Answer on the question #54222 – Chemistry – Physical Chemistry

Question:

4.9 gr $K_2Cr_2O_7$ is taken to prepare 0.1 litre of the solution. 10 ml of this solution is further taken to oxidise SN^{+2} ion into Sn^{+4} ion. The SN^{+4} so produced is used in 2nd reaction to prepare Fe^{+3} ion, then the millimoles of Fe^{+3} ion formed will be (assume all other components are in sufficient amounts).

Solution:

The equations of chemical reactions are:

$$Cr_2O_7^{2-} + 3Sn^{2+} + 14H^+ = 2Cr^{3+} + 3Sn^{4+} + 7H_2O,$$

$$Sn^{4+} + 2Fe^{2+} = Sn^{2+} + 2Fe^{3+}.$$

According to these equations, the number of moles of $Cr_2O_7^{2-}$ anions and number of moles of Fe^{3+}ions relate as:

$$n(Cr_2O_7^{2-}) = \frac{n(Sn^{4+})}{3},$$

$$n(Sn^{4+}) = \frac{n(Fe^{3+})}{2},$$

$$n(Fe^{3+}) = 2n(Sn^{4+}) = 2 \times 3 \times n(Cr_2O_7^{2-}).$$

Number of moles of $Cr_2O_7^{2-}$ can be calculated from the solution preparation data:

$$n(Cr_2O_7^{2-}) = \frac{m(K_2Cr_2O_7^{2-})}{M(K_2Cr_2O_7^{2-})} \times \frac{V(sample)}{V(total)} = \frac{4.9}{294.185} \times \frac{0.01}{0.1} = 1.666\ mmol.$$

Then, the number of moles of Fe^{3+} is:

$$n(Fe^{3+}) = 6 \times n(Cr_2O_7^{2-}) = 9.994\ mmol.$$

Answer: 9.994 mmol (millimoles) of Fe^{3+} is formed.