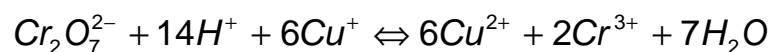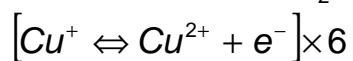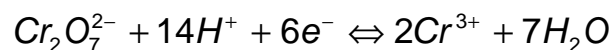# Metrohm

Thermo. Titr. Application Note No. H-005

Title:	Determination of Cuprous Ion in the Presence of Ferrous Ion

Scope:	Determination of cuprous ion in the presence of ferrous ion in electrochemical copper leach solutions

Principle:	Acidified aliquots of electrochemically-derived copper leach feed solution containing iron are titrated against standard potassium dichromate to a second exothermic endpoint. The presence of ferrous ion appears to protect the cuprous ion against oxidation. The cuprous content is determined from the difference between the first (ferrous) and second (cuprous) endpoints

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \Leftrightarrow 2Cr^{3+} + 7H_2O$$

$$\frac{\left[Cu^+ \Leftrightarrow Cu^{2+} + e^-\right] \times 6}{Cr_2O_7^{2-} + 14H^+ + 6Cu^+ \Leftrightarrow 6Cu^{2+} + 2Cr^{3+} + 7H_2O}$$

Reagents:	Standard 0.1 mol/L (0.6N) $K_2Cr_2O_7$ solution
	10% w/v H_2SO_4 solution

Method:	Basic Experimental Parameters:
	Data rate (per second) 5
	Titrant delivery rate (mL/min.) 1
	No. of endothermic endpoints 2
	Data smoothing factor 40
	Procedure:
	Dilute 20mL of copper leach solution and 10mL 10% H_2SO_4 solution to 200mL in a volumetric flask. Pipette 15mL of this solution into a titration vessel, add 10 mL 10% H_2SO_4 solution, and titrate to a second exothermic endpoint

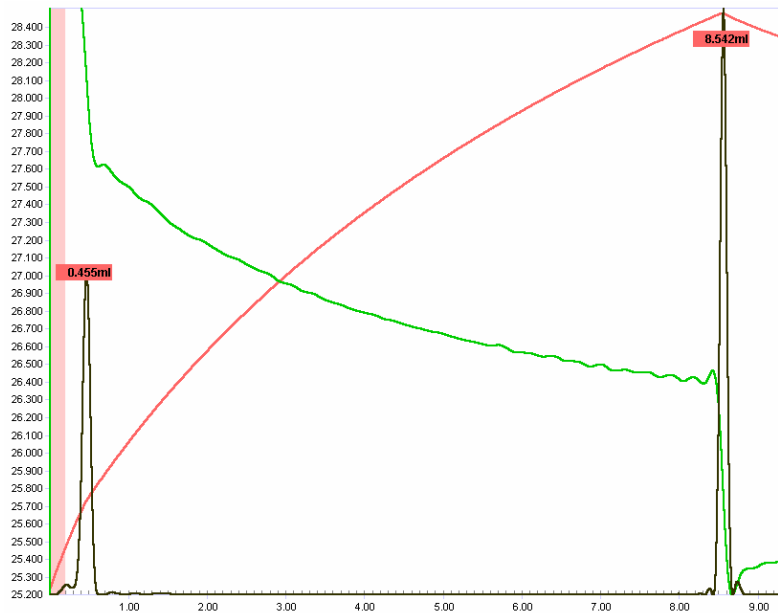| **Results:**	Analysis of an electrochemical copper leach solution:
	Mean (n=5) 205.7 ± 0.1 g/L Cu^+
	Note: it was observed that while the values for Fe^{2+} (from the first endpoint) varied significantly, the Cu^+ values were particularly constant

Calculation:	$$Cu^+ g/L = \frac{((EP2 - EP1) \times MCr_2O_7^{2-} \times 6 \times FW\ Cu)}{aliquot,\ mL}$$
	Example:
	$$Cu^+ g/L = \frac{((8.542 - 0.455) \times 0.1 \times 6 \times 63.546)}{1.5} = 205.9\ g/L$$

Thermometric Titration Plot:

Legend:

Red = solution temperature curve

Green = first derivative curve

Black = second derivative curve