LESSON MAKER PRO

pH Power Moves

Use powers of ten to connect pH, pOH, and ion concentration.

HIGH SCHOOL · CHE.6.d

CHE.6.d "Use mathematics to calculate the pH, pOH, [OH-], and [H3O+] of common solutions."

NAME _____ DATE _____

THE BIG IDEA

At 25 °C, pH = -log[H_3O^+] and pOH = -log[OH^-], using concentrations in M. If an ion concentration is 1 x 10^{-n} M, its matching pH or pOH is n. Use pH + pOH = 14 to find the other value, then use that value as the negative exponent of its ion concentration.

WORKED EXAMPLE

A solution has [H_3O^+] = 1 x 10^{-3} M. Find its pH, pOH, and [OH^-].

1. The exponent gives pH = 3.
2. pOH = 14 - 3 = 11.
3. Use pOH to find [OH^-] = 1 x 10^{-11} M.

Answer: pH = 3; pOH = 11; [OH^-] = 1 x 10^{-11} M

PRACTICE 6 problems

1 A solution has pH 2. Find [H_3O^+].

ANSWER _____

2 A solution has pOH 4. Find [OH^-].

ANSWER _____

3 A solution has [H_3O^+] = 1 x 10^{-7} M. Find its pH.

ANSWER _____

4 A solution has [OH^-] = 1 x 10^{-10} M. Find its pOH.

ANSWER _____

5 A solution has pH 12. Find its pOH and [OH^-].

ANSWER _____

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6 A solution has pOH 1. Find its pH and [H_3O^+].

ANSWER _____

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APPLY IT Show your work

1 A skin-care toner is labeled pH 5. At 25 °C, what are its pOH and $[H_3O^+]$?

WORK SPACE

ANSWER _____

2 A test of a swimming pool shows pH 8. At 25 °C, what are its pOH and $[OH^-]$?

WORK SPACE

ANSWER _____

CHALLENGE One step up

An energy drink has pH 4. A cleaning solution has $[OH^-] = 1 \times 10^{-6}$ M. At 25 °C, find the cleaning solution's pH. Then find how many times greater the drink's $[H_3O^+]$ is than the cleaning solution's.

WORK SPACE AND ANSWER

pH Power Moves

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A solution has pH 2. Find $[H_3O^+]$.	**1×10^{-2} M**
2	A solution has pOH 4. Find $[OH^-]$.	**1×10^{-4} M**
3	A solution has $[H_3O^+] = 1 \times 10^{-7}$ M. Find its pH.	**7**
4	A solution has $[OH^-] = 1 \times 10^{-10}$ M. Find its pOH.	**10**
5	A solution has pH 12. Find its pOH and $[OH^-]$.	**pOH = 2; $[OH^-] = 1 \times 10^{-2}$ M**
6	A solution has pOH 1. Find its pH and $[H_3O^+]$.	**pH = 13; $[H_3O^+] = 1 \times 10^{-13}$ M**

PART 2 · APPLY IT

1. **pOH = 9; $[H_3O^+] = 1 \times 10^{-5}$ M** Subtract the pH from 14 to get pOH 9. Use the pH as the negative exponent for the hydronium concentration.
2. **pOH = 6; $[OH^-] = 1 \times 10^{-6}$ M** Subtract the pH from 14 to get pOH 6. Use the pOH as the negative exponent for the hydroxide concentration.

CHALLENGE

The cleaning solution has pOH 6 and pH 8. The drink has $[H_3O^+] = 1 \times 10^{-4}$ M, while the cleaning solution has $[H_3O^+] = 1 \times 10^{-8}$ M, so the drink's concentration is 10,000 times greater.

Accept equivalent powers-of-ten notation, such as 10^{-2} M instead of 1×10^{-2} M. Ion concentrations must include M.