LESSON MAKER PRO

The pH Code

Turn hydrogen-ion concentration into pH.

HIGH SCHOOL · CHE.9.5

CHE.9.5 "Enrichment: Use mathematical and computational thinking to calculate pH from the hydrogen-ion concentration."

NAME _____ DATE _____

READ THE EXPONENT

The pH of a solution is $-\log_{10}([H^+])$, where $[H^+]$ is measured in mol/L. If $[H^+] = 10^{-n}$ mol/L, the pH is n.

WORKED EXAMPLE

Find the pH when $[H^+] = 10^{-5}$ mol/L.

1. Write the rule: $pH = -\log_{10}([H^+])$.
2. Substitute: $pH = -\log_{10}(10^{-5})$.
3. The exponent is -5, so $pH = -(-5) = 5$.

Answer: pH = 5

PRACTICE 6 problems

1 Find the pH when $[H^+] = 10^{-2}$ mol/L.

ANSWER _____

2 Find the pH when $[H^+] = 10^{-4}$ mol/L.

ANSWER _____

3 Find the pH when $[H^+] = 10^{-6}$ mol/L.

ANSWER _____

4 Find the pH when $[H^+] = 10^{-9}$ mol/L.

ANSWER _____

5 A solution has $[H^+] = 10^{-10}$ mol/L. Find its pH. Is its pH above or below neutral pH 7?

ANSWER _____

6 A solution has $[H^+] = 10^{-12}$ mol/L. Find its pH and how many pH units it is above neutral pH 7.

ANSWER _____

APPLY IT Show your work

1 A student checks a sports drink before a game. Its $[H^+]$ is 10^{-3} mol/L. What is its pH? How many pH units lower is that than neutral pH 7?

WORK SPACE

ANSWER _____

2 Before a swim meet, a student tests the pool water. Its $[H^+]$ is 10^{-8} mol/L. What is the pool water's pH, and is it above or below neutral pH 7?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A lab sample changes from $[H^+] = 10^{-11}$ mol/L to $[H^+] = 10^{-7}$ mol/L. Find the pH before and after the change. How many pH units did it change, and did the pH rise or fall?

WORK SPACE AND ANSWER

ANSWER KEY

The pH Code

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the pH when $[H^+] = 10^{-2}$ mol/L.	**pH = 2**
2	Find the pH when $[H^+] = 10^{-4}$ mol/L.	**pH = 4**
3	Find the pH when $[H^+] = 10^{-6}$ mol/L.	**pH = 6**
4	Find the pH when $[H^+] = 10^{-9}$ mol/L.	**pH = 9**
5	A solution has $[H^+] = 10^{-10}$ mol/L. Find its pH. Is its pH above or below neutral pH 7?	**pH = 10; above neutral pH 7**
6	A solution has $[H^+] = 10^{-12}$ mol/L. Find its pH and how many pH units it is above neutral pH 7.	**pH = 12; 5 pH units above neutral pH 7**

PART 2 · APPLY IT

1. **pH = 3; 4 pH units lower** The exponent -3 gives a pH of 3. Subtract 3 from 7 to find a difference of 4 pH units.
2. **pH = 8; above neutral pH 7** The exponent -8 gives a pH of 8, which is above 7.

CHALLENGE

Before: pH = 11. After: pH = 7. The pH fell by 4 units.

Accept answers written as numbers without the label pH. For comparisons, accept equivalent wording such as higher or lower than 7.