

Marks
8

- Boric acid, $B(OH)_3$, is a weak acid ($pK_a = 9.24$) that is used as a mild antiseptic and eye wash. Unusually, the Lewis acidity of the compound accounts for its Brønsted acidity. By using an appropriate chemical equation, show how this compound acts as a Brønsted acid in aqueous solution.

Solution A consists of a 0.60 M aqueous solution of boric acid at 25 °C. Calculate the pH of Solution A.

pH =

At 25 °C, 1.00 L of Solution B consists of 112 g of $NaB(OH)_4$ dissolved in water. Calculate the pH of Solution B.

pH =

Using both Solutions A and B, calculate the volumes (mL) required to prepare a 1.0 L solution with a pH = 9.24.

Answer:

- Boric acid, $B(OH)_3$, is a weak acid ($pK_a = 9.24$) that is used as a mild antiseptic and eye wash. Unusually, the Lewis acidity of the compound accounts for its Brønsted acidity. By using an appropriate chemical equation, show how this compound acts as a Brønsted acid in aqueous solution.

Solution A consists of a 0.40 M aqueous solution of boric acid at 25 °C. Calculate the pH of Solution A.

pH =

At 25 °C, 1.00 L of Solution B consists of 101.8 g of $NaB(OH)_4$ dissolved in water. Calculate the pH of Solution B.

pH =

Using both Solutions A and B, calculate the volumes (mL) required to prepare a 1.0 L solution with a pH = 8.00.

- Boric acid, $B(OH)_3$, is a weak acid ($pK_a = 9.24$) that is used as a mild antiseptic and eye wash. Unusually, the Lewis acidity of the compound accounts for its Brønsted acidity. By using an appropriate chemical equation, show how this compound acts as a Brønsted acid in aqueous solution.

Solution A consists of a 0.050 M aqueous solution of boric acid at 25 °C. Calculate the pH of Solution A.

pH =

At 25 °C, 1.00 L of Solution B consists of 10.18 g of $NaB(OH)_4$ dissolved in water. Calculate the pH of Solution B.

pH =

Using both Solutions A and B, calculate the volumes (mL) required to prepare a 1.0 L solution with a pH = 8.50.

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- Aqua ligands in coordination complexes are generally acidic. Briefly explain this phenomenon using $[\text{Co}(\text{NH}_3)_5(\text{OH}_2)]^{3+}$ as an example.

Solution A consists of a 0.10 M aqueous solution of $[\text{Co}(\text{NH}_3)_5(\text{OH}_2)](\text{NO}_3)_3$ at 25 °C. Calculate the pH of Solution A. The $\text{p}K_a$ of $[\text{Co}(\text{NH}_3)_5(\text{OH}_2)]^{3+} = 5.69$.

pH =

At 25 °C, 1.00 L of Solution B consists of 28.5 g of $[\text{Co}(\text{NH}_3)_5(\text{OH})](\text{NO}_3)_2$ dissolved in water. Calculate the pH of Solution B.

pH =

Using both Solutions A and B, calculate the volumes (in mL) required to prepare a 1.0 L solution with a pH = 7.00.

- A dilute solution of ammonia has a pH of 10.54. Calculate what amount of HCl(g) must be added to 1.0 L of this solution to give a final pH of 8.46. The pK_a of NH_4^+ is 9.24.

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Answer:

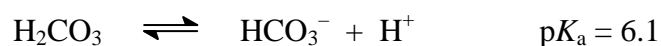
- A 300.0 mL solution of HCl has a pH of 1.22. Given that the pK_a of iodic acid, HIO_3 , is 0.79, how many moles of sodium iodate, NaIO_3 , would need to be added to this solution to raise its pH to 2.00?

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Answer:

Marks
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- The primary buffering system in blood plasma is represented by the following equation:



What is the ratio $\text{HCO}_3^- : \text{H}_2\text{CO}_3$ at the normal plasma pH of 7.4?

Answer:

A typical person has 2 L of blood plasma. If such a person were to drink 1 L of soft drink with a pH of 2.5, what would the plasma pH be if it were not buffered? (Assume all of the H^+ from the soft drink is absorbed by the plasma, but the volume of plasma does not increase.)

Answer:

What is the pH in this typical person with a normal HCO_3^- concentration of 0.020 M? Ignore any other contributions to the buffering.

Answer:

Marks
2

- Calculate the pH of a solution that is prepared by mixing 750 mL of 1.0 M potassium dihydrogenphosphate with 250 mL of 1.0 M potassium hydrogenphosphate.

For H_3PO_4 , $\text{p}K_{\text{a}1} = 2.15$, $\text{p}K_{\text{a}2} = 7.20$, $\text{p}K_{\text{a}3} = 12.38$

Answer:

Marks
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- Solution A consists of a 0.15 M aqueous solution of nitrous acid (HNO_2) at 25 °C. Calculate the pH of Solution A. The $\text{p}K_a$ of HNO_2 is 3.15.

ANSWER:

At 25 °C, 1.00 L of Solution B consists of 13.8 g of sodium nitrite (NaNO_2) dissolved in water. Calculate the pH of Solution B.

ANSWER:

Solution B (1.00 L) is poured into Solution A (1.00 L) and allowed to equilibrate at 25 °C. Calculate the pH of the final solution.

ANSWER:

If you wanted to adjust the pH of the mixture of Solution A and Solution B to be exactly equal to 3.00, which component in the mixture would you need to increase in concentration?