $\text{NaCN}(\text{aq})$, is ($K_b(\text{CN}^-) = 2.5 \cdot 10^{-5}$)

e. 11.30

5. We examine the following reaction at 250 °C: $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$. At equilibrium we find $[\text{PCl}_5] = 3.4 \times 10^{-5} \text{ M}$, $[\text{PCl}_3] = 1.3 \times 10^{-2} \text{ M}$, and $[\text{Cl}_2] = 1.0 \times 10^{-4} \text{ M}$. Calculate the equilibrium constant, K_c , for the reaction.

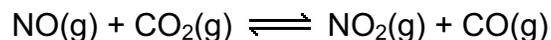
d. 0.038

6. 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

7. 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

8. A 2.00 liter flask is filled with 1.5 mole SO₃, 2.5 mole SO₂, and 0.5 mole O₂, and allowed to reach equilibrium. At this temperature, K_C = 1.0. Predict the effect on the concentration of O₂ as equilibrium is being achieved by using Q, the reaction quotient.



a. [O₂] will increase because Q < K

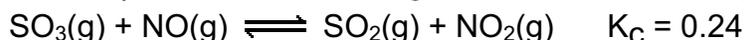
9. Consider the reaction 2A(g) ⇌ B(g) where K_C = 0.5 at the temperature of the reaction. If 2.0 moles of A and 2.0 moles of B are introduced into a 1.00 liter flask, what change in concentrations (if any) would occur in time?

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

10. Consider the reaction A(g) ⇌ 2B(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

11. 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 SO₃ and NO will be observed?

a. [SO₃] increases; [NO] increases

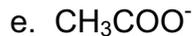
12. A flask contains the following system at equilibrium:



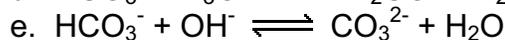
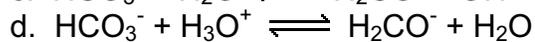
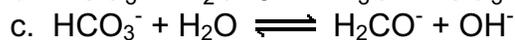
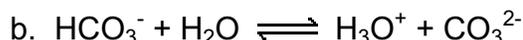
Which of the following reagents could be added to increase the solubility of Mg(OH)₂?

c. HCl

13. All of the following can function both as an acid and base **EXCEPT**



14. The $K_a(\text{HCO}_3^-)$ is the equilibrium constant for the reaction



15. What is the pH of a 0.054 M NaOH solution at 25 °C?

d. 12.73

16. We have a 4.63×10^{-4} M solution of HCl. What is the pH of this solution at 25 °C?

a. 3.33

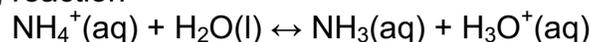
17. A 0.20 M solution of an acid, HA, has a pH of 3.82 at 25 °C. What is K_a for this acid?

c. 1.1×10^{-7}

18. What is the pH of a 1.86 M $\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$ solution at 25 °C? $K_a = 1.3 \cdot 10^{-5}$

d. 2.31

19. In the following reaction



a. NH_4^+ is an acid and NH_3 is its conjugate base.

20. At 25 °C, what is the pH of a 3.25 M solution of ammonium chloride, NH_4Cl ?
 $K_a(\text{NH}_4^+) = 5.6 \cdot 10^{-10}$

b. 4.37