3.091 Fall Term 2004

Homework Quiz #11B

solution outline

(a) The value of K_a for hydrochloric acid HCl(*aq*) is 1×10^6. Calculate the *p*H and the *p*OH of 0.065 M HCl(*aq*).

HCl is a strong acid $\Rightarrow$ complete dissociation

$\therefore$ 0.065 M HCl(aq) $\Rightarrow$ 0.065 M = $[H^+]$ = $[Cl^-]$

$\therefore$ pH = $-\log_{10}[H^+] = -\log_{10} 0.065 = 1.19$

$\because$ pOH + pH = 14 $\Rightarrow$ pOH = 12.81

(b) The fictitious compound, administratium fluoride (AdF_3), has a K_{sp} value in water of 3.091×10^{-9} at room temperature. Calculate the solubility of AdF_3 in water. Express your answer in units of molarity.

$AdF_3 = Ad^{3+} + 3\ F^-$

$\therefore K_{sp} = [Ad^{3+}][F^-]^3$, but $[F^-] = 3\ [Ad^+] = 3\ c_S$

$\therefore K_{sp} = c_S\ (3\ c_S)^3 = 27\ c_S^4$ $\quad\therefore\quad c_S = \left(\frac{K_{sp}}{27}\right)^{1/4} = 3.27 \times 10^{-3}\ M$