Self-Assessment: Aqueous Solutions

Weekly Homework Quiz – Solution Outlines

(a) The value of K_a for perchloric acid, $HClO_4(aq)$, is 1×10^8. Calculate the *p*H and the *p*OH of 1.11 M $HClO_4(aq)$ in water.

with a value of $K_a = 10^8$, $HClO_4$ is a strong acid $\Rightarrow$ complete dissociation

$\therefore$ 1.11 M HI(aq) $\Rightarrow$ 1.11 M = $[H^+] = [ClO_4^-]$

$\therefore$ $pH = -\log_{10}[H^+] = -\log_{10}1.11 = -0.0453$

$\because$ pOH + pH = 14 $\Rightarrow$ pOH = 14.0453

(b) The compound, yttrium iodate, $Y(IO_3)_3$, upon dissolution in water dissociates into Y^{3+} and IO_3^-. At 37°C the solubility of $Y(IO_3)_3$ in water is 2.22×10^{-3} M. Calculate the value of the solubility product, K_{sp}, of $Y(IO_3)_3$.

$Y(IO_3)_3 \;=\; Y^{3+} \;+ 3\; IO_3^-$, from which we get $K_{sp} \;=\; [Y^{3+}][IO_3^-]^3$

$c_s \;=\; 2.22 \times 10^{-3} \;=\; [Y^{3+}] \;=\; 1/3\; [IO_3^-]$ ☞ $[IO_3^-] \;=\; 3\; [Y^{3+}]$

$\therefore K_{sp} = c_s\,(3\,c_s)^3 \;=\; 27\; c_s^4 \;=\; 27\; (2.22 \times 10^{-3})^4 \;=\; 6.56 \times 10^{-10}$

3.091SC Introduction to Solid State Chemistry

Fall 2009