

NCERT/CBSE CHEMISTRY CLASS 11 textbook

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Solutions/Answers to NCERT/CBSE CHEMISTRY Class 11(Class XI)textbook

CHAPTER SEVEN

EQUILIBRIUM

7.72 What is the minimum volume of water required to dissolve 1g of calcium sulphate at 298 K? (For calcium sulphate, K_{sp} is 9.1×10^{-6}).

Solution:

Let the solubility of CaSO_4 be s .



At equilibrium: s s

We have, $K_{sp} = s \times s = s^2$

$$\Rightarrow 9.1 \times 10^{-6} = s^2$$

Solving, $s = 3 \times 10^{-3} \text{ M}$

So $3 \times 10^{-3} \times 136 \text{ g}$ is dissolved in 1 l.

Minimum volume of water required for dissolution of 1 g $\text{CaSO}_4 = \frac{1}{3 \times 10^{-3} \times 136} = 2.46 \text{ L}$

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.70 The ionization constant of benzoic acid is 6.46×10^{-5} and K_{sp} for silver benzoate is 2.5×10^{-13} . How many times is silver benzoate more

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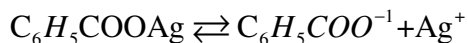
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Let the solubility of silver benzoate in water be s .

The reaction is:



At eqbm.: $s \qquad s$

We have, $K_{sp} = [C_6H_5COO^{-1}][Ag^{+}]$

$$\Rightarrow 2.5 \times 10^{-13} = s^2$$

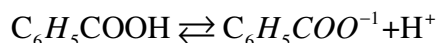
Solving, $s = 5.0 \times 10^{-7} \text{ M}$

Now in case of buffer of given pH,

$$3.19 = -\log[H^{+}]$$

$$\Rightarrow [H^{+}] = 10^{-3.19} = \text{Antilog}(\bar{4}.81) = 6.457 \times 10^{-4}$$

Reaction for dissociation of benzoic acid is:



Concentration of hydrogen ions can be assumed to be constant as the solution is a buffer.

Assume solubility in buffer solution to be s' .

We have,

$$K_a = \frac{[C_6H_5COO^{-1}][H^{+}]}{[C_6H_5COOH]} = 6.46 \times 10^{-5}$$

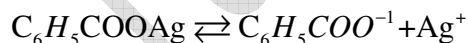
$$\Rightarrow \frac{[C_6H_5COOH]}{[C_6H_5COO^{-1}]} = \frac{6.457 \times 10^{-4}}{6.46 \times 10^{-5}} \approx 10$$

Now:

$[Ag]^{+} = s' = [C_6H_5COO^{-1}] + [C_6H_5COOH]$ (These values are to be substituted from above).

$$\Rightarrow s' = 11[C_6H_5COO^{-1}]$$

$$\Rightarrow [C_6H_5COO^{-1}] = \frac{s'}{11}$$



At eqbm.: $\frac{s'}{11} \qquad s'$

$$\text{Now, } k_{sp} = [C_6H_5COO^{-1}][Ag^{+}] = \frac{s'^2}{11} = 1.66 \times 10^{-6}$$

$$\text{Now ratio of solubilities} = \frac{s'}{s} = \frac{1.66 \times 10^{-6}}{5.0 \times 10^{-7}} = 3.32$$

Thus, silver benzoate is 3.32 times more soluble in a buffer of pH 3.19

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compared to its solubility in pure water.
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