Question #70854

25 cm^3 of a 0.1M KMnO$_4$ solution was added to 25 cm^3 of a FeC$_2$O$_4$ solution. 12.5 cm^3 of 0.2M Fe^{2+} solution was required to react with remaining amount of KMnO$_4$ after the above reaction. Determine the concentration of C$_2$O$_4^{2-}$ ions in the solution.

Solution

The following balanced redox reactions took place in the solution.

1) $5Fe^{2+} + MnO_4^- + 8H^+ \rightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$

2) $5C_2O_4^{2-} + 2MnO_4^- + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$
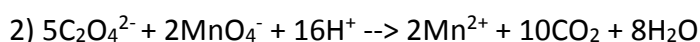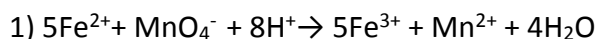
1. $\frac{12.5 \times 0.2}{1000} = 0,0025$ (mol) – the amount of Fe^{2+} required to react with remaining amount of KMnO$_4$ after the reaction.

2. $\frac{0.0025}{5} = 0.0005$ (mol) – the remaining amount of KMnO$_4$ after the reaction.

3. $\frac{25 \times 0.1}{1000} = 0.0025$ (mol) – the initial amount of KMnO$_4$.

4. $0.0025 - 0.0005 = 0.002$ (mol) – the amount of KMnO$_4$ reacted with FeC$_2$O$_4$.

5. $\frac{0.002 \times 2}{3} = 0.0013$ (mol) -- the amount of MnO$_4^-$ reacted with C$_2$O$_4^{2-}$.

6. $\frac{0.0013 \times 5}{2} = 0.0033$ (mol) -- the amount of C$_2$O$_4^{2-}$ in the initial solution.

7. $\frac{0.0033 \times 1000}{25} = 0.133$ (mol/l) – the molar concentration of C$_2$O$_4^{2-}$ ions in the solution.

Answer

The concentration of C$_2$O$_4^{2-}$ ions in the solution is ***0.133M***