

EXPERIMENT NO:

DATE:

Potentiometric estimation of FAS using Standard $K_2Cr_2O_7$

PRINCIPLE: Nernst equation gives the relation between potential of the electrode and the concentration of the active species in the solution. For the reaction oxidized form + ne = reduced form,

The Nernst equation is given as

$$E = E^0 + \log[\text{Oxidised form}] / [\text{Reduced form}]$$

Where E^0 is the standard electrode potential and the terms in the brackets are concentrations. It can be easily understood by the equation that potential depends on the concentrations of oxidized and reduced species in the solution. When a reducing agent in solution is oxidised using an oxidising agent the concentrations and potential changes. Potentiometry is the measurement of change in potential when a solution is oxidised or reduced. When a reducing agent is titrated against an oxidising agent in presence of electrodes like platinum and calomel are connected to potentiometer potential increases gradually and increases rapidly at the end point. When a graph of change in potential against volume of oxidising agent is plotted the sudden change in potential will be the equivalence point. The sudden change can be explained as that the potential increase in the beginning due to slow oxidation of ferrous iron to ferric iron and the equation given below holds good.

$$E = E^0 + 0.0591/n \log \frac{[Fe^{3+}]}{[Fe^{2+}]} \quad (\text{Here } n=1)$$

Thus the potential depends on the concentrations of ferric and ferrous ions. Near the end point concentration of ferrous ions becomes very small, and the ratio of $[Fe^{3+}]/[Fe^{2+}]$ increases rapidly. Thus the emf increases rapidly close to the end point. Beyond the equivalence point no ferrous ion exists, and the potential depends on dichromate and chromium ions.

$$E = E^0_{\text{dichromate/chromium}} + 0.0591/n \log \frac{[Cr^{6+}]}{[Cr^{3+}]}$$

Thus after the end point, it is the electrode potential of the $Pt/[Cr^{6+}]/[Cr^{3+}]$ electrode, which is going to change. Because of both factors, there is a large change in potential at the end point.

PROCEDURE: Pipette out 25cm^3 of the given ferrous ammonium sulphate solution into a beaker. Add 1 test tubes of dilute sulphuric acid and dip the electrode assembly into the solution and connect to a potentiometer. Measure the potential. Fill a burette with the given potassium dichromate solution and add 0.5cm^3 . Mix the solution and note down the potential developed. Continue the process of addition of potassium dichromate in terms of 0.5cm^3 and note down the potential value till a rapid increase is got. Take another five values by the addition of same quantity of dichromate solution. Plot a graph of $\Delta E/\Delta V$ volume of dichromate solution added and find out the equivalence point. Calculate the normality of ferrous ammonium sulphate solution and the amount of iron in the given volume of the solution.

REPORT: Amount of iron present in the given solution is = g

Signature of the teacher

Observation and Calculations

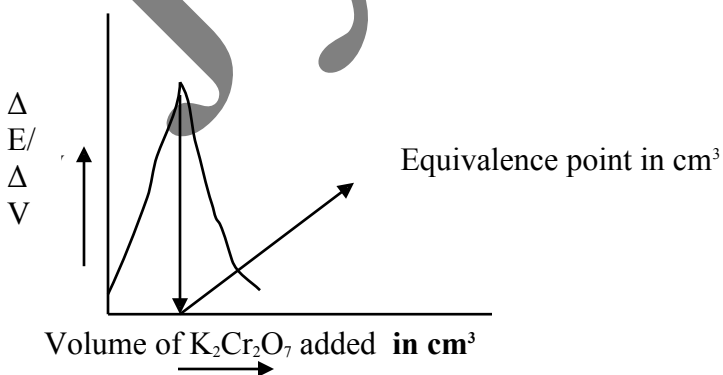
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Volume of $\text{K}_2\text{Cr}_2\text{O}_7$ required for titration = (V) cm^3 from the graph

$$N_{Fe} = N_{FAS} = \frac{(N \times V)_{K_2Cr_2O_7}}{V_{FAS}}$$

Amount of iron present in 1000cm³ of its solution = $N_{\text{FAS}} \times \text{Gram equivalent weight of iron}$

$$= \quad \times 55.85 \quad = \quad \text{g}$$



Signature of the teacher