Question #72874, Chemistry / Other / Completed

If a 0.12196 M solution of $KMnO_4$ is titrated with a salt containing ferrous ion and 19.04 mL is required to reach the end point, calculate the moles of potassium permanganate used in the titration.

Solution

$$\mathbf{C}_a = \frac{\mathbf{C}_t \mathbf{V}_t \mathbf{M}}{\mathbf{V}_a}$$

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.

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

The quantity of Fe^{2+} ions are 5 times more than that of $KMnO_4$ by the reaction. So M = 1/5

The moles of potassium permanganate:

$n = C_aV_a = C_tV_tM = C_t \cdot 19.04$ mL $\cdot$ 1/5 $\cdot$ 1/1000. 1/1000 means for 1 liter.

$$n = 0.003808\ C_t$$

So if C_t = 0.1 M, then n = 0.0003808 mol.

Answer: 0.003808 mol for C_t = 0.1 M*.

*We are not given enough of data that's why we use "if" and "for"!

The data table is attached:

Ct, M	n, mol
0.1	0.0003808
0.2	0.0007616
0.3	0.0011424
0.4	0.0015232
0.5	0.0019040
0.6	0.0022848
0.7	0.0026656