

Name: _____ Period: _____

K_a and K_b Calculations Worksheet

When a strong acid or base is placed in water, they completely ionize. This means that approximately 100% of the acid or base forms products (or the arrow in the chemical equation points one direction). In the case of a weak acid or base, the substance only partially ionizes. This means equilibrium is established in an aqueous solution of a weak acid or base. Using your understanding of acid/base chemistry, complete the following problems.

1. Write chemical equations which represent the dissociation of each of these acids or bases in aqueous solution. Use a single arrow in the case of a strong acid or base, and a double arrow to represent the equilibrium condition that exists in the solution of a weak acid or base.

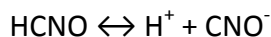
a. HCl
b. NaOH
c. H ₂ SO ₄
d. KOH
e. HC ₂ H ₃ O ₂
f. HCN
g. Cu(OH) ₂
h. NH ₄ OH

2. Calculate the [H⁺] and [OH⁻] of a 1.0 x 10⁻³ M solution of HCl, a strong acid.

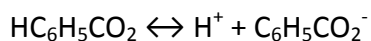
3. Calculate the [OH⁻] and the [H⁺] of a 0.0020 M solution of NaOH, a strong base.

4. Benzoic acid, $\text{HC}_6\text{H}_5\text{CO}_2$, is an organic acid whose sodium salt, $\text{NaC}_6\text{H}_5\text{CO}_2$, has long been used as a safe food additive to protect beverages and many foods against harmful yeasts and bacteria. The acid is monoprotic. Write the equation for its K_a .

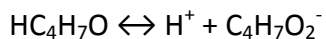
5. The $[\text{H}^+]$ of a 0.10 M solution of cyanic acid (HCNO) is found to be 0.0010 M. Calculate the K_a for cyanic acid.



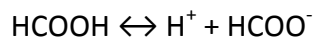
6. If 1.22 grams of benzoic acid, $\text{HC}_6\text{H}_5\text{CO}_2$, is dissolved in 1.0 L of water, the $[\text{H}^+]$ is found to be 8.0×10^{-4} M. Calculate the K_a for benzoic acid.



7. A 0.0050 M solution of butyric acid, HC_4H_7 , has a $\text{pH} = 4.0$, calculate K_a .



8. Determine the $[\text{OH}^-]$ and the $[\text{H}^+]$ of a 0.20 M solution of formic acid. The $K_a = 1.8 \times 10^{-4}$



9. HCN has an initial molarity of 0.50 M, with a K_a value of 3.7×10^{-8} . Calculate its pH at equilibrium. (Hint: This is an ICE problem.)
10. Ethylamine ($C_2H_5NH_3$) is a weak Bronsted-Lowry base. If it has an initial molarity of 0.024 M and a K_b of 5.6×10^{-4} , calculate its pH at equilibrium. (Hint: This is an ICE Problem.)
11. A chemist adds 0.75 moles of NH_3 to enough water to make 0.50 liters of solution. K_b of ammonia is 1.8×10^{-5} . Determine the pH of this solution at equilibrium. (Hint: This is an ICE problem.)
12. Hydrazine, N_2H_4 , has been used as a rocket fuel. Like ammonia, it is a Bronsted base. A 0.15 M solution has a pH of 10.70. What is the K_b for hydrazine?