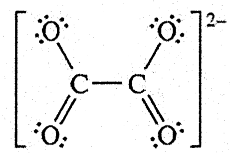
Unit 14 – AP Review

2022 FRQ #7

Name KEY

Period 4 PTS



BOTH CARBONS ARE SAME.

7. A Lewis electron-dot diagram of the oxalate ion, $C_2O_4^{2-}$, is shown.

a) Identify the hybridization of the valence orbitals of either carbon atom in the oxalate ion.

3 σ BONDS, ∅ UNSHARED PAIRS = 3 → sp^2

(π DOESN'T AFFECT)

(1 PT)

b) Silver oxalate, $Ag_2C_2O_{4(s)}$, is slightly soluble in water. The value of K_{sp} for $Ag_2C_2O_4$ is 5.40×10^{-12}.

(i) Write the expression for the solubility-product constant, K_{sp}, for $Ag_2C_2O_4$.

$Ag_2C_2O_{4(s)} \rightarrow 2Ag^{+1}_{(aq)} + C_2O_4^{-2}{}_{(aq)}$

$K_{sp} = \frac{[PRODUCTS]}{[REACTANTS]}$, LEAVING OUT SOLIDS + LIQUIDS.

(1 PT) $K_{sp} = [Ag^{+1}]^2[C_2O_4^{2-}]$

(ii) Calculate the molar solubility of $Ag_2C_2O_4$ in neutral distilled water.

$5.40\times10^{-12} = [2x]^2[x] \rightarrow 5.40\times10^{-12} = 4x^3 \rightarrow x^3 = \frac{5.40\times10^{-12}}{4}$

(1 PT) $x = 1.11\times10^{-4}\ M$

(iii) The molar solubility of $Ag_2C_2O_4$ increases when it is dissolved in 0.5 *M* $HClO_{4(aq)}$ instead of neutral distilled water. Write a balanced, net-ionic equation for the process that occurs between species in solution that contributes to the increased solubility of $Ag_2C_2O_{4(aq)}$ in $HClO_{4(aq)}$.

→ STRONG ACID, LOTS OF H^+ IONS IN SOLUTION

$2H^+_{(aq)} + C_2O_4^{2-}{}_{(aq)} \rightarrow H_2C_2O_{4(aq)}$

(1 PT)

OXALATE IONS ARE REMOVED FROM SOLUTION, SHIFTING REACTION TO THE RIGHT (PRODUCTS) BECAUSE OF LE CHATLIER'S PRINCIPLE, THIS ALLOWS FOR MORE SILVER OXALATE TO DISSOLVE.