

Name : _____ Date : _____

Acids and Bases Problems

1. Without doing any calculations, identify each of the following solutions as acidic or basic:
- a) $[\text{H}_3\text{O}^+] = 3.4 \times 10^{-8} \text{ M}$ _____
- b) $[\text{OH}^-] = 1.8 \times 10^{-5} \text{ M}$ _____
- c) $[\text{OH}^-] = 6.5 \times 10^{-12} \text{ M}$ _____
- d) $[\text{H}_3\text{O}^+] = 2.6 \times 10^{-4} \text{ M}$ _____
2. A solution of HBr has $[\text{H}_3\text{O}^+] = 4.5 \times 10^{-3} \text{ M}$. Calculate the pH of this solution.

3. Complete the following table.

pH	$[\text{H}_3\text{O}^+]$	$[\text{OH}^-]$	Acidic, basic, or neutral?
	5.4×10^{-4}		
	1.3×10^{-5}		
10.75	1.8×10^{-11}	5.6×10^{-4}	

4. If the pH of a solution is 10.3, what is the $[\text{H}^+]$ concentration?
5. If the $[\text{H}^+]$ is $2.1 \times 10^{-12} \text{ M}$ HClO_4 , what is the pH? Is the solution ACIDIC, BASIC, or NEUTRAL?
6. Calculate the pH if the $[\text{OH}^-]$ concentration is $5.9 \times 10^{-1} \text{ M}$? Is the solution ACIDIC, BASIC, or NEUTRAL?

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Answers

1. Without doing any calculations, identify each of the following solutions as acidic or basic:

a) $[H_3O^+] = 3.4 \times 10^{-8} \text{ M}$ Basic

b) $[OH^-] = 1.8 \times 10^{-5} \text{ M}$ Basic

c) $[OH^-] = 6.5 \times 10^{-12} \text{ M}$ Acidic

d) $[H_3O^+] = 2.6 \times 10^{-4} \text{ M}$ Acidic

2. A solution of HBr has $[H_3O^+] = 4.5 \times 10^{-3} \text{ M}$. Calculate the pH of this solution.

$$\text{pH} = -\log[H_3O^+] = -\log[4.5 \times 10^{-3}] = 2.35$$

3. Complete the following table.

pH	$[H_3O^+]$	$[OH^-]$	Acidic, basic, or neutral?
3.27	5.4×10^{-4}	1.85×10^{-11}	Acidic
4.89	1.3×10^{-5}	7.8×10^{-8}	Acidic
10.75	1.8×10^{-11}	5.6×10^{-4}	Basic

4. If the pH of a solution is 10.3, what is the $[H^+]$ concentration?

$$\text{pH} = -\log[H^+] \Rightarrow 10.3 = -\log [H^+] \Rightarrow [H^+] = 10^{(-10.3)} \Rightarrow [H^+] = 5 \times 10^{-11} \text{ M}$$

5. If the $[H^+]$ is $2.1 \times 10^{-12} \text{ M}$ HClO_4 , what is the pH? Is the solution ACIDIC, BASIC, or NEUTRAL?

$$\text{pH} = -\log[H^+] \Rightarrow \text{pH} = -\log (2.1 \times 10^{-12}) \Rightarrow \text{pH} = 5 \times 10^{-11} = 11.7. \text{ The solution is BASIC.}$$

6. Calculate the pH if the $[OH^-]$ concentration is $5.9 \times 10^{-1} \text{ M}$? Is the solution ACIDIC, BASIC, or NEUTRAL?

$$\text{pOH} = -\log[OH^-] \Rightarrow \text{pOH} = -\log(5.9 \times 10^{-1}) = 0.23.$$

$$\text{Therefore, pH} = 14 - 0.23 = 13.77. \text{ The solution is BASIC.}$$