LESSON MAKER PRO

The pH Code

Use hydrogen-ion concentrations to compare solutions.

HIGH SCHOOL · CHE.9

CHE.9 "Enrichment: Students will understand the nature and properties of acids, bases, and salt solutions. Enrichment: Analyze and interpret data to describe the properties of acids, bases, and salts..."

NAME _____ **DATE** _____

POWERS OF TEN AND PH

When $[H^+] = 1 \times 10^{-n}$ mol/L, the pH is n. A pH below 7 is acidic, 7 is neutral, and above 7 is basic. Each step on the pH scale represents a tenfold change in hydrogen-ion concentration.

WORKED EXAMPLE

A solution has $[H^+] = 1 \times 10^{-4}$ mol/L. Find its pH.

1. Identify n in 1×10^{-n}: n = 4.
2. Use pH = n.

Answer: pH = 4

PRACTICE 6 problems

1 A solution has $[H^+] = 1 \times 10^{-2}$ mol/L. What is its pH?

ANSWER _____

2 A solution has $[H^+] = 1 \times 10^{-8}$ mol/L. Find its pH and classify it as acidic, neutral, or basic.

ANSWER _____

3 A solution has $[H^+] = 1 \times 10^{-1}$ mol/L. What is its pH?

ANSWER _____

4 Use the table. Which solution has the lower pH, and how many pH units lower is it?

HYDROGEN-ION CONCENTRATIONS

Solution	$[H^+]$ (mol/L)
A	1×10^{-3}
B	1×10^{-5}

ANSWER _____

5 A solution has a pH of 9. What is its hydrogen-ion concentration in mol/L?

ANSWER _____

6 A solution has $[H^+] = 1 \times 10^{-10}$ mol/L. Find its pH and classify it as acidic, neutral, or basic.

ANSWER _____

APPLY IT Show your work

1 You test the water in a school aquarium and find $[H^+] = 1 \times 10^{-6}$ mol/L. What is its pH? Is the water acidic, neutral, or basic?

WORK SPACE

ANSWER _____

2 A sports drink has $[H^+] = 1 \times 10^{-2}$ mol/L. Drinking water has $[H^+] = 1 \times 10^{-7}$ mol/L. Find each pH. How many pH units apart are they?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Two solutions have $[H^+]$ values of 1×10^{-6} mol/L and 1×10^{-9} mol/L. Find both pH values. Which solution has more hydrogen ions, and how many times more? Explain using the pH scale.

WORK SPACE AND ANSWER

The pH Code

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A solution has $[H^+] = 1 \times 10^{-2}$ mol/L. What is its pH?	**pH = 2**
2	A solution has $[H^+] = 1 \times 10^{-8}$ mol/L. Find its pH and classify it as acidic, neutral, or basic.	**pH = 8; basic**
3	A solution has $[H^+] = 1 \times 10^{-1}$ mol/L. What is its pH?	**pH = 1**
4	Use the table. Which solution has the lower pH, and how many pH units lower is it?	**Solution A; 2 pH units lower**
5	A solution has a pH of 9. What is its hydrogen-ion concentration in mol/L?	**1×10^{-9} mol/L**
6	A solution has $[H^+] = 1 \times 10^{-10}$ mol/L. Find its pH and classify it as acidic, neutral, or basic.	**pH = 10; basic**

PART 2 · APPLY IT

1. **pH = 6; acidic** The exponent gives a pH of 6. Since 6 is below 7, the water is acidic.
2. **Sports drink: pH 2; drinking water: pH 7; 5 pH units apart** The pH values are 2 and 7. Their difference is 7 - 2 = 5 pH units.

CHALLENGE

The pH values are 6 and 9. The pH 6 solution has 1,000 times more hydrogen ions because a difference of 3 pH units represents 10 × 10 × 10.

Accept equivalent notation for concentrations, such as 0.000000001 mol/L for 1×10^{-9} mol/L. For the challenge, accept 10^3 in place of 1,000.