

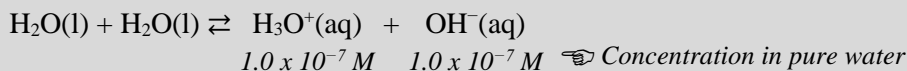
Exercise 15.1a

pH & pOH

Name: _____

Date: _____ Per: _____

In any aqueous solution the water present will self-ionize to form hydronium (H_3O^+) and hydroxide (OH^-) ions according to the equation below. In pure water these concentrations must be equal due to the mole ratio in which they form during ionization. The amounts produced of each ion in pure water at 25°C are listed below the ionization equation. As the concentration of either ion changes, the concentration of the other changes to maintain equilibrium. pH and pOH are based on these concentrations. As pH increases, pOH decreases and vice versa.



In this chapter and those that follow, the symbols [] placed around a formula or number mean "the molar concentration of".

DIRECTIONS: Complete the following in the spaces provided:

1. $K_w = [\text{H}_3\text{O}^+][\text{OH}^-] = \left[\quad \right] \left[\quad \right] = \left[\quad \right]$

2. Complete the formulas for calculating the following from $[\text{OH}^-]$ & $[\text{H}_3\text{O}^+]$ concentrations:

$[\text{H}_3\text{O}^+] = \left[\quad \right] \quad \quad \quad [\text{OH}^-] = \left[\quad \right]$

3. What type of relationship exists between the $[\text{H}_3\text{O}^+]$ and $[\text{OH}^-]$ in an aqueous solution? _____.

4. If the concentration of $[\text{H}_3\text{O}^+]$ in an aqueous solution doubles the $[\text{OH}^-]$ _____.

5. Complete the formulas for calculating the following from $[\text{H}_3\text{O}^+]$ & $[\text{OH}^-]$ concentrations:

$\text{pH} = \left[\quad \right] \quad \quad \quad \text{pOH} = \left[\quad \right]$

6. Without using a calculator, find the:

	$[\text{H}_3\text{O}^+] = 1.0 \times 10^{-5} \text{ M}$	$[\text{OH}^-] = 1.0 \times 10^{-3} \text{ M}$	$[\text{OH}^-] = 1.0 \times 10^{-11} \text{ M}$	$[\text{H}_3\text{O}^+] = 1.0 \times 10^{-8} \text{ M}$
pH of a solution with:				
pOH of a solution with:				
<i>This solution is:</i>	acid base	acid base	acid base	acid base

7. Without using a calculator, find the:

	$\text{pH} = 4$	$\text{pOH} = 12$	$\text{pH} = 1$	$\text{pOH} = -1$
$[\text{H}_3\text{O}^+]$ in a solution with:				
$[\text{OH}^-]$ in a solution with:				
<i>This solution is:</i>	acid base	acid base	acid base	acid base

8. Complete the formulas for calculating the following from pH & pOH :

$[\text{H}_3\text{O}^+] = \left[\quad \right] \quad \quad \quad [\text{OH}^-] = \left[\quad \right]$

9. Complete the formulas for calculating the following from pOH & pH :

$\text{pH} = \left[\quad \right] \quad \quad \quad \text{pOH} = \left[\quad \right]$

(OVER)

Exercise 15.1a

pH & pOH

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DIRECTIONS: Using the logarithm/antilog functions of a calculator, complete the following:

	[H ⁺]	pH	[OH ⁻]	pOH	Acid/Base
10.	$3.50 \times 10^{-3} M$				
11.		5.30			
12.			$6.70 \times 10^{-3} M$		
13.				9.70	
14.	$4.50 \times 10^{-9} M$				
15.		11.2			
16.			$9.10 \times 10^{-11} M$		
17.				1.40	

DIRECTIONS: Using the logarithm/antilog functions of a calculator, complete the following:

18. Uric acid is a chemical created when the body breaks down substances called purines. A 0.128 M solution of uric acid (HC₅H₃N₄O₃) has a pH of 2.39. Calculate the K_a of uric acid.

19. Codeine (C₁₈H₂₁NO₃) is a weak organic base. A $5.0 \times 10^{-3} M$ solution of codeine has a pH of 9.95. Calculate the value of K_b for this substance.