

Questions

Calculate the pH of a buffer solution: Calculate the pH of a solution prepared by dissolving 2.20 g of sodium acetate, CH_3COONa , in 60.5 mL of 0.20 M acetic acid, $\text{CH}_3\text{COOH}(aq)$. Assume the volume change upon dissolving the sodium acetate is negligible. K_a of CH_3COOH is 1.75×10^{-5} .

pH = 5.10

Determine buffer capacity: Which of the following additions will exceed the buffer capacity of a buffer that contains 0.20 moles acetic acid and 0.10 moles sodium acetate in a total volume of 2.0 L?

100 mL of 1.5 M $\text{HCl}(aq)$

Collected Lab Data

Addition of hydrochloric acid

Beaker 1: Volume of DI water (mL)	0.5
Beaker 2: Volume of 0.1 M sodium chloride (mL)	0.5
Beaker 3: Mass of sodium acetate (g)	0.48
Beaker 3: Volume of 0.1 M acetic acid (mL)	0.5

Addition of sodium hydroxide

Beaker 4: Volume of DI water (mL)	0.51
Beaker 5: Volume of 0.1 M sodium chloride (mL)	0.50
Beaker 6: Mass of sodium acetate (g)	0.51
Beaker 6: Volume of 0.1 M acetic acid (mL)	0.50

Buffer sol

pH change from addition of hydrochloric acid

Volume 1 M HCl(aq) added (mL)	Beaker 1 DI water	Beaker 2 0.1 M sodium chloride	Beaker 3 0.1 M acetic acid and sodium acetate
0	7.12	6.92	5.33
1	1.81	1.61	5.16
2	1.52	1.32	5.00
3	1.35	1.15	4.81
4	1.23	1.03	4.57
5	1.15	0.95	4.19
6	1.07	0.87	1.21
7	1.02	0.82	1.18
8	0.97	0.77	1.15
9	0.92	0.72	1.12
10	0.88	0.68	1.10

Best buffer when adding HCl (aq)

Acetic acid/sodium acetate solution

High

pH change from addition of sodium hydroxide

Volume 1 M NaOH(aq) added (mL)	Beaker 4 DI water	Beaker 5 0.1 M sodium chloride	Beaker 6 0.1 M acetic acid and sodium acetate
0	7.12	6.92	5.36
1	12.41	12.22	5.52
2	12.71	12.51	5.71
3	12.87	12.68	5.94
4	12.99	12.80	6.31
5	13.08	12.89	13.82
6	13.15	12.96	13.85
7	13.21	13.02	13.87
8	13.26	13.07	13.90
9	13.30	13.11	13.92
10	13.34	13.15	13.94

Best buffer when adding NaOH (aq)

Acetic acid/sodium acetate solution

Prepare buffer solutions

Beaker	Mass of sodium acetate (g)	Volume of 0.1 M acetic acid (mL)
1	0.51	50.0
2	0.73	72.0
3	0.96	98.0
4	0.53	48.0
5	0.75	73.0
6	0.98	97.0

Buffer solution and pH change from addition of hydrochloric acid

Volume 1 M HCl(aq) added (mL)	Beaker 1 pH	Beaker 2 pH	Beaker 3 pH
0	5.35	5.35	5.33
1	5.20	5.24	5.25
2	5.04	5.13	5.17
3	4.86	5.02	5.09
4	4.65	4.90	5.00
5	4.34	4.76	4.91
6	3.55	4.60	4.81
7	1.18	4.38	4.70
8	1.15	4.03	4.58
9	1.12	1.20	4.41
10	1.10	1.18	4.19

Highest buffer capacity when adding HCl(aq)

Solution 3

Buffer solution and pH change from addition of sodium hydroxide

Volume 1 M NaOH(aq) added (mL)	Beaker 4 pH	Beaker 5 pH	Beaker 6 pH
0	5.39	5.35	5.35
1	5.55	5.46	5.43
2	5.74	5.58	5.51
3	5.98	5.71	5.61
4	6.37	5.86	5.70
5	13.83	6.05	5.81
6	13.86	6.32	5.94
7	13.89	6.99	6.10
8	13.91	13.83	6.33
9	13.93	13.84	6.73
10	13.95	13.86	13.81

Highest buffer capacity when adding NaOH(aq)

Solution 6

Indicates incorrect data