Marks

- 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. **8**

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:

Marks
9

- 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.

Marks
9

- 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.

Marks

- Aqua ligands in coordination complexes are generally acidic. Briefly explain this phenomenon using $[Co(NH_3)_5(OH_2)]^{3+}$ as an example. **8**

Solution A consists of a 0.10 M aqueous solution of $[Co(NH_3)_5(OH_2)](NO_3)_3$ at 25 °C. Calculate the pH of Solution A. The pK_a of $[Co(NH_3)_5(OH_2)]^{3+}$ = 5.69.

pH =

At 25 °C, 1.00 L of Solution B consists of 28.5 g of $[Co(NH_3)_5(OH)](NO_3)_2$ 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.

Page Total:

- 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.

4

Answer:

Page Total:

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

$$H_2CO_3 \rightleftharpoons HCO_3^- + H^+ \qquad pK_a = 6.1$$

What is the ratio HCO_3^- : H_2CO_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
• 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, $pK_{a1} = 2.15$, $pK_{a2} = 7.20$, $pK_{a3} = 12.38$	**2**
Answer:	

Marks

- 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 pK_a of HNO_2 is 3.15. **8**

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?