

Answer on the question #48120, Chemistry, Physical Chemistry

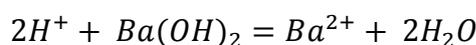
Question:

What is the concentration of $[OH^-]$ in the final solution prepared by mixing 20.0 mL of 0.050 M HCl with 30.0 of 0.10M $Ba(OH)_2$?

- (1) 0.10 M
- (2) 0.40M
- (3) 0.0050M
- (4) 0.12M

Solution:

If a $Ba(OH)_2$ is completely dissociated:



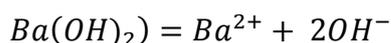
$$\frac{n(H^+)}{2} = n(Ba(OH)_2)$$

Then, there is the lack of H^+ ions. The $n(Ba(OH)_2)$ is:

$$\begin{aligned} n(Ba(OH)_2) &= n_0(Ba(OH)_2) - \frac{n(H^+)}{2} = c(Ba(OH)_2)V(Ba(OH)_2) - \frac{c(H^+)V(H^+)}{2} \\ &= (3 - 1) * 10^{-3} = 2 * 10^{-3} \text{ mol} \end{aligned}$$

$$c(Ba(OH)_2) = \frac{n(Ba(OH)_2)}{V} = \frac{2 * 10^{-3}}{50 * 10^{-3}} = 0.04 \text{ mol/L}$$

As the $Ba(OH)_2$ is little dissociated, let's consider the equation:



According to the reference data:

$$[Ba^{2+}][OH^-]^2 = 5 * 10^{-3}$$

$$\text{As } [Ba^{2+}] = \frac{[OH^-]}{2}:$$

$$[OH^-]^3 = 10^{-2}$$

$$[OH^-] = 0.215$$

As $0.04 < 0.215$, we can consider full dissociation of barium hydroxide:

$$c(OH^-) = 2c(Ba(OH)_2) = 0.08 \approx 0.1 \frac{\text{mol}}{\text{L}}$$

Answer: 0.1 mol/L, (1).