Chemistry Lecture #96: pH and pOH

In addition to pH, there's also pOH. Mathematically,

$pOH = -log[OH^-]$

What is the pOH of a solution that contains 8.7×10^{-3} M OH^-?

Answer
$pOH = -log[OH^-]$
$pOH = -log[8.7 \times 10^{-3}]$
$pOH = -(-2.06)$
$pOH = 2.06.$

The pOH is given with two places past the decimal since 8.7×10^{-3} has two significant figures.

If a solution is described as a strong base or a strong acid we can assume 100% ionization. The concentration of the acid is also the concentration of H^+, and the concentration of the base is the concentration of OH^-.

Find the pH of 0.050 M HCl, a strong acid.
Answer
Since this is a strong acid, we assume 0.050 HCl means
0.050 M H^+.

$pH = -log[H^+]$
$pH = -log[0.050]$
$pH = 1.30$

Find the pOH of 0.030 M NaOH, a strong base.

Answer

Since this is a strong base, we assume that 0.030 M NaOH means 0.030 M OH^-.

pOH = -log[OH^-]
pOH = -log[0.030]
pOH = 1.52

Find the pOH of a 7.5×10^{-4} M solution of $Ca(OH)_2$, a strong base.

Answer

Notice that $Ca(OH)_2$ contains *two* hydroxide groups. One formula unit of $Ca(OH)_2$ will ionize to produce two OH^-.

$$Ca(OH)_2 \longrightarrow Ca^{2+} + 2OH^-$$

Thus, to find the concentration of OH^-, multiply the concentration of $Ca(OH)_2$ by 2.

$[OH^-] = 2 \times (7.5 \times 10^{-4})$
$[OH^-] = 0.0015$ M

pOH = -log[OH^-]
pOH = -log[0.0015]
pOH = 2.82

If the pH and the pOH of a solution is added together, the sum will equal 14.00.

pH + pOH = 14.00

The hydroxide ion concentration of an ammonia solution is 4.0×10^{-3} M. Find the pH.

pOH = -log[OH^-]
pOH = -log[4.0×10^{-3}]
pOH = 2.40

pH + pOH = 14.00
pH + 2.40 = 14.00
pH = 11.60

The pOH of a solution is 5.42. Find the concentration of H^+.

pH + pOH = 14.00
pH + 5.42 = 14.00
pH = 8.58

pH = -log[H^+]
8.58 = -log[H^+]
-8.58 = log[H^+]
[H^+] = $10^{-8.58}$
[H^+] = 2.6×10^{-9} M