pH and pOH Calculations

1) Determine the pH of a 0.0034 M HNO_3 solution.

2) Determine the pOH of a 0.0034 M HNO_3 solution.

3) Determine the pH of a 4.3×10^{-4} M NaOH solution.

4) If a solution is created by adding water to 2.3×10^{-4} moles of NaOH and 4.5×10^{-6} moles of HBr until the final volume is 1 L, what is the pH of this solution?

5) Determine the pH of a 4.5×10^{-11} M NaOH solution.

6) Why would we say that a solution with a H^+ concentration of 1.00×10^{-7} M is said to be neutral. If it contains acid, shouldn't it be acidic?

pH and pOH Calculations - Answers

1) Determine the pH of a 0.0034 M HNO_3 solution.

$pH = -\log[H^+] = -\log(0.0034) = 2.47$

2) Determine the pOH of a 0.0034 M HNO_3 solution.

$pH = -\log[H^+] = -\log(0.0034) = 2.47$
$pOH = 14 - pH = 14 - 2.47 = 11.53$

3) Determine the pH of a 4.3×10^{-4} M NaOH solution.

$pOH = -\log[OH^-] = -\log(4.3 \times 10^{-4}) = 3.37$
$pH = 14 - pOH = 14 - 3.37 = 10.63$

4) If a solution is created by adding water to 2.3×10^{-4} moles of NaOH and 4.5×10^{-6} moles of HBr until the final volume is 1 L, what is the pH of this solution?

To solve:

- **Both acid and base are present. Since they neutralize each other, you must first figure out how much acid or base is left over after it neutralizes. Since the amount of base is larger than the amount of acid, there will be more base than acid. The amount of base is $2.3 \times 10^{-4} - 4.5 \times 10^{-6} = 2.26 \times 10^{-4}$ moles.**
- **Since there is one L of solution, the molarity of the base is 2.26×10^{-4} M.**
- **To find pOH, take the –log of 2.26×10^{-4}, which is 3.65.**
- **To find pH, subtract 3.65 from 14. The pH of this solution is 10.35.**

5) Determine the pH of a 4.5×10^{-11} M NaOH solution.

Although there is some NaOH present in the solution, the pH isn't found by taking the –log of anything. The reason for this is that the concentration of base is much, much smaller than the concentration of acid which is naturally found in neutral water. As a result, this base doesn't really have any affect on the pH, so the pH of the solution is 7.00.

6) Why would we say that a solution with a H^+ concentration of 1.00×10^{-7} M is said to be neutral. If it contains acid, shouldn't it be acidic?

It isn't acidic because while there is some acid in the solution, there is an equal quantity of base. In neutral solutions, the H^+ and OH^- concentrations are identical, because water breaks up to form them. As a result, the solution is neither acidic nor basic.

