

Recitation Worksheet 8 (Acids and Bases 2)

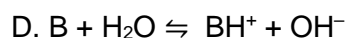
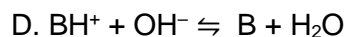
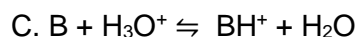
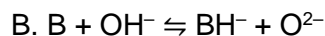
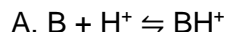
Name:

UGA ID:

Instructions:

- Please enter your first and last name as it appears on the eLC roster (do not use a nickname).
- Your UGA myID is a combination of letters and numbers (example: mine is wpe28548). Do not use your 81x number.
- If you do not have a printer, type your answers in the then upload the worksheet template to Gradescope by Tuesday, March 30 at 11:59 pm. Write your work on separate sheets of paper, convert to a PDF and upload to eLC.
- If you have a printer download the worksheet, convert it to a PDF and upload to Gradescope by Tuesday, March 30 at 11:59 pm. You do not need to upload anything to eLC.

1. The base ionization constant K_b describes which of the following reactions for a weak base, B, in aqueous solution?



2. Which one of the following is basic?



3. When $[H^+] = 4.0 \times 10^{-9}$ M in water at 25 °C, then _____

- A. pH = 9.40.
- B. pH = 8.40.
- C. pH = 7.00.
- D. pH = -9.40
- E. pH = -8.40.

4. Solutions of each of the hypothetical acids in the following table are prepared with an initial concentration of 0.100 M. Which of the four solutions will have the lowest pH and be most acidic? Acid pK_a :

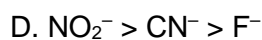
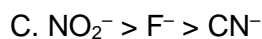
HA 4.00
HB 7.00
HC 10.00
HD 11.00

- A. HA
- B. HD
- C. HB
- D. HC
- E. All will have the same pH because the concentrations are the same.

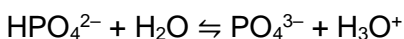
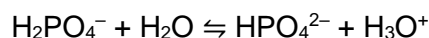
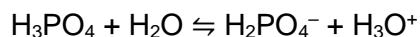
5. When values of K_a are small (e.g., 1×10^{-5}) and concentrations of weak acids $[HA]$ are relatively large (e.g., 0.10 M), and assuming there is no other source of anion A^- , the hydronium ion concentration of the solution can be calculated using which expression?

- A. $[H^+] = K_a$
- B. $[H^+] = K_a K_b [HA]$
- C. $[H^+] = K_a [HA]$
- D. $[H^+] = K_a [HA]^2 / [A^-]$
- E. $[H^+] = (K_a [HA])^{1/2}$

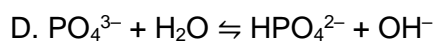
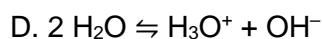
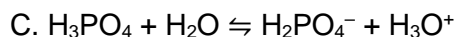
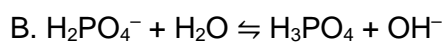
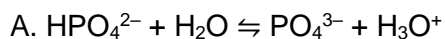
6. Use the following acid ionization constants to identify the correct decreasing order of base strength



7. Phosphoric acid is a triprotic acid, ionizing in the following sequential steps:



Which equilibrium is most important in determining the pH of a solution of sodium phosphate?



8. Aqueous solutions of _____ are basic.



9. Which one of the following salts forms aqueous solutions with pH = 7?

- A. Na_2S
- B. NaNO_2
- C. NaBr
- D. Na_2CO_3
- E. NaClO_2

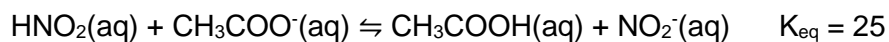
10. Which one of the following, A–D, is correct? If all are correct, respond E.

- A. K_2SO_3 is a stronger base than KHSO_3 .
- B. Na_2HPO_4 is a weaker base than NaH_2PO_4 .
- C. K_2CO_3 is a weaker base than KHCO_3 .
- D. NaHSO_3 is a stronger acid than NaHSO_4 .
- E. All of these statements are correct.

11. Which of the following groups, A–D, consist of salts that all form basic solutions in water? (Ac = acetate) If none or all satisfy this criterion, respond E.

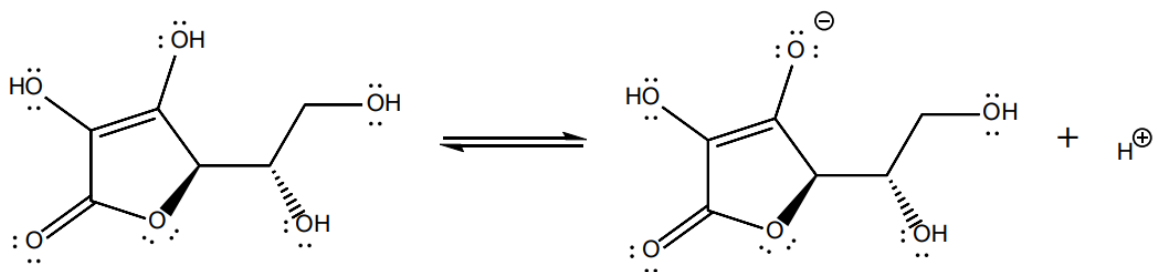
- A. NaNO_3 , NH_4CN , NaAc , NH_4Cl
- B. NaHCO_3 , NaF , NH_4Cl , Na_2SO_3
- C. Na_2CO_3 , KCl , NaAc , NH_4Cl
- D. Na_2CO_3 , NaF , NaAc , NaCN
- E. None or all of the above.

12. For the reaction shown, which of the following statements would be true, given the listed value for K_{eq} ?

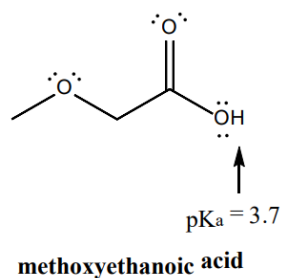
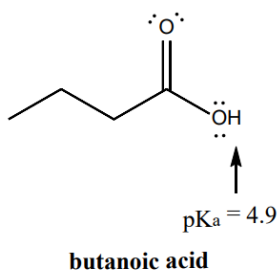


- A. CH_3COO^- is the weakest acid
- B. HNO_2 is the weakest acid
- C. CH_3COOH is the weakest acid
- D. NO_2^- is the strongest base
- E. The solution will contain more HNO_2 than CH_3COOH at equilibrium

13. What is the pH of a solution that is made up to be 0.25 M in ascorbic acid ($pK_a = 4.17$)?



14. The structures and pK_a values for butanoic acid and methoxyethanoic acid are shown below:



Is the reaction between butanoic acid and the methoxyethanoate anion ($\text{CH}_3\text{CH}_2\text{CO}_2^-$):

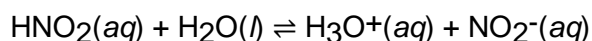
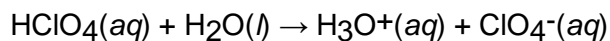
- A. reactant favored
- B. product-favored at 25 °C?

15. Calculate the pH of a 0.800 M $\text{CH}_3\text{NH}_3\text{Cl}$ solution. K_b for methylamine, CH_3NH_2 , is 3.7×10^{-4} .

16. Calculate the pH of a 0.80 M H_2SO_3 solution that has the stepwise dissociation constants $K_{a1} = 1.5 \times 10^{-2}$ and $K_{a2} = 6.3 \times 10^{-8}$.

17. Calculate the pH of a 0.800 M KBrO solution. K_a for hypobromous acid, HBrO , is 2.0×10^{-9} .

18. From the following chemical reactions determine the relative Brønsted-Lowry acid strengths (strongest to weakest).



A. $\text{HClO}_4 > \text{H}_3\text{O}^+ > \text{HNO}_2$

B. $\text{HClO}_4 > \text{HNO}_2 > \text{H}_3\text{O}^+$

C. $\text{H}_3\text{O}^+ > \text{HClO}_4 > \text{HNO}_2$

D. $\text{H}_3\text{O}^+ > \text{HNO}_2 > \text{HClO}_4$

19. What is the pH of a 0.020 M HClO_4 solution?

20. What is the pH of a solution prepared by diluting 25.00 mL of 0.020 M $\text{Mg}(\text{OH})_2$ with enough water to produce a total volume of 250.00 mL?