Question #72909, Chemistry / Other / Completed

A salt unknown containing ferrous ion was dissolved and diluted to 250.0 mL. A 25.00 mL aliquot of the ferrous ion solution was titrated with 0.01450 M potassium permanganate solution, and the mean of three acceptable, corrected titrations volumes was 14.43 mL. Calculate the mass of iron in the 250.0 mL solution.

Give your answer to 4 places after the decimal. Do not enter units.

Solution

$$C_a = \frac{C_t V_t M}{V_a}$$

where Ca is the concentration of the analyte, typically in molarity; Ct is the concentration of the titrant, typically in molarity; Vt is the volume of the titrant used, typically in liters; M is the mole ratio of the analyte and reactant from the balanced chemical equation; and Va is the volume of the analyte used, typically in liters.

$$MnO_4^- + 8H^+ + 5Fe^{2+} \longrightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$$

The quantity of Fe^{2+} ions are 5 times more than that of $KMnO_4$ by the reaction. So M = 5

The concentration of Fe^{2+}:

$C_a = C_tV_tM / V_a$ = 0.01450 M · 14.43 mL · 5 / 25 mL = 0.041847 M

$n (Fe^{2+})$ = 0.041847 M · 0.250 L = 0.01046175 mol – in 250 mL of the solution

$m (Fe^{2+})$ = n · M = 0.01046175 mol · 55.85 g/mol = 0.5843 g

Answer: 0.5843.

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