

- Trichloroacetic acid, CCl_3COOH , a corrosive acid used to precipitate proteins, has a K_a of 0.16 M . What is the pH of a 0.050 M solution of trichloroacetic acid?

Hint: If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Answer:

Marks
6

- The H_2PO_4^- and HPO_4^{2-} ions play a major role in maintaining the intracellular pH balance. Write balanced equations to show how a solution containing these ions can act as a buffer.

For phosphoric acid, $K_{a1} = 7.1 \times 10^{-3} \text{ M}$, $K_{a2} = 6.3 \times 10^{-8} \text{ M}$, $K_{a3} = 4.2 \times 10^{-13} \text{ M}$.
At what pH would the $\text{H}_2\text{PO}_4^- / \text{HPO}_4^{2-}$ buffer system be most effective? Why?

Calculate the ratio of $\text{H}_2\text{PO}_4^- / \text{HPO}_4^{2-}$ needed to give a solution buffered to a pH of 7.35.

<ul style="list-style-type: none">Find the concentration of H_3O^+ in a 0.60 M aqueous solution of nitrous acid. The acid dissociation constant of HNO_2 is $K_a = 7.1 \times 10^{-4}$ M.	Marks 2
Answer:	
<ul style="list-style-type: none">An aqueous solution of a weak acid has $[\text{H}_3\text{O}^+] = 2.54 \times 10^{-4}$ M. Find the pH and pOH of the solution.	1
pH =	pOH =
<ul style="list-style-type: none">Ammonia, NH_3, is a Brønsted-Lowry base and a Lewis base, but not an Arrhenius base. Why?	3

Marks
4

- Triethylamine, $\text{N}(\text{CH}_2\text{CH}_3)_3$, is a weak base with $K_b = 5.2 \times 10^{-4}$ M. A 20.00 mL solution of 0.100 M triethylamine was titrated with 0.100 M HCl. Calculate the pH of the titration solution after the addition of:

a) 5.00 mL HCl solution

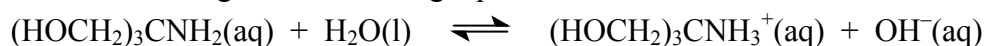
pH =

b) 20.10 mL HCl solution

pH =

2

- Tris(hydroxymethyl)aminomethane, commonly called TRIS, is a weak base with $K_b = 1.19 \times 10^{-6}$ M. It is often used in buffers for biochemical research. It reacts with water according to the following equation.



At what pH does TRIS show its maximum buffering ability?

pH =

What is the TRIS/TRIS- H^+ ratio in a buffer of pH 7.40?

Answer:

- Explain why the acidity of hydrogen halides *increases* with increasing halogen size (*i.e.*, $K_a(\text{HCl}) < K_a(\text{HBr}) < K_a(\text{HI})$), while the acidity of hypohalous acids *decreases* with increasing halogen size (*i.e.*, $K_a(\text{HOCl}) > K_a(\text{HOBr}) > K_a(\text{HOI})$).

Marks
5

- The K_a of benzoic acid is 6.3×10^{-5} M at 25 °C.

Calculate the pH of a 0.0100 M aqueous solution of sodium benzoate (C_6H_5COONa).

Answer:

A buffer solution is prepared by adding 375 mL of this 0.0100 M aqueous solution of sodium benzoate to 225 mL of 0.0200 M aqueous benzoic acid. Calculate the pH of the buffer solution.

Answer:

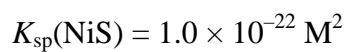
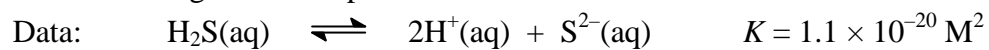
- A 300.0 mL solution of HCl has a pH of 1.22. Given that the pK_a of iodic acid, HIO_3 , is 0.79, how many moles of sodium iodate, NaIO_3 , would need to be added to this solution to raise its pH to 2.00?

3

Answer:

Marks
5

- The pH of a solution can be controlled by adding small amounts of gaseous HCl. Assuming no change in volume, calculate what the pH of the solution must be to just dissolve 1.00 g of NiS suspended in 1.0 L of water.



pH =

Marks
6

- Calculate the pH of a 0.10 mol L^{-1} solution of HF. (The pK_a of HF is 3.17.)

Answer:

What mass of NaF needs to be added to 100.0 mL of the above solution to make a buffer with a pH of 3.00?

Answer:

Explain why HCl is a much stronger acid than HF.

Marks
3

- A solution is prepared by dissolving 0.050 mol of acetic acid, 0.020 mol of sodium acetate and 0.0010 mol of HCl in water to give a final volume of 250 mL. The pK_a of acetic acid is 4.76. What is the pH of this solution?

pH =

Marks
7

- A 20.0 mL solution of nitrous acid (HNO_2 , $\text{p}K_{\text{a}} = 3.15$) was titrated to its equivalence point with 24.8 mL of 0.020 M NaOH. What is the concentration of the HNO_2 solution?

Answer:

What was the pH at the start of the titration?

pH =

What was the pH after (a) 12.4 mL and (b) 24.8 mL of the NaOH had been added?

(a) 12.4 mL: pH =

(b) 24.8 mL: pH =

Qualitatively, how would each of these three pH values be affected if 0.020 M NH_3 had been used in place of the NaOH solution? The $\text{p}K_{\text{b}}$ of NH_3 is 4.76.