pH and pOH Calculations

1) Determine the pH of a 0.00340 M HNO_3 solution.

2) Determine the pOH of a 0.00340 M HNO_3 solution.

3) Determine the pH of a 4.30×10^{-4} M NaOH solution.

4) If a solution is created by adding water to 2.30×10^{-4} moles of NaOH and 4.50×10^{-6} moles of HBr until the final volume is 1.00 L, what is the pH of this solution?

5) Why would we say that a solution with a H_3O^+ concentration of 1.00×10^{-7} M is said to be neutral. If it contains acid, shouldn't it be acidic?

6) What is the pH of a solution that contains 25 grams of hydrochloric acid (HCl) dissolved in 1.5 liters of water?

7) What is the pH of a solution that contains 1.32 grams of nitric acid (HNO_3) dissolved in 750.0 mL of water?

8) What is the pH of a solution that contains 1.20 moles of nitric acid (HNO_3) and 1.70 moles of hydrochloric acid (HCl) dissolved in 1000. liters of water?

9) If a solution has a $[H_3O^+]$ concentration of 4.50×10^{-7} M, is this an acidic or basic solution? Explain.

10) An acidic solution has a pH of 4.00 If I dilute 10.0 mL of this solution to a final volume of 1000.0 mL, what is the pH of the resulting solution?

pH and pOH Calculations - Answers

1) Determine the pH of a 0.00340 M HNO3 solution.

pH = -log[H+] = -log(0.00340) = 2.47

2) Determine the pOH of a 0.00340 M HNO3 solution.

pH = -log[H+] = -log(0.0034) = 2.47
pOH = 14 – pH = 14 – 2.47 = 11.53

3) Determine the pH of a 4.30×10^{-4} M NaOH solution.

pOH = -log[OH-] = -log(4.30×10^{-4}) = 3.37
pH = 14 – pOH = 14 – 3.37 = 10.63

4) If a solution is created by adding water to 2.30×10^{-4} moles of NaOH and 4.50×10^{-6} moles of HBr until the final volume is 1.00 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 $2.30 \times 10^{-4} – 4.50 \times 10^{-6} = 2.26 \times 10^{-4}$ 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) Why 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_3O^+ and OH^- concentrations are identical, because water breaks up to form them. As a result, the solution is neither acidic nor basic.

6) In this problem, there are 0.685 moles of HCl dissolved in 1.5 L H_2O, making a total acid concentration of 0.457 M. To find the answer, take the negative log of this to find that the pH = 0.34

7) pH = 1.55

8) pH = 2.53

9) The pH of this solution is 6.35, making the solution very slightly acidic.

10) The pH will be 6.00 This is solved in the same way that dilution problems are solved. If the pH = 4.00, this means that the concentration of [H_3O^+] present is 0.000100 M. When you use the dilution equation, $M_1V_1 = M_2V_2$, where V_2 is 1000. mL, you find that the concentration of acid after dilution is 1.00×10^{-6},