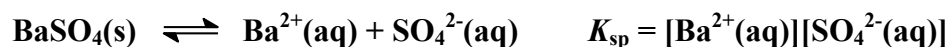


Marks
5

- BaSO₄ is used as a contrast agent in medical imaging. It has a K_{sp} of 1.1×10^{-10} . What is the molarity of Ba²⁺ ions in a saturated aqueous solution of BaSO₄?

The dissolution reaction is:



From the reaction, $[\text{Ba}^{2+}(\text{aq})] = [\text{SO}_4^{2-}(\text{aq})]$. Hence if $[\text{Ba}^{2+}(\text{aq})] = S$:

$$S^2 = K_{sp} = 1.1 \times 10^{-10}$$

$$S = 1.0 \times 10^{-5} \text{ M}$$

Answer: $1.0 \times 10^{-5} \text{ M}$

What is the molar solubility of BaSO₄ in the presence of a 0.1 M solution of Na₂SO₄?

The added SO₄²⁻ will dominate over that produced in the dissolution reaction so $[\text{SO}_4^{2-}(\text{aq})] = 0.1 \text{ M}$. For the dissolution reaction to still be at equilibrium:

$$K_{sp} = [\text{Ba}^{2+}(\text{aq})][\text{SO}_4^{2-}(\text{aq})] = 1.1 \times 10^{-10}$$

With $[\text{SO}_4^{2-}(\text{aq})] = 0.1 \text{ M}$,

$$[\text{Ba}^{2+}(\text{aq})] = K_{sp} / [\text{SO}_4^{2-}(\text{aq})] = 1.1 \times 10^{-10} / 0.1 \text{ M} = 1 \times 10^{-9} \text{ M}$$

Answer: $1 \times 10^{-9} \text{ M}$

The lethal concentration of Ba²⁺ in humans is about 60 mg L⁻¹ ($4 \times 10^{-4} \text{ M}$). Is there any advantage to administering BaSO₄ in the presence of 0.1 M Na₂SO₄ solution? Explain your reasoning.

No. The lethal $[\text{Ba}^{2+}(\text{aq})]$ is 40 times greater than the $[\text{Ba}^{2+}(\text{aq})]$ in normal aqueous solution.

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