

ACIDS AND BASES: K_a and K_b PROBLEMS

1. Lactic acid is a monoprotic acid, $C_3H_5O_3H$. A 3.5 M solution is 4.8% ionized. Determine the K_a value for lactic acid.
2. A certain weak acid, HA is 1.5% ionized in a 0.25 M solution of the acid. What is the value of K_a for this acid?
3. The pH of a 2.5 M weak monoprotic acid, HA solution is 3.50. What is the K_a value for this acid?
4. 0.25 mole formic acid, HCOOH, is dissolved in enough water to make one liter of solution. The pH of that solution is 2.19. What is the K_a of formic acid?
5. Calculate the pH of a 0.022 M hypochlorous acid, HOCl, solution, $K_a = 3.2 \times 10^{-8}$.
6. What is the percent ionization of 0.036 M benzoic acid, C_6H_5COOH , given $K_a = 1.42 \times 10^{-4}$.
7. Calculate the percent ionization of 0.020 M CH_3COOH . $K_a = 1.8 \times 10^{-5}$
8. A 1.02 M HF solution is only 2.6 percent ionized. What is the value of K_a for HF?
9. Phenoxide ion, $C_6H_5O^-$ is a weak base with $K_b = 7.7 \times 10^{-5}$. Calculate the pH of a 0.25 M solution of $C_6H_5O^-$.
10. Ammonia, NH_3 , has a base ionization constant, $K_b = 1.8 \times 10^{-5}$. Calculate the pH of a 0.25 M solution of NH_3 .
11. The pH of a 1.2 M $C_2H_5NH_2$, ethylamine solution is 12.41. Calculate the K_b value for ethylamine.
12. The pOH of 1.5 M methylamine, CH_3NH_2 , solution is 1.59. What is the K_b value for methylamine?
13. Given the K_a for HOCN is 3.3×10^{-4} , what is K_b for OCN^- ?
14. The ionization constant, K_a , for hypobromous acid, HOBr, is 2.0×10^{-9} . What is the value of the conjugate base ionization constant, K_b , for OBr^- ion?
15. A 0.1 M solution of barbituric acid is buffered with 0.1 M of sodium barbiturate in 1.0 L of acid. Calculate the pH for this solution. ($K_a = 1.0 \times 10^{-4}$)
16. Write an equation to show the reaction between methylamine, CH_3NH_2 , and boron trifluoride, BF_3 . Identify the Lewis acid and Lewis base and explain your choice.
17. Which of the following could act as Lewis acids but not as Bronsted acids?
a) SO_3 b) HSO_3^- c) BF_3 d) $SnCl_4$ e) SeF_4 f) NH_3 g) CH_3COOH
18. Codeine is a cough suppressant extracted from crude opium, it is a weak base, with a pK_a of 4.76. What will be the pH of a $0.022 \text{ mol dm}^{-3}$ solution of codeine.
19. Hydrazine, N_2H_4 has been used as a rocket fuel. Like ammonia, NH_3 , it is a weak base. A 0.15 mol dm^{-3} solution has a pH of 10.25. Calculate the K_b and pK_b for hydrazine and determine the pK_a of its conjugate base.
20. Ethylamine has a strong pungent odour similar to ammonia. Like ammonia it is a Bronsted base. A $0.100 \text{ mol dm}^{-3}$ solution has a pH of 11.86. Calculate K_b and pK_b of ethylamine, and the pK_a of the conjugate acid $CH_3CH_2NH_3^{+1}$.