

Week 8 Challenge Problems
March 13, 2019

1. Tris(hydroxymethyl)aminomethane, commonly called TRIS or Trizma, is often used as a buffer in biochemical studies. MM (TRIS) = 121.14 g/mol
 - a. What is the optimal pH for TRIS buffers?
 - b. Calculate the ratio $[\text{TRIS}]/[\text{TRISH}^+]$ at pH = 7.00 and pH = 9.00.
 - c. A buffer is prepared by diluting 50.0 g TRIS base and 65.0 g TRIS Hydrochloride (TRISHCl) to a total volume of 2.0 L. What is the pH of this buffer? What is the pH after 2.00 mL of 12 M HCl is added to a 200 mL portion of the buffer?
2. To prepare a buffer solution with pH = 4.70, how many moles of NaN_3 should be added to a 1.0 L solution that is 0.40 M in HN_3 ? Assume no change in volume.
3. You need 1.0 L of a buffer solution at a pH of 7.2 How would you prepare this buffer? (give the identity and appropriate amounts of buffers to use).
4. Given a 200. mL solution of 1.2 M benzoic acid being titrated with 6.0 M NaOH, what would be the pH at the following points in the titration?
 - a. 15.0 mL NaOH added
 - b. The equivalence point
 - c. 5.00 mL beyond the equivalence point
5. You have a 250 mL buffered solution that is 0.5 M in benzoic acid and 0.6 M in sodium benzoate. What is the pH if you add 25.0 mL of 1.0 M HCl? What is the pH if you add 25.0 mL of 1.0 M NaOH?
6. If you start with 40.0 mL of 2.00 M HClO_4 , calculate $[\text{H}^+]$ after the addition of 60.0 mL of 0.60 M KOH. Is this before or after the equivalence point?

Week 8 Challenge Problems
March 13, 2019

1. Tris(hydroxymethyl)aminomethane, commonly called TRIS or Trizma, is often used as a buffer in biochemical studies. MM (TRIS) = 121.14 g/mol
 - a. What is the optimal pH for TRIS buffers?
 - b. Calculate the ratio $[\text{TRIS}]/[\text{TRISH}^+]$ at pH = 7.00 and pH = 9.00.
 - c. A buffer is prepared by diluting 50.0 g TRIS base and 65.0 g TRIS Hydrochloride (TRISHCl) to a total volume of 2.0 L. What is the pH of this buffer? What is the pH after 2.00 mL of 12 M HCl is added to a 200 mL portion of the buffer?
2. To prepare a buffer solution with pH = 4.70, how many moles of NaN_3 should be added to a 1.0 L solution that is 0.40 M in HN_3 ? Assume no change in volume.
3. You need 1.0 L of a buffer solution at a pH of 7.2 How would you prepare this buffer? (give the identity and appropriate amounts of buffers to use).
4. Given a 200. mL solution of 1.2 M benzoic acid being titrated with 6.0 M NaOH, what would be the pH at the following points in the titration?
 - a. 15.0 mL NaOH added
 - b. The equivalence point
 - c. 5.00 mL beyond the equivalence point
5. You have a 250 mL buffered solution that is 0.5 M in benzoic acid and 0.6 M in sodium benzoate. What is the pH if you add 25.0 mL of 1.0 M HCl? What is the pH if you add 25.0 mL of 1.0 M NaOH?
6. If you start with 40.0 mL of 2.00 M HClO_4 , calculate $[\text{H}^+]$ after the addition of 60.0 mL of 0.60 M KOH. Is this before or after the equivalence point?

7. You have a 1.0 L buffered solution of 2.0 M ammonia (NH₃) and 1.5 M ammonium chloride. How many moles of HCl would you have to add to shift the pH to 8.0?

Acid	K _a	Base	K _b
HN ₃	2.6×10^{-5}	NH ₃	1.8×10^{-5}
HCN	6.2×10^{-10}	CH ₃ NH ₂	4.4×10^{-4}
HC ₂ H ₃ O ₂	1.8×10^{-5}	TRIS	1.19×10^{-6}
Benzoic acid	6.3×10^{-5}		
HF	7.2×10^{-4}		
HOCl	3.5×10^{-8}		

7. You have a 1.0 L buffered solution of 2.0 M ammonia (NH₃) and 1.5 M ammonium chloride. How many moles of HCl would you have to add to shift the pH to 8.0?

Acid	K _a	Base	K _b
HN ₃	2.6×10^{-5}	NH ₃	1.8×10^{-5}
HCN	6.2×10^{-10}	CH ₃ NH ₂	4.4×10^{-4}
HC ₂ H ₃ O ₂	1.8×10^{-5}	TRIS	1.19×10^{-6}
Benzoic acid	6.3×10^{-5}		
HF	7.2×10^{-4}		
HOCl	3.5×10^{-8}		