MASTER

9/325

UCRL-9187
UC-4 Chemistry-General
TID-4500(15th Ed.)

UNIVERSITY OF CALIFORNIA

Lawrence Radiation Laboratory
Berkeley, California

Contract No. W-7405-eng-48

ANALYSIS OF CURRENT DISTRIBUTION IN ELECTROLYTIC CELLS WITH FLOWING MERCURY CATHODES

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(M. S. Thesis)

July 19, 1960

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ABSTRACT

An idealized model is postulated embodying the essential features of industrial caustic-chlorine cells with horizontal flowing mercury cathodes. This model is examined in detail and relationships expressing the local anode potential, cathode potential, and ohmic potential drop in the electrolyte in terms of local current density and other parameters are established. These relationships are combined to give a system of equations relating current density at any location along the cell to applied total potential and to operating conditions in the cell upstream of the point in question.

Numerical solutions of these equations for several cases of cell operating conditions are carried out on a digital computing machine. The effects of changes in operating parameters upon average current density, individual electrode potentials, and current distribution are evaluated.

I. INTRODUCTION

The Problem

The current distribution in industrial electrochemical cells is an important factor in defining cell performance. Nonuniformity of current distribution in a cell, which in many cases is undesirable, may be due to electrode geometry and (or) to other, nongeometric, factors. The effects upon current distribution due to electrode configuration fall in the realm of potential theory and have been dealt with at length by many authors (e.g. Kasper[1, 2, 3] and Wagner[4]). In this dissertation an important electrolytic cell process from industry is considered in which the nonuniformity is due almost entirely to nongeometric factors, and the effects of various of these factors upon cell performance are evaluated.

The example chosen is the caustic-chlorine cell with a horizontal-flowing mercury (amalgam) cathode, often referred to as the Solvay or Krebs type cell. In this cell the electrodes are parallel planes and current distribution would be uniform if determined solely by geometry. Based upon typical construction and operating characteristics for industrial cells of this general type, a well-defined theoretical model is established to represent a caustic-chlorine cell for computational purposes. This model is then considered in light of the available theoretical and empirical relationships for the interrelated, detailed processes involved, in order to derive a system of equations describing the cell behavior. Numerical solutions to these equations yield current distributions and average current densities for various specified values of parameters affecting cell operation.

Applications

The methods utilized herein are, in general, applicable to the investigation of performance of a wide variety of industrial cells in which the electrodes are equipotential and their geometry is such as to yield uniform current distribution in the absence of other factors. Before equations characterizing cell operation can be derived, the cell must be exactly described, and the relationships between local potentials (e.g. anodic overvoltage) and other operating variables must be available or be determined. Generally the system of equations that is established to represent the cell cannot be solved by analytic means because of the nonlinear interrelation of processes within the cell. Numerical solutions for specific cases can, however, be carried out on a suitable computing machine.

Use of this technique can permit a more rational approach to the design and operation of industrial cells. It yields quantitative information concerning the effects of interrelated design and operational parameters, which may permit the operating or design values of these parameters to be better selected.

Previous Work

Previous investigations of cells involving mercury electrodes have usually either been concerned with laboratory polarographic cells (e.g. Okinaka and Kolthoff[5]) or have limited their consideration to specific individual electrode or other processes (e.g. Drozin and Filipov[6]).

Okada et al.[7] conducted a comprehensive investigation of caustic-chlorine cells with flowing mercury cathodes from the standpoint of characterizing sources of current loss and relating current loss to cell operating conditions. The phases of their study that were concerned with overall cell behavior were, however, of an empirical nature. Moreover, the statistical deviations of their data were such that no conclusions concerning current distribution can reasonably be drawn.

Hine, Yoshizawa, and Okada examined analytically and in detail the effects upon current distribution in a Krebs-type caustic-chlorine cell due to electrode (anode) configuration.[8] This study showed that, if spacings between adjacent anodes and between anodes and cell walls are small, the current distribution is essentially uniform. However, no factors other than electrode geometry were considered in this work.

II. DESCRIPTION OF THE THEORETICAL MODEL

Industrial Equipment Serving as a Basis for the Model

The industrial electrolytic cell upon which this investigation is based is a caustic-chlorine cell with a horizontal-flowing mercury cathode. This type of cell consists of a trough, perhaps 65 cm in width by 250 to 1500 cm in length, the bottom of which is formed of a conducting material and connected as the cathode. A layer of mercury about 0.5 cm thick covers the bottom and serves as the cathode proper. Since the trough is inclined slightly in the longitudinal direction, this mercury layer flows by gravity from the inlet end, where it is supplied by a pumping system, to the outlet end, where it is removed by a suitable overflow-wier arrangement.

Situated in a plane parallel to the mercury cathode and about 0.5 cm above the mercury surface are a set of graphite anodes. These anodes are 20 to 40 cm wide, 40 to 60 cm long, and about 5 cm thick, and are arranged to form an essentially continuous, equipotential anode plane with only small (about 0.5 cm) gaps between the individual electrodes. The anodes are usually either drilled in some regular pattern or grooved in the longitudinal direction to permit chlorine gas evolved at the anode to escape more easily.

In the space between the cathode and anodes (and over the upper anode surfaces) the electrolyte--a concentrated sodium chloride brine--flows in the same direction as the mercury cathode. The brine enters at about 40°C to 65°C and may increase in temperature from as little as 5° to as much as 50°. During its passage through the cell the brine decreases in concentration from approximately 305 to 310 gm/l at the inlet to about 270 to 275 gm/l at the outlet. Concurrently the concentration of sodium (as amalgam) in the mercury cathode increases from about 0.01 wt % sodium to perhaps 0.1 to 0.2 wt %.

The reaction occurring in this cell is the electrolytic decomposition of sodium chloride into sodium--which dissolves in the mercury cathode to form sodium amalgam--and chlorine gas--which evolves at the anode and is removed from the cell by an appropriate ducting arrangement. The outlet brine is concentrated, purified, and recirculated. The sodium-rich amalgam is fed to a decomposer, where it is contacted with water to form sodium hydroxide of high purity and mercury of very low sodium content. The mercury is returned to the inlet end of the cell.

Detailed descriptions of various specific types of these cells may be found in such references as Encyclopedia of Chemical Technology,[9] De Nora,[10] Gardiner,[11] and Gonzalez-Martinez.[12]

Derivation of Theoretical Model

In order to permit a systematic investigation of cell performance, a theoretical model must be established which is firmly based upon an industrial type cell as described above, but which is simplified sufficiently to permit exact description of all characteristics affecting its performance. This simplification applies particularly to details of construction and exact operating procedures, which may vary widely in industry.

In order to restrict consideration to the important basic phenomena involved, the effects of impurities in the brine are ignored; that is, the brine is assumed to be pure sodium chloride solution. Effects of impurities have been investigated in detail by several authors including Yoshizawa and Nishida,[13] Okada and Yoshizawa,[14] and Drozin and Filipov.[6]

The investigation involves the basic cell only. Such appurtenances as the amalgam decomposer, mercury and brine circulating equipment, chlorine removal equipment, and electrical connections are not subject to consideration. Edge effects (the effects of electrode edge geometry on current distribution) for the anode are not considered; they have been shown to be of small order ($< 2\%$) by Hine, Yoshizawa, and Okada.[8] In view of this, a section of unit width from a cell of unspecified width may be regarded as a suitable model.

Based upon these requirements and simplifications, a model may be established. Certain characteristics of the model (e.g. the cell length) are arbitrarily fixed; these characteristics are, however, typical of the range encountered in industrial practice and could just as well be chosen to conform to any particular cell in question. The operating temperature of the cell is also arbitrarily established. In practice it is usually as high as corrosion rates for materials of construction will permit. It is assumed for this study that the temperature would be chosen as high as would be consistent with mechanical design and solution handling limitations. Other characteristics of the model--those which can reasonably be varied to influence operation of the corresponding industrial cell--will be considered operating parameters and are not fixed in the description of the theoretical model.

Detailed Description of Theoretical Model

The theoretical model utilized as a basis for this study is an electrolytic cell in the form of a trough 1000 cm long and of unit width. This model is illustrated in Fig. 1. The sides of the trough are of such nature as to give rise to no edge effects. The bottom of the trough is covered by a 0.5-cm-thick layer of dilute sodium amalgam flowing from one end of the trough (the inlet end) to the other (the outlet end). This amalgam layer constitutes the cathode of the cell. Above the amalgam in a plane parallel to its surface is a graphite anode which is continuous except for gaps that have no other effect than to permit the escape of evolved chlorine gas. An electrolyte brine of sodium chloride in pure water flows parallel to the amalgam in the uniform space between the anode and the cathode. The amalgam and brine are available at the inlet end ($x = 0$) at specified concentrations and are removed completely at the outlet end ($x = 1000$ cm).

The brine is electrolyzed as it passes through the cell, the sodium formed dissolving in the amalgam cathode and the chlorine evolving at the anode, where it saturates the brine with dissolved Cl_2. Thus, moving from the inlet toward the outlet of the cell, the brine becomes depleted in sodium chloride and the amalgam becomes enriched in sodium.

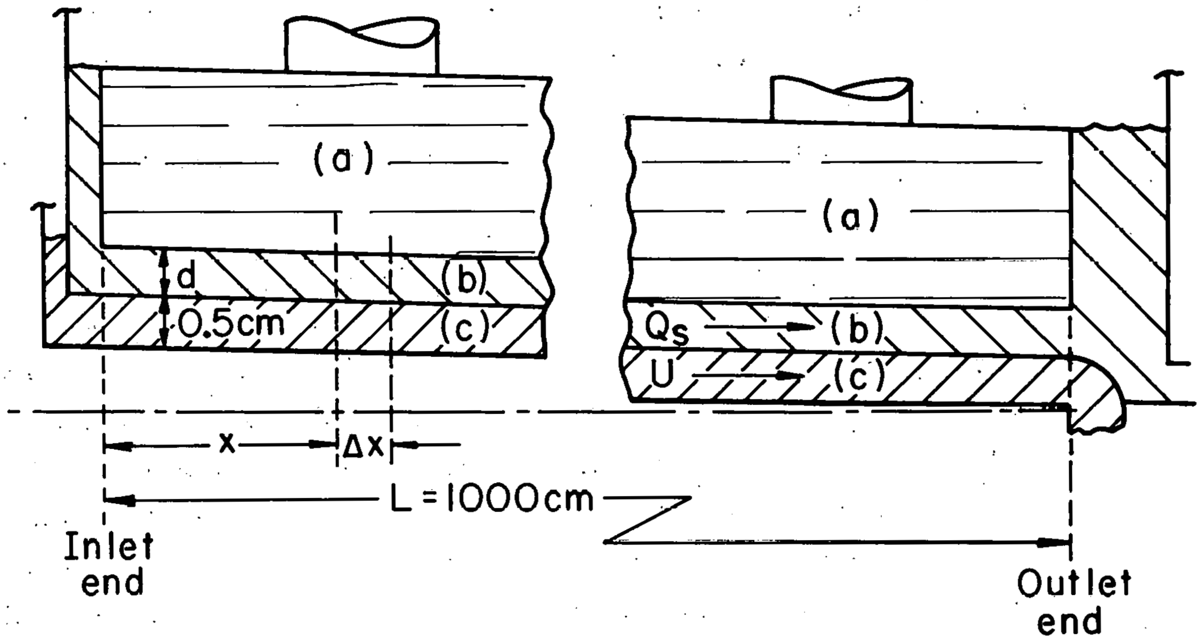

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Fig. 1. Model for caustic-chlorine cell with horizontal flowing mercury cathode.
(a) Graphite anode
(b) Flowing electrolyte (NaCl brine)
(c) Flowing mercury cathode

The operating parameters of this cell and the ranges of values that are considered for each are:

a. Anode type: plane, drilled, or grooved

b. Applied cell potential (E_T): 3.4 to 4.1 v

c. Brine flow rate (Q): 4.0 to 6.5 gm H_2O/sec

d. Amalgam velocity (U): 4.0 to 10.0 cm/sec

e. Inlet concentration of NaCl in brine (m_o): 5.0 to 6.4 molal

f. Inlet concentration of Na in amalgam (N_o): 0.005 to 0.050 wt % Na

g. Distance between electrodes (d): 0.5 to 3.0 cm.

These parameters are chosen to establish any desired operating condition for the cell.

The variables characterizing cell operation that are determined for any given operating condition (choice of operating parameters) are:

a. Current density at any point along the length of the cell (I) in amp/cm^2

b. Concentration of NaCl in brine at any point along the length of the cell (m) in mol/1000 gm solvent

c. Concentration of Na in amalgam at any point along the length of the cell (N) in wt % Na

d. Anode potential at any point along the length of the cell ($-E_A$) in volts

e. Cathode potential at any point along the length of the cell (E_C) in volts

f. Ohmic potential drop in the electrolyte at any point along the length of cell (E_R) in volts

g. Average current density for the cell (I_{Av}) in amp/cm^2

h. Average anode potential for the cell ($-\bar{E}_A$) in volts

i. Average cathode potential for the cell ($\bar{E}_C$) in volts

j. Average ohmic potential drop in the electrolyte for the cell ($\bar{E}_R$) in volts

Basic Assumptions in Treatment of Theoretical Model

In calculating relationships based upon the theoretical model just described, nine basic assumptions are made. These assumptions can be considered to be part of the definition of the model itself, but they are here described separately since they concern effects that would not be defined, a priori, by the description or design of an industrial cell. Certain of these assumptions (1, 2) concern phenomena which would be measured empirically in an operating cell, or by means of a model study in the design of a new cell. Others (4, 7, 8) involve effects for which no adequate data are currently available. Two (3, 6) are made to prevent the techniques utilized from becoming too involved to yield meaningful results. The basic assumptions invoked are:

1. The amalgam flow is completely turbulent with complete cross-mixing and no diffusion boundary layer. The complete turbulence is to be expected from stability criteria (see Section III) and is in agreement with industrial experience.[15] The absence of a diffusion boundary layer would be approached because of the surface mixing phenomena for mercury cathodes as described by Osugi, Inoue, and Imai[16] and by Yoshizawa and Nishida.[17, 18, 13]

2. The brine flow is completely turbulent and has a diffusion boundary layer at the cathode whose thickness is independent of brine or amalgam flow rates. The turbulence will be encouraged by the extensive chlorine-gas evolution in the narrow flow channel. With this gas evolution and with a moving interface, the effect of bulk velocities on the diffusion boundary layer cannot be reliably predicted.

3. The cell is essentially isothermal at 65°C. This condition is assumed as a simplification and is not necessarily in accord with experience for the analogous industrial cells, many of which are highly nonisothermal. It is a condition that is approached, however, in several industrial installations.

4. Evolved gas distribution is independent of electrode spacing and brine flow rate.

5. No appreciable ClO_3^- is formed by cell side reactions.[7]

6. Current loss is 4% and is due entirely to the recombination of dissolved Cl_2 with sodium amalgam at the cathode. This condition is closely approached in well-operated industrial cells as determined by analysis of the gas produced.

7. There is no significant overvoltage for the primary cathode reaction.

8. The pH of the electrolyte remains close to pH 4 for a wide range of feed pH.[7]

9. The current density is independent of distance in the direction normal to the electrode surfaces.

III. ANALYSIS OF THEORETICAL MODEL

Electrochemical Reactions of Cell

The primary electrochemical reactions occurring in the model described are, at the cathode,

$$Na^{+} + e^{-} \rightarrow Na(Hg), \qquad (a)$$

and at the anode,

$$Cl^{-} \rightarrow \frac{1}{2}\, Cl_2(gas) + e^{-}. \qquad (b)$$

In addition, side reactions may occur at the cathode, at the anode, or in the bulk of the electrolyte. The important possible side reactions at the cathode are:

$$H^{+} + e^{-} \rightarrow \frac{1}{2}\, H_2(gas) \qquad (c)$$

$$\frac{1}{2}\, Cl_2(aq) + Na(Hg) \rightarrow Na^{+} + Cl^{-} + (Hg) \qquad (d)$$

$$ClO^{-} + H_2O + 2e^{-} \rightarrow Cl^{-} + 2OH^{-}. \qquad (e)$$

Those at the anode are:

$$Cl^{-} \rightarrow \frac{1}{2}\, Cl_2(aq) + e^{-} \qquad (f)$$

$$Cl^{-} + OH^{-} \rightarrow HClO + 2e^{-} \qquad (g)$$

$$4OH^{-} + C \rightarrow 2H_2O + CO_2 + 2e^{-}. \qquad (h)$$

Throughout the bulk of the electrolyte, the chemical reactions which will occur are:

$$Cl_2(aq) + H_2O \rightleftharpoons HClO + H^{+} + Cl^{-} \qquad (i)$$

$$HClO \rightleftharpoons H^{+} + ClO^{-} \qquad (j)$$

If these possible side reactions are considered with regard to specified conditions, the majority can be eliminated as far as having any significant effect on cell performance. Reaction (c) is inhibited because of the high hydrogen-evolution overvoltage for a mercury cathode (about 0.78 v for pure mercury[19]); it takes place only to a negligible extent except in cases of extreme depletion of sodium ion at the cathode surface. Reaction (h) proceeds to an extent determined largely by the nature of the anode graphite, nature of chlorine evolution, and current density. Analysis of gas evolved in operating industrial cells analogous to the model shows that this reaction accounts for a very small part of the total current passed ($< 1/2\%$).

Reactions (e) and (g) proceed to an extent governed by the equilibria of reactions (i) and (j). For a solution of pH 3 saturated with chlorine at $65^{\circ}C$ (about 5×10^{-3} mol/l) the equilibrium concentration of HClO is 3×10^{-5} mol/l and that of ClO^- is 10^{-9} mol/l. Thus, with Cl^- concentration on the order of 5 mol/l, electrode reactions involving ClO^- or HClO may be disregarded.

Cathode reaction (d) comprises the recombination reaction for the cell (i.e. the recombination to sodium chloride of electrolytically separated sodium and chlorine). This reaction occurs to an appreciable extent and, in fact, accounts for essentially all observed current loss in the analogous industrial cells. It is governed by the mass transport of dissolved chlorine from the anode area to the cathode surface where it recombines with the sodium in the amalgam.

Mercury Flow Characterization

In determining stability criteria for the mercury (amalgam) flow, the flow pattern is considered essentially flow over a smooth, flat plate where the "Blasius case" velocity distribution law is followed at velocities less than critical. For this situation, the boundary-layer thickness, $\delta(x)$, is given according to Schlichting[20] as (see Nomenclature section for definition of terms)

$$\delta(x) = 3.0\ \delta_*(x) = (3.0)\ (1.73)\ (x)\left(\frac{Ux}{\nu}\right)^{-1/2} \qquad (1)$$

$$= 0.0654\ x^{1/2}\ \text{cm for } U = 6.25\ \text{cm/sec.}$$

With a mercury layer 0.50 cm thick, the boundary layer thus encompasses the entire mercury cathode for $x > 58$ cm--that is, for most of the length of the 1000-cm cell. Therefore we have

$$\delta_*(x) = \frac{\delta}{3.0} = \frac{0.50}{3.0} = 0.167\ \text{cm} \qquad (2)$$

for most of the length of the cell.

Now the stability criterion for the boundary layer (here the entire mercury layer for 94% of cell length) is, according to Schlichting,[21]

$$[Re]_{\delta_*} = 575 \qquad (3)$$

at critical flow.

Thus, with $\nu = 0.001045\ cm^2/sec$ and $\delta_* = 0.167$, the critical mercury velocity is found:

$$[Re]_{\delta_*} = \left(\frac{U\delta_*}{\nu}\right) = 575 \qquad (4)$$

$$U_{critical} = 575\ \frac{0.001045}{0.167} = 3.54\ cm/sec \qquad (5)$$

Instability therefore occurs at mercury velocities greater than about 3.5 cm/sec. Actual transition to turbulent flow will require a slightly higher velocity, but the amalgam velocities of the range considered in this model (4.0 to 10.0 cm/sec) correspond to a mercury layer that is completely turbulent over much of its length. This is in agreement with the findings of Sugino.[22]

If the flow dynamics of the mercury layer are examined, ignoring effects of the brine layer in contact with its surface, the variation of layer thickness along the direction of flow is ascertained. By using the 1/7-power velocity-distribution law for turbulent flows over flat surfaces[23] and carrying out a balance of gravity forces, drag forces, and pressure forces, the depth profile is found for any flow velocity. For velocities in excess of 5.0 cm/sec the mercury depth does not vary significantly from the inlet depth except over the 300 cm of cell length nearest the outlet end, and depth variation does not exceed 0.1 cm except over the last 100 cm of cell length.

Brine-Flow Characterization

Because of the extensive evolution of chlorine gas at the anode and to the irregularities of the anode surface, the flow of brine in its channel between the anode and the cathode is turbulent over the greatest portion of its depth. Complete turbulence except for diffusion layers at the anode and cathode surfaces is assumed, as stated in Section II.

Diffusion Layers

At the anode, chlorine gas is evolved and, for this reason, the structure of any laminar diffusion layer (layer through which mass transport from the turbulent core to the electrode takes place under the control of molecular diffusion and migration) is not adequately defined. The effect of mass transport through any anode diffusion layer is included in the overall anode potential relationships outlined in a following section (Anode Potential), and this diffusion layer is not separately considered.

At the cathode, a diffusion layer of thickness b will exist. As this thickness will be determined by the overall hydrodynamics of the brine flow, including the behavior of evolved gases, and by the velocity of the moving cathode interface, it cannot be unambiguously described in terms of brine flow rate. For this reason the thickness of the cathode diffusion layer is assumed to be a constant independent of brine velocity (see Section II concerning Basic Assumptions).

Since the current loss assumed at 4% is entirely due to the recombination reaction, the thickness of the cathode diffusion layer can be determined by consideration of this phenomena. The rate of recombination is controlled by the molecular diffusion of dissolved chlorine to the cathode through this diffusion layer. In the bulk of the brine, the presence of Cl_2 gas bubbles in large quantities assures saturation of the solution with chlorine. At the cathode surface, the dissolved-chlorine concentration must be zero because of the high potential of the recombination reaction (reaction (d)). Thus by application of Fick's Law for diffusion, we have

$$\frac{(0.04)I}{n\mathcal{F}} = \frac{D_{Cl}}{b}\left(C_{Cl(bulk)} - C_{Cl(wall)}\right) \qquad (6)$$

$$= \frac{D_{Cl}}{b}\left(C_{Cl(sat)}\right)$$

Using a typical value of current density, I = 0.35 amp/cm^2; the number of electrons transferred, n = 2; the saturation value for chlorine in the NaCl brine at 65°C and pH 4, $C_{Cl(sat)} = 5.18 \times 10^{-6}$ mol/cm^3; and the diffusion coefficient of dissolved chlorine at 65°C, $D_{Cl} = 4.7 \times 10^{-5}$ cm^2/sec, one determines the value of b:

$$b = \frac{D_{Cl}\, C_{Cl(sat)}\, n\, \mathcal{F}}{0.04\ I} = 3.4 \times 10^{-3}\ \text{cm} \qquad (7)$$

Such a low value of diffusion-layer thickness is not unexpected because of the high degree of turbulence from the stirring effect of the evolved gas and especially because of the presence of ripples or waves in the amalgam surface forming the interface.

Cathode Potential

The cathode potential--the portion of the total cell potential associated with the reaction at the cathode and in its associated electric double layer--can be given in the assumed absence of overvoltages (see Section II) as

$$E_C = E_C^o - \frac{RT}{\mathcal{F}} \ln \frac{a_{\pm(wall)}}{a_{NaHg(wall)}}, \qquad (8)$$

where the activities are at the mercury surface. Since the amalgam is completely cross-mixed at any position along the cathode, we have

$$a_{NaHg(wall)} = a_{NaHg}, \qquad (9)$$

and thus

$$E_C = E_C^o - \frac{RT}{\mathcal{F}} \ln \frac{a_\pm}{a_{NaHg}} \frac{a_{\pm(wall)}}{a_\pm} \qquad (10)$$

$$= E_C^o - \frac{RT}{\mathcal{F}} \ln \frac{a_\pm}{a_{NaHg}} - \frac{RT}{\mathcal{F}} \ln \frac{a_{\pm(wall)}}{a_\pm},$$

where the last term on the right side of Eq. (10) constitutes the concentration polarization.

Consider this concentration-polarization term. The discharged sodium ions are brought to the cathode surface by diffusion and migration, yielding a modification of Fick's Law:

$$\frac{I}{\mathcal{F}} = \frac{D}{b}\,(a_{\pm} - a_{\pm(\text{wall})}) + \frac{t_{+}I}{\mathcal{F}} \tag{11}$$

or

$$a_{\pm} - a_{\pm(\text{wall})} = \frac{Ib}{\mathcal{F}D}\,(1 - t_{+}). \tag{12}$$

To investigate the significance of this term one needs only to choose typical values for I, D, and t_+ as follows:

$I = 0.35$ amp/cm^2

$D = 4.3 \times 10^{-5}$ cm^2/sec (D for NaCl at 65°C, 6.0 molal)

$t_+ = 0.5$.

Then, using the value for b previously determined, we have

$$a_{\pm} - a_{\pm(\text{wall})} = 0.143. \tag{13}$$

At the typical activity of 5.6, this concentration polarization effect will cause a potential component of only

$$E = -\frac{RT}{\mathcal{F}} \ln \frac{5.60 - 0.14}{5.60} = 0.00072 \text{ v} \tag{14}$$

Thus this effect is negligible and will be ignored.

The cathode potential can then be represented as

$$E_C = E_C^o - \frac{RT}{\mathcal{F}} \ln \frac{a_{\pm}}{a_{NaHg}} \tag{15}$$

Anode Potential

The anode potential, or portion of cell potential associated with the chlorine-evolution reaction at the graphite anodes of the cell, cannot be represented in simple theoretical relation such as that for the cathode potential. This is because of the appreciable overvoltages for chlorine evolution at graphite electrodes and to the masking effect of the evolved chlorine on the surface area of the anode, which reduces the effective anode area and thus produces an apparent polarization effect.

The overvoltage phenomena are not covered by any adequate theory. The magnitude of overvoltage (and thus of anode potential) varies considerably among various types of graphites and even with the orientation of the anode surface with respect to the cleavage plane of the graphite, as shown by the studies of Inoue and Sugino.[24] Also, the masking effect of the chlorine gas bubbles is very much a function of type of anode (plane, drilled, or grooved).

Because of these effects, which severely restrict theoretical consideration, the empirical relations of Okada <u>et al.</u> for electrode potentials at horizontal graphite anodes with chlorine evolution are utilized.[25,26] These data pertain to anodes of artificial graphite and to saturated pure sodium chloride brine. A suitable correction must be made for brine concentration.

If all polarization effects are combined in a term ω_A, we have

$$-E_A = -E^o_A + \frac{RT}{\mathcal{F}} \ln \frac{a_{Cl}}{a_{\pm}} + \omega_A. \qquad (16)$$

Considering the potential for saturated brine at the same temperature,

$$-E_{A(sat)} = -E^o_A + \frac{RT}{\mathcal{F}} \ln \frac{a_{Cl}}{a_{\pm(sat)}} + \omega_A, \qquad (17)$$

and combining Eqs. (16) and (17), we obtain

$$-E_A = -E_{A(sat)} - \frac{RT}{\mathcal{F}} \ln \frac{a_{\pm}}{a_{\pm(sat)}}. \qquad (18)$$

For a temperature of 65°C the saturation activity $a_{\pm(sat)}$ is 6.31 (see Appendix I); thus we have

$$-E_A = -E_{A(sat)} + 0.0537 - \frac{RT}{\mathcal{F}} \ln a_{\pm}. \qquad (19)$$

The term $-E_{A(sat)}$ is found from the data of Okada et al[25,26] by utilizing available 65°C data and scaling other 55°C data to 65°C by the ratio $-E_{A(sat)}(65^oC)/-E_{A(sat)}(55^oC)$ derived from cases evaluated at both temperatures. Three types of electrodes are considered, as illustrated in Fig. 2:

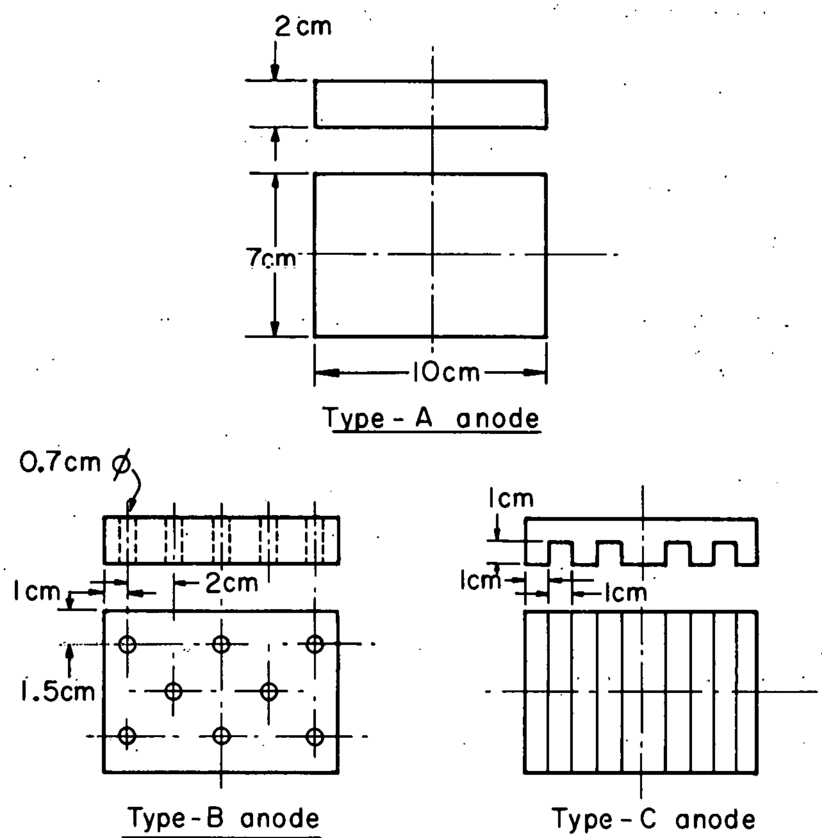

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Fig. 2. Graphite anodes.

Type A: Plane electrode

Type B: Drilled electrode

Type C: Grooved electrode.

For each of these anodes a relationship of the form

$$-E_{A(sat)} = \alpha + \beta I + \gamma I^2 \qquad (20)$$

is derived from the corrected data by regression analysis over the range of I from 0.10 to 0.50 amp/cm^2. The resulting constants are summarized in Table I.

Table I

Regression constants for Eq. (20) for a saturated aqueous solution of NaCl at 65°C.

Anode Type	α	β	γ
A	1.37	0.400	4.00
B	1.23	0.927	0
C	1.25	1.22	-0.57

Thus we derive a relationship for the anode potential at 65°C in terms of sodium chloride activity and current density:

$$-E_A = 0.0537 + \alpha + \beta I + \gamma I^2 - \frac{RT}{\mathcal{F}} \ln a_{\pm} \qquad (21)$$

Ohmic Potential Drop in the Electrolyte

The potential drop in the electrolyte between the anode and the cathode is determined not only by the conductivity of the electrolyte solution itself (k_e) but also by the presence of essentially nonconducting gas bubbles from the evolution of chlorine at the anode. Thus the effective conductivity of the electrolyte with gas bubbles (k_m) can be stated in terms of solution conductivity at the temperature and concentration in question, and a relative conductivity factor (K_m) which accounts for the effect of the dispersed phase:

$$k_m = K_m k_e . \qquad (22)$$

The distribution of gas bubbles cannot be predicted by any known theoretical means. It is a function of anode configuration and of current density but, because of the uniformity of the flow channel and the length of the cell, not a function of brine velocity. In order to derive quantitative expressions for K_m, the empirical relationships of Okada et al. for relative resistivities (P_m) of electrolytes in cells evolving chlorine at horizontal (downward-facing) graphite anodes in saturated sodium chloride brines are used.[25, 26] These data were established for a geometry adequately approximating the model under consideration. It is assumed that the relative resistivity is not affected by changes in brine concentration. The relative resistivity data are scaled as required from 55 to 65°C in a manner analogous to that used in scaling the anode potential in the preceding section. The three types of anodes shown in Fig. 2 are considered, since the anode configuration has a pronounced effect upon relative resistivity. By converting the data for P_m to the form of relative conductivity,

$$K_m = \frac{1}{P_m}, \qquad (23)$$

and expression of the form

$$K_m = \lambda + \mu(\ln I) + \xi(\ln I)^2 \qquad (24)$$

is derived from the corrected data by regression analysis for current densities ranging from 0.10 to 0.50 amp/cm^2. The resulting constants are summarized in Table II.

Table II

Regression constants for Eq. (24) for an aqueous solution of NaCl at 65°C

Anode Type	λ	μ	ξ
A	0.731	0.122	0.0646
B	0.812	0.0710	0.0556
C	0.888	0.0208	0.0208

Thus we derive an expression for ohmic potential drop in the electrolyte at 65°C in terms of pure solution conductivity (see Appendix III) and current density:

$$E_R = \frac{Id}{k_m} = \frac{Id}{[\lambda + \mu(\ln I) + \xi(\ln I)^2]\; k_e}. \qquad (25)$$

IV. CHARACTERIZATION OF CELL PERFORMANCE

Total Cell Potential

Because of the assumption of equipotential electrodes, the total cell potential (electrode-to-electrode) must be the same at all points along the length of the cell trough. Thus, at any point in the cell we have

$$E_T = -E_A + E_R + E_C, \tag{26}$$

where $-E_A$, E_R, and E_C are as defined by Eqs. (21), (25), and (15), respectively. Substituting these expressions and rearranging, we obtain

$$\gamma I^2 + \left\{ \beta + \frac{d}{k_e[\lambda + \mu(\ln I) + \xi(\ln I)^2]} \right\} I$$

$$+ \left\{ 0.0537 + \alpha + E_C^o - E_T + \frac{RT}{\mathcal{F}} \ln \frac{a_{NaHg}}{a_\pm^2} \right\} = 0. \tag{27}$$

For given activities in the electrolyte and amalgam and given pure electrolyte conductivities, Eq. (27) is an implicit function of I which may be solved for I by numerical techniques. Since the activities $a_\pm$ and a_{NaHg} and the conductivity can be expressed as known functions of sodium chloride concentration in the electrolyte (m) and sodium concentration in the amalgam (N) (see Appendices I, II, and III), Eq. (27) yields values for local current density (I) at any point in the cell where m and N are known.

Material Balances

If an increment Δx of the cell length in the direction of brine and amalgam flow is considered, the rate of loss of sodium chloride by the brine in this increment is given by

$$G = \frac{\eta I}{\mathcal{F}} \Delta x. \tag{28}$$

Of course, Eq. (28) also expresses the rate of gain of sodium by the amalgam cathode in the increment.

By a material balance on the electrolyte stream over the incremental length of cell, Δx, the decrease in sodium chloride concentration in the brine for this distance is

$$-\Delta m = \frac{1000\ G}{Q} = \frac{1000\ \eta I \Delta x}{Q\ \mathcal{F}} \quad . \tag{29}$$

Through a similar balance on the flowing amalgam cathode, the increase in the sodium concentration in the amalgam is

$$N = \frac{100\ M_{Na} G}{U \delta\ \rho_{Hg}} = \frac{100\ M_{Na}\ \eta I \Delta x}{U\ \delta\ \rho_{Hg}\ \mathcal{F}} \quad . \tag{30}$$

Thus, given the concentrations m and N at the upstream end of any increment of cell length Δx over which the current density can be considered constant, the corresponding concentrations at the downstream end of the increment can be computed.

Technique for Numerical Solutions

By use of Eqs. (27), (29), and (30), and suitable numerical methods, the current density and concentrations at any point in the cell can be determined for any desired operating condition as specified by the values assigned to the operating parameters.

The solution is accomplished by considering increments of cell length that are sufficiently small that current density does not change appreciably over their length. The technique then proceeds according to the following steps, starting from the cell inlet end:

1. Using given inlet concentrations (and other operating parameters), calculate the current density (I) at $x = 0$ by numerical solution of Eq. (27). Note: this equation is insensitive to the value of I used in the term for K_m, and thus the trial-and-error procedure will usually close in one trial. The numerical method employed is to use the last estimate of I in the term mentioned above, and to solve for I by the quadratic formula.

2. Assuming the value of I calculated in step 1 or 4 to be valid over Δx, calculate changes in concentrations $-\Delta m$ and ΔN by Eqs. (29) and (30) respectively.

3. Use the increments in concentrations found in step 2 to calculate concentrations at the downstream end of increment Δx.

4. Using the concentrations calculated in step 3, calculate current density (I) at the upstream end of the next cell increment.

5. Repeat step 2.

In this manner, current densities, and at the same time anode, cathode, and ohmic drop potentials, are determined at intervals of Δx along the length of the cell. When the outlet end of the cell is reached, outlet concentrations are known, and average current densities and average individual electrode potentials over the entire cell may be determined.

Because of the extremely laborious nature of these calculations, a program has been written to conduct them using an IBM-650 Data Processing System (digital computer). To facilitate the computer calculations, all data which would normally be represented by tables of graphical curves (e. g. activities) have been reduced to power-series representations by regression analysis. When provided the values of the operating parameters characterizing the example considered (anode type, E_T, Q, U, m_o, N_o, d) the program calculates and records values for current density (I), concentrations (m and N), anode potential ($-E_A$), cathode potential (E_C), and ohmic potential drop in the electrolyte (E_R) at 1 cm intervals along the length of the cell. It also calculates average current density and average individual potentials for the entire cell.

V. EFFECT OF VARIATION IN OPERATING PARAMETERS UPON CELL OPERATING CHARACTERISTICS

Selection of Cell Operating Conditions

In order to determine the effects of variations in the operating parameters defined in Section I upon the variables characterizing cell operation, a base example, analogous for the model to typical operation of an industrial cell, was selected. The values of parameters used to establish this base example are shown in Table III. Other examples were then chosen in order to investigate the effects of varying the values of each of the operating parameters individually. The values of the parameters used in these examples are listed in Table III; it should be noted that in each case all parameters except the one being investigated are maintained at the level used to establish the base example.

Each of the examples listed in Table III was analyzed by the methods described in Section IV. The detailed results of these analyses in the form of local current densities, component potentials, and concentrations at each centimeter of cell length are presented in tabular form in Appendix V. These results are summarized in Table IV, which includes average current densities and component potentials, and outlet-end concentrations.

Effect of Anode Type

Changing the anode from the drilled type used in the base example to a grooved type (see Fig. 2) has little effect upon cell performance. However, changing to a plane anode while maintaining other operating parameters as in the base example causes a drastic reduction in current densities at all points in the cell. This effect is illustrated in Fig. 3, which presents current distribution in the cell for the three anode types. In the case of the plane anode the current density is reduced because this anode configuration does not facilitate the escape of evolved chlorine gas, and thus anode masking and inclusion of gas bubbles in the electrolyte occur to a much greater extent than in the cases of the drilled or grooved anodes.

Table III

Values of operating parameters for examples considered

Example number	Anode type	E_T (volts)	Q (gm H_2)/sec)	U (cm/sec)	m_o (molality)	N_o (wt%)	d (cm)
1 (base example)	B	3.80	5.60	6.25	6.00	0.010	0.500
2	C						
3	A						
4	B	3.40					
5		3.60					
6		4.00					
7		4.10					
8		3.80	4.00				
9			6.50				
10			5.60	4.00			
11				10.0			
12				6.25	5.00		
13					6.40		
14					6.00	0.005	
15						0.020	
16						0.050	
17						0.010	1.00
18							3.00

Table IV

Summary of cell operation for examples defined in Table III

Example number	m_L (molality)	N_L (wt%)	I_{av} (amp/cm^2)	$-E_{A_{av}}$ (volts)	$E_{R_{av}}$ (volts)	$E_{C_{av}}$ (volts)
1 (base example)	5.38	0.199	0.349	1.56	0.481	1.76
2	5.39	0.198	0.347	1.61	0.430	1.76
3	5.59	0.136	0.233	1.69	0.369	1.75
4	5.66	0.114	0.192	1.41	0.247	1.74
5	5.52	0.156	0.270	1.49	0.364	1.75
6	5.24	0.242	0.429	1.63	0.600	1.77
7	5.17	0.264	0.469	1.67	0.659	1.77
8	5.14	0.197	0.346	1.56	0.482	1.76
9	5.47	0.199	0.350	1.56	0.481	1.76
10	5.39	0.300	0.343	1.55	0.473	1.77
11	5.37	0.130	0.355	1.56	0.490	1.75
12	4.43	0.185	0.324	1.54	0.490	1.77
13	5.77	0.203	0.356	1.56	0.481	1.76
14	5.38	0.194	0.350	1.56	0.483	1.76
15	5.39	0.208	0.347	1.56	0.478	1.76
16	5.40	0.235	0.343	1.55	0.472	1.77
17	5.59	0.073	0.234	1.45	0.621	1.73
18	5.81	0.020	0.110	1.34	0.772	1.69

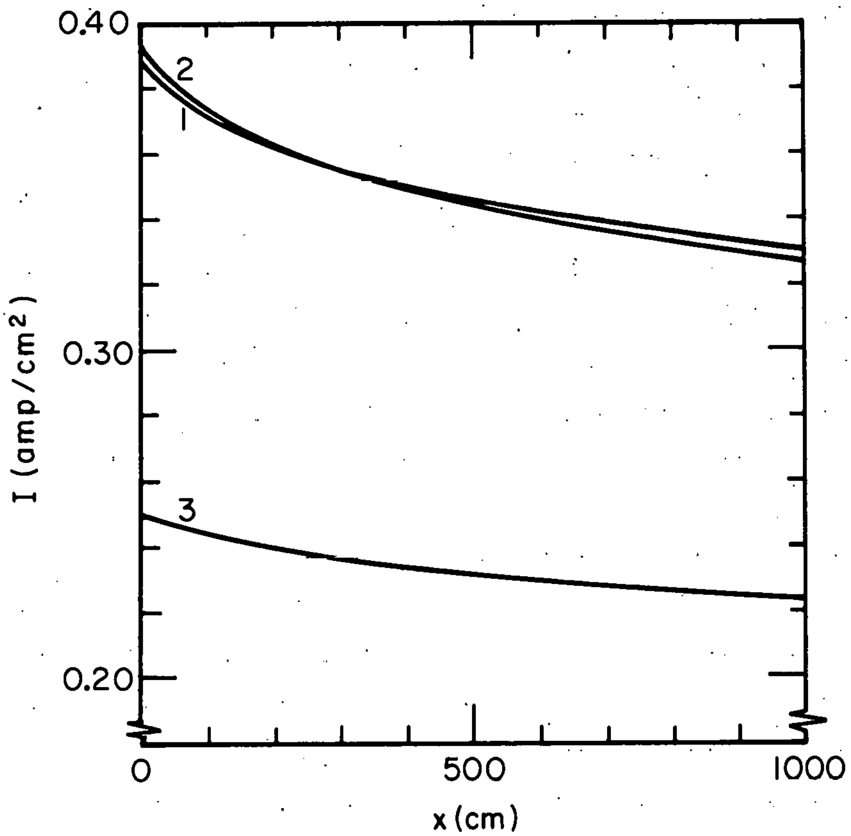

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Fig. 3. Effect of anode type upon current distribution.
(1) Base example (Type B anode (drilled))
(2) Type C anode (grooved)
(3) Type A anode (plane)

Effect of Applied Total Cell Potential

The total applied cell potential (E_T) has, as would be expected, a profound effect upon the performance of the model. Other parameters being held constant, increasing or decreasing this potential from its value in the base example (3.80 v) causes a corresponding increase or decrease in average current density, which, as is shown in Fig. 4, is almost linearly related to voltage change. As the applied potential and thus the average current density are reduced, the current distribution in the cell becomes more uniform, as portrayed in Fig. 5.

Effect of Brine Flow Rate

Varying brine flow rate (Q) over a range spanning 38% of its maximum value has very little effect upon cell performance, other operating parameters being held constant, as is illustrated in Fig. 6. The average current density varies less than 2%, and the component potentials remain essentially unaffected. The insensitiveness of this model to brine flow can, for the most part, be accounted for by two basic factors: first, there is not a significant concentration polarization effect at the cathode, and thus a flow-dependent diffusion layer is not a consideration in this cell; and second, the change in depletion rate of sodium chloride in the brine due to its changed flow rate is partially counter-balanced by the resulting slight change in current density, so that concentration at the cell outlet is but little affected (see Table IV).

Effect of Amalgam Velocity

Changes in the velocity of the flowing amalgam cathode (U) have only a minor effect upon the model-cell performance if other operating parameters are maintained at their values for the base example. With a 2.5-fold range of velocities considered, average current density has a spread of less than 4%, and component potentials are not appreciably affected. This behavior is shown in Fig. 7 and is explained by the insensitivity of the cathode potential to sodium concentration in the amalgam in the range of concentrations involved under this effect.

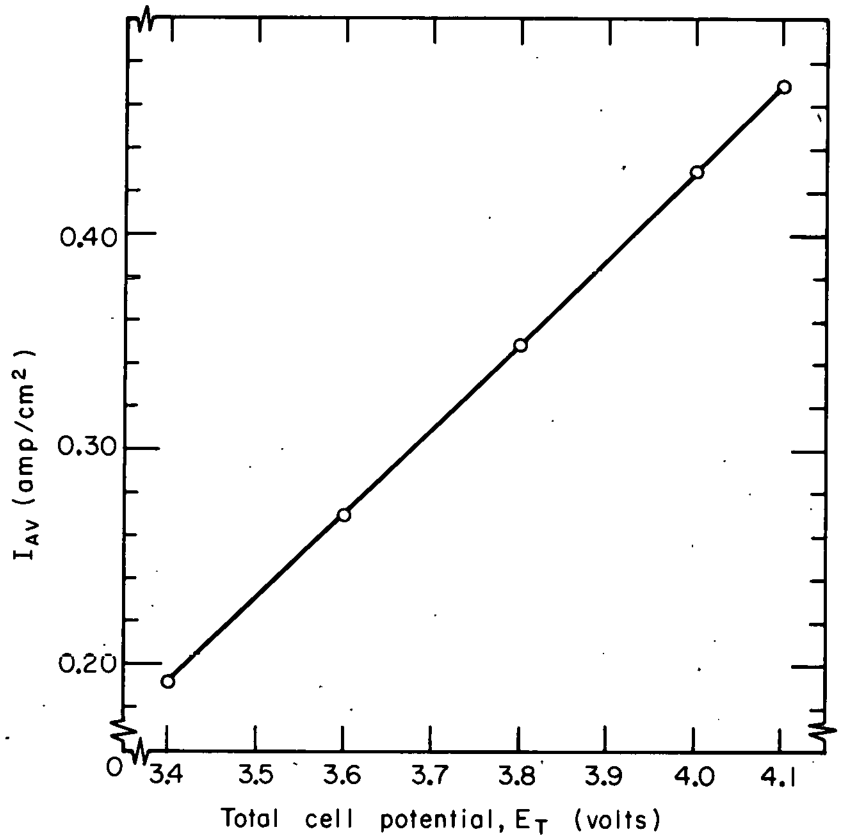

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Fig. 4. Effect of total cell potential upon average current density (all other operating parameters are at base example values).

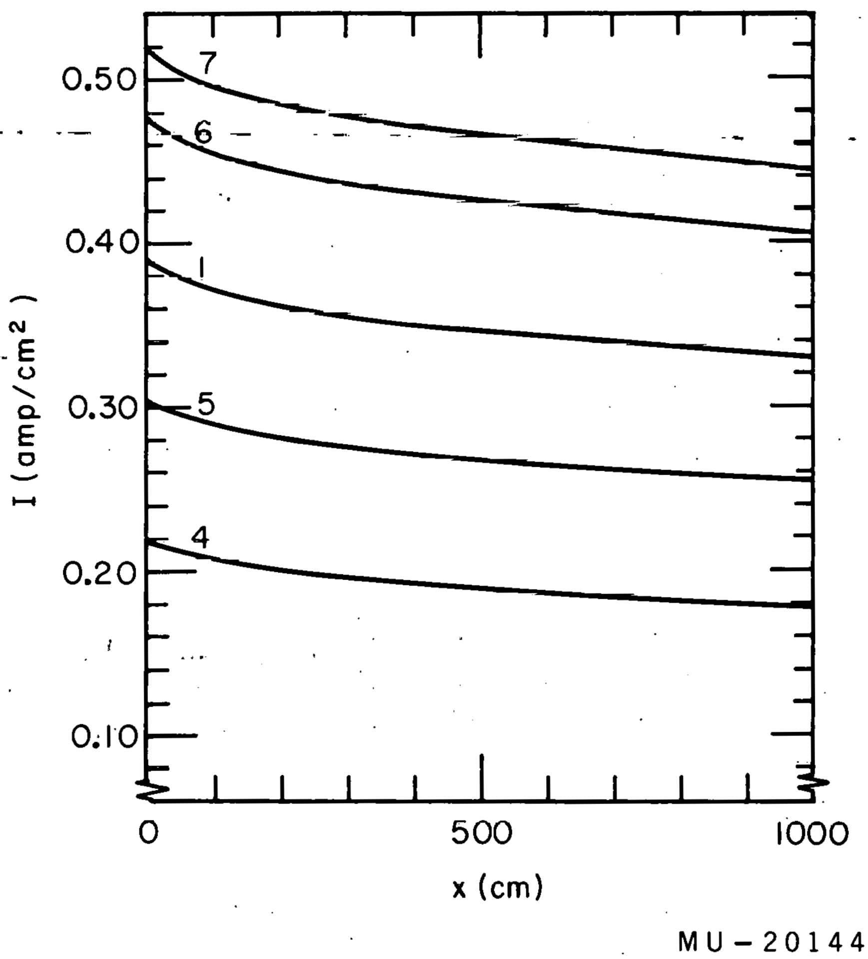

Fig. 5. Effect of total cell potential upon current distribution.
(1) Base example (E_T = 3.80 v)
(4) E_T = 3.40 v
(5) E_T = 3.60 v
(6) E_T = 4.00 v
(7) E_T = 4.10 v

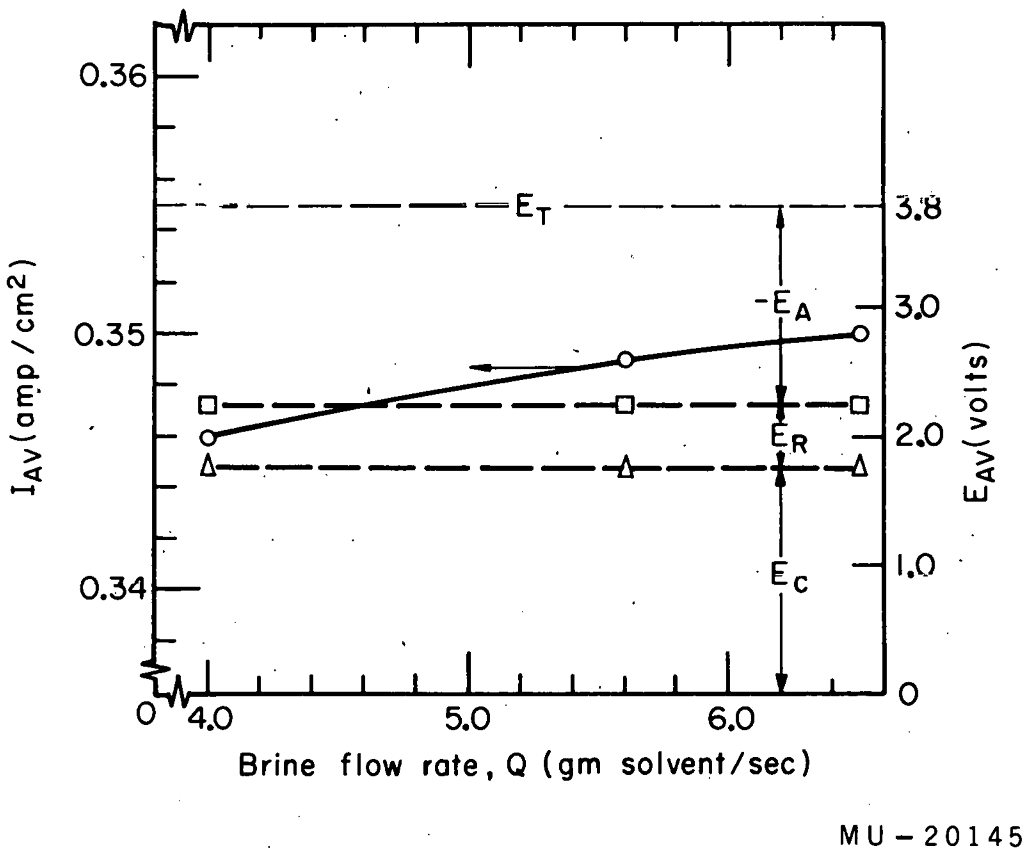

Fig. 6. Effect of brine flow rate upon average current density (all other operating parameters are at base example values).

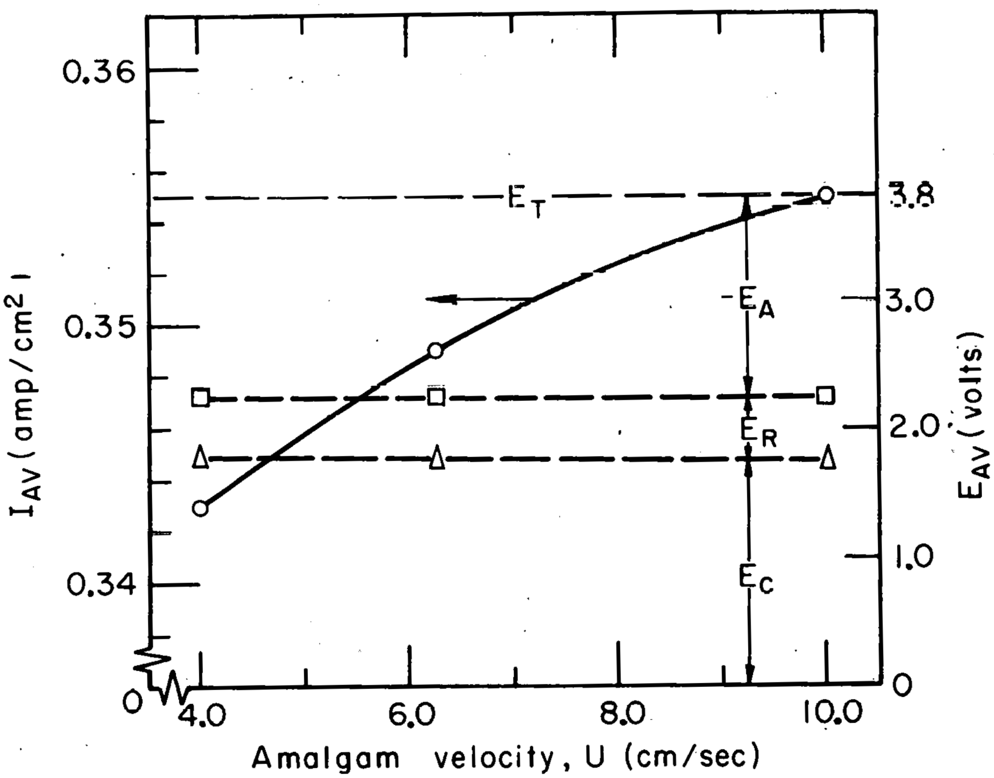

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Fig. 7. Effect of amalgam velocity upon average current density (all other operating parameters are at base example values).

Effect of Inlet Sodium Chloride Concentration in Electrolyte

The concentration of sodium chloride in the brine entering at the inlet end of the cell has a pronounced effect upon cell performance, due primarily to its effect upon electrolyte conductivity. Altering inlet concentration over a range from 5.0 to 6.43 molal (saturation) caused variations spanning 8.5% in current density, as shown in Fig. 8. However, the distribution of total potential among anode, cathode, and ohmic drop potentials is completely insensitive to inlet concentration of brine in the range of concentrations considered.

Effect of Inlet Sodium Concentration in Amalgam

Although sodium concentration in the amalgam entering at the inlet end of the cell has little effect upon overall cell performance in the range of concentrations considered (0.005 to 0.05 wt% Na), as is illustrated in Fig. 9, this operating parameter has an important effect upon current distribution in the cell, as is shown in Fig. 10. Low sodium concentrations in the inlet amalgam reduce cathode potential to an appreciable extent (see Eq. (15)) near the inlet end of the cell and permit high local current densities to be attained. However, as sodium is transferred to the flowing amalgam electrode, the very low initial concentration is rapidly increased (relative to the initial value), and the current density falls until it reaches a value for the bulk of the cell that is little affected by variations in inlet amalgam concentration over the range in question.

Effect of Distance between Electrodes

The performance of the cell is drastically influenced by the distance established between the cathode and anode. If this distance is increased above the 0.500-cm value used for the base example, average current density is markedly decreased (as shown in Fig. 11) due to the increased ohmic potential drop in the electrolyte. The current distribution in the cell becomes more uniform as electrode spacing increases, as is shown in Fig. 12.

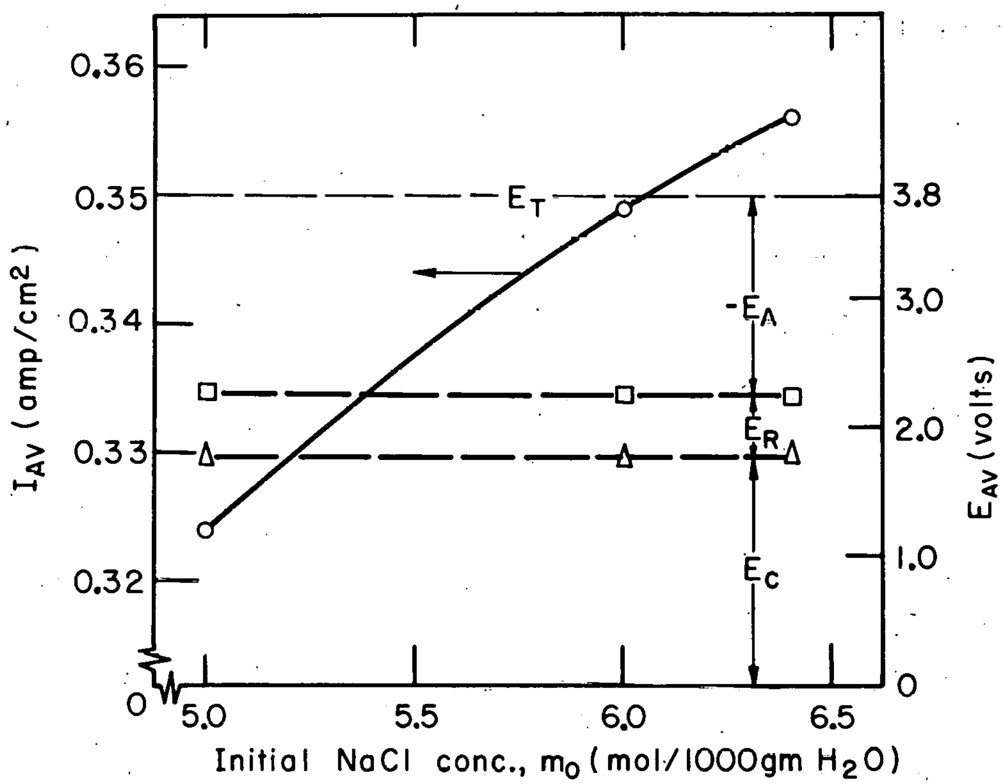

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Fig. 8. Effect of inlet sodium chloride concentration in electrolyte upon average current density (all other operating parameters are at base example values).

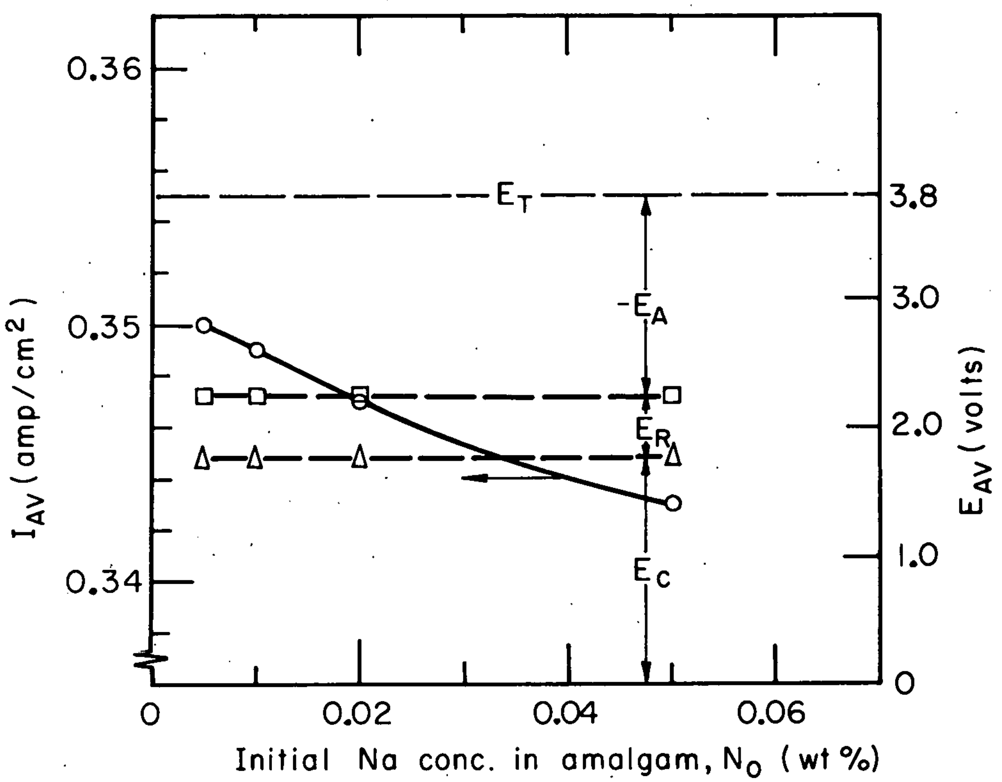

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Fig. 9. Effect of inlet sodium concentration in amalgam upon average current density (all other operating parameters at base example values).

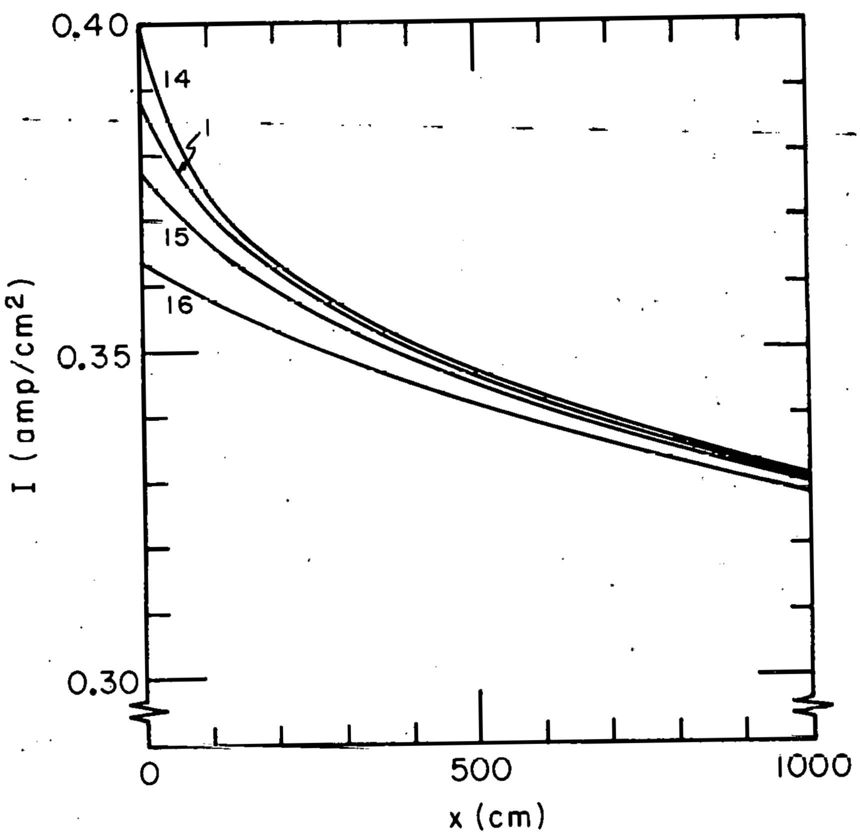

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Fig. 10. Effect of inlet sodium concentration in amalgam upon current distribution.
(1) Base example (N_o = 0.010 wt%)
(14) N_o = 0.005 wt%
(15) N_o = 0.020 wt%
(16) N_o = 0.050 wt%

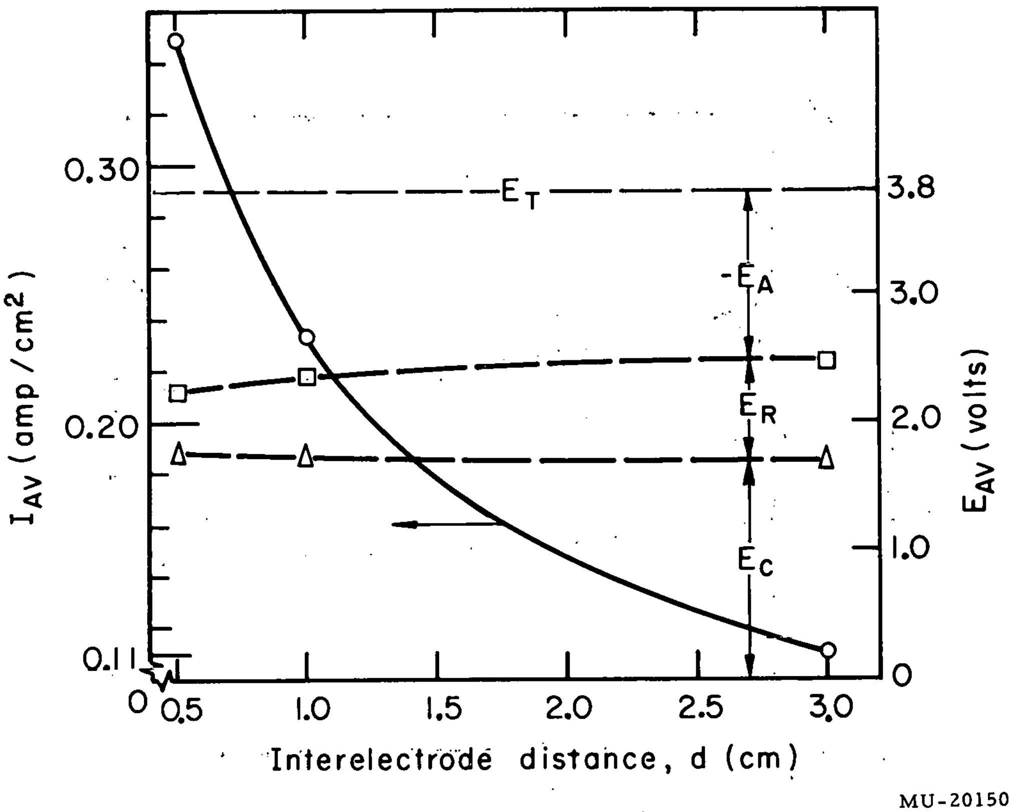

Fig. 11. Effect of distance between electrodes upon average current density (all other operating parameters at base example values).

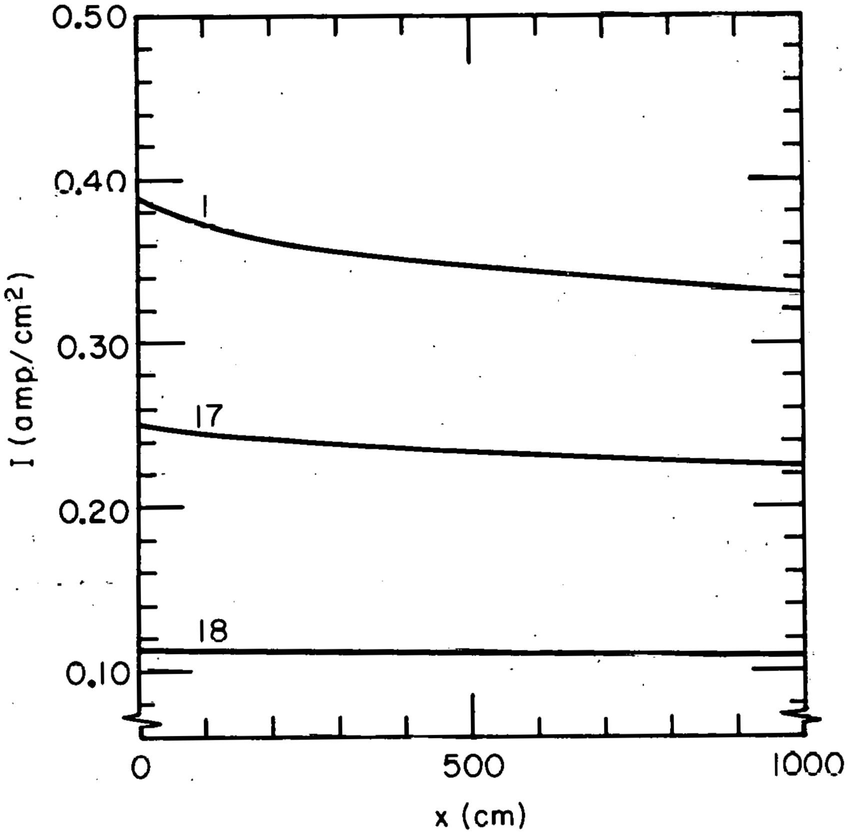

Fig. 12. Effect of distance between electrodes upon current distribution.
(1) Base example (d = 0.500 cm)
(17) d = 1.00 cm
(18) d = 3.00 cm

VI. CONCLUSIONS

If a factor representing the effect of each of the operating parameters upon the average current density for the cell is considered in the form

$$F = \frac{\partial (I/I^*)}{\partial (p/p^*)} , \qquad (31)$$

where the starred quantities refer to base example values, the average values for the factors, F, for the parameters considered are as shown in Table V.

Table V

Effectiveness factors for operating parameters

Operating parameter	F_{av}
E_T	4.27
Q	0.017
U	0.040
m_o	0.40
N_o	0.0057
d	0.40

Although the applied potential (E_T) can most effectively influence average current density, increases in this parameter also increase in direct proportion the power consumption per unit product for the cell. Thus, by discounting this parameter and considering the base example as a starting point, current densities may be most readily increased by increasing inlet sodium chloride concentration in the brine (m_o) or be decreasing electrode spacing (d). The concentration m_o cannot be greatly increased, because saturation is reached at 6.43 molal (at 65°C). The decrease in distance between electrodes is governed by the mechanical details of construction of the cell.

For the model considered, it is important that inlet brine be saturated and that electrode spacing be minimized to achieve highest average current densities without increasing power consumption per unit product. To a lesser extent, high brine and amalgam velocities and low inlet concentrations of sodium in the amalgam also help to achieve this result.

In the anologous industrial caustic-chlorine cell, since inlet brine concentration is limited by brine-concentration equipment, the importance of maintaining minimum electrode spacing becomes the overriding consideration. Unfortunately, this objective is not usually accomplished in industry.

Within the limitations of the model as defined for this study, realistic expressions have been used to characterize the individual, detailed processes involved. This realistic representation would not have been possible if consideration had been restricted to linear relationships. Models more closely corresponding to industrial cells, especially in regards to nonisothermal operation, can be defined and analyzed. In the case of a nonisothermal model, a local heat balance for each cell increment would be required in the analysis of cell operations.

By such techniques as used in this investigation, models which have been defined to realistically represent given industrial cells can be analyzed to determine cell performance for any given operating conditions or design parameters. Given a criteria for optimum operation, one can find the operating conditions to achieve this goal. Thus, the analysis of realistic theoretical cell models by methods similar to those used in this dissertation provides a powerful tool for rational cell design and operation.

ACKNOWLEDGMENTS

I wish to express my thanks to Professor C. W. Tobias for his encouragement, advice, and direction in the conduct of this study; and to Professors D. N. Hanson and S. F. Ravitz for their review of this thesis.

This work was performed under the auspices of the U. S. Atomic Energy Commission.

APPENDICES

APPENDIX I

Mean Ionic Activities for Concentrated Sodium Chloride Solutions at 65°C

Mean ionic activity coefficients for sodium chloride in water at 65°C are calculated from the activity coefficients at 25°C by use of the formula given by Harned and Owen:[27]

$$\log \gamma_{\pm} = \log \gamma_{\pm}(25^{\circ}C) + \frac{y}{2}\bar{L}_2(25^{\circ}C) - \frac{z}{2}\bar{J}_2(25^{\circ}C), \quad (32)$$

where the values of y and z are taken from Table 5-1-2 (for 65°C) of the reference cited, and of $\bar{L}_2(25^{\circ}C)$ and $\bar{J}_2(25^{\circ}C)$ from Tables 8-2-2A and 8-4-3. The mean activity coefficients at 25°C are extracted from Conway.[28] By substitution in Eq. (32), the activity coefficients and in turn the activities are derived, as summarized in Table VI.

Table VI

Mean ionic activities and activity coefficients for NaCl in H_2O at 65°C

Molality(mols/1000 gm H_2O) m	Activity coefficient $\gamma_{\pm}$	Activity $a_{\pm}$
4.50	0.809	3.64
5.00	0.849	4.25
5.50	0.895	4.92
6.00	0.942	5.65
6.43(sat)	0.981	6.31

These data are put in a form amenable to computer use by a regression analysis of the form

$$a_{\pm} = a + bm + cm^2. \quad (33)$$

This yields the relation

$$a_{\pm} = 1.84 - 0.281m + 0.152m^2, \quad (34)$$

which is compared in Fig. 13 with the data utilized.

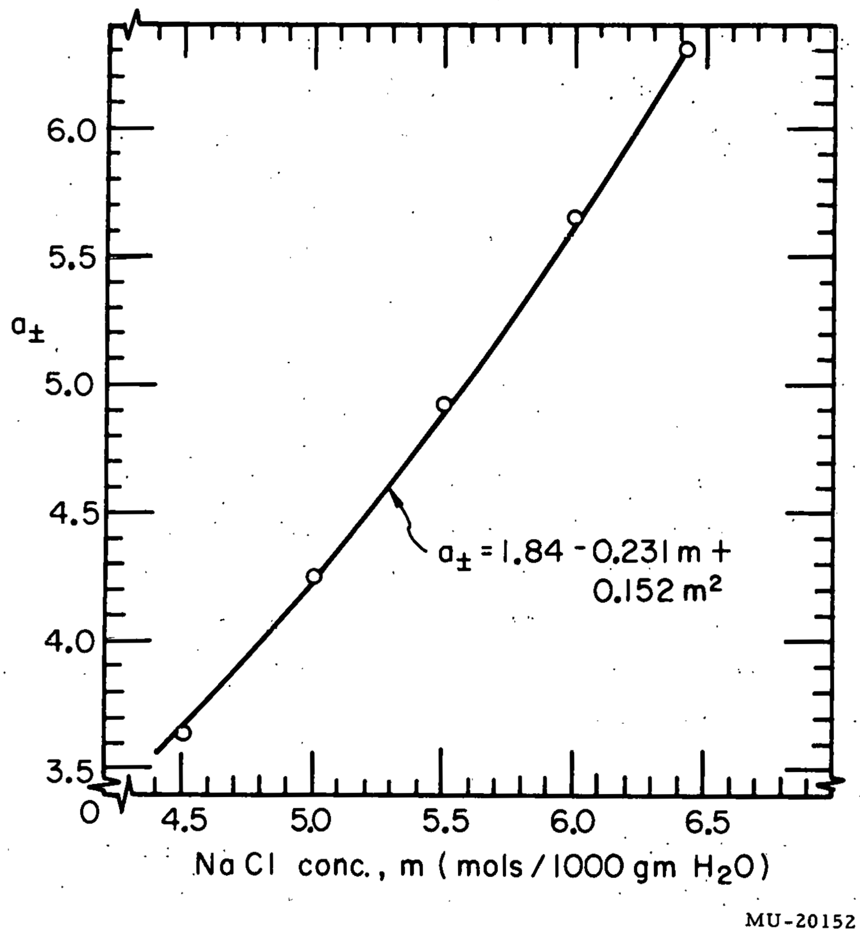

Fig. 13. Mean ionic activity vs molality for aqueous sodium chloride at 65°C.

APPENDIX II

Activities for Sodium in Dilute Sodium Amalgams at 65°C

Sodium activities in dilute sodium amalgams at 40°C, 60°C, and 80°C are calculated by considering a cell with a concentrated aqueous sodium chloride electrolyte and two sodium amalgam electrodes of different compositions. Under these circumstances we have

$$\Delta E = \frac{RT}{\mathcal{F}} \ln \frac{a_2}{a_1} \qquad (35)$$

or

$$\frac{a_2}{a_1} = \exp \frac{\Delta E \mathcal{F}}{RT} \, . \qquad (36)$$

The equilibrium potentials, E_i, together with electrode compositions, are given for a number of these amalgam electrodes in 300 gm/l NaCl at the above-mentioned temperatures by Sugino and Aoki.[29] From these data a series of cells may be established by arranging the potentials, E_i, in descending order, and their cell potentials calculated according to

$$\Delta E = E_2 - E_1 . \qquad (37)$$

If a pseudo-activity a'_2 = 1.000 is arbitrarily set for the most concentrated amalgam in an electrode of the series and pseudo-activities for other amlagams are scaled from this basis by Eq. (36), a pseudo-activity coefficient

$$f' = \frac{a'}{S} \qquad (38)$$

may be established, where S is the mol fraction of sodium in the amalgam,

$$S = \frac{8.73\,N}{100 - N} \, . \qquad (39)$$

Then f' is extrapolated to zero concentration, and the resulting f'_0 compared to f_0, which must be 1.000. Thus true activity coefficients may be found from the expression,

$$f = \frac{f'}{f'_0} , \tag{40}$$

and activities in turn calculated.

The resulting activities show no appreciable variation with temperature, and when compared with the data of Yoshizawa and Muto,[30] which were taken at 8°C (see Fig. 14) are found not to differ significantly over the range of concentrations of interest. These data may be represented in a form suitable for computer calculations as

$$\ln a_{NaHg} = 1.26 \ln N - 1.31, \tag{41}$$

which is compared to the data in Fig. 14.

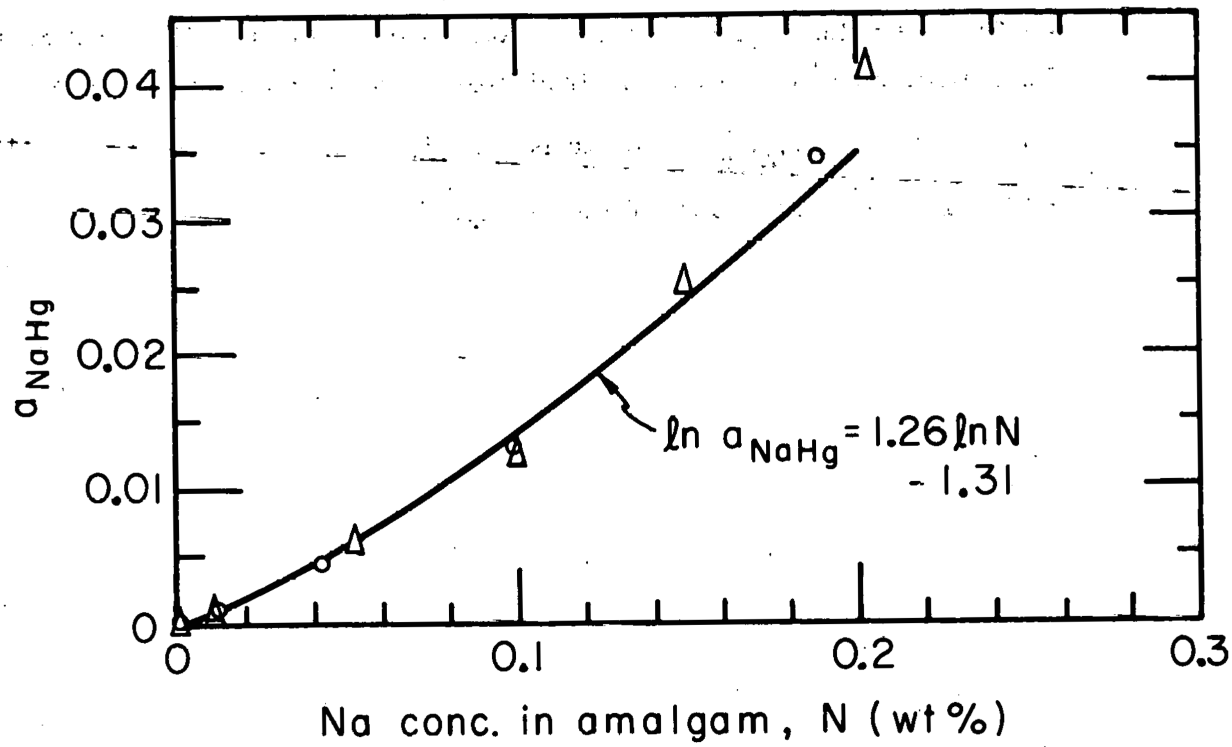

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Fig. 14. Activity vs concentration (wt% Na) for sodium in sodium amalgam at 65°C.
O: Data of Yoshizawa and Muto[30] (8°C)
Δ: Calculated from data of Sugino and Aoki[29] (40 to 80°C)

APPENDIX III

Conductivity of Concentrated Sodium Chloride Solutions at 65°C

The conductivities of pure, concentrated, aqueous sodium chloride solutions at 65°C are interpolated from data published in the International Critical Tables[31] and Landolt-Bornstein.[32] The available data are first plotted as specific conductance *vs* temperature at various concentrations, as in Fig. 15. These data are then cross-plotted to yield a curve (Fig. 16) showing specific conductance *vs* concentration at 65°C. The portion of this curve representing the range of concentrations of interest (4.0 to 6.43 molal) is represented in a form suitable for computer use as

$$k_e = -0.093 + 0.161\ m - 0.0114\ m^2, \qquad (42)$$

which expression is also represented in Fig. 16.

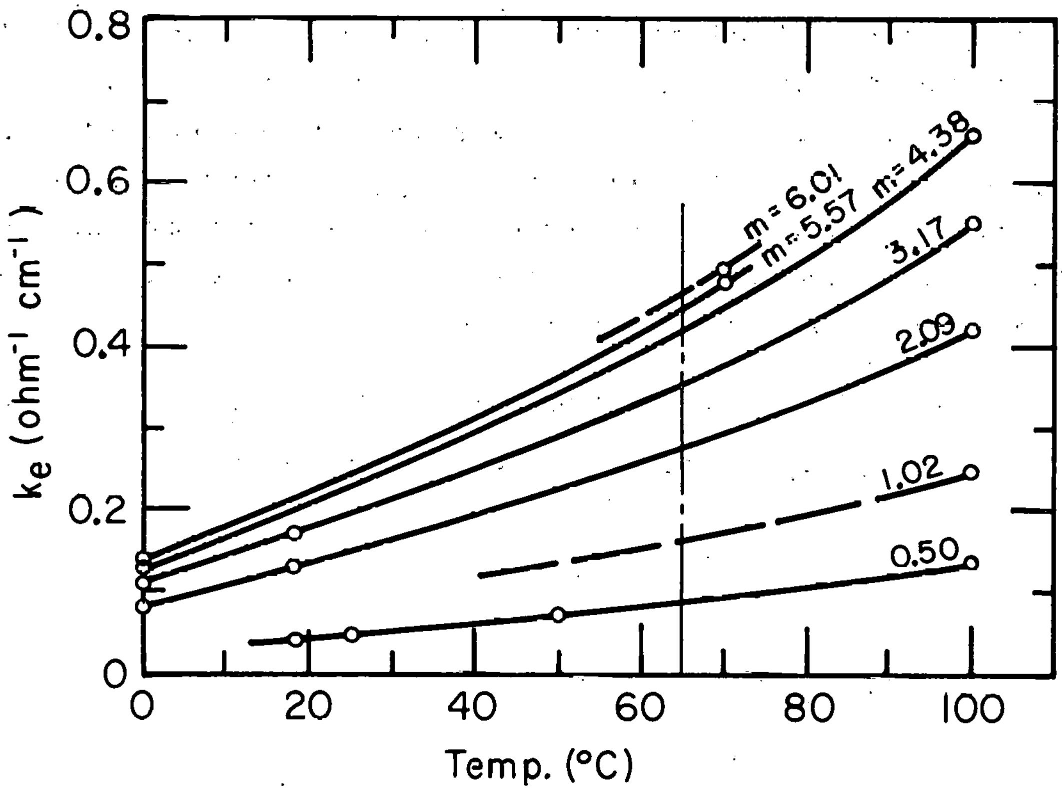

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Fig. 15. Conductivity vs temperature for aqueous sodium chloride solutions.

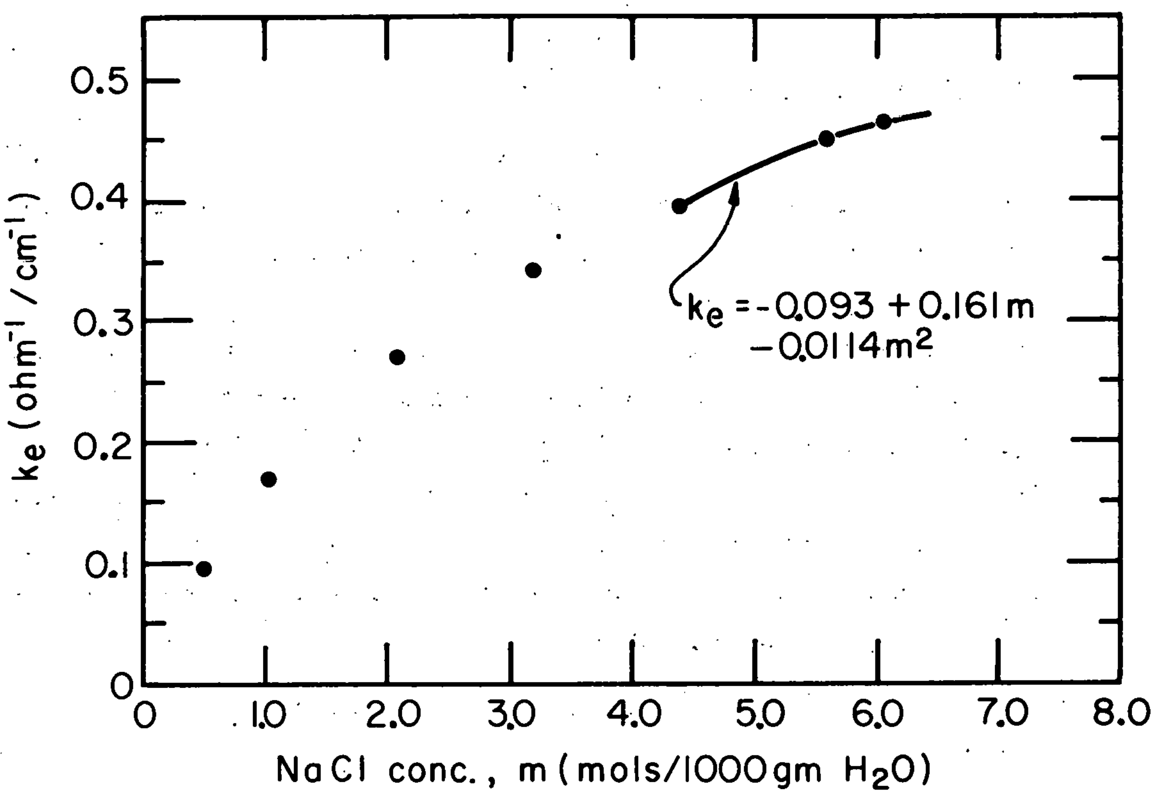

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Fig. 16. Conductivity vs molality for aqueous sodium chloride solutions at 65°C (data from cross-plot of Fig. 15).

APPENDIX IV

Standard Cathode Potential for $Na(Hg) \rightarrow Na^+ + e^-$ at 65°C

The standard cathode potential for the reaction

$$Na(Hg) \rightarrow Na^+ + e^- \qquad (k)$$

will differ from that for the reaction

$$Na \rightarrow Na^+ + e^- \qquad (1)$$

since the standard states for unit activity of sodium differ in the two cases. In addition, the standard potential is required at 65°C, not the usually specified 25°C.

The standard cathode potential at 65°C consistent with the data utilized for activities of sodium in amalgam are obtained from the equilibrium potential data of Sugino and Aoki.[29] This source lists equilibrium cathode potentials referred to a 20°C saturated calomel electrode for several concentrations of sodium in sodium amalgam and sodium chloride in the aqueous electrolyte, and for temperatures of 40°C, 60°C, and 80°C. The reaction cell is

$$Na(Hg) \,|\, Na^+,\ Cl^- \,\vdots\, K^+,\ Cl^- \,|\, Hg_2Cl_2 \,|\, Hg.$$

Now we have

$$E_C = E_C^{\,o} - \frac{RT}{\mathcal{F}} \ln \frac{a_\pm}{a_{NaHg}} \qquad (43)$$

$$E_C^{\,o} = E_C + \frac{RT}{\mathcal{F}} \ln \frac{a_\pm}{a_{NaHg}} \;, \qquad (44)$$

where activities are derived from Appendices I and II and where E_C must first be converted to refer to the standard hydrogen electrode. For the saturated calomel electrode at 20°C, Sugino and Aoki give the potential referred to the hydrogen electrode as -0.249 v.[29] Thus 0.249 v must be subtracted from the cathode potential data before it is used in Eq. (44). When the calculations are carried through one obtains the results shown in Table VII.

Table VII

Standard cathode potential for $Na(Hg) \rightarrow Na^{+} + e^{-}$

Temperature °C	Average standard cathode potential (v)
40	1.934
60	1.935
80	1.936

Thus at 65°C the standard potential for reaction (k) is 1.935 v.

APPENDIX V

Detailed Characteristics of Cell Operation for Examples Considered

Listed on the following pages are the detailed results of analysis of examples 1 through 18, from which the summary in Table IV is derived. In these listings the first two lines indicate the operating parameters defining the example, with the following notation:

a. ANODE TYPE -- type of anode as shown in Fig. 2.
b. U -- amalgam velocity (cm/sec)
c. Q -- brine flow rate (gm H_2O/sec)
d. d -- distance between electrodes (cm)
e. E_T--total applied cell potential (v)
f. N_o--inlet sodium concentration in amalgam (wt% Na)
g. m_o--inlet NaCl concentration in brine (mol/1000 gm H_2O).

The following lines of the tabulations list, characteristics of cell operation at each centimeter of cell length, as follows:

a. CARD--distance in tens of centimeters from cell inlet
b. I--current density (amp/cm^2)
c. $-E_A$--anode potential (v)
d. E_R--ohmic potential drop in electrolyte (v)
c. E_C--cathode potential (v)
f. N--sodium concentration in amalgam (wt% Na)
g. m--NaCl concentration in brine (mol/1000 gm H_2O)
h. k_m--electrolyte conductivity ($ohm^{-1}cm^{-1}$).

The last line indicates average values of current density and individual potentials for the cell.

Example Number 1

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	5.60	0.500	3.80	0.010	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.3885	01.593	00.5293	01.6760	00.01210	05.993	00.3674
0002	00.3857	01.590	00.5248	01.6830	00.01418	05.986	00.3674
0003	00.3831	01.588	00.5213	01.6890	00.01626	05.979	00.3673
0004	00.3808	01.586	00.5183	01.6940	00.01832	05.972	00.3673
0005	00.3788	01.584	00.5156	01.6990	00.02037	05.966	00.3673
0006	00.3770	01.583	00.5132	01.7030	00.02241	05.959	00.3672
0007	00.3754	01.581	00.5111	01.7060	00.02444	05.952	00.3672
0008	00.3739	01.580	00.5092	01.7100	00.02646	05.946	00.3671
0009	00.3726	01.579	00.5074	01.7130	00.02848	05.939	00.3670
0010	00.3713	01.577	00.5058	01.7150	00.03049	05.933	00.3670
0011	00.3701	01.576	00.5043	01.7180	00.03249	05.926	00.3669
0012	00.3690	01.575	00.5029	01.7200	00.03449	05.920	00.3668
0013	00.3680	01.575	00.5015	01.7230	00.03648	05.913	00.3667
0014	00.3670	01.574	00.5003	01.7250	00.03847	05.907	00.3666
0015	00.3660	01.573	00.4991	01.7270	00.04045	05.900	00.3665
0016	00.3651	01.572	00.4980	01.7290	00.04242	05.894	00.3665
0017	00.3642	01.571	00.4969	01.7300	00.04440	05.887	00.3664
0018	00.3634	01.571	00.4959	01.7320	00.04636	05.881	00.3663
0019	00.3626	01.570	00.4950	01.7340	00.04833	05.875	00.3662
0020	00.3619	01.569	00.4941	01.7350	00.05028	05.868	00.3661
0021	00.3611	01.569	00.4932	01.7370	00.05224	05.862	00.3660
0022	00.3604	01.568	00.4923	01.7380	00.05419	05.855	00.3659
0023	00.3597	01.567	00.4915	01.7400	00.05614	05.849	00.3658
0024	00.3590	01.567	00.4907	01.7410	00.05808	05.843	00.3657
0025	00.3584	01.566	00.4900	01.7420	00.06002	05.836	00.3656
0026	00.3578	01.566	00.4893	01.7440	00.06195	05.830	00.3655
0027	00.3571	01.565	00.4886	01.7450	00.06389	05.824	00.3654
0028	00.3565	01.565	00.4879	01.7460	00.06582	05.817	00.3652
0029	00.3560	01.564	00.4872	01.7470	00.06774	05.811	00.3651
0030	00.3554	01.564	00.4866	01.7480	00.06967	05.805	00.3650
0031	00.3548	01.563	00.4860	01.7490	00.07159	05.799	00.3649
0032	00.3543	01.563	00.4854	01.7500	00.07350	05.792	00.3648
0033	00.3538	01.562	00.4848	01.7510	00.07542	05.786	00.3647
0034	00.3532	01.562	00.4842	01.7520	00.07733	05.780	00.3646
0035	00.3527	01.562	00.4837	01.7530	00.07924	05.774	00.3645
0036	00.3522	01.561	00.4832	01.7540	00.08115	05.768	00.3643
0037	00.3517	01.561	00.4826	01.7550	00.08305	05.761	00.3642
0038	00.3512	01.560	00.4821	01.7560	00.08495	05.755	00.3641
0039	00.3508	01.560	00.4816	01.7570	00.08685	05.749	00.3640
0040	00.3503	01.560	00.4812	01.7580	00.08874	05.743	00.3639
0041	00.3498	01.559	00.4807	01.7590	00.09064	05.737	00.3637
0042	00.3494	01.559	00.4802	01.7600	00.09253	05.730	00.3636
0043	00.3489	01.558	00.4798	01.7600	00.09442	05.724	00.3635
0044	00.3485	01.558	00.4793	01.7610	00.09630	05.718	00.3634
0045	00.3481	01.558	00.4789	01.7620	00.09819	05.712	00.3632
0046	00.3477	01.557	00.4785	01.7630	00.10000	05.706	00.3631
0047	00.3472	01.557	00.4781	01.7630	00.10190	05.700	00.3630
0048	00.3468	01.557	00.4777	01.7640	00.10380	05.694	00.3629
0049	00.3464	01.556	00.4773	01.7650	00.10570	05.687	00.3627
0050	00.3460	01.556	00.4769	01.7660	00.10750	05.681	00.3626
0051	00.3456	01.556	00.4765	01.7660	00.10940	05.675	00.3625
0052	00.3452	01.555	00.4761	01.7670	00.11130	05.669	00.3624
0053	00.3448	01.555	00.4758	01.7680	00.11310	05.663	00.3622
0054	00.3445	01.555	00.4754	01.7680	00.11500	05.657	00.3621
0055	00.3441	01.555	00.4751	01.7690	00.11690	05.651	00.3620
0056	00.3437	01.554	00.4747	01.7700	00.11870	05.645	00.3618
0057	00.3433	01.554	00.4744	01.7700	00.12060	05.639	00.3617
0058	00.3430	01.554	00.4741	01.7710	00.12240	05.633	00.3616
0059	00.3426	01.553	00.4737	01.7720	00.12430	05.627	00.3614
0060	00.3422	01.553	00.4734	01.7720	00.12610	05.621	00.3613
0061	00.3419	01.553	00.4731	01.7730	00.12800	05.615	00.3612
0062	00.3415	01.553	00.4728	01.7730	00.12980	05.609	00.3610
0063	00.3412	01.552	00.4725	01.7740	00.13170	05.603	00.3609
0064	00.3408	01.552	00.4722	01.7740	00.13350	05.597	00.3607
0065	00.3405	01.552	00.4719	01.7750	00.13540	05.591	00.3606
0066	00.3402	01.551	00.4716	01.7760	00.13720	05.585	00.3605
0067	00.3398	01.551	00.4713	01.7760	00.13910	05.579	00.3603
0068	00.3395	01.551	00.4710	01.7770	00.14090	05.573	00.3602
0069	00.3392	01.551	00.4708	01.7770	00.14270	05.567	00.3600
0070	00.3388	01.550	00.4705	01.7780	00.14460	05.561	00.3599
0071	00.3385	01.550	00.4702	01.7780	00.14640	05.555	00.3598
0072	00.3382	01.550	00.4700	01.7790	00.14820	05.549	00.3596
0073	00.3379	01.550	00.4697	01.7790	00.15000	05.543	00.3595
0074	00.3375	01.549	00.4695	01.7800	00.15190	05.537	00.3593
0075	00.3372	01.549	00.4692	01.7800	00.15370	05.531	00.3592
0076	00.3369	01.549	00.4690	01.7810	00.15550	05.525	00.3590
0077	00.3366	01.549	00.4687	01.7810	00.15730	05.519	00.3589
0078	00.3363	01.548	00.4685	01.7820	00.15920	05.513	00.3587
0079	00.3360	01.548	00.4682	01.7820	00.16100	05.507	00.3586
0080	00.3357	01.548	00.4680	01.7830	00.16280	05.501	00.3584
0081	00.3354	01.548	00.4678	01.7830	00.16460	05.495	00.3583
0082	00.3351	01.548	00.4676	01.7840	00.16640	05.489	00.3582
0083	00.3348	01.547	00.4673	01.7840	00.16820	05.483	00.3580
0084	00.3345	01.547	00.4671	01.7840	00.17010	05.477	00.3579
0085	00.3342	01.547	00.4669	01.7850	00.17190	05.472	00.3577
0086	00.3339	01.547	00.4667	01.7850	00.17370	05.466	00.3575
0087	00.3336	01.546	00.4665	01.7860	00.17550	05.460	00.3574
0088	00.3333	01.546	00.4663	01.7860	00.17730	05.454	00.3572
0089	00.3330	01.546	00.4661	01.7870	00.17910	05.448	00.3571
0090	00.3327	01.546	00.4658	01.7870	00.18090	05.442	00.3569
0091	00.3324	01.546	00.4656	01.7870	00.18270	05.436	00.3568
0092	00.3322	01.545	00.4654	01.7880	00.18450	05.430	00.3566
0093	00.3319	01.545	00.4653	01.7880	00.18630	05.425	00.3565
0094	00.3316	01.545	00.4651	01.7890	00.18810	05.419	00.3563
0095	00.3313	01.545	00.4649	01.7890	00.18990	05.413	00.3562
0096	00.3310	01.544	00.4647	01.7890	00.19170	05.407	00.3560
0097	00.3308	01.544	00.4645	01.7900	00.19340	05.401	00.3558
0098	00.3305	01.544	00.4643	01.7900	00.19520	05.395	00.3557
0099	00.3302	01.544	00.4641	01.7910	00.19700	05.390	00.3555
0100	00.3299	01.544	00.4640	01.7910	00.19880	05.384	00.3554
AVG	00.3490	01.5593	00.48142	01.7589	,	,	,

Example Number 2

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type C	6.25	5.60	0.500	3.80	0.010	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.3918	01.643	00.4790	01.6760	00.01212	05.993	00.4100
0002	00.3888	01.641	00.4741	01.6840	00.01422	05.986	00.4099
0003	00.3858	01.639	00.4705	01.6890	00.01631	05.979	00.4099
0004	00.3832	01.637	00.4674	01.6950	00.01838	05.972	00.4098
0005	00.3809	01.635	00.4647	01.6990	00.02044	05.965	00.4097
0006	00.3788	01.633	00.4623	01.7030	00.02249	05.959	00.4096
0007	00.3769	01.632	00.4601	01.7070	00.02453	05.952	00.4095
0008	00.3752	01.631	00.4582	01.7100	00.02656	05.945	00.4094
0009	00.3737	01.630	00.4564	01.7130	00.02859	05.939	00.4093
0010	00.3722	01.628	00.4547	01.7160	00.03060	05.932	00.4091
0011	00.3709	01.627	00.4532	01.7180	00.03261	05.926	00.4090
0012	00.3696	01.626	00.4518	01.7200	00.03461	05.919	00.4089
0013	00.3684	01.626	00.4504	01.7230	00.03660	05.913	00.4088
0014	00.3673	01.625	00.4492	01.7250	00.03859	05.906	00.4087
0015	00.3662	01.624	00.4480	01.7270	00.04057	05.900	00.4085
0016	00.3652	01.623	00.4469	01.7290	00.04255	05.893	00.4084
0017	00.3642	01.622	00.4458	01.7310	00.04452	05.887	00.4083
0018	00.3632	01.622	00.4448	01.7320	00.04648	05.881	00.4082
0019	00.3623	01.621	00.4438	01.7340	00.04844	05.874	00.4080
0020	00.3615	01.620	00.4429	01.7350	00.05040	05.868	00.4079
0021	00.3606	01.620	00.4420	01.7370	00.05235	05.861	00.4078
0022	00.3598	01.619	00.4412	01.7380	00.05430	05.855	00.4076
0023	00.3590	01.619	00.4403	01.7400	00.05624	05.849	00.4075
0024	00.3583	01.618	00.4396	01.7410	00.05818	05.842	00.4074
0025	00.3576	01.617	00.4388	01.7420	00.06012	05.836	00.4072
0026	00.3568	01.617	00.4381	01.7440	00.06205	05.830	00.4071
0027	00.3561	01.616	00.4374	01.7450	00.06397	05.824	00.4070
0028	00.3555	01.616	00.4367	01.7460	00.06590	05.817	00.4068
0029	00.3548	01.615	00.4360	01.7470	00.06782	05.811	00.4067
0030	00.3542	01.615	00.4354	01.7480	00.06974	05.805	00.4065
0031	00.3536	01.614	00.4348	01.7490	00.07165	05.798	00.4064
0032	00.3529	01.614	00.4342	01.7500	00.07356	05.792	00.4063
0033	00.3523	01.614	00.4336	01.7510	00.07547	05.786	00.4061
0034	00.3518	01.613	00.4330	01.7520	00.07737	05.780	00.4060
0035	00.3512	01.613	00.4325	01.7530	00.07927	05.774	00.4058
0036	00.3506	01.612	00.4320	01.7540	00.08117	05.767	00.4057
0037	00.3501	01.612	00.4314	01.7550	00.08306	05.761	00.4055
0038	00.3495	01.612	00.4309	01.7560	00.08495	05.755	00.4054
0039	00.3490	01.611	00.4304	01.7570	00.08684	05.749	00.4052
0040	00.3485	01.611	00.4300	01.7580	00.08873	05.743	00.4051
0041	00.3480	01.610	00.4295	01.7590	00.09061	05.737	00.4049
0042	00.3475	01.610	00.4290	01.7600	00.09249	05.731	00.4048
0043	00.3470	01.610	00.4286	01.7600	00.09437	05.724	00.4046
0044	00.3465	01.609	00.4281	01.7610	00.09625	05.718	00.4045
0045	00.3460	01.609	00.4277	01.7620	00.09812	05.712	00.4043
0046	00.3456	01.609	00.4273	01.7630	00.09999	05.706	00.4042
0047	00.3451	01.608	00.4269	01.7630	00.10180	05.700	00.4040
0048	00.3446	01.608	00.4265	01.7640	00.10370	05.694	00.4039
0049	00.3442	01.608	00.4261	01.7650	00.10550	05.688	00.4037
0050	00.3438	01.607	00.4257	01.7660	00.10740	05.682	00.4036
0051	00.3433	01.607	00.4253	01.7660	00.10930	05.676	00.4034
0052	00.3429	01.607	00.4249	01.7670	00.11110	05.670	00.4033
0053	00.3425	01.606	00.4246	01.7680	00.11300	05.664	00.4031
0054	00.3420	01.606	00.4242	01.7680	00.11480	05.658	00.4029
0055	00.3416	01.606	00.4239	01.7690	00.11670	05.652	00.4028
0056	00.3412	01.606	00.4235	01.7700	00.11850	05.646	00.4026
0057	00.3408	01.605	00.4232	01.7700	00.12040	05.640	00.4025
0058	00.3404	01.605	00.4228	01.7710	00.12220	05.634	00.4023
0059	00.3400	01.605	00.4225	01.7710	00.12400	05.628	00.4021
0060	00.3396	01.604	00.4222	01.7720	00.12590	05.622	00.4020
0061	00.3392	01.604	00.4219	01.7730	00.12770	05.616	00.4018
0062	00.3388	01.604	00.4216	01.7730	00.12950	05.610	00.4017
0063	00.3384	01.604	00.4213	01.7740	00.13140	05.604	00.4015
0064	00.3381	01.603	00.4210	01.7740	00.13320	05.598	00.4013
0065	00.3377	01.603	00.4207	01.7750	00.13500	05.592	00.4012
0066	00.3373	01.603	00.4204	01.7750	00.13690	05.586	00.4010
0067	00.3370	01.603	00.4201	01.7760	00.13870	05.580	00.4008
0068	00.3366	01.602	00.4198	01.7770	00.14050	05.574	00.4007
0069	00.3362	01.602	00.4195	01.7770	00.14230	05.568	00.4005
0070	00.3359	01.602	00.4193	01.7780	00.14410	05.562	00.4003
0071	00.3355	01.602	00.4190	01.7780	00.14600	05.556	00.4002
0072	00.3352	01.601	00.4187	01.7790	00.14780	05.550	00.4000
0073	00.3348	01.601	00.4185	01.7790	00.14960	05.544	00.3998
0074	00.3345	01.601	00.4182	01.7800	00.15140	05.538	00.3996
0075	00.3341	01.601	00.4180	01.7800	00.15320	05.532	00.3995
0076	00.3338	01.600	00.4177	01.7810	00.15500	05.527	00.3993
0077	00.3334	01.600	00.4175	01.7810	00.15680	05.521	00.3991
0078	00.3331	01.600	00.4172	01.7820	00.15860	05.515	00.3990
0079	00.3328	01.600	00.4170	01.7820	00.16040	05.509	00.3988
0080	00.3324	01.599	00.4168	01.7820	00.16220	05.503	00.3986
0081	00.3321	01.599	00.4165	01.7830	00.16400	05.497	00.3984
0082	00.3318	01.599	00.4163	01.7830	00.16580	05.491	00.3983
0083	00.3315	01.599	00.4161	01.7840	00.16760	05.485	00.3981
0084	00.3311	01.598	00.4159	01.7840	00.16940	05.480	00.3979
0085	00.3308	01.598	00.4157	01.7850	00.17120	05.474	00.3977
0086	00.3305	01.598	00.4154	01.7850	00.17300	05.468	00.3976
0087	00.3302	01.598	00.4152	01.7860	00.17480	05.462	00.3974
0088	00.3299	01.598	00.4150	01.7860	00.17650	05.456	00.3972
0089	00.3296	01.597	00.4148	01.7860	00.17830	05.450	00.3970
0090	00.3292	01.597	00.4146	01.7870	00.18010	05.445	00.3968
0091	00.3289	01.597	00.4144	01.7870	00.18190	05.439	00.3967
0092	00.3286	01.597	00.4142	01.7880	00.18370	05.433	00.3965
0093	00.3283	01.597	00.4140	01.7880	00.18550	05.427	00.3963
0094	00.3280	01.596	00.4138	01.7890	00.18720	05.422	00.3961
0095	00.3277	01.596	00.4136	01.7890	00.18900	05.416	00.3959
0096	00.3274	01.596	00.4134	01.7890	00.19080	05.410	00.3958
0097	00.3271	01.596	00.4132	01.7900	00.19250	05.404	00.3956
0098	00.3268	01.596	00.4131	01.7900	00.19430	05.398	00.3954
0099	00.3265	01.595	00.4129	01.7900	00.19610	05.393	00.3952
0100	00.3262	01.595	00.4127	01.7910	00.19780	05.387	00.3950
AVG	00.34722	01.6105	00.43024	01.7589	.	.	.

Example Number 3

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type A	6.25	5.60	0.500	3.80	0.010	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.2513	01.726	00.3963	01.6760	00.01135	05.995	00.3171
0002	00.2501	01.723	00.3944	01.6810	00.01271	05.991	00.3171
0003	00.2491	01.721	00.3926	01.6850	00.01406	05.986	00.3172
0004	00.2481	01.719	00.3911	01.6890	00.01540	05.982	00.3172
0005	00.2473	01.717	00.3897	01.6920	00.01674	05.978	00.3172
0006	00.2465	01.715	00.3885	01.6960	00.01807	05.973	00.3172
0007	00.2458	01.713	00.3873	01.6980	00.01940	05.969	00.3172
0008	00.2451	01.711	00.3862	01.7010	00.02073	05.965	00.3172
0009	00.2444	01.710	00.3852	01.7030	00.02205	05.960	00.3172
0010	00.2438	01.709	00.3843	01.7060	00.02337	05.956	00.3172
0011	00.2433	01.707	00.3834	01.7080	00.02469	05.952	00.3172
0012	00.2427	01.706	00.3826	01.7100	00.02600	05.947	00.3172
0013	00.2422	01.705	00.3818	01.7120	00.02731	05.943	00.3172
0014	00.2418	01.704	00.3810	01.7140	00.02862	05.939	00.3172
0015	00.2413	01.703	00.3803	01.7160	00.02993	05.935	00.3172
0016	00.2408	01.702	00.3797	01.7170	00.03123	05.930	00.3171
0017	00.2404	01.701	00.3790	01.7190	00.03253	05.926	00.3171
0018	00.2400	01.700	00.3784	01.7200	00.03383	05.922	00.3171
0019	00.2396	01.699	00.3778	01.7220	00.03513	05.918	00.3171
0020	00.2392	01.698	00.3772	01.7230	00.03642	05.913	00.3170
0021	00.2389	01.697	00.3767	01.7250	00.03772	05.909	00.3170
0022	00.2385	01.697	00.3762	01.7260	00.03901	05.905	00.3170
0023	00.2382	01.696	00.3757	01.7270	00.04030	05.901	00.3169
0024	00.2378	01.695	00.3752	01.7280	00.04158	05.897	00.3169
0025	00.2375	01.694	00.3747	01.7300	00.04287	05.892	00.3169
0026	00.2372	01.694	00.3742	01.7310	00.04415	05.888	00.3168
0027	00.2369	01.693	00.3738	01.7320	00.04543	05.884	00.3168
0028	00.2366	01.692	00.3734	01.7330	00.04671	05.880	00.3167
0029	00.2363	01.692	00.3729	01.7340	00.04799	05.876	00.3167
0030	00.2360	01.691	00.3725	01.7350	00.04927	05.871	00.3167
0031	00.2357	01.690	00.3722	01.7360	00.05055	05.867	00.3166
0032	00.2354	01.690	00.3718	01.7370	00.05182	05.863	00.3166
0033	00.2352	01.689	00.3714	01.7380	00.05309	05.859	00.3165
0034	00.2349	01.689	00.3710	01.7390	00.05436	05.855	00.3165
0035	00.2346	01.688	00.3707	01.7400	00.05563	05.851	00.3164
0036	00.2344	01.688	00.3703	01.7410	00.05690	05.847	00.3164
0037	00.2341	01.687	00.3700	01.7420	00.05817	05.842	00.3163
0038	00.2339	01.687	00.3697	01.7420	00.05944	05.838	00.3163
0039	00.2337	01.686	00.3694	01.7430	00.06070	05.834	00.3162
0040	00.2334	01.686	00.3690	01.7440	00.06196	05.830	00.3162
0041	00.2332	01.685	00.3687	01.7450	00.06323	05.826	00.3161
0042	00.2330	01.685	00.3684	01.7460	00.06449	05.822	00.3161
0043	00.2328	01.684	00.3682	01.7460	00.06575	05.818	00.3160
0044	00.2325	01.684	00.3679	01.7470	00.06701	05.814	00.3160
0045	00.2323	01.683	00.3676	01.7480	00.06826	05.810	00.3159
0046	00.2321	01.683	00.3673	01.7490	00.06952	05.805	00.3159
0047	00.2319	01.682	00.3670	01.7490	00.07077	05.801	00.3158
0048	00.2317	01.682	00.3668	01.7500	00.07203	05.797	00.3158
0049	00.2315	01.681	00.3665	01.7510	00.07328	05.793	00.3157
0050	00.2313	01.681	00.3663	01.7510	00.07453	05.789	00.3157
0051	00.2311	01.681	00.3660	01.7520	00.07578	05.785	00.3156
0052	00.2309	01.680	00.3658	01.7530	00.07703	05.781	00.3156
0053	00.2307	01.680	00.3655	01.7530	00.07828	05.777	00.3155
0054	00.2305	01.679	00.3653	01.7540	00.07953	05.773	00.3154
0055	00.2303	01.679	00.3651	01.7540	00.08078	05.769	00.3154
0056	00.2302	01.679	00.3649	01.7550	00.08202	05.765	00.3153
0057	00.2300	01.678	00.3646	01.7560	00.08327	05.761	00.3153
0058	00.2298	01.678	00.3644	01.7560	00.08451	05.757	00.3152
0059	00.2296	01.678	00.3642	01.7570	00.08575	05.752	00.3151
0060	00.2294	01.677	00.3640	01.7570	00.08700	05.748	00.3151
0061	00.2293	01.677	00.3638	01.7580	00.08824	05.744	00.3150
0062	00.2291	01.677	00.3636	01.7590	00.08948	05.740	00.3150
0063	00.2289	01.676	00.3634	01.7590	00.09072	05.736	00.3149
0064	00.2288	01.676	00.3632	01.7600	00.09195	05.732	00.3148
0065	00.2286	01.675	00.3630	01.7600	00.09319	05.728	00.3148
0066	00.2284	01.675	00.3628	01.7610	00.09443	05.724	00.3147
0067	00.2283	01.675	00.3626	01.7610	00.09566	05.720	00.3147
0068	00.2281	01.674	00.3624	01.7620	00.09690	05.716	00.3146
0069	00.2279	01.674	00.3623	01.7620	00.09813	05.712	00.3145
0070	00.2278	01.674	00.3621	01.7630	00.09936	05.708	00.3145
0071	00.2276	01.674	00.3619	01.7630	00.10060	05.704	00.3144
0072	00.2275	01.673	00.3617	01.7640	00.10180	05.700	00.3143
0073	00.2273	01.673	00.3616	01.7640	00.10300	05.696	00.3143
0074	00.2272	01.673	00.3614	01.7650	00.10420	05.692	00.3142
0075	00.2270	01.672	00.3612	01.7650	00.10550	05.688	00.3141
0076	00.2269	01.672	00.3611	01.7660	00.10670	05.684	00.3141
0077	00.2267	01.672	00.3609	01.7660	00.10790	05.680	00.3140
0078	00.2266	01.671	00.3607	01.7670	00.10920	05.676	00.3139
0079	00.2264	01.671	00.3606	01.7670	00.11040	05.672	00.3139
0080	00.2263	01.671	00.3604	01.7670	00.11160	05.668	00.3138
0081	00.2261	01.671	00.3603	01.7680	00.11280	05.664	00.3137
0082	00.2260	01.670	00.3601	01.7680	00.11400	05.660	00.3137
0083	00.2258	01.670	00.3600	01.7690	00.11530	05.656	00.3136
0084	00.2257	01.670	00.3598	01.7690	00.11650	05.652	00.3135
0085	00.2256	01.669	00.3597	01.7700	00.11770	05.648	00.3135
0086	00.2254	01.669	00.3595	01.7700	00.11890	05.644	00.3134
0087	00.2253	01.669	00.3594	01.7700	00.12020	05.640	00.3133
0088	00.2251	01.669	00.3593	01.7710	00.12140	05.636	00.3133
0089	00.2250	01.668	00.3591	01.7710	00.12260	05.632	00.3132
0090	00.2249	01.668	00.3590	01.7720	00.12380	05.628	00.3131
0091	00.2247	01.668	00.3589	01.7720	00.12500	05.624	00.3130
0092	00.2246	01.668	00.3587	01.7720	00.12620	05.620	00.3130
0093	00.2245	01.667	00.3586	01.7730	00.12750	05.616	00.3129
0094	00.2243	01.667	00.3585	01.7730	00.12870	05.612	00.3128
0095	00.2242	01.667	00.3583	01.7740	00.12990	05.608	00.3128
0096	00.2241	01.667	00.3582	01.7740	00.13110	05.605	00.3127
0097	00.2240	01.666	00.3581	01.7740	00.13230	05.601	00.3126
0098	00.2238	01.666	00.3580	01.7750	00.13350	05.597	00.3125
0099	00.2237	01.666	00.3578	01.7750	00.13470	05.593	00.3125
0100	00.2236	01.666	00.3577	01.7750	00.13590	05.589	00.3124
AVG	00.23282	01.6851	00.36896	01.7456	,	,	,

Example Number 4

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	5.60	0.500	3.40	0.010	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.2182	01.435	00.2872	01.6760	00.01118	05.996	00.3851
0002	00.2181	01.435	00.2831	01.6810	00.01236	05.992	00.3850
0003	00.2164	01.433	00.2810	01.6840	00.01353	05.988	00.3853
0004	00.2149	01.432	00.2789	01.6880	00.01469	05.984	00.3856
0005	00.2136	01.431	00.2770	01.6910	00.01585	05.980	00.3858
0006	00.2124	01.430	00.2753	01.6930	00.01700	05.977	00.3860
0007	00.2113	01.429	00.2737	01.6960	00.01814	05.973	00.3861
0008	00.2102	01.428	00.2722	01.6990	00.01928	05.969	00.3863
0009	00.2093	01.427	00.2708	01.7010	00.02041	05.966	00.3864
0010	00.2083	01.426	00.2695	01.7030	00.02154	05.962	00.3866
0011	00.2075	01.425	00.2683	01.7050	00.02266	05.958	00.3867
0012	00.2066	01.425	00.2672	01.7070	00.02378	05.955	00.3868
0013	00.2058	01.424	00.2661	01.7090	00.02489	05.951	00.3869
0014	00.2051	01.423	00.2650	01.7100	00.02600	05.947	00.3870
0015	00.2044	01.423	00.2640	01.7120	00.02711	05.944	00.3871
0016	00.2037	01.422	00.2631	01.7140	00.02821	05.940	00.3872
0017	00.2030	01.421	00.2622	01.7150	00.02931	05.937	00.3873
0018	00.2024	01.421	00.2613	01.7160	00.03041	05.933	00.3873
0019	00.2018	01.420	00.2604	01.7180	00.03150	05.929	00.3874
0020	00.2012	01.420	00.2596	01.7190	00.03259	05.926	00.3875
0021	00.2006	01.419	00.2588	01.7200	00.03367	05.922	00.3875
0022	00.2001	01.419	00.2581	01.7220	00.03476	05.919	00.3876
0023	00.1995	01.418	00.2574	01.7230	00.03584	05.915	00.3877
0024	00.1990	01.418	00.2567	01.7240	00.03691	05.912	00.3877
0025	00.1985	01.418	00.2560	01.7250	00.03799	05.908	00.3878
0026	00.1980	01.417	00.2553	01.7260	00.03906	05.905	00.3878
0027	00.1976	01.417	00.2547	01.7270	00.04013	05.901	00.3879
0028	00.1971	01.416	00.2541	01.7280	00.04120	05.898	00.3879
0029	00.1966	01.416	00.2535	01.7290	00.04226	05.894	00.3879
0030	00.1962	01.416	00.2529	01.7300	00.04332	05.891	00.3880
0031	00.1958	01.415	00.2523	01.7310	00.04438	05.887	00.3880
0032	00.1954	01.415	00.2517	01.7320	00.04544	05.884	00.3880
0033	00.1950	01.414	00.2512	01.7330	00.04649	05.880	00.3881
0034	00.1946	01.414	00.2507	01.7340	00.04755	05.877	00.3881
0035	00.1942	01.414	00.2501	01.7350	00.04860	05.874	00.3881
0036	00.1938	01.413	00.2496	01.7360	00.04965	05.870	00.3881
0037	00.1934	01.413	00.2491	01.7360	00.05069	05.867	00.3881
0038	00.1930	01.413	00.2487	01.7370	00.05174	05.863	00.3882
0039	00.1927	01.413	00.2482	01.7380	00.05278	05.860	00.3882
0040	00.1923	01.412	00.2477	01.7390	00.05382	05.857	00.3882
0041	00.1920	01.412	00.2473	01.7390	00.05486	05.853	00.3882
0042	00.1917	01.412	00.2468	01.7400	00.05590	05.850	00.3882
0043	00.1913	01.411	00.2464	01.7410	00.05694	05.846	00.3882
0044	00.1910	01.411	00.2460	01.7420	00.05797	05.843	00.3882
0045	00.1907	01.411	00.2455	01.7420	00.05900	05.840	00.3883
0046	00.1904	01.411	00.2451	01.7430	00.06003	05.836	00.3883
0047	00.1900	01.410	00.2447	01.7440	00.06106	05.833	00.3883
0048	00.1897	01.410	00.2443	01.7440	00.06209	05.830	00.3883
0049	00.1894	01.410	00.2439	01.7450	00.06311	05.826	00.3883
0050	00.1891	01.410	00.2436	01.7460	00.06414	05.823	00.3883
0051	00.1889	01.409	00.2432	01.7460	00.06516	05.820	00.3883
0052	00.1886	01.409	00.2428	01.7470	00.06618	05.816	00.3883
0053	00.1883	01.409	00.2424	01.7470	00.06720	05.813	00.3883
0054	00.1880	01.409	00.2421	01.7480	00.06822	05.810	00.3883
0055	00.1877	01.408	00.2417	01.7490	00.06923	05.806	00.3883
0056	00.1875	01.408	00.2414	01.7490	00.07025	05.803	00.3883
0057	00.1872	01.408	00.2410	01.7500	00.07126	05.800	00.3883
0058	00.1869	01.408	00.2407	01.7500	00.07227	05.796	00.3883
0059	00.1867	01.407	00.2404	01.7510	00.07328	05.793	00.3882
0060	00.1864	01.407	00.2401	01.7510	00.07429	05.790	00.3882
0061	00.1862	01.407	00.2397	01.7520	00.07530	05.787	00.3882
0062	00.1859	01.407	00.2394	01.7520	00.07630	05.783	00.3882
0063	00.1857	01.407	00.2391	01.7530	00.07731	05.780	00.3882
0064	00.1854	01.406	00.2388	01.7530	00.07831	05.777	00.3882
0065	00.1852	01.406	00.2385	01.7540	00.07932	05.773	00.3882
0066	00.1849	01.406	00.2382	01.7540	00.08032	05.770	00.3882
0067	00.1847	01.406	00.2379	01.7550	00.08132	05.767	00.3882
0068	00.1845	01.406	00.2376	01.7550	00.08231	05.764	00.3881
0069	00.1842	01.405	00.2373	01.7560	00.08331	05.760	00.3881
0070	00.1840	01.405	00.2370	01.7560	00.08431	05.757	00.3881
0071	00.1838	01.405	00.2367	01.7570	00.08530	05.754	00.3881
0072	00.1836	01.405	00.2365	01.7570	00.08630	05.751	00.3881
0073	00.1833	01.405	00.2362	01.7580	00.08729	05.747	00.3881
0074	00.1831	01.405	00.2359	01.7580	00.08828	05.744	00.3880
0075	00.1829	01.404	00.2357	01.7590	00.08927	05.741	00.3880
0076	00.1827	01.404	00.2354	01.7590	00.09026	05.738	00.3880
0077	00.1825	01.404	00.2351	01.7590	00.09125	05.735	00.3880
0078	00.1823	01.404	00.2349	01.7600	00.09223	05.731	00.3880
0079	00.1821	01.404	00.2346	01.7600	00.09322	05.728	00.3879
0080	00.1819	01.404	00.2344	01.7610	00.09420	05.725	00.3879
0081	00.1816	01.403	00.2341	01.7610	00.09519	05.722	00.3879
0082	00.1814	01.403	00.2339	01.7620	00.09617	05.719	00.3879
0083	00.1812	01.403	00.2336	01.7620	00.09715	05.715	00.3878
0084	00.1810	01.403	00.2334	01.7620	00.09813	05.712	00.3878
0085	00.1808	01.403	00.2331	01.7630	00.09911	05.709	00.3878
0086	00.1807	01.403	00.2329	01.7630	00.10000	05.706	00.3878
0087	00.1805	01.402	00.2327	01.7640	00.10100	05.703	00.3877
0088	00.1803	01.402	00.2324	01.7640	00.10200	05.699	00.3877
0089	00.1801	01.402	00.2322	01.7640	00.10300	05.696	00.3877
0090	00.1799	01.402	00.2320	01.7650	00.10390	05.693	00.3877
0091	00.1797	01.402	00.2318	01.7650	00.10490	05.690	00.3876
0092	00.1795	01.402	00.2315	01.7650	00.10590	05.687	00.3876
0093	00.1793	01.402	00.2313	01.7660	00.10690	05.684	00.3876
0094	00.1792	01.401	00.2311	01.7660	00.10780	05.680	00.3875
0095	00.1790	01.401	00.2309	01.7660	00.10880	05.677	00.3875
0096	00.1788	01.401	00.2307	01.7670	00.10980	05.674	00.3875
0097	00.1786	01.401	00.2305	01.7670	00.11070	05.671	00.3875
0098	00.1784	01.401	00.2302	01.7680	00.11170	05.668	00.3874
0099	00.1783	01.401	00.2300	01.7680	00.11270	05.665	00.3874
0100	00.1781	01.401	00.2298	01.7680	00.11360	05.661	00.3874
AVG	00.19159	01.4122	00.24714	01.7402	,	,	,

Example Number 5

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	5.60	0.500	3.60	0.010	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.3041	01.515	00.4076	01.6760	00.01164	05.994	00.3728
0002	00.3015	01.512	00.4043	01.6820	00.01327	05.989	00.3730
0003	00.2994	01.510	00.4013	01.6870	00.01489	05.984	00.3731
0004	00.2975	01.509	00.3987	01.6910	00.01650	05.978	00.3731
0005	00.2959	01.507	00.3964	01.6950	00.01810	05.973	00.3732
0006	00.2944	01.506	00.3943	01.6980	00.01970	05.968	00.3732
0007	00.2930	01.505	00.3924	01.7020	00.02128	05.963	00.3733
0008	00.2917	01.504	00.3907	01.7040	00.02286	05.958	00.3733
0009	00.2905	01.502	00.3891	01.7070	00.02443	05.952	00.3733
0010	00.2894	01.501	00.3876	01.7100	00.02600	05.947	00.3733
0011	00.2884	01.501	00.3862	01.7120	00.02756	05.942	00.3734
0012	00.2874	01.500	00.3848	01.7140	00.02912	05.937	00.3734
0013	00.2865	01.499	00.3836	01.7160	00.03067	05.932	00.3734
0014	00.2856	01.498	00.3824	01.7180	00.03221	05.927	00.3733
0015	00.2847	01.497	00.3813	01.7200	00.03375	05.922	00.3733
0016	00.2839	01.497	00.3802	01.7220	00.03529	05.917	00.3733
0017	00.2832	01.496	00.3792	01.7230	00.03682	05.912	00.3733
0018	00.2824	01.495	00.3783	01.7250	00.03835	05.907	00.3733
0019	00.2817	01.495	00.3774	01.7270	00.03988	05.902	00.3732
0020	00.2811	01.494	00.3765	01.7280	00.04140	05.897	00.3732
0021	00.2804	01.494	00.3756	01.7290	00.04291	05.892	00.3732
0022	00.2798	01.493	00.3748	01.7310	00.04443	05.887	00.3731
0023	00.2792	01.492	00.3740	01.7320	00.04594	05.882	00.3731
0024	00.2786	01.492	00.3733	01.7330	00.04745	05.877	00.3731
0025	00.2780	01.491	00.3725	01.7350	00.04895	05.872	00.3730
0026	00.2774	01.491	00.3718	01.7360	00.05045	05.868	00.3730
0027	00.2769	01.491	00.3711	01.7370	00.05195	05.863	00.3729
0028	00.2764	01.490	00.3705	01.7380	00.05345	05.858	00.3729
0029	00.2758	01.490	00.3698	01.7390	00.05494	05.853	00.3729
0030	00.2753	01.489	00.3692	01.7400	00.05643	05.848	00.3728
0031	00.2748	01.489	00.3686	01.7410	00.05792	05.843	00.3728
0032	00.2744	01.488	00.3680	01.7420	00.05940	05.838	00.3727
0033	00.2739	01.488	00.3674	01.7430	00.06089	05.834	00.3727
0034	00.2734	01.488	00.3669	01.7440	00.06237	05.829	00.3726
0035	00.2730	01.487	00.3663	01.7450	00.06384	05.824	00.3725
0036	00.2726	01.487	00.3658	01.7460	00.06532	05.819	00.3725
0037	00.2721	01.487	00.3652	01.7470	00.06679	05.814	00.3724
0038	00.2717	01.486	00.3647	01.7480	00.06826	05.810	00.3724
0039	00.2713	01.486	00.3642	01.7490	00.06973	05.805	00.3723
0040	00.2709	01.485	00.3638	01.7490	00.07120	05.800	00.3723
0041	00.2705	01.485	00.3633	01.7500	00.07266	05.795	00.3722
0042	00.2701	01.485	00.3628	01.7510	00.07412	05.790	00.3721
0043	00.2697	01.485	00.3624	01.7520	00.07558	05.786	00.3721
0044	00.2693	01.484	00.3619	01.7530	00.07704	05.781	00.3720
0045	00.2690	01.484	00.3615	01.7530	00.07849	05.776	00.3719
0046	00.2686	01.484	00.3611	01.7540	00.07995	05.771	00.3719
0047	00.2682	01.483	00.3606	01.7550	00.08140	05.767	00.3718
0048	00.2679	01.483	00.3602	01.7550	00.08285	05.762	00.3717
0049	00.2675	01.483	00.3598	01.7560	00.08430	05.757	00.3717
0050	00.2672	01.482	00.3594	01.7570	00.08574	05.753	00.3716
0051	00.2669	01.482	00.3590	01.7570	00.08719	05.748	00.3715
0052	00.2665	01.482	00.3587	01.7580	00.08863	05.743	00.3714
0053	00.2662	01.482	00.3583	01.7590	00.09007	05.738	00.3714
0054	00.2659	01.481	00.3579	01.7590	00.09151	05.734	00.3713
0055	00.2655	01.481	00.3576	01.7600	00.09295	05.729	00.3712
0056	00.2652	01.481	00.3572	01.7610	00.09438	05.724	00.3712
0057	00.2649	01.481	00.3568	01.7610	00.09582	05.720	00.3711
0058	00.2646	01.480	00.3565	01.7620	00.09725	05.715	00.3710
0059	00.2643	01.480	00.3562	01.7620	00.09868	05.710	00.3709
0060	00.2640	01.480	00.3558	01.7630	00.10010	05.706	00.3708
0061	00.2637	01.480	00.3555	01.7640	00.10150	05.701	00.3708
0062	00.2634	01.479	00.3552	01.7640	00.10290	05.696	00.3707
0063	00.2631	01.479	00.3549	01.7650	00.10430	05.692	00.3706
0064	00.2628	01.479	00.3545	01.7650	00.10580	05.687	00.3705
0065	00.2625	01.479	00.3542	01.7660	00.10720	05.682	00.3705
0066	00.2623	01.478	00.3539	01.7660	00.10860	05.678	00.3704
0067	00.2620	01.478	00.3536	01.7670	00.11000	05.673	00.3703
0068	00.2617	01.478	00.3533	01.7670	00.11140	05.669	00.3702
0069	00.2614	01.478	00.3530	01.7680	00.11290	05.664	00.3701
0070	00.2612	01.478	00.3528	01.7680	00.11430	05.659	00.3700
0071	00.2609	01.477	00.3525	01.7690	00.11570	05.655	00.3700
0072	00.2606	01.477	00.3522	01.7690	00.11710	05.650	00.3699
0073	00.2604	01.477	00.3519	01.7700	00.11850	05.646	00.3698
0074	00.2601	01.477	00.3516	01.7700	00.11990	05.641	00.3697
0075	00.2598	01.477	00.3514	01.7710	00.12130	05.636	00.3696
0076	00.2596	01.476	00.3511	01.7710	00.12270	05.632	00.3695
0077	00.2593	01.476	00.3508	01.7720	00.12410	05.627	00.3694
0078	00.2591	01.476	00.3506	01.7720	00.12550	05.623	00.3694
0079	00.2588	01.476	00.3503	01.7730	00.12690	05.618	00.3693
0080	00.2586	01.476	00.3501	01.7730	00.12830	05.614	00.3692
0081	00.2583	01.475	00.3498	01.7730	00.12970	05.609	00.3691
0082	00.2581	01.475	00.3496	01.7740	00.13110	05.604	00.3690
0083	00.2578	01.475	00.3493	01.7740	00.13250	05.600	00.3689
0084	00.2576	01.475	00.3491	01.7750	00.13390	05.595	00.3688
0085	00.2574	01.475	00.3489	01.7750	00.13530	05.591	00.3687
0086	00.2571	01.474	00.3486	01.7760	00.13670	05.586	00.3686
0087	00.2569	01.474	00.3484	01.7760	00.13810	05.582	00.3685
0088	00.2566	01.474	00.3482	01.7760	00.13950	05.577	00.3685
0089	00.2564	01.474	00.3479	01.7770	00.14090	05.573	00.3684
0090	00.2562	01.474	00.3477	01.7770	00.14220	05.568	00.3683
0091	00.2560	01.474	00.3475	01.7780	00.14360	05.564	00.3682
0092	00.2557	01.473	00.3473	01.7780	00.14500	05.559	00.3681
0093	00.2555	01.473	00.3470	01.7780	00.14640	05.555	00.3680
0094	00.2553	01.473	00.3468	01.7790	00.14780	05.550	00.3679
0095	00.2551	01.473	00.3466	01.7790	00.14920	05.546	00.3678
0096	00.2548	01.473	00.3464	01.7800	00.15050	05.541	00.3677
0097	00.2546	01.473	00.3462	01.7800	00.15190	05.537	00.3676
0098	00.2544	01.472	00.3460	01.7800	00.15330	05.532	00.3675
0099	00.2542	01.472	00.3458	01.7810	00.15470	05.528	00.3674
0100	00.2540	01.472	00.3456	01.7810	00.15600	05.523	00.3673
AVG	00.26998	01.4854	00.36354	01.7506	,	,	,

Example Number 6

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	5.60	0.500	4.00	0.010	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.4759	01.674	00.6483	01.6760	00.01257	05.991	00.3652
0002	00.4708	01.669	00.6445	01.6850	00.01512	05.983	00.3651
0003	00.4677	01.667	00.6404	01.6920	00.01765	05.975	00.3650
0004	00.4651	01.664	00.6370	01.6970	00.02017	05.966	00.3649
0005	00.4628	01.662	00.6341	01.7020	00.02267	05.958	00.3647
0006	00.4608	01.660	00.6316	01.7070	00.02516	05.950	00.3646
0007	00.4589	01.659	00.6293	01.7110	00.02765	05.942	00.3645
0008	00.4573	01.657	00.6272	01.7140	00.03012	05.934	00.3643
0009	00.4557	01.656	00.6254	01.7170	00.03259	05.926	00.3642
0010	00.4543	01.655	00.6237	01.7200	00.03505	05.918	00.3641
0011	00.4530	01.653	00.6221	01.7230	00.03750	05.910	00.3639
0012	00.4518	01.652	00.6206	01.7260	00.03994	05.902	00.3638
0013	00.4506	01.651	00.6193	01.7280	00.04238	05.894	00.3636
0014	00.4495	01.650	00.6180	01.7300	00.04481	05.886	00.3635
0015	00.4484	01.649	00.6168	01.7320	00.04724	05.878	00.3633
0016	00.4474	01.649	00.6156	01.7340	00.04966	05.870	00.3632
0017	00.4464	01.648	00.6146	01.7360	00.05208	05.862	00.3630
0018	00.4455	01.647	00.6136	01.7380	00.05449	05.854	00.3629
0019	00.4446	01.646	00.6126	01.7400	00.05690	05.847	00.3627
0020	00.4438	01.645	00.6117	01.7420	00.05930	05.839	00.3626
0021	00.4429	01.645	00.6108	01.7430	00.06169	05.831	00.3624
0022	00.4421	01.644	00.6099	01.7450	00.06409	05.823	00.3622
0023	00.4414	01.643	00.6091	01.7460	00.06648	05.815	00.3621
0024	00.4406	01.643	00.6084	01.7480	00.06886	05.808	00.3619
0025	00.4399	01.642	00.6076	01.7490	00.07124	05.800	00.3618
0026	00.4392	01.642	00.6069	01.7500	00.07362	05.792	00.3616
0027	00.4385	01.641	00.6062	01.7510	00.07599	05.784	00.3614
0028	00.4378	01.640	00.6055	01.7530	00.07836	05.777	00.3613
0029	00.4371	01.640	00.6049	01.7540	00.08073	05.769	00.3611
0030	00.4365	01.639	00.6043	01.7550	00.08309	05.761	00.3610
0031	00.4358	01.639	00.6037	01.7560	00.08545	05.753	00.3608
0032	00.4352	01.638	00.6031	01.7570	00.08780	05.746	00.3606
0033	00.4346	01.638	00.6025	01.7580	00.09015	05.738	00.3604
0034	00.4340	01.637	00.6020	01.7590	00.09250	05.730	00.3603
0035	00.4334	01.637	00.6015	01.7600	00.09485	05.723	00.3601
0036	00.4329	01.636	00.6010	01.7610	00.09719	05.715	00.3599
0037	00.4323	01.636	00.6005	01.7620	00.09953	05.708	00.3598
0038	00.4317	01.635	00.6000	01.7630	00.10180	05.700	00.3596
0039	00.4312	01.635	00.5995	01.7640	00.10420	05.692	00.3594
0040	00.4307	01.635	00.5990	01.7650	00.10650	05.685	00.3592
0041	00.4301	01.634	00.5986	01.7660	00.10880	05.677	00.3591
0042	00.4296	01.634	00.5982	01.7670	00.11110	05.670	00.3589
0043	00.4291	01.633	00.5977	01.7680	00.11350	05.662	00.3587
0044	00.4286	01.633	00.5973	01.7680	00.11580	05.654	00.3585
0045	00.4281	01.632	00.5969	01.7690	00.11810	05.647	00.3583
0046	00.4276	01.632	00.5965	01.7700	00.12040	05.639	00.3582
0047	00.4271	01.632	00.5961	01.7710	00.12270	05.632	00.3580
0048	00.4266	01.631	00.5958	01.7720	00.12500	05.624	00.3578
0049	00.4261	01.631	00.5954	01.7720	00.12730	05.617	00.3576
0050	00.4257	01.630	00.5950	01.7730	00.12960	05.609	00.3574
0051	00.4252	01.630	00.5947	01.7740	00.13190	05.602	00.3573
0052	00.4247	01.630	00.5944	01.7750	00.13420	05.594	00.3571
0053	00.4243	01.629	00.5940	01.7750	00.13650	05.587	00.3569
0054	00.4238	01.629	00.5937	01.7760	00.13880	05.579	00.3567
0055	00.4234	01.629	00.5934	01.7770	00.14110	05.572	00.3565
0056	00.4229	01.628	00.5931	01.7770	00.14340	05.564	00.3563
0057	00.4225	01.628	00.5928	01.7780	00.14570	05.557	00.3561
0058	00.4220	01.628	00.5925	01.7790	00.14800	05.549	00.3559
0059	00.4216	01.627	00.5922	01.7790	00.15030	05.542	00.3557
0060	00.4212	01.627	00.5919	01.7800	00.15250	05.535	00.3555
0061	00.4207	01.627	00.5916	01.7800	00.15480	05.527	00.3554
0062	00.4203	01.626	00.5913	01.7810	00.15710	05.520	00.3552
0063	00.4199	01.626	00.5911	01.7820	00.15940	05.512	00.3550
0064	00.4195	01.626	00.5908	01.7820	00.16160	05.505	00.3548
0065	00.4191	01.625	00.5905	01.7830	00.16390	05.498	00.3546
0066	00.4186	01.625	00.5903	01.7830	00.16620	05.490	00.3544
0067	00.4182	01.625	00.5900	01.7840	00.16840	05.483	00.3542
0068	00.4178	01.624	00.5898	01.7850	00.17070	05.475	00.3540
0069	00.4174	01.624	00.5896	01.7850	00.17300	05.468	00.3538
0070	00.4170	01.624	00.5893	01.7860	00.17520	05.461	00.3536
0071	00.4166	01.623	00.5891	01.7860	00.17750	05.453	00.3534
0072	00.4162	01.623	00.5889	01.7870	00.17970	05.446	00.3532
0073	00.4158	01.623	00.5887	01.7870	00.18200	05.439	00.3530
0074	00.4154	01.623	00.5884	01.7880	00.18420	05.431	00.3528
0075	00.4150	01.622	00.5882	01.7880	00.18650	05.424	00.3526
0076	00.4147	01.622	00.5880	01.7890	00.18870	05.417	00.3524
0077	00.4143	01.622	00.5878	01.7890	00.19090	05.409	00.3521
0078	00.4139	01.621	00.5876	01.7900	00.19320	05.402	00.3519
0079	00.4135	01.621	00.5874	01.7900	00.19540	05.395	00.3517
0080	00.4131	01.621	00.5872	01.7910	00.19770	05.387	00.3515
0081	00.4127	01.620	00.5870	01.7910	00.19990	05.380	00.3513
0082	00.4124	01.620	00.5868	01.7920	00.20210	05.373	00.3511
0083	00.4120	01.620	00.5867	01.7920	00.20440	05.366	00.3509
0084	00.4116	01.620	00.5865	01.7930	00.20660	05.358	00.3507
0085	00.4113	01.619	00.5863	01.7930	00.20880	05.351	00.3505
0086	00.4109	01.619	00.5861	01.7940	00.21100	05.344	00.3503
0087	00.4105	01.619	00.5860	01.7940	00.21330	05.337	00.3500
0088	00.4101	01.618	00.5858	01.7940	00.21550	05.329	00.3498
0089	00.4098	01.618	00.5856	01.7950	00.21770	05.322	00.3496
0090	00.4094	01.618	00.5855	01.7950	00.21990	05.315	00.3494
0091	00.4091	01.618	00.5853	01.7960	00.22210	05.308	00.3492
0092	00.4087	01.617	00.5852	01.7960	00.22430	05.301	00.3490
0093	00.4083	01.617	00.5850	01.7970	00.22650	05.293	00.3487
0094	00.4080	01.617	00.5849	01.7970	00.22880	05.286	00.3485
0095	00.4076	01.617	00.5847	01.7970	00.23100	05.279	00.3483
0096	00.4073	01.616	00.5846	01.7980	00.23320	05.272	00.3481
0097	00.4069	01.616	00.5844	01.7980	00.23540	05.265	00.3479
0098	00.4065	01.616	00.5843	01.7990	00.23760	05.257	00.3476
0099	00.4062	01.615	00.5842	01.7990	00.23980	05.250	00.3474
0100	00.4058	01.615	00.5840	01.7990	00.24200	05.243	00.3472
AVG	00.42875	01.6338	00.59992	01.7659	.	.	.

Example Number 7

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	5.60	0.500	4.10	0.010	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.5170	01.712	00.7102	01.6760	00.01279	05.990	00.3649
0002	00.5138	01.709	00.7039	01.6860	00.01557	05.981	00.3648
0003	00.5105	01.706	00.6997	01.6930	00.01834	05.972	00.3646
0004	00.5077	01.704	00.6961	01.6990	00.02108	05.963	00.3644
0005	00.5052	01.701	00.6931	01.7040	00.02382	05.954	00.3643
0006	00.5031	01.700	00.6905	01.7090	00.02654	05.946	00.3641
0007	00.5011	01.698	00.6881	01.7130	00.02925	05.937	00.3639
0008	00.4994	01.696	00.6860	01.7160	00.03195	05.928	00.3638
0009	00.4978	01.695	00.6841	01.7200	00.03465	05.919	00.3636
0010	00.4963	01.694	00.6824	01.7230	00.03733	05.910	00.3634
0011	00.4949	01.692	00.6808	01.7260	00.04001	05.902	00.3632
0012	00.4936	01.691	00.6793	01.7280	00.04268	05.893	00.3631
0013	00.4923	01.690	00.6780	01.7310	00.04535	05.884	00.3629
0014	00.4912	01.689	00.6767	01.7330	00.04801	05.876	00.3627
0015	00.4901	01.688	00.6755	01.7350	00.05066	05.867	00.3625
0016	00.4890	01.687	00.6743	01.7370	00.05330	05.858	00.3624
0017	00.4880	01.686	00.6733	01.7390	00.05595	05.850	00.3622
0018	00.4870	01.685	00.6722	01.7410	00.05858	05.841	00.3620
0019	00.4861	01.685	00.6713	01.7430	00.06121	05.833	00.3618
0020	00.4852	01.684	00.6704	01.7440	00.06384	05.824	00.3616
0021	00.4843	01.683	00.6695	01.7460	00.06646	05.815	00.3615
0022	00.4834	01.682	00.6687	01.7480	00.06907	05.807	00.3613
0023	00.4826	01.682	00.6679	01.7490	00.07169	05.798	00.3611
0024	00.4818	01.681	00.6671	01.7500	00.07429	05.790	00.3609
0025	00.4810	01.680	00.6664	01.7520	00.07690	05.781	00.3607
0026	00.4803	01.680	00.6657	01.7530	00.07950	05.773	00.3605
0027	00.4796	01.679	00.6650	01.7540	00.08209	05.764	00.3603
0028	00.4788	01.679	00.6643	01.7560	00.08468	05.756	00.3602
0029	00.4781	01.678	00.6637	01.7570	00.08727	05.748	00.3600
0030	00.4774	01.677	00.6631	01.7580	00.08985	05.739	00.3598
0031	00.4768	01.677	00.6625	01.7590	00.09243	05.731	00.3596
0032	00.4761	01.676	00.6620	01.7600	00.09501	05.722	00.3594
0033	00.4754	01.676	00.6614	01.7610	00.09758	05.714	00.3592
0034	00.4748	01.675	00.6609	01.7630	00.10010	05.706	00.3590
0035	00.4742	01.675	00.6604	01.7640	00.10270	05.697	00.3588
0036	00.4736	01.674	00.6599	01.7650	00.10520	05.689	00.3586
0037	00.4730	01.674	00.6594	01.7660	00.10780	05.680	00.3584
0038	00.4724	01.673	00.6589	01.7660	00.11040	05.672	00.3582
0039	00.4718	01.673	00.6585	01.7670	00.11290	05.664	00.3580
0040	00.4712	01.672	00.6580	01.7680	00.11550	05.656	00.3578
0041	00.4706	01.672	00.6576	01.7690	00.11800	05.647	00.3576
0042	00.4701	01.671	00.6572	01.7700	00.12050	05.639	00.3574
0043	00.4695	01.671	00.6568	01.7710	00.12310	05.631	00.3572
0044	00.4689	01.671	00.6564	01.7720	00.12560	05.622	00.3570
0045	00.4684	01.670	00.6560	01.7730	00.12820	05.614	00.3568
0046	00.4679	01.670	00.6556	01.7730	00.13070	05.606	00.3565
0047	00.4673	01.669	00.6553	01.7740	00.13320	05.598	00.3563
0048	00.4668	01.669	00.6549	01.7750	00.13570	05.589	00.3561
0049	00.4663	01.668	00.6546	01.7760	00.13830	05.581	00.3559
0050	00.4658	01.668	00.6542	01.7760	00.14080	05.573	00.3557
0051	00.4653	01.668	00.6539	01.7770	00.14330	05.565	00.3555
0052	00.4647	01.667	00.6536	01.7780	00.14580	05.556	00.3553
0053	00.4642	01.667	00.6533	01.7790	00.14830	05.548	00.3551
0054	00.4637	01.666	00.6530	01.7790	00.15080	05.540	00.3548
0055	00.4633	01.666	00.6527	01.7800	00.15340	05.532	00.3546
0056	00.4628	01.666	00.6524	01.7810	00.15590	05.524	00.3544
0057	00.4623	01.665	00.6521	01.7810	00.15840	05.516	00.3542
0058	00.4618	01.665	00.6518	01.7820	00.16090	05.507	00.3540
0059	00.4613	01.664	00.6516	01.7830	00.16340	05.499	00.3537
0060	00.4608	01.664	00.6513	01.7830	00.16580	05.491	00.3535
0061	00.4604	01.664	00.6511	01.7840	00.16830	05.483	00.3533
0062	00.4599	01.663	00.6508	01.7840	00.17080	05.475	00.3531
0063	00.4594	01.663	00.6506	01.7850	00.17330	05.467	00.3528
0064	00.4590	01.663	00.6503	01.7860	00.17580	05.459	00.3526
0065	00.4585	01.662	00.6501	01.7860	00.17830	05.451	00.3524
0066	00.4581	01.662	00.6499	01.7870	00.18080	05.443	00.3522
0067	00.4576	01.662	00.6496	01.7870	00.18320	05.435	00.3519
0068	00.4572	01.661	00.6494	01.7880	00.18570	05.426	00.3517
0069	00.4567	01.661	00.6492	01.7890	00.18820	05.418	00.3515
0070	00.4563	01.661	00.6490	01.7890	00.19070	05.410	00.3512
0071	00.4558	01.660	00.6488	01.7900	00.19310	05.402	00.3510
0072	00.4554	01.660	00.6486	01.7900	00.19560	05.394	00.3508
0073	00.4549	01.659	00.6484	01.7910	00.19800	05.386	00.3505
0074	00.4545	01.659	00.6482	01.7910	00.20050	05.378	00.3503
0075	00.4541	01.659	00.6480	01.7920	00.20300	05.370	00.3501
0076	00.4536	01.658	00.6479	01.7920	00.20540	05.362	00.3498
0077	00.4532	01.658	00.6477	01.7930	00.20790	05.354	00.3496
0078	00.4528	01.658	00.6475	01.7930	00.21030	05.346	00.3494
0079	00.4524	01.657	00.6473	01.7940	00.21280	05.338	00.3491
0080	00.4519	01.657	00.6472	01.7940	00.21520	05.330	00.3489
0081	00.4515	01.657	00.6470	01.7950	00.21770	05.322	00.3486
0082	00.4511	01.657	00.6469	01.7950	00.22010	05.314	00.3484
0083	00.4507	01.656	00.6467	01.7960	00.22250	05.306	00.3481
0084	00.4502	01.656	00.6466	01.7960	00.22500	05.298	00.3479
0085	00.4498	01.656	00.6464	01.7970	00.22740	05.290	00.3477
0086	00.4494	01.655	00.6463	01.7970	00.22980	05.283	00.3474
0087	00.4490	01.655	00.6461	01.7980	00.23230	05.275	00.3472
0088	00.4486	01.655	00.6460	01.7980	00.23470	05.267	00.3469
0089	00.4482	01.654	00.6459	01.7990	00.23710	05.259	00.3467
0090	00.4478	01.654	00.6457	01.7990	00.23950	05.251	00.3464
0091	00.4473	01.654	00.6456	01.7990	00.24200	05.243	00.3462
0092	00.4469	01.653	00.6455	01.8000	00.24440	05.235	00.3459
0093	00.4465	01.653	00.6454	01.8000	00.24680	05.227	00.3457
0094	00.4461	01.653	00.6452	01.8010	00.24920	05.219	00.3454
0095	00.4457	01.652	00.6451	01.8010	00.25160	05.212	00.3452
0096	00.4453	01.652	00.6450	01.8020	00.25400	05.204	00.3449
0097	00.4449	01.652	00.6449	01.8020	00.25640	05.196	00.3446
0098	00.4445	01.651	00.6448	01.8020	00.25890	05.188	00.3444
0099	00.4441	01.651	00.6447	01.8030	00.26130	05.180	00.3441
0100	00.4437	01.651	00.6446	01.8030	00.26370	05.172	00.3439
AVG	00.46885	01,6713	00.65932	01,7690	,	,	,

Example Number 8

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	4.00	0.500	3.80	0.010	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.3885	01.593	00.5293	01.6760	00.01210	05.990	00.3673
0002	00.3856	01.590	00.5248	01.6830	00.01418	05.980	00.3673
0003	00.3829	01.588	00.5213	01.6890	00.01626	05.971	00.3672
0004	00.3806	01.586	00.5183	01.6940	00.01832	05.962	00.3671
0005	00.3786	01.584	00.5156	01.6990	00.02037	05.952	00.3670
0006	00.3768	01.582	00.5133	01.7030	00.02241	05.943	00.3669
0007	00.3751	01.581	00.5111	01.7070	00.02444	05.934	00.3668
0008	00.3736	01.580	00.5092	01.7100	00.02646	05.924	00.3667
0009	00.3722	01.578	00.5075	01.7130	00.02847	05.915	00.3666
0010	00.3709	01.577	00.5058	01.7160	00.03048	05.906	00.3664
0011	00.3696	01.576	00.5043	01.7180	00.03248	05.897	00.3663
0012	00.3685	01.575	00.5029	01.7210	00.03447	05.888	00.3662
0013	00.3674	01.574	00.5016	01.7230	00.03646	05.879	00.3660
0014	00.3663	01.573	00.5004	01.7250	00.03844	05.870	00.3659
0015	00.3653	01.572	00.4992	01.7270	00.04042	05.861	00.3657
0016	00.3644	01.572	00.4981	01.7290	00.04239	05.852	00.3656
0017	00.3634	01.571	00.4970	01.7310	00.04436	05.843	00.3654
0018	00.3626	01.570	00.4960	01.7320	00.04632	05.834	00.3653
0019	00.3617	01.569	00.4951	01.7340	00.04828	05.825	00.3651
0020	00.3609	01.569	00.4942	01.7360	00.05023	05.816	00.3650
0021	00.3601	01.568	00.4933	01.7370	00.05210	05.807	00.3648
0022	00.3593	01.567	00.4925	01.7390	00.05413	05.798	00.3646
0023	00.3586	01.567	00.4917	01.7400	00.05607	05.789	00.3645
0024	00.3579	01.566	00.4909	01.7420	00.05800	05.780	00.3643
0025	00.3572	01.566	00.4901	01.7430	00.05994	05.772	00.3642
0026	00.3565	01.565	00.4894	01.7440	00.06187	05.763	00.3640
0027	00.3558	01.565	00.4887	01.7450	00.06379	05.754	00.3638
0028	00.3552	01.564	00.4881	01.7470	00.06571	05.745	00.3636
0029	00.3545	01.564	00.4874	01.7480	00.06763	05.736	00.3635
0030	00.3539	01.563	00.4868	01.7490	00.06955	05.728	00.3633
0031	00.3533	01.563	00.4862	01.7500	00.07146	05.719	00.3631
0032	00.3527	01.562	00.4856	01.7510	00.07337	05.710	00.3629
0033	00.3521	01.562	00.4850	01.7520	00.07527	05.702	00.3628
0034	00.3515	01.561	00.4845	01.7530	00.07718	05.693	00.3626
0035	00.3510	01.561	00.4840	01.7540	00.07908	05.684	00.3624
0036	00.3504	01.560	00.4834	01.7550	00.08097	05.676	00.3622
0037	00.3499	01.560	00.4829	01.7560	00.08287	05.667	00.3620
0038	00.3493	01.559	00.4824	01.7570	00.08476	05.658	00.3618
0039	00.3488	01.559	00.4820	01.7580	00.08664	05.650	00.3616
0040	00.3483	01.559	00.4815	01.7590	00.08853	05.641	00.3614
0041	00.3478	01.558	00.4810	01.7600	00.09041	05.632	00.3613
0042	00.3473	01.558	00.4806	01.7600	00.09229	05.624	00.3611
0043	00.3468	01.557	00.4802	01.7610	00.09417	05.615	00.3609
0044	00.3463	01.557	00.4797	01.7620	00.09604	05.607	00.3607
0045	00.3458	01.557	00.4793	01.7630	00.09791	05.598	00.3605
0046	00.3453	01.556	00.4789	01.7640	00.09978	05.590	00.3603
0047	00.3448	01.556	00.4785	01.7640	00.10160	05.581	00.3601
0048	00.3444	01.555	00.4781	01.7650	00.10350	05.573	00.3599
0049	00.3439	01.555	00.4777	01.7660	00.10530	05.564	00.3597
0050	00.3434	01.555	00.4774	01.7670	00.10720	05.556	00.3595
0051	00.3430	01.554	00.4770	01.7670	00.10900	05.547	00.3593
0052	00.3425	01.554	00.4767	01.7680	00.11090	05.539	00.3591
0053	00.3421	01.554	00.4763	01.7690	00.11270	05.530	00.3589
0054	00.3416	01.553	00.4760	01.7690	00.11460	05.522	00.3586
0055	00.3412	01.553	00.4756	01.7700	00.11640	05.513	00.3584
0056	00.3408	01.553	00.4753	01.7710	00.11830	05.505	00.3582
0057	00.3403	01.552	00.4750	01.7710	00.12010	05.497	00.3580
0058	00.3399	01.552	00.4747	01.7720	00.12200	05.488	00.3570
0059	00.3395	01.552	00.4744	01.7730	00.12380	05.480	00.3576
0060	00.3391	01.551	00.4741	01.7730	00.12560	05.471	00.3574
0061	00.3387	01.551	00.4738	01.7740	00.12750	05.463	00.3572
0062	00.3382	01.551	00.4735	01.7740	00.12930	05.455	00.3569
0063	00.3378	01.550	00.4732	01.7750	00.13110	05.446	00.3567
0064	00.3374	01.550	00.4729	01.7760	00.13300	05.438	00.3565
0065	00.3370	01.550	00.4726	01.7760	00.13480	05.430	00.3563
0066	00.3366	01.550	00.4724	01.7770	00.13660	05.421	00.3561
0067	00.3362	01.549	00.4721	01.7770	00.13840	05.413	00.3558
0068	00.3358	01.549	00.4719	01.7780	00.14020	05.405	00.3556
0069	00.3354	01.549	00.4716	01.7780	00.14210	05.396	00.3554
0070	00.3351	01.548	00.4714	01.7790	00.14390	05.388	00.3552
0071	00.3347	01.548	00.4711	01.7790	00.14570	05.380	00.3549
0072	00.3343	01.548	00.4709	01.7800	00.14750	05.372	00.3547
0073	00.3339	01.547	00.4706	01.7810	00.14930	05.363	00.3545
0074	00.3335	01.547	00.4704	01.7810	00.15110	05.355	00.3542
0075	00.3331	01.547	00.4702	01.7820	00.15290	05.347	00.3540
0076	00.3328	01.547	00.4699	01.7820	00.15470	05.339	00.3538
0077	00.3324	01.546	00.4697	01.7830	00.15650	05.331	00.3535
0078	00.3320	01.546	00.4695	01.7830	00.15830	05.322	00.3533
0079	00.3316	01.546	00.4693	01.7840	00.16010	05.314	00.3531
0080	00.3313	01.546	00.4691	01.7840	00.16190	05.306	00.3528
0081	00.3309	01.545	00.4689	01.7850	00.16370	05.298	00.3526
0082	00.3305	01.545	00.4687	01.7850	00.16550	05.290	00.3524
0083	00.3302	01.545	00.4685	01.7850	00.16730	05.281	00.3521
0084	00.3298	01.544	00.4683	01.7860	00.16900	05.273	00.3519
0085	00.3295	01.544	00.4681	01.7860	00.17080	05.265	00.3516
0086	00.3291	01.544	00.4679	01.7870	00.17260	05.257	00.3514
0087	00.3287	01.544	00.4677	01.7870	00.17440	05.249	00.3512
0088	00.3284	01.543	00.4675	01.7880	00.17620	05.241	00.3509
0089	00.3280	01.543	00.4673	01.7880	00.17790	05.233	00.3507
0090	00.3277	01.543	00.4672	01.7890	00.17970	05.225	00.3504
0091	00.3273	01.543	00.4670	01.7890	00.18150	05.217	00.3502
0092	00.3270	01.542	00.4668	01.7890	00.18330	05.208	00.3499
0093	00.3266	01.542	00.4666	01.7900	00.18500	05.200	00.3497
0094	00.3263	01.542	00.4665	01.7900	00.18680	05.192	00.3494
0095	00.3259	01.542	00.4663	01.7910	00.18850	05.184	00.3492
0096	00.3256	01.541	00.4662	01.7910	00.19030	05.176	00.3489
0097	00.3252	01.541	00.4660	01.7920	00.19210	05.168	00.3487
0098	00.3249	01.541	00.4658	01.7920	00.19380	05.160	00.3484
0099	00.3245	01.541	00.4657	01.7920	00.19560	05.152	00.3482
0100	00.3242	01.540	00.4655	01.7930	00.19730	05.144	00.3479
AVG	00.3463	01.5578	00.48201	01.7598	,	,	,

Example Number 9

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	6.50	0.500	3.80	0.010	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.3885	01.593	00.5293	01.6760	00.01210	05.994	00.3674
0002	00.3857	01.590	00.5248	01.6830	00.01418	05.988	00.3674
0003	00.3831	01.588	00.5213	01.6890	00.01626	05.982	00.3674
0004	00.3808	01.586	00.5182	01.6940	00.01832	05.976	00.3674
0005	00.3789	01.584	00.5156	01.6990	00.02037	05.970	00.3674
0006	00.3771	01.583	00.5132	01.7030	00.02241	05.965	00.3673
0007	00.3755	01.581	00.5111	01.7060	00.02444	05.959	00.3673
0008	00.3741	01.580	00.5092	01.7100	00.02647	05.953	00.3672
0009	00.3727	01.579	00.5074	01.7130	00.02848	05.948	00.3672
0010	00.3715	01.578	00.5058	01.7150	00.03049	05.942	00.3671
0011	00.3703	01.577	00.5043	01.7180	00.03250	05.936	00.3671
0012	00.3692	01.576	00.5028	01.7200	00.03450	05.931	00.3670
0013	00.3682	01.575	00.5015	01.7220	00.03649	05.925	00.3670
0014	00.3672	01.574	00.5003	01.7250	00.03848	05.919	00.3669
0015	00.3663	01.573	00.4991	01.7270	00.04046	05.914	00.3668
0016	00.3654	01.572	00.4980	01.7280	00.04244	05.908	00.3668
0017	00.3645	01.571	00.4969	01.7300	00.04441	05.903	00.3667
0018	00.3637	01.571	00.4959	01.7320	00.04638	05.897	00.3666
0019	00.3629	01.570	00.4949	01.7340	00.04834	05.892	00.3665
0020	00.3622	01.569	00.4940	01.7350	00.05030	05.886	00.3665
0021	00.3615	01.569	00.4931	01.7370	00.05226	05.881	00.3664
0022	00.3608	01.568	00.4923	01.7380	00.05421	05.875	00.3663
0023	00.3601	01.568	00.4915	01.7400	00.05616	05.870	00.3662
0024	00.3594	01.567	00.4907	01.7410	00.05810	05.864	00.3661
0025	00.3588	01.566	00.4899	01.7420	00.06005	05.859	00.3660
0026	00.3582	01.566	00.4892	01.7430	00.06198	05.853	00.3660
0027	00.3576	01.565	00.4885	01.7450	00.06392	05.848	00.3659
0028	00.3570	01.565	00.4878	01.7460	00.06585	05.843	00.3658
0029	00.3564	01.564	00.4872	01.7470	00.06778	05.837	00.3657
0030	00.3559	01.564	00.4865	01.7480	00.06971	05.832	00.3656
0031	00.3553	01.564	00.4859	01.7490	00.07163	05.826	00.3655
0032	00.3548	01.563	00.4853	01.7500	00.07355	05.821	00.3654
0033	00.3543	01.563	00.4847	01.7510	00.07547	05.816	00.3653
0034	00.3538	01.562	00.4842	01.7520	00.07738	05.810	00.3652
0035	00.3533	01.562	00.4836	01.7530	00.07929	05.805	00.3651
0036	00.3528	01.561	00.4831	01.7540	00.08120	05.799	00.3650
0037	00.3523	01.561	00.4826	01.7550	00.08311	05.794	00.3650
0038	00.3519	01.561	00.4820	01.7560	00.08501	05.789	00.3649
0039	00.3514	01.560	00.4815	01.7570	00.08692	05.783	00.3648
0040	00.3510	01.560	00.4811	01.7580	00.08882	05.778	00.3647
0041	00.3505	01.560	00.4806	01.7590	00.09071	05.773	00.3646
0042	00.3501	01.559	00.4801	01.7590	00.09261	05.767	00.3645
0043	00.3497	01.559	00.4797	01.7600	00.09450	05.762	00.3644
0044	00.3493	01.558	00.4792	01.7610	00.09639	05.757	00.3643
0045	00.3488	01.558	00.4788	01.7620	00.09828	05.752	00.3642
0046	00.3484	01.558	00.4784	01.7620	00.10010	05.746	00.3641
0047	00.3480	01.557	00.4780	01.7630	00.10200	05.741	00.3640
0048	00.3476	01.557	00.4776	01.7640	00.10390	05.736	00.3639
0049	00.3473	01.557	00.4772	01.7650	00.10580	05.730	00.3637
0050	00.3469	01.557	00.4768	01.7650	00.10760	05.725	00.3636
0051	00.3465	01.556	00.4764	01.7660	00.10950	05.720	00.3635
0052	00.3461	01.556	00.4760	01.7670	00.11140	05.715	00.3634
0053	00.3458	01.556	00.4756	01.7670	00.11330	05.709	00.3633
0054	00.3454	01.555	00.4753	01.7680	00.11510	05.704	00.3632
0055	00.3450	01.555	00.4749	01.7690	00.11700	05.699	00.3631
0056	00.3447	01.555	00.4746	01.7690	00.11890	05.694	00.3630
0057	00.3443	01.554	00.4742	01.7700	00.12070	05.688	00.3629
0058	00.3440	01.554	00.4739	01.7710	00.12260	05.683	00.3628
0059	00.3436	01.554	00.4736	01.7710	00.12440	05.678	00.3627
0060	00.3433	01.554	00.4732	01.7720	00.12630	05.673	00.3626
0061	00.3430	01.553	00.4729	01.7720	00.12820	05.667	00.3625
0062	00.3426	01.553	00.4726	01.7730	00.13000	05.662	00.3623
0063	00.3423	01.553	00.4723	01.7730	00.13190	05.657	00.3622
0064	00.3420	01.553	00.4720	01.7740	00.13370	05.652	00.3621
0065	00.3417	01.552	00.4717	01.7750	00.13560	05.647	00.3620
0066	00.3413	01.552	00.4714	01.7750	00.13740	05.641	00.3619
0067	00.3410	01.552	00.4711	01.7760	00.13930	05.636	00.3618
0068	00.3407	01.552	00.4708	01.7760	00.14110	05.631	00.3617
0069	00.3404	01.551	00.4705	01.7770	00.14290	05.626	00.3615
0070	00.3401	01.551	00.4703	01.7770	00.14480	05.621	00.3614
0071	00.3398	01.551	00.4700	01.7780	00.14660	05.616	00.3613
0072	00.3395	01.551	00.4697	01.7780	00.14850	05.610	00.3612
0073	00.3392	01.550	00.4695	01.7790	00.15030	05.605	00.3611
0074	00.3389	01.550	00.4692	01.7790	00.15210	05.600	00.3610
0075	00.3386	01.550	00.4689	01.7800	00.15400	05.595	00.3608
0076	00.3383	01.550	00.4687	01.7800	00.15580	05.590	00.3607
0077	00.3380	01.549	00.4684	01.7810	00.15760	05.585	00.3606
0078	00.3377	01.549	00.4682	01.7810	00.15950	05.580	00.3605
0079	00.3374	01.549	00.4680	01.7820	00.16130	05.574	00.3604
0080	00.3371	01.549	00.4677	01.7820	00.16310	05.569	00.3602
0081	00.3369	01.549	00.4675	01.7830	00.16490	05.564	00.3601
0082	00.3366	01.548	00.4672	01.7830	00.16670	05.559	00.3600
0083	00.3363	01.548	00.4670	01.7840	00.16860	05.554	00.3599
0084	00.3360	01.548	00.4668	01.7840	00.17040	05.549	00.3598
0085	00.3357	01.548	00.4666	01.7840	00.17220	05.544	00.3596
0086	00.3355	01.547	00.4663	01.7850	00.17400	05.539	00.3595
0087	00.3352	01.547	00.4661	01.7850	00.17580	05.534	00.3594
0088	00.3349	01.547	00.4659	01.7860	00.17760	05.528	00.3593
0089	00.3347	01.547	00.4657	01.7860	00.17950	05.523	00.3591
0090	00.3344	01.547	00.4655	01.7860	00.18130	05.518	00.3590
0091	00.3341	01.546	00.4653	01.7870	00.18310	05.513	00.3589
0092	00.3339	01.546	00.4651	01.7870	00.18490	05.508	00.3588
0093	00.3336	01.546	00.4649	01.7880	00.18670	05.503	00.3586
0094	00.3333	01.546	00.4647	01.7880	00.18850	05.498	00.3585
0095	00.3331	01.546	00.4645	01.7890	00.19030	05.493	00.3584
0096	00.3328	01.545	00.4643	01.7890	00.19210	05.488	00.3583
0097	00.3326	01.545	00.4641	01.7890	00.19390	05.483	00.3581
0098	00.3323	01.545	00.4639	01.7900	00.19570	05.478	00.3580
0099	00.3321	01.545	00.4637	01.7900	00.19750	05.473	00.3579
0100	00.3318	01.545	00.4635	01.7900	00.19930	05.468	00.3577
AVG	00.34989	01.5598	00.48125	01.7586	.	.	.

Example Number 10

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	4.00	5.60	0.500	3.80	0.010	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.3885	01.593	00.5293	01.6760	00.01328	05.993	00.3674
0002	00.3842	01.589	00.5220	01.6870	00.01653	05.986	00.3674
0003	00.3806	01.586	00.5179	01.6950	00.01975	05.979	00.3675
0004	00.3777	01.583	00.5139	01.7020	00.02294	05.972	00.3675
0005	00.3753	01.581	00.5106	01.7070	00.02612	05.966	00.3674
0006	00.3731	01.579	00.5077	01.7120	00.02927	05.959	00.3674
0007	00.3712	01.577	00.5052	01.7160	00.03241	05.953	00.3674
0008	00.3695	01.576	00.5029	01.7200	00.03553	05.946	00.3673
0009	00.3680	01.574	00.5008	01.7230	00.03865	05.940	00.3673
0010	00.3665	01.573	00.4990	01.7270	00.04175	05.933	00.3672
0011	00.3652	01.572	00.4973	01.7290	00.04483	05.927	00.3671
0012	00.3640	01.571	00.4957	01.7320	00.04791	05.920	00.3671
0013	00.3628	01.570	00.4942	01.7350	00.05098	05.914	00.3670
0014	00.3610	01.569	00.4928	01.7370	00.05404	05.908	00.3669
0015	00.3607	01.568	00.4915	01.7390	00.05709	05.901	00.3668
0016	00.3598	01.567	00.4903	01.7410	00.06013	05.895	00.3668
0017	00.3588	01.566	00.4891	01.7430	00.06317	05.889	00.3667
0018	00.3579	01.566	00.4880	01.7450	00.06619	05.882	00.3666
0019	00.3571	01.565	00.4870	01.7470	00.06921	05.876	00.3665
0020	00.3563	01.564	00.4860	01.7490	00.07223	05.870	00.3664
0021	00.3555	01.563	00.4851	01.7500	00.07523	05.863	00.3663
0022	00.3548	01.563	00.4842	01.7520	00.07823	05.857	00.3662
0023	00.3540	01.562	00.4833	01.7530	00.08123	05.851	00.3661
0024	00.3533	01.562	00.4825	01.7550	00.08421	05.845	00.3660
0025	00.3527	01.561	00.4817	01.7560	00.08720	05.838	00.3659
0026	00.3520	01.560	00.4809	01.7570	00.09017	05.832	00.3658
0027	00.3514	01.560	00.4002	01.7590	00.09314	05.826	00.3657
0028	00.3507	01.559	00.4794	01.7600	00.09611	05.820	00.3656
0029	00.3501	01.559	00.4787	01.7610	00.09907	05.814	00.3655
0030	00.3495	01.558	00.4781	01.7620	00.10200	05.807	00.3654
0031	00.3490	01.558	00.4774	01.7630	00.10490	05.801	00.3653
0032	00.3484	01.557	00.4768	01.7640	00.10790	05.795	00.3652
0033	00.3479	01.557	00.4762	01.7660	00.11080	05.789	00.3651
0034	00.3473	01.556	00.4756	01.7670	00.11380	05.783	00.3650
0035	00.3468	01.556	00.4750	01.7680	00.11670	05.777	00.3649
0036	00.3463	01.556	00.4745	01.7690	00.11960	05.771	00.3648
0037	00.3458	01.555	00.4739	01.7700	00.12250	05.765	00.3647
0038	00.3453	01.555	00.4734	01.7700	00.12550	05.758	00.3645
0039	00.3448	01.554	00.4729	01.7710	00.12840	05.752	00.3644
0040	00.3443	01.554	00.4724	01.7720	00.13130	05.746	00.3643
0041	00.3439	01.554	00.4719	01.7730	00.13420	05.740	00.3642
0042	00.3434	01.553	00.4714	01.7740	00.13710	05.734	00.3641
0043	00.3429	01.553	00.4709	01.7750	00.14000	05.728	00.3640
0044	00.3425	01.553	00.4705	01.7760	00.14290	05.722	00.3638
0045	00.3421	01.552	00.4700	01.7760	00.14580	05.716	00.3637
0046	00.3416	01.552	00.4696	01.7770	00.14870	05.710	00.3636
0047	00.3412	01.551	00.4692	01.7780	00.15160	05.704	00.3635
0048	00.3408	01.551	00.4687	01.7790	00.15440	05.698	00.3634
0049	00.3404	01.551	00.4683	01.7800	00.15730	05.692	00.3632
0050	00.3400	01.550	00.4679	01.7800	00.16020	05.686	00.3631
0051	00.3396	01.550	00.4675	01.7810	00.16310	05.680	00.3630
0052	00.3392	01.550	00.4672	01.7820	00.16590	05.674	00.3629
0053	00.3388	01.549	00.4668	01.7820	00.16880	05.668	00.3627
0054	00.3384	01.549	00.4664	01.7830	00.17170	05.662	00.3626
0055	00.3380	01.549	00.4660	01.7840	00.17450	05.656	00.3625
0056	00.3376	01.549	00.4657	01.7840	00.17740	05.650	00.3624
0057	00.3373	01.548	00.4653	01.7850	00.18020	05.644	00.3622
0058	00.3369	01.548	00.4650	01.7860	00.18310	05.638	00.3621
0059	00.3365	01.548	00.4647	01.7860	00.18590	05.632	00.3620
0060	00.3362	01.547	00.4643	01.7870	00.18880	05.626	00.3618
0061	00.3358	01.547	00.4640	01.7880	00.19160	05.620	00.3617
0062	00.3355	01.547	00.4637	01.7880	00.19440	05.615	00.3616
0063	00.3351	01.547	00.4634	01.7890	00.19730	05.609	00.3614
0064	00.3348	01.546	00.4631	01.7890	00.20010	05.603	00.3613
0065	00.3344	01.546	00.4628	01.7900	00.20290	05.597	00.3612
0066	00.3341	01.546	00.4625	01.7900	00.20580	05.591	00.3610
0067	00.3338	01.546	00.4622	01.7910	00.20860	05.585	00.3609
0068	00.3334	01.545	00.4619	01.7920	00.21140	05.579	00.3608
0069	00.3331	01.545	00.4616	01.7920	00.21420	05.573	00.3606
0070	00.3328	01.545	00.4613	01.7930	00.21700	05.567	00.3605
0071	00.3324	01.544	00.4610	01.7930	00.21980	05.562	00.3604
0072	00.3321	01.544	00.4608	01.7940	00.22270	05.556	00.3602
0073	00.3318	01.544	00.4605	01.7940	00.22550	05.550	00.3601
0074	00.3315	01.544	00.4602	01.7950	00.22830	05.544	00.3599
0075	00.3312	01.544	00.4600	01.7950	00.23110	05.538	00.3598
0076	00.3308	01.543	00.4597	01.7960	00.23390	05.532	00.3597
0077	00.3305	01.543	00.4595	01.7960	00.23670	05.526	00.3595
0078	00.3302	01.543	00.4592	01.7970	00.23940	05.521	00.3594
0079	00.3299	01.543	00.4590	01.7970	00.24220	05.515	00.3592
0080	00.3296	01.542	00.4587	01.7980	00.24500	05.509	00.3591
0081	00.3293	01.542	00.4585	01.7980	00.24780	05.503	00.3589
0082	00.3290	01.542	00.4583	01.7990	00.25060	05.497	00.3588
0083	00.3287	01.542	00.4580	01.7990	00.25340	05.492	00.3587
0084	00.3284	01.541	00.4578	01.7990	00.25610	05.486	00.3585
0085	00.3281	01.541	00.4576	01.8000	00.25890	05.480	00.3584
0086	00.3278	01.541	00.4574	01.8000	00.26170	05.474	00.3582
0087	00.3275	01.541	00.4571	01.8010	00.26450	05.468	00.3581
0088	00.3273	01.541	00.4569	01.8010	00.26720	05.463	00.3579
0089	00.3270	01.540	00.4567	01.8020	00.27000	05.457	00.3578
0090	00.3267	01.540	00.4565	01.8020	00.27280	05.451	00.3576
0091	00.3264	01.540	00.4563	01.8020	00.27550	05.445	00.3575
0092	00.3261	01.540	00.4561	01.8030	00.27830	05.440	00.3573
0093	00.3258	01.539	00.4559	01.8030	00.28100	05.434	00.3572
0094	00.3256	01.539	00.4557	01.8040	00.28380	05.428	00.3570
0095	00.3253	01.539	00.4555	01.8040	00.28650	05.422	00.3569
0096	00.3250	01.539	00.4553	01.8050	00.28930	05.417	00.3567
0097	00.3247	01.539	00.4551	01.8050	00.29200	05.411	00.3566
0098	00.3245	01.538	00.4549	01.8050	00.29480	05.405	00.3564
0099	00.3242	01.538	00.4547	01.8060	00.29750	05.399	00.3563
0100	00.3239	01.538	00.4545	01.8060	00.30030	05.394	00.3561
AVG	00.34335	01.554	00.4730	01.7726	,	,	,

Example Number 11

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	10.0	5.60	0.500	3.80	0.010	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.3885	01.593	00.5293	01.6760	00.01131	05.993	00.3674
0002	00.3867	01.591	00.5263	01.6810	00.01262	05.986	00.3673
0003	00.3849	01.590	00.5239	01.6850	00.01392	05.979	00.3673
0004	00.3832	01.588	00.5217	01.6890	00.01522	05.972	00.3672
0005	00.3817	01.587	00.5197	01.6920	00.01651	05.966	00.3671
0006	00.3803	01.586	00.5179	01.6950	00.01779	05.959	00.3671
0007	00.3790	01.584	00.5162	01.6980	00.01908	05.952	00.3670
0008	00.3778	01.583	00.5147	01.7010	00.02035	05.945	00.3669
0009	00.3767	01.582	00.5133	01.7030	00.02163	05.939	00.3668
0010	00.3756	01.581	00.5119	01.7050	00.02290	05.932	00.3667
0011	00.3746	01.581	00.5107	01.7070	00.02416	05.926	00.3667
0012	00.3736	01.580	00.5095	01.7090	00.02543	05.919	00.3666
0013	00.3727	01.579	00.5083	01.7110	00.02669	05.912	00.3665
0014	00.3718	01.578	00.5073	01.7130	00.02795	05.906	00.3664
0015	00.3710	01.577	00.5062	01.7150	00.02920	05.899	00.3663
0016	00.3702	01.577	00.5053	01.7170	00.03045	05.893	00.3662
0017	00.3694	01.576	00.5043	01.7180	00.03170	05.886	00.3661
0018	00.3686	01.575	00.5035	01.7200	00.03295	05.880	00.3660
0019	00.3679	01.575	00.5026	01.7210	00.03419	05.873	00.3659
0020	00.3672	01.574	00.5018	01.7230	00.03544	05.867	00.3658
0021	00.3665	01.574	00.5010	01.7240	00.03668	05.860	00.3657
0022	00.3659	01.573	00.5002	01.7250	00.03791	05.854	00.3656
0023	00.3652	01.573	00.4995	01.7270	00.03915	05.847	00.3654
0024	00.3646	01.572	00.4988	01.7280	00.04038	05.841	00.3653
0025	00.3640	01.572	00.4981	01.7290	00.04161	05.835	00.3652
0026	00.3634	01.571	00.4975	01.7300	00.04284	05.828	00.3651
0027	00.3628	01.571	00.4968	01.7310	00.04407	05.822	00.3650
0028	00.3623	01.570	00.4962	01.7320	00.04530	05.815	00.3649
0029	00.3617	01.570	00.4956	01.7330	00.04652	05.809	00.3648
0030	00.3612	01.569	00.4950	01.7340	00.04774	05.803	00.3647
0031	00.3606	01.569	00.4945	01.7350	00.04896	05.796	00.3645
0032	00.3601	01.568	00.4939	01.7360	00.05018	05.790	00.3644
0033	00.3596	01.568	00.4934	01.7370	00.05140	05.784	00.3643
0034	00.3591	01.567	00.4928	01.7380	00.05261	05.777	00.3642
0035	00.3586	01.567	00.4923	01.7390	00.05382	05.771	00.3641
0036	00.3582	01.567	00.4918	01.7400	00.05503	05.765	00.3639
0037	00.3577	01.566	00.4914	01.7410	00.05624	05.758	00.3638
0038	00.3572	01.566	00.4909	01.7420	00.05745	05.752	00.3637
0039	00.3568	01.566	00.4904	01.7430	00.05866	05.746	00.3636
0040	00.3563	01.565	00.4900	01.7440	00.05986	05.739	00.3634
0041	00.3559	01.565	00.4895	01.7440	00.06107	05.733	00.3633
0042	00.3554	01.564	00.4891	01.7450	00.06227	05.727	00.3632
0043	00.3550	01.564	00.4887	01.7460	00.06347	05.721	00.3631
0044	00.3546	01.564	00.4883	01.7470	00.06467	05.714	00.3629
0045	00.3542	01.563	00.4879	01.7470	00.06587	05.708	00.3628
0046	00.3537	01.563	00.4875	01.7480	00.06707	05.702	00.3627
0047	00.3533	01.563	00.4871	01.7490	00.06826	05.696	00.3625
0048	00.3529	01.562	00.4867	01.7500	00.06945	05.689	00.3624
0049	00.3525	01.562	00.4863	01.7500	00.07065	05.683	00.3623
0050	00.3521	01.562	00.4860	01.7510	00.07184	05.677	00.3621
0051	00.3518	01.561	00.4856	01.7520	00.07303	05.671	00.3620
0052	00.3514	01.561	00.4853	01.7520	00.07422	05.664	00.3619
0053	00.3510	01.561	00.4849	01.7530	00.07540	05.658	00.3617
0054	00.3506	01.561	00.4846	01.7530	00.07659	05.652	00.3616
0055	00.3502	01.560	00.4843	01.7540	00.07777	05.646	00.3615
0056	00.3499	01.560	00.4839	01.7550	00.07896	05.640	00.3613
0057	00.3495	01.560	00.4836	01.7550	00.08014	05.634	00.3612
0058	00.3491	01.559	00.4833	01.7560	00.08132	05.627	00.3610
0059	00.3488	01.559	00.4830	01.7570	00.08250	05.621	00.3609
0060	00.3484	01.559	00.4827	01.7570	00.08368	05.615	00.3608
0061	00.3481	01.559	00.4824	01.7580	00.08486	05.609	00.3606
0062	00.3477	01.558	00.4821	01.7580	00.08603	05.603	00.3605
0063	00.3474	01.558	00.4818	01.7590	00.08721	05.597	00.3603
0064	00.3471	01.558	00.4815	01.7590	00.08838	05.591	00.3602
0065	00.3467	01.558	00.4812	01.7600	00.08955	05.584	00.3601
0066	00.3464	01.557	00.4810	01.7600	00.09073	05.578	00.3599
0067	00.3460	01.557	00.4807	01.7610	00.09190	05.572	00.3598
0068	00.3457	01.557	00.4804	01.7610	00.09307	05.566	00.3596
0069	00.3454	01.557	00.4802	01.7620	00.09423	05.560	00.3595
0070	00.3451	01.556	00.4799	01.7620	00.09540	05.554	00.3593
0071	00.3447	01.556	00.4797	01.7630	00.09657	05.548	00.3592
0072	00.3444	01.556	00.4794	01.7630	00.09773	05.542	00.3590
0073	00.3441	01.556	00.4792	01.7640	00.09890	05.536	00.3589
0074	00.3438	01.555	00.4789	01.7640	00.10000	05.530	00.3587
0075	00.3435	01.555	00.4787	01.7650	00.10120	05.524	00.3586
0076	00.3432	01.555	00.4784	01.7650	00.10230	05.518	00.3584
0077	00.3428	01.555	00.4782	01.7660	00.10350	05.512	00.3583
0078	00.3425	01.554	00.4780	01.7660	00.10470	05.505	00.3581
0079	00.3422	01.554	00.4778	01.7670	00.10580	05.499	00.3580
0080	00.3419	01.554	00.4775	01.7670	00.10700	05.493	00.3578
0081	00.3416	01.554	00.4773	01.7680	00.10810	05.487	00.3577
0082	00.3413	01.553	00.4771	01.7680	00.10930	05.481	00.3575
0083	00.3410	01.553	00.4769	01.7690	00.11040	05.475	00.3574
0084	00.3407	01.553	00.4767	01.7690	00.11160	05.469	00.3572
0085	00.3404	01.553	00.4765	01.7690	00.11270	05.463	00.3570
0086	00.3401	01.552	00.4763	01.7700	00.11390	05.457	00.3569
0087	00.3398	01.552	00.4761	01.7700	00.11500	05.451	00.3567
0088	00.3395	01.552	00.4759	01.7710	00.11620	05.445	00.3566
0089	00.3393	01.552	00.4757	01.7710	00.11730	05.439	00.3564
0090	00.3390	01.552	00.4755	01.7720	00.11850	05.433	00.3563
0091	00.3387	01.551	00.4753	01.7720	00.11960	05.427	00.3561
0092	00.3384	01.551	00.4751	01.7720	00.12080	05.421	00.3559
0093	00.3381	01.551	00.4749	01.7730	00.12190	05.415	00.3558
0094	00.3378	01.551	00.4747	01.7730	00.12310	05.409	00.3556
0095	00.3375	01.551	00.4745	01.7740	00.12420	05.404	00.3555
0096	00.3373	01.550	00.4744	01.7740	00.12530	05.398	00.3553
0097	00.3370	01.550	00.4742	01.7740	00.12650	05.392	00.3551
0098	00.3367	01.550	00.4740	01.7750	00.12760	05.386	00.3550
0099	00.3364	01.550	00.4738	01.7750	00.12880	05.380	00.3548
0100	00.3362	01.549	00.4737	01.7750	00.12990	05.374	00.3546
AVG	00.35464	01,5645	00.48983	01,7452	,	,	,

Example Number 12

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	5.60	0.500	3.80	0.010	5.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.3641	01.579	00.5354	01.6850	00.01197	04.993	00.3400
0002	00.3613	01.576	00.5312	01.6910	00.01392	04.987	00.3399
0003	00.3589	01.574	00.5278	01.6970	00.01586	04.980	00.3398
0004	00.3567	01.572	00.5249	01.7020	00.01779	04.974	00.3397
0005	00.3549	01.570	00.5223	01.7060	00.01971	04.968	00.3395
0006	00.3532	01.569	00.5200	01.7100	00.02163	04.962	00.3394
0007	00.3516	01.567	00.5179	01.7130	00.02353	04.955	00.3392
0008	00.3502	01.566	00.5160	01.7170	00.02542	04.949	00.3391
0009	00.3488	01.565	00.5143	01.7190	00.02731	04.943	00.3389
0010	00.3476	01.564	00.5127	01.7220	00.02919	04.937	00.3388
0011	00.3464	01.563	00.5113	01.7250	00.03107	04.931	00.3386
0012	00.3453	01.562	00.5099	01.7270	00.03294	04.925	00.3384
0013	00.3443	01.561	00.5086	01.7290	00.03480	04.919	00.3382
0014	00.3433	01.560	00.5074	01.7310	00.03666	04.913	00.3381
0015	00.3423	01.559	00.5063	01.7330	00.03851	04.907	00.3379
0016	00.3414	01.558	00.5052	01.7350	00.04036	04.901	00.3377
0017	00.3405	01.558	00.5042	01.7370	00.04220	04.894	00.3375
0018	00.3397	01.557	00.5032	01.7390	00.04404	04.889	00.3373
0019	00.3389	01.556	00.5023	01.7400	00.04587	04.883	00.3371
0020	00.3381	01.556	00.5014	01.7420	00.04770	04.877	00.3369
0021	00.3374	01.555	00.5006	01.7430	00.04953	04.871	00.3368
0022	00.3366	01.554	00.4998	01.7450	00.05135	04.865	00.3366
0023	00.3359	01.554	00.4990	01.7460	00.05317	04.859	00.3364
0024	00.3352	01.553	00.4982	01.7470	00.05498	04.853	00.3362
0025	00.3345	01.552	00.4975	01.7490	00.05679	04.047	00.3360
0026	00.3339	01.552	00.4968	01.7500	00.05860	04.841	00.3358
0027	00.3333	01.551	00.4962	01.7510	00.06040	04.835	00.3356
0028	00.3326	01.551	00.4955	01.7520	00.06220	04.829	00.3354
0029	00.3320	01.550	00.4949	01.7530	00.06400	04.823	00.3352
0030	00.3314	01.550	00.4943	01.7540	00.06579	04.818	00.3350
0031	00.3308	01.549	00.4938	01.7560	00.06759	04.812	00.3348
0032	00.3303	01.549	00.4932	01.7570	00.06937	04.806	00.3346
0033	00.3297	01.548	00.4927	01.7580	00.07116	04.800	00.3344
0034	00.3292	01.548	00.4921	01.7590	00.07294	04.794	00.3342
0035	00.3286	01.547	00.4916	01.7600	00.07472	04.788	00.3340
0036	00.3281	01.547	00.4911	01.7600	00.07649	04.783	00.3338
0037	00.3276	01.547	00.4907	01.7610	00.07827	04.777	00.3336
0038	00.3270	01.546	00.4902	01.7620	00.08004	04.771	00.3334
0039	00.3265	01.546	00.4897	01.7630	00.08180	04.765	00.3331
0040	00.3260	01.545	00.4893	01.7640	00.08357	04.760	00.3329
0041	00.3256	01.545	00.4889	01.7650	00.08533	04.754	00.3327
0042	00.3251	01.545	00.4884	01.7660	00.08709	04.748	00.3325
0043	00.3246	01.544	00.4880	01.7660	00.08884	04.742	00.3323
0044	00.3241	01.544	00.4876	01.7670	00.09060	04.737	00.3321
0045	00.3237	01.543	00.4872	01.7680	00.09235	04.731	00.3319
0046	00.3232	01.543	00.4869	01.7690	00.09410	04.725	00.3317
0047	00.3228	01.543	00.4865	01.7700	00.09585	04.720	00.3315
0048	00.3223	01.542	00.4861	01.7700	00.09759	04.714	00.3313
0049	00.3219	01.542	00.4858	01.7710	00.09933	04.708	00.3310
0050	00.3214	01.542	00.4854	01.7720	00.10100	04.703	00.3308
0051	00.3210	01.541	00.4851	01.7720	00.10280	04.697	00.3306
0052	00.3206	01.541	00.4848	01.7730	00.10450	04.691	00.3304
0053	00.3202	01.541	00.4844	01.7740	00.10620	04.686	00.3302
0054	00.3197	01.540	00.4841	01.7740	00.10800	04.680	00.3300
0055	00.3193	01.540	00.4838	01.7750	00.10970	04.674	00.3298
0056	00.3189	01.540	00.4835	01.7760	00.11140	04.669	00.3295
0057	00.3185	01.539	00.4832	01.7760	00.11310	04.663	00.3293
0058	00.3181	01.539	00.4829	01.7770	00.11490	04.657	00.3291
0059	00.3177	01.539	00.4826	01.7770	00.11660	04.652	00.3289
0060	00.3173	01.538	00.4824	01.7780	00.11830	04.646	00.3287
0061	00.3169	01.538	00.4821	01.7790	00.12000	04.641	00.3284
0062	00.3165	01.538	00.4818	01.7790	00.12170	04.635	00.3282
0063	00.3162	01.537	00.4816	01.7800	00.12340	04.629	00.3280
0064	00.3158	01.537	00.4813	01.7800	00.12510	04.624	00.3278
0065	00.3154	01.537	00.4811	01.7810	00.12690	04.618	00.3276
0066	00.3150	01.536	00.4808	01.7810	00.12860	04.613	00.3273
0067	00.3147	01.536	00.4806	01.7820	00.13030	04.607	00.3271
0068	00.3143	01.536	00.4803	01.7830	00.13200	04.602	00.3269
0069	00.3139	01.536	00.4801	01.7830	00.13370	04.596	00.3267
0070	00.3136	01.535	00.4799	01.7840	00.13540	04.591	00.3265
0071	00.3132	01.535	00.4796	01.7840	00.13710	04.585	00.3262
0072	00.3128	01.535	00.4794	01.7850	00.13870	04.580	00.3260
0073	00.3125	01.534	00.4792	01.7850	00.14040	04.574	00.3258
0074	00.3121	01.534	00.4790	01.7860	00.14210	04.569	00.3256
0075	00.3118	01.534	00.4788	01.7860	00.14380	04.563	00.3253
0076	00.3114	01.534	00.4786	01.7870	00.14550	04.558	00.3251
0077	00.3111	01.533	00.4784	01.7870	00.14720	04.552	00.3249
0078	00.3107	01.533	00.4782	01.7870	00.14890	04.547	00.3247
0079	00.3104	01.533	00.4780	01.7880	00.15050	04.541	00.3244
0080	00.3100	01.532	00.4778	01.7880	00.15220	04.536	00.3242
0081	00.3097	01.532	00.4776	01.7890	00.15390	04.530	00.3240
0082	00.3094	01.532	00.4774	01.7890	00.15560	04.525	00.3237
0083	00.3090	01.532	00.4772	01.7900	00.15720	04.519	00.3235
0084	00.3087	01.531	00.4771	01.7900	00.15890	04.514	00.3233
0085	00.3084	01.531	00.4769	01.7910	00.16060	04.508	00.3231
0086	00.3080	01.531	00.4767	01.7910	00.16230	04.503	00.3228
0087	00.3077	01.531	00.4765	01.7910	00.16390	04.497	00.3226
0088	00.3074	01.530	00.4764	01.7920	00.16560	04.492	00.3224
0089	00.3071	01.530	00.4762	01.7920	00.16720	04.487	00.3221
0090	00.3067	01.530	00.4760	01.7930	00.16890	04.481	00.3219
0091	00.3064	01.530	00.4759	01.7930	00.17060	04.476	00.3217
0092	00.3061	01.529	00.4757	01.7940	00.17220	04.470	00.3214
0093	00.3058	01.529	00.4756	01.7940	00.17390	04.465	00.3212
0094	00.3055	01.529	00.4754	01.7940	00.17550	04.460	00.3210
0095	00.3051	01.529	00.4753	01.7950	00.17720	04.454	00.3207
0096	00.3048	01.528	00.4751	01.7950	00.17880	04.449	00.3205
0097	00.3045	01.528	00.4750	01.7960	00.18050	04.444	00.3203
0098	00.3042	01.528	00.4748	01.7960	00.18210	04.438	00.3200
0099	00.3039	01.528	00.4747	01.7960	00.18380	04.433	00.3198
0100	00.3036	01.527	00.4746	01.7970	00.18540	04.427	00.3196
AVG	00.32425	01.5446	00.48998	01.7650	,	,	,

Example Number 13

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	5.60	0.500	3.80	0.010	6.40
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.3950	01.596	00.5296	01.6730	00.01213	06.393	00.3734
0002	00.3921	01.593	00.5250	01.6800	00.01426	06.386	00.3734
0003	00.3895	01.591	00.5214	01.6860	00.01636	06.379	00.3735
0004	00.3872	01.589	00.5184	01.6920	00.01846	06.372	00.3735
0005	00.3852	01.587	00.5157	01.6960	00.02054	06.365	00.3735
0006	00.3834	01.585	00.5133	01.7000	00.02262	06.358	00.3735
0007	00.3818	01.584	00.5111	01.7040	00.02469	06.352	00.3735
0008	00.3804	01.583	00.5092	01.7070	00.02674	06.345	00.3734
0009	00.3790	01.581	00.5074	01.7100	00.02879	06.338	00.3734
0010	00.3777	01.580	00.5057	01.7130	00.03084	06.332	00.3734
0011	00.3766	01.579	00.5042	01.7150	00.03288	06.325	00.3733
0012	00.3755	01.578	00.5028	01.7180	00.03491	06.318	00.3733
0013	00.3744	01.577	00.5014	01.7200	00.03693	06.312	00.3733
0014	00.3734	01.577	00.5002	01.7220	00.03896	06.305	00.3732
0015	00.3725	01.576	00.4990	01.7240	00.04097	06.299	00.3732
0016	00.3716	01.575	00.4978	01.7260	00.04298	06.292	00.3731
0017	00.3707	01.574	00.4968	01.7280	00.04499	06.285	00.3731
0018	00.3699	01.573	00.4957	01.7290	00.04699	06.279	00.3730
0019	00.3692	01.573	00.4948	01.7310	00.04899	06.272	00.3730
0020	00.3684	01.572	00.4938	01.7330	00.05098	06.266	00.3729
0021	00.3677	01.572	00.4929	01.7340	00.05297	06.259	00.3729
0022	00.3670	01.571	00.4921	01.7360	00.05496	06.253	00.3728
0023	00.3663	01.570	00.4912	01.7370	00.05694	06.246	00.3727
0024	00.3656	01.570	00.4904	01.7380	00.05892	06.240	00.3727
0025	00.3650	01.569	00.4897	01.7400	00.06090	06.234	00.3726
0026	00.3644	01.569	00.4889	01.7410	00.06287	06.227	00.3726
0027	00.3638	01.568	00.4882	01.7420	00.06484	06.221	00.3725
0028	00.3632	01.568	00.4875	01.7430	00.06680	06.214	00.3724
0029	00.3626	01.567	00.4868	01.7450	00.06876	06.208	00.3724
0030	00.3621	01.567	00.4862	01.7460	00.07072	06.201	00.3723
0031	00.3616	01.566	00.4855	01.7470	00.07268	06.195	00.3722
0032	00.3610	01.566	00.4849	01.7480	00.07463	06.189	00.3721
0033	00.3605	01.565	00.4843	01.7490	00.07659	06.182	00.3721
0034	00.3600	01.565	00.4837	01.7500	00.07853	06.176	00.3720
0035	00.3595	01.565	00.4832	01.7510	00.08048	06.170	00.3719
0036	00.3590	01.564	00.4826	01.7520	00.08242	06.163	00.3718
0037	00.3586	01.564	00.4821	01.7530	00.08436	06.157	00.3718
0038	00.3581	01.564	00.4816	01.7540	00.08630	06.151	00.3717
0039	00.3576	01.563	00.4811	01.7540	00.08824	06.144	00.3716
0040	00.3572	01.563	00.4806	01.7550	00.09017	06.138	00.3715
0041	00.3567	01.562	00.4801	01.7560	00.09210	06.132	00.3714
0042	00.3563	01.562	00.4796	01.7570	00.09403	06.126	00.3714
0043	00.3559	01.562	00.4791	01.7580	00.09596	06.119	00.3713
0044	00.3555	01.561	00.4787	01.7590	00.09788	06.113	00.3712
0045	00.3551	01.561	00.4782	01.7590	00.09980	06.107	00.3711
0046	00.3546	01.561	00.4778	01.7600	00.10170	06.100	00.3710
0047	00.3542	01.560	00.4773	01.7610	00.10360	06.094	00.3709
0048	00.3539	01.560	00.4769	01.7620	00.10550	06.088	00.3709
0049	00.3535	01.560	00.4765	01.7620	00.10740	06.082	00.3708
0050	00.3531	01.559	00.4761	01.7630	00.10930	06.075	00.3707
0051	00.3527	01.559	00.4757	01.7640	00.11120	06.069	00.3706
0052	00.3523	01.559	00.4753	01.7640	00.11310	06.063	00.3705
0053	00.3520	01.559	00.4749	01.7650	00.11510	06.057	00.3704
0054	00.3516	01.558	00.4746	01.7660	00.11700	06.051	00.3703
0055	00.3512	01.558	00.4742	01.7660	00.11890	06.044	00.3702
0056	00.3509	01.558	00.4738	01.7670	00.12080	06.038	00.3701
0057	00.3505	01.557	00.4735	01.7680	00.12270	06.032	00.3700
0058	00.3502	01.557	00.4731	01.7680	00.12450	06.026	00.3699
0059	00.3498	01.557	00.4728	01.7690	00.12640	06.020	00.3698
0060	00.3495	01.557	00.4724	01.7700	00.12830	06.014	00.3697
0061	00.3492	01.556	00.4721	01.7700	00.13020	06.007	00.3696
0062	00.3488	01.556	00.4718	01.7710	00.13210	06.001	00.3695
0063	00.3485	01.556	00.4715	01.7710	00.13400	05.995	00.3695
0064	00.3482	01.556	00.4712	01.7720	00.13590	05.989	00.3694
0065	00.3478	01.555	00.4708	01.7720	00.13780	05.983	00.3693
0066	00.3475	01.555	00.4705	01.7730	00.13960	05.977	00.3691
0067	00.3472	01.555	00.4702	01.7740	00.14150	05.971	00.3690
0068	00.3469	01.555	00.4699	01.7740	00.14340	05.964	00.3689
0069	00.3466	01.554	00.4696	01.7750	00.14530	05.958	00.3688
0070	00.3463	01.554	00.4693	01.7750	00.14710	05.952	00.3687
0071	00.3460	01.554	00.4691	01.7760	00.14900	05.946	00.3686
0072	00.3457	01.554	00.4688	01.7760	00.15090	05.940	00.3685
0073	00.3454	01.553	00.4685	01.7770	00.15280	05.934	00.3684
0074	00.3451	01.553	00.4682	01.7770	00.15460	05.928	00.3683
0075	00.3448	01.553	00.4680	01.7780	00.15650	05.922	00.3682
0076	00.3445	01.553	00.4677	01.7780	00.15840	05.916	00.3681
0077	00.3442	01.553	00.4674	01.7790	00.16020	05.910	00.3680
0078	00.3439	01.552	00.4672	01.7790	00.16210	05.903	00.3679
0079	00.3436	01.552	00.4669	01.7800	00.16390	05.897	00.3678
0080	00.3433	01.552	00.4667	01.7800	00.16580	05.891	00.3677
0081	00.3430	01.552	00.4664	01.7810	00.16770	05.885	00.3676
0082	00.3427	01.551	00.4662	01.7810	00.16950	05.879	00.3674
0083	00.3424	01.551	00.4659	01.7810	00.17140	05.873	00.3673
0084	00.3422	01.551	00.4657	01.7820	00.17320	05.867	00.3672
0085	00.3419	01.551	00.4655	01.7820	00.17510	05.861	00.3671
0086	00.3416	01.551	00.4652	01.7830	00.17690	05.855	00.3670
0087	00.3413	01.550	00.4650	01.7830	00.17880	05.849	00.3669
0088	00.3411	01.550	00.4648	01.7840	00.18060	05.843	00.3668
0089	00.3408	01.550	00.4646	01.7840	00.18250	05.837	00.3666
0090	00.3405	01.550	00.4643	01.7850	00.18430	05.831	00.3665
0091	00.3403	01.550	00.4641	01.7850	00.18610	05.825	00.3664
0092	00.3400	01.549	00.4639	01.7850	00.18800	05.819	00.3663
0093	00.3397	01.549	00.4637	01.7860	00.18980	05.813	00.3662
0094	00.3395	01.549	00.4635	01.7860	00.19170	05.807	00.3661
0095	00.3392	01.549	00.4633	01.7870	00.19350	05.801	00.3659
0096	00.3389	01.549	00.4631	01.7870	00.19530	05.795	00.3658
0097	00.3387	01.548	00.4629	01.7870	00.19720	05.789	00.3657
0098	00.3384	01.548	00.4627	01.7880	00.19900	05.783	00.3656
0099	00.3382	01.548	00.4625	01.7880	00.20080	05.777	00.3654
0100	00.3379	01.548	00.4623	01.7890	00.20260	05.771	00.3653
AVG	00.3561	01.5627	00.48063	01.7563	,	,	,

Example Number 14

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	5.60	0.500	3.80	0.005	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.3996	01.603	00.5445	01.6510	00.007162	05.992	00.3670
0002	00.3938	01.598	00.5366	01.6640	00.009294	05.985	00.3670
0003	00.3896	01.594	00.5307	01.6740	00.01140	05.979	00.3671
0004	00.3863	01.591	00.5262	01.6810	00.01349	05.972	00.3671
0005	00.3836	01.589	00.5224	01.6880	00.01556	05.965	00.3670
0006	00.3812	01.586	00.5192	01.6930	00.01763	05.958	00.3670
0007	00.3791	01.585	00.5165	01.6980	00.01960	05.952	00.3670
0008	00.3773	01.583	00.5140	01.7020	00.02172	05.945	00.3669
0009	00.3756	01.581	00.5118	01.7050	00.02375	05.938	00.3669
0010	00.3741	01.580	00.5098	01.7090	00.02578	05.932	00.3668
0011	00.3727	01.579	00.5080	01.7120	00.02780	05.925	00.3667
0012	00.3714	01.578	00.5063	01.7150	00.02981	05.919	00.3667
0013	00.3702	01.577	00.5048	01.7170	00.03181	05.912	00.3666
0014	00.3691	01.576	00.5033	01.7200	00.03381	05.906	00.3665
0015	00.3680	01.575	00.5020	01.7220	00.03580	05.899	00.3664
0016	00.3670	01.574	00.5007	01.7240	00.03779	05.893	00.3663
0017	00.3660	01.573	00.4995	01.7260	00.03977	05.886	00.3662
0018	00.3651	01.572	00.4984	01.7280	00.04174	05.880	00.3662
0019	00.3642	01.571	00.4973	01.7300	00.04371	05.873	00.3661
0020	00.3634	01.571	00.4963	01.7320	00.04568	05.867	00.3660
0021	00.3626	01.570	00.4953	01.7330	00.04764	05.860	00.3659
0022	00.3618	01.569	00.4944	01.7350	00.04960	05.854	00.3658
0023	00.3611	01.569	00.4935	01.7360	00.05155	05.848	00.3657
0024	00.3603	01.568	00.4927	01.7380	00.05350	05.841	00.3656
0025	00.3596	01.567	00.4918	01.7390	00.05545	05.835	00.3655
0026	00.3590	01.567	00.4910	01.7410	00.05739	05.829	00.3654
0027	00.3583	01.566	00.4903	01.7420	00.05933	05.822	00.3653
0028	00.3577	01.566	00.4895	01.7430	00.06127	05.816	00.3652
0029	00.3570	01.565	00.4888	01.7450	00.06320	05.810	00.3650
0030	00.3564	01.565	00.4882	01.7460	00.06513	05.803	00.3649
0031	00.3558	01.564	00.4875	01.7470	00.06706	05.797	00.3648
0032	00.3553	01.564	00.4869	01.7480	00.06898	05.791	00.3647
0033	00.3547	01.563	00.4862	01.7490	00.07090	05.785	00.3646
0034	00.3542	01.563	00.4856	01.7500	00.07281	05.778	00.3645
0035	00.3536	01.562	00.4850	01.7510	00.07473	05.772	00.3644
0036	00.3531	01.562	00.4845	01.7520	00.07664	05.766	00.3643
0037	00.3526	01.562	00.4839	01.7530	00.07855	05.760	00.3641
0038	00.3521	01.561	00.4834	01.7540	00.08045	05.753	00.3640
0039	00.3516	01.561	00.4829	01.7550	00.08235	05.747	00.3639
0040	00.3511	01.560	00.4824	01.7560	00.08426	05.741	00.3638
0041	00.3506	01.560	00.4819	01.7570	00.08615	05.735	00.3637
0042	00.3501	01.560	00.4814	01.7580	00.08805	05.729	00.3635
0043	00.3497	01.559	00.4809	01.7590	00.08994	05.723	00.3634
0044	00.3492	01.559	00.4804	01.7590	00.09183	05.716	00.3633
0045	00.3488	01.558	00.4800	01.7600	00.09372	05.710	00.3632
0046	00.3483	01.558	00.4795	01.7610	00.09560	05.704	00.3630
0047	00.3479	01.558	00.4791	01.7620	00.09749	05.698	00.3629
0048	00.3475	01.557	00.4787	01.7630	00.09937	05.692	00.3628
0049	00.3471	01.557	00.4783	01.7630	00.10120	05.686	00.3627
0050	00.3466	01.557	00.4779	01.7640	00.10310	05.680	00.3625
0051	00.3462	01.556	00.4775	01.7650	00.10490	05.673	00.3624
0052	00.3458	01.556	00.4771	01.7660	00.10680	05.667	00.3623
0053	00.3454	01.556	00.4767	01.7660	00.10870	05.661	00.3621
0054	00.3450	01.555	00.4763	01.7670	00.11060	05.655	00.3620
0055	00.3446	01.555	00.4760	01.7680	00.11240	05.649	00.3619
0056	00.3443	01.555	00.4756	01.7680	00.11430	05.643	00.3617
0057	00.3439	01.554	00.4753	01.7690	00.11610	05.637	00.3616
0058	00.3435	01.554	00.4749	01.7700	00.11800	05.631	00.3615
0059	00.3431	01.554	00.4746	01.7700	00.11990	05.625	00.3613
0060	00.3428	01.554	00.4742	01.7710	00.12170	05.619	00.3612
0061	00.3424	01.553	00.4739	01.7710	00.12360	05.613	00.3611
0062	00.3420	01.553	00.4736	01.7720	00.12540	05.607	00.3609
0063	00.3417	01.553	00.4733	01.7730	00.12730	05.601	00.3608
0064	00.3413	01.552	00.4730	01.7730	00.12910	05.595	00.3607
0065	00.3410	01.552	00.4727	01.7740	00.13100	05.589	00.3605
0066	00.3406	01.552	00.4724	01.7740	00.13280	05.583	00.3604
0067	00.3403	01.552	00.4721	01.7750	00.13460	05.577	00.3602
0068	00.3399	01.551	00.4718	01.7750	00.13650	05.571	00.3601
0069	00.3396	01.551	00.4715	01.7760	00.13830	05.565	00.3600
0070	00.3393	01.551	00.4712	01.7770	00.14020	05.559	00.3598
0071	00.3389	01.551	00.4709	01.7770	00.14200	05.553	00.3597
0072	00.3386	01.550	00.4707	01.7780	00.14380	05.547	00.3595
0073	00.3383	01.550	00.4704	01.7780	00.14570	05.541	00.3594
0074	00.3380	01.550	00.4701	01.7790	00.14750	05.535	00.3592
0075	00.3376	01.550	00.4699	01.7790	00.14930	05.529	00.3591
0076	00.3373	01.549	00.4696	01.7800	00.15110	05.523	00.3590
0077	00.3370	01.549	00.4694	01.7800	00.15300	05.517	00.3588
0078	00.3367	01.549	00.4691	01.7810	00.15480	05.511	00.3587
0079	00.3364	01.549	00.4689	01.7810	00.15660	05.505	00.3585
0080	00.3361	01.548	00.4686	01.7820	00.15840	05.499	00.3584
0081	00.3358	01.548	00.4684	01.7820	00.16020	05.493	00.3582
0082	00.3354	01.548	00.4682	01.7830	00.16210	05.487	00.3581
0083	00.3351	01.548	00.4679	01.7830	00.16390	05.481	00.3579
0084	00.3348	01.547	00.4677	01.7840	00.16570	05.475	00.3578
0085	00.3345	01.547	00.4675	01.7840	00.16750	05.470	00.3576
0086	00.3342	01.547	00.4673	01.7840	00.16930	05.464	00.3575
0087	00.3339	01.547	00.4671	01.7850	00.17110	05.458	00.3573
0088	00.3336	01.547	00.4668	01.7850	00.17290	05.452	00.3572
0089	00.3334	01.546	00.4666	01.7860	00.17470	05.446	00.3570
0090	00.3331	01.546	00.4664	01.7860	00.17650	05.440	00.3569
0091	00.3328	01.546	00.4662	01.7870	00.17830	05.434	00.3567
0092	00.3325	01.546	00.4660	01.7870	00.18010	05.428	00.3565
0093	00.3322	01.545	00.4658	01.7870	00.18190	05.422	00.3564
0094	00.3319	01.545	00.4656	01.7880	00.18370	05.417	00.3562
0095	00.3316	01.545	00.4654	01.7880	00.18550	05.411	00.3561
0096	00.3313	01.545	00.4652	01.7890	00.18730	05.405	00.3559
0097	00.3311	01.545	00.4650	01.7890	00.18910	05.399	00.3558
0098	00.3308	01.544	00.4648	01.7890	00.19090	05.393	00.3556
0099	00.3305	01.544	00.4647	01.7900	00.19270	05.387	00.3554
0100	00.3302	01.544	00.4645	01.7900	00.19450	05.382	00.3553
AVG	00.35022	01,5604	00.48323	01,7559	,	,	,

Example Number 15

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	5.60	0.500	3.80	0.020	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.3774	01.583	00.5141	01.7020	00.02204	05.993	00.3679
0002	00.3763	01.582	00.5114	01.7060	00.02407	05.986	00.3678
0003	00.3748	01.580	00.5095	01.7090	00.02610	05.980	00.3677
0004	00.3734	01.579	00.5077	01.7120	00.02812	05.973	00.3677
0005	00.3721	01.578	00.5060	01.7150	00.03014	05.966	00.3676
0006	00.3709	01.577	00.5045	01.7170	00.03214	05.960	00.3675
0007	00.3698	01.576	00.5031	01.7200	00.03415	05.953	00.3674
0008	00.3687	01.575	00.5017	01.7220	00.03614	05.947	00.3674
0009	00.3677	01.574	00.5005	01.7240	00.03813	05.940	00.3673
0010	00.3668	01.573	00.4993	01.7260	00.04012	05.934	00.3672
0011	00.3659	01.572	00.4981	01.7280	00.04210	05.927	00.3671
0012	00.3650	01.572	00.4971	01.7300	00.04407	05.921	00.3670
0013	00.3642	01.571	00.4960	01.7320	00.04604	05.915	00.3669
0014	00.3634	01.570	00.4951	01.7330	00.04801	05.908	00.3669
0015	00.3626	01.570	00.4942	01.7350	00.04997	05.902	00.3668
0016	00.3619	01.569	00.4933	01.7360	00.05193	05.895	00.3667
0017	00.3611	01.568	00.4924	01.7380	00.05388	05.889	00.3666
0018	00.3604	01.568	00.4916	01.7390	00.05584	05.883	00.3665
0019	00.3598	01.567	00.4908	01.7410	00.05778	05.876	00.3664
0020	00.3591	01.567	00.4901	01.7420	00.05973	05.870	00.3663
0021	00.3585	01.566	00.4893	01.7430	00.06167	05.864	00.3662
0022	00.3579	01.566	00.4886	01.7440	00.06360	05.857	00.3661
0023	00.3573	01.565	00.4879	01.7460	00.06554	05.851	00.3660
0024	00.3567	01.565	00.4873	01.7470	00.06747	05.845	00.3658
0025	00.3561	01.564	00.4866	01.7480	00.06939	05.838	00.3657
0026	00.3555	01.564	00.4860	01.7490	00.07132	05.832	00.3656
0027	00.3550	01.563	00.4854	01.7500	00.07324	05.826	00.3655
0028	00.3545	01.563	00.4848	01.7510	00.07516	05.820	00.3654
0029	00.3539	01.562	00.4843	01.7520	00.07707	05.813	00.3653
0030	00.3534	01.562	00.4837	01.7530	00.07899	05.807	00.3652
0031	00.3529	01.562	00.4832	01.7540	00.08090	05.801	00.3651
0032	00.3524	01.561	00.4826	01.7550	00.08280	05.795	00.3650
0033	00.3520	01.561	00.4821	01.7560	00.08471	05.789	00.3648
0034	00.3515	01.560	00.4816	01.7570	00.08661	05.782	00.3647
0035	00.3510	01.560	00.4811	01.7580	00.08851	05.776	00.3646
0036	00.3506	01.560	00.4807	01.7580	00.09041	05.770	00.3645
0037	00.3501	01.559	00.4802	01.7590	00.09230	05.764	00.3644
0038	00.3497	01.559	00.4798	01.7600	00.09419	05.758	00.3643
0039	00.3492	01.558	00.4793	01.7610	00.09608	05.751	00.3641
0040	00.3488	01.558	00.4789	01.7620	00.09797	05.745	00.3640
0041	00.3484	01.558	00.4785	01.7620	00.09986	05.739	00.3639
0042	00.3479	01.557	00.4780	01.7630	00.10170	05.733	00.3638
0043	00.3475	01.557	00.4776	01.7640	00.10360	05.727	00.3636
0044	00.3471	01.557	00.4772	01.7650	00.10550	05.721	00.3635
0045	00.3467	01.556	00.4769	01.7650	00.10730	05.715	00.3634
0046	00.3463	01.556	00.4765	01.7660	00.10920	05.708	00.3633
0047	00.3459	01.556	00.4761	01.7670	00.11110	05.702	00.3631
0048	00.3456	01.556	00.4757	01.7670	00.11290	05.696	00.3630
0049	00.3452	01.555	00.4754	01.7680	00.11480	05.690	00.3629
0050	00.3448	01.555	00.4750	01.7690	00.11670	05.684	00.3628
0051	00.3444	01.555	00.4747	01.7690	00.11850	05.678	00.3626
0052	00.3440	01.554	00.4743	01.7700	00.12040	05.672	00.3625
0053	00.3437	01.554	00.4740	01.7710	00.12230	05.666	00.3624
0054	00.3433	01.554	00.4737	01.7710	00.12410	05.660	00.3622
0055	00.3430	01.553	00.4733	01.7720	00.12600	05.654	00.3621
0056	00.3426	01.553	00.4730	01.7720	00.12780	05.648	00.3620
0057	00.3423	01.553	00.4727	01.7730	00.12970	05.642	00.3618
0058	00.3419	01.553	00.4724	01.7740	00.13150	05.636	00.3617
0059	00.3416	01.552	00.4721	01.7740	00.13340	05.630	00.3616
0060	00.3412	01.552	00.4718	01.7750	00.13520	05.624	00.3614
0061	00.3409	01.552	00.4715	01.7750	00.13710	05.618	00.3613
0062	00.3405	01.552	00.4712	01.7760	00.13890	05.612	00.3612
0063	00.3402	01.551	00.4710	01.7760	00.14080	05.606	00.3610
0064	00.3399	01.551	00.4707	01.7770	00.14260	05.600	00.3609
0065	00.3396	01.551	00.4704	01.7770	00.14440	05.594	00.3607
0066	00.3392	01.551	00.4701	01.7780	00.14630	05.588	00.3606
0067	00.3389	01.550	00.4699	01.7780	00.14810	05.582	00.3605
0068	00.3386	01.550	00.4696	01.7790	00.14990	05.576	00.3603
0069	00.3383	01.550	00.4694	01.7790	00.15180	05.570	00.3602
0070	00.3380	01.550	00.4691	01.7800	00.15360	05.564	00.3600
0071	00.3376	01.549	00.4689	01.7800	00.15540	05.558	00.3599
0072	00.3373	01.549	00.4686	01.7810	00.15730	05.552	00.3598
0073	00.3370	01.549	00.4684	01.7810	00.15910	05.546	00.3596
0074	00.3367	01.549	00.4681	01.7820	00.16090	05.540	00.3595
0075	00.3364	01.548	00.4679	01.7820	00.16270	05.534	00.3593
0076	00.3361	01.548	00.4677	01.7830	00.16450	05.528	00.3592
0077	00.3358	01.548	00.4674	01.7830	00.16640	05.522	00.3590
0078	00.3355	01.548	00.4672	01.7840	00.16820	05.516	00.3589
0079	00.3352	01.547	00.4670	01.7840	00.17000	05.510	00.3587
0080	00.3349	01.547	00.4668	01.7850	00.17180	05.504	00.3586
0081	00.3346	01.547	00.4665	01.7850	00.17360	05.498	00.3584
0082	00.3343	01.547	00.4663	01.7850	00.17540	05.493	00.3583
0083	00.3341	01.547	00.4661	01.7860	00.17720	05.487	00.3581
0084	00.3338	01.546	00.4659	01.7860	00.17900	05.481	00.3580
0085	00.3335	01.546	00.4657	01.7870	00.18080	05.475	00.3578
0086	00.3332	01.546	00.4655	01.7870	00.18260	05.469	00.3577
0087	00.3329	01.546	00.4653	01.7880	00.18440	05.463	00.3575
0088	00.3326	01.546	00.4651	01.7880	00.18620	05.457	00.3574
0089	00.3323	01.545	00.4649	01.7880	00.18800	05.451	00.3572
0090	00.3321	01.545	00.4647	01.7890	00.18980	05.446	00.3571
0091	00.3318	01.545	00.4645	01.7890	00.19160	05.440	00.3569
0092	00.3315	01.545	00.4643	01.7900	00.19340	05.434	00.3568
0093	00.3312	01.544	00.4642	01.7900	00.19520	05.428	00.3566
0094	00.3310	01.544	00.4640	01.7900	00.19700	05.422	00.3565
0095	00.3307	01.544	00.4638	01.7910	00.19880	05.416	00.3563
0096	00.3304	01.544	00.4636	01.7910	00.20060	05.411	00.3562
0097	00.3301	01.544	00.4634	01.7920	00.20240	05.405	00.3560
0098	00.3299	01.543	00.4633	01.7920	00.20420	05.399	00.3558
0099	00.3296	01.543	00.4631	01.7920	00.20590	05.393	00.3557
0100	00.3293	01.543	00.4629	01.7930	00.20770	05.387	00.3555
AVG	00.34702	01,5574	00.47848	01,7637	,	,	,

Example Number 16

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	5.60	0.500	3.80	0.050	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.3626	01.569	00.4941	01.7360	00.05196	05.993	00.3686
0002	00.3629	01.569	00.4923	01.7370	00.05392	05.987	00.3685
0003	00.3622	01.569	00.4915	01.7380	00.05588	05.980	00.3684
0004	00.3616	01.568	00.4907	01.7400	00.05784	05.974	00.3683
0005	00.3609	01.568	00.4899	01.7410	00.05979	05.968	00.3682
0006	00.3603	01.567	00.4892	01.7420	00.06174	05.961	00.3681
0007	00.3597	01.567	00.4885	01.7440	00.06369	05.955	00.3680
0008	00.3591	01.566	00.4878	01.7450	00.06563	05.949	00.3679
0009	00.3585	01.566	00.4871	01.7460	00.06757	05.942	00.3678
0010	00.3579	01.565	00.4865	01.7470	00.06951	05.936	00.3677
0011	00.3573	01.565	00.4858	01.7480	00.07144	05.930	00.3676
0012	00.3568	01.564	00.4852	01.7490	00.07337	05.923	00.3675
0013	00.3563	01.564	00.4847	01.7500	00.07530	05.917	00.3674
0014	00.3558	01.563	00.4841	01.7510	00.07723	05.911	00.3673
0015	00.3552	01.563	00.4835	01.7520	00.07915	05.904	00.3672
0016	00.3547	01.562	00.4830	01.7530	00.08107	05.898	00.3671
0017	00.3543	01.562	00.4824	01.7540	00.08299	05.892	00.3670
0018	00.3538	01.562	00.4819	01.7550	00.08490	05.886	00.3669
0019	00.3533	01.561	00.4814	01.7560	00.08601	05.879	00.3668
0020	00.3528	01.561	00.4809	01.7570	00.08872	05.873	00.3667
0021	00.3524	01.560	00.4805	01.7580	00.09063	05.867	00.3666
0022	00.3519	01.560	00.4800	01.7590	00.09253	05.861	00.3665
0023	00.3515	01.560	00.4795	01.7590	00.09444	05.855	00.3664
0024	00.3511	01.559	00.4791	01.7600	00.09634	05.848	00.3663
0025	00.3506	01.559	00.4786	01.7610	00.09823	05.842	00.3661
0026	00.3502	01.559	00.4782	01.7620	00.10010	05.836	00.3660
0027	00.3498	01.558	00.4778	01.7620	00.10200	05.830	00.3659
0028	00.3494	01.558	00.4774	01.7630	00.10390	05.824	00.3658
0029	00.3490	01.558	00.4770	01.7640	00.10580	05.818	00.3657
0030	00.3486	01.557	00.4766	01.7650	00.10760	05.811	00.3656
0031	00.3482	01.557	00.4762	01.7650	00.10950	05.805	00.3655
0032	00.3478	01.557	00.4758	01.7660	00.11140	05.799	00.3653
0033	00.3474	01.556	00.4755	01.7670	00.11330	05.793	00.3652
0034	00.3471	01.556	00.4751	01.7670	00.11520	05.787	00.3651
0035	00.3467	01.556	00.4747	01.7680	00.11700	05.781	00.3650
0036	00.3463	01.556	00.4744	01.7690	00.11890	05.775	00.3649
0037	00.3459	01.555	00.4740	01.7690	00.12080	05.769	00.3647
0038	00.3456	01.555	00.4737	01.7700	00.12270	05.762	00.3646
0039	00.3452	01.555	00.4734	01.7710	00.12450	05.756	00.3645
0040	00.3449	01.554	00.4730	01.7710	00.12640	05.750	00.3644
0041	00.3445	01.554	00.4727	01.7720	00.12830	05.744	00.3643
0042	00.3442	01.554	00.4724	01.7720	00.13010	05.738	00.3641
0043	00.3438	01.554	00.4721	01.7730	00.13200	05.732	00.3640
0044	00.3435	01.553	00.4718	01.7730	00.13380	05.726	00.3639
0045	00.3432	01.553	00.4715	01.7740	00.13570	05.720	00.3637
0046	00.3428	01.553	00.4712	01.7750	00.13760	05.714	00.3636
0047	00.3425	01.553	00.4709	01.7750	00.13940	05.708	00.3635
0048	00.3422	01.552	00.4706	01.7760	00.14130	05.702	00.3634
0049	00.3418	01.552	00.4703	01.7760	00.14310	05.696	00.3632
0050	00.3415	01.552	00.4700	01.7770	00.14500	05.690	00.3631
0051	00.3412	01.552	00.4698	01.7770	00.14680	05.684	00.3630
0052	00.3409	01.551	00.4695	01.7780	00.14870	05.678	00.3628
0053	00.3406	01.551	00.4692	01.7780	00.15050	05.672	00.3627
0054	00.3402	01.551	00.4690	01.7790	00.15230	05.666	00.3626
0055	00.3399	01.551	00.4687	01.7790	00.15420	05.660	00.3625
0056	00.3396	01.550	00.4685	01.7800	00.15600	05.654	00.3623
0057	00.3393	01.550	00.4682	01.7800	00.15790	05.648	00.3622
0058	00.3390	01.550	00.4680	01.7810	00.15970	05.642	00.3620
0059	00.3387	01.550	00.4677	01.7810	00.16150	05.636	00.3619
0060	00.3384	01.549	00.4675	01.7820	00.16340	05.630	00.3618
0061	00.3381	01.549	00.4673	01.7820	00.16520	05.624	00.3616
0062	00.3378	01.549	00.4670	01.7830	00.16700	05.618	00.3615
0063	00.3375	01.549	00.4668	01.7830	00.16880	05.612	00.3614
0064	00.3372	01.549	00.4666	01.7840	00.17070	05.606	00.3612
0065	00.3369	01.548	00.4663	01.7840	00.17250	05.600	00.3611
0066	00.3367	01.548	00.4661	01.7840	00.17430	05.594	00.3609
0067	00.3364	01.548	00.4659	01.7850	00.17610	05.588	00.3608
0068	00.3361	01.548	00.4657	01.7850	00.17790	05.582	00.3607
0069	00.3358	01.547	00.4655	01.7860	00.17980	05.576	00.3605
0070	00.3355	01.547	00.4653	01.7860	00.18160	05.570	00.3604
0071	00.3352	01.547	00.4651	01.7870	00.18340	05.564	00.3602
0072	00.3350	01.547	00.4648	01.7870	00.18520	05.559	00.3601
0073	00.3347	01.547	00.4646	01.7870	00.18700	05.553	00.3600
0074	00.3344	01.546	00.4644	01.7880	00.18880	05.547	00.3598
0075	00.3341	01.546	00.4643	01.7880	00.19060	05.541	00.3597
0076	00.3338	01.546	00.4641	01.7890	00.19240	05.535	00.3595
0077	00.3336	01.546	00.4639	01.7890	00.19420	05.529	00.3594
0078	00.3333	01.546	00.4637	01.7890	00.19610	05.523	00.3592
0079	00.3330	01.545	00.4635	01.7900	00.19790	05.517	00.3591
0080	00.3328	01.545	00.4633	01.7900	00.19970	05.511	00.3589
0081	00.3325	01.545	00.4631	01.7910	00.20150	05.506	00.3588
0082	00.3322	01.545	00.4629	01.7910	00.20330	05.500	00.3586
0083	00.3320	01.545	00.4628	01.7910	00.20500	05.494	00.3585
0084	00.3317	01.544	00.4626	01.7920	00.20680	05.488	00.3583
0085	00.3314	01.544	00.4624	01.7920	00.20860	05.482	00.3582
0086	00.3312	01.544	00.4622	01.7920	00.21040	05.476	00.3580
0087	00.3309	01.544	00.4621	01.7930	00.21220	05.470	00.3579
0088	00.3307	01.544	00.4619	01.7930	00.21400	05.465	00.3577
0089	00.3304	01.543	00.4617	01.7930	00.21580	05.459	00.3576
0090	00.3301	01.543	00.4616	01.7940	00.21760	05.453	00.3574
0091	00.3299	01.543	00.4614	01.7940	00.21940	05.447	00.3573
0092	00.3296	01.543	00.4612	01.7950	00.22120	05.441	00.3571
0093	00.3294	01.543	00.4611	01.7950	00.22290	05.435	00.3570
0094	00.3291	01.543	00.4609	01.7950	00.22470	05.430	00.3568
0095	00.3289	01.542	00.4608	01.7960	00.22650	05.424	00.3567
0096	00.3286	01.542	00.4606	01.7960	00.22830	05.418	00.3565
0097	00.3284	01.542	00.4605	01.7960	00.23010	05.412	00.3564
0098	00.3281	01.542	00.4603	01.7970	00.23180	05.406	00.3562
0099	00.3279	01.542	00.4602	01.7970	00.23360	05.401	00.3560
0100	00.3276	01.541	00.4600	01.7970	00.23540	05.395	00.3559
AVG	00.34267	01,5533	00.4720	01,7743	,	,	,

Example Number 17

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	5.60	1.00	3.80	0.010	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.2497	01.464	00.6580	01.6760	00.01067	05.995	00.3794
0002	00.2490	01.464	00.6562	01.6790	00.01134	05.991	00.3795
0003	00.2483	01.463	00.6545	01.6810	00.01202	05.986	00.3795
0004	00.2477	01.463	00.6528	01.6830	00.01269	05.982	00.3795
0005	00.2472	01.462	00.6513	01.6850	00.01336	05.978	00.3795
0006	00.2466	01.462	00.6499	01.6870	00.01402	05.973	00.3795
0007	00.2461	01.461	00.6485	01.6890	00.01469	05.969	00.3795
0008	00.2456	01.461	00.6472	01.6910	00.01535	05.965	00.3795
0009	00.2451	01.460	00.6459	01.6920	00.01602	05.960	00.3794
0010	00.2446	01.460	00.6447	01.6940	00.01668	05.956	00.3794
0011	00.2442	01.460	00.6436	01.6960	00.01734	05.952	00.3794
0012	00.2438	01.459	00.6425	01.6970	00.01800	05.947	00.3794
0013	00.2433	01.459	00.6414	01.6980	00.01866	05.943	00.3794
0014	00.2429	01.458	00.6404	01.7000	00.01932	05.939	00.3793
0015	00.2426	01.458	00.6394	01.7010	00.01997	05.934	00.3793
0016	00.2422	01.458	00.6385	01.7020	00.02063	05.930	00.3793
0017	00.2418	01.458	00.6375	01.7040	00.02128	05.926	00.3793
0018	00.2415	01.457	00.6367	01.7050	00.02193	05.922	00.3792
0019	00.2411	01.457	00.6358	01.7060	00.02259	05.917	00.3792
0020	00.2408	01.457	00.6350	01.7070	00.02324	05.913	00.3792
0021	00.2404	01.456	00.6342	01.7080	00.02389	05.909	00.3791
0022	00.2401	01.456	00.6334	01.7090	00.02454	05.905	00.3791
0023	00.2398	01.456	00.6326	01.7100	00.02519	05.900	00.3790
0024	00.2395	01.456	00.6319	01.7110	00.02584	05.896	00.3790
0025	00.2392	01.455	00.6311	01.7120	00.02648	05.892	00.3790
0026	00.2389	01.455	00.6304	01.7130	00.02713	05.888	00.3789
0027	00.2386	01.455	00.6297	01.7140	00.02778	05.884	00.3789
0028	00.2383	01.455	00.6291	01.7150	00.02842	05.879	00.3788
0029	00.2381	01.454	00.6284	01.7160	00.02907	05.875	00.3788
0030	00.2378	01.454	00.6278	01.7170	00.02971	05.871	00.3787
0031	00.2375	01.454	00.6271	01.7170	00.03035	05.867	00.3787
0032	00.2373	01.454	00.6265	01.7180	00.03099	05.863	00.3786
0033	00.2370	01.454	00.6259	01.7190	00.03164	05.858	00.3786
0034	00.2368	01.453	00.6253	01.7200	00.03228	05.854	00.3785
0035	00.2365	01.453	00.6248	01.7210	00.03292	05.850	00.3785
0036	00.2363	01.453	00.6242	01.7210	00.03356	05.846	00.3784
0037	00.2360	01.453	00.6237	01.7220	00.03419	05.842	00.3784
0038	00.2358	01.453	00.6231	01.7230	00.03483	05.838	00.3783
0039	00.2355	01.452	00.6226	01.7240	00.03547	05.833	00.3783
0040	00.2353	01.452	00.6221	01.7240	00.03611	05.829	00.3782
0041	00.2351	01.452	00.6216	01.7250	00.03674	05.825	00.3782
0042	00.2349	01.452	00.6211	01.7260	00.03738	05.821	00.3781
0043	00.2346	01.452	00.6206	01.7260	00.03801	05.817	00.3780
0044	00.2344	01.452	00.6201	01.7270	00.03865	05.813	00.3780
0045	00.2342	01.451	00.6196	01.7280	00.03928	05.809	00.3779
0046	00.2340	01.451	00.6191	01.7280	00.03991	05.804	00.3779
0047	00.2338	01.451	00.6187	01.7290	00.04055	05.800	00.3778
0048	00.2336	01.451	00.6182	01.7290	00.04118	05.796	00.3777
0049	00.2334	01.451	00.6178	01.7300	00.04181	05.792	00.3777
0050	00.2332	01.451	00.6173	01.7310	00.04244	05.788	00.3776
0051	00.2330	01.450	00.6169	01.7310	00.04307	05.784	00.3776
0052	00.2328	01.450	00.6165	01.7320	00.04370	05.780	00.3775
0053	00.2326	01.450	00.6161	01.7320	00.04433	05.776	00.3774
0054	00.2324	01.450	00.6157	01.7330	00.04496	05.771	00.3774
0055	00.2322	01.450	00.6152	01.7340	00.04559	05.767	00.3773
0056	00.2320	01.450	00.6148	01.7340	00.04622	05.763	00.3772
0057	00.2318	01.450	00.6145	01.7350	00.04684	05.759	00.3772
0058	00.2316	01.449	00.6141	01.7350	00.04747	05.755	00.3771
0059	00.2314	01.449	00.6137	01.7360	00.04810	05.751	00.3770
0060	00.2312	01.449	00.6133	01.7360	00.04872	05.747	00.3770
0061	00.2311	01.449	00.6129	01.7370	00.04935	05.743	00.3769
0062	00.2309	01.449	00.6126	01.7370	00.04997	05.739	00.3768
0063	00.2307	01.449	00.6122	01.7380	00.05060	05.735	00.3768
0064	00.2305	01.449	00.6118	01.7380	00.05122	05.731	00.3767
0065	00.2303	01.449	00.6115	01.7390	00.05184	05.727	00.3766
0066	00.2302	01.448	00.6111	01.7390	00.05247	05.723	00.3766
0067	00.2300	01.448	00.6108	01.7400	00.05309	05.718	00.3765
0068	00.2298	01.448	00.6105	01.7400	00.05371	05.714	00.3764
0069	00.2297	01.448	00.6101	01.7410	00.05433	05.710	00.3763
0070	00.2295	01.448	00.6098	01.7410	00.05495	05.706	00.3763
0071	00.2293	01.448	00.6095	01.7410	00.05557	05.702	00.3762
0072	00.2291	01.448	00.6091	01.7420	00.05619	05.698	00.3761
0073	00.2290	01.448	00.6088	01.7420	00.05681	05.694	00.3760
0074	00.2288	01.447	00.6085	01.7430	00.05743	05.690	00.3760
0075	00.2287	01.447	00.6082	01.7430	00.05805	05.686	00.3759
0076	00.2285	01.447	00.6079	01.7440	00.05867	05.682	00.3758
0077	00.2283	01.447	00.6076	01.7440	00.05929	05.678	00.3757
0078	00.2282	01.447	00.6073	01.7440	00.05991	05.674	00.3757
0079	00.2280	01.447	00.6070	01.7450	00.06052	05.670	00.3756
0080	00.2279	01.447	00.6067	01.7450	00.06114	05.666	00.3755
0081	00.2277	01.447	00.6064	01.7460	00.06176	05.662	00.3754
0082	00.2275	01.446	00.6061	01.7460	00.06237	05.658	00.3754
0083	00.2274	01.446	00.6058	01.7460	00.06299	05.654	00.3753
0084	00.2272	01.446	00.6055	01.7470	00.06360	05.650	00.3752
0085	00.2271	01.446	00.6052	01.7470	00.06422	05.646	00.3751
0086	00.2269	01.446	00.6049	01.7480	00.06483	05.642	00.3751
0087	00.2268	01.446	00.6047	01.7480	00.06544	05.638	00.3750
0088	00.2266	01.446	00.6044	01.7480	00.06606	05.634	00.3749
0089	00.2265	01.446	00.6041	01.7490	00.06667	05.630	00.3748
0090	00.2263	01.446	00.6039	01.7490	00.06728	05.626	00.3747
0091	00.2262	01.446	00.6036	01.7500	00.06789	05.622	00.3747
0092	00.2260	01.445	00.6033	01.7500	00.06851	05.618	00.3746
0093	00.2259	01.445	00.6031	01.7500	00.06912	05.614	00.3745
0094	00.2257	01.445	00.6028	01.7510	00.06973	05.610	00.3744
0095	00.2256	01.445	00.6026	01.7510	00.07034	05.606	00.3743
0096	00.2255	01.445	00.6023	01.7510	00.07095	05.602	00.3742
0097	00.2253	01.445	00.6020	01.7520	00.07156	05.598	00.3742
0098	00.2252	01.445	00.6018	01.7520	00.07217	05.594	00.3741
0099	00.2250	01.445	00.6016	01.7520	00.07278	05.590	00.3740
0100	00.2249	01.445	00.6013	01.7530	00.07339	05.586	00.3739
AVG	00.23429	01,4521	00.62072	01,7268	,	,	,

Example Number 18

Data	Anode	U	Q	d	E_T	N_o	m_o
Init.	Type B	6.25	5.60	3.00	3.80	0.010	6.00
Card	I	$-E_A$	E_R	E_c	N	m	k_m
0001	00.1118	01.336	00.7858	01.6760	00.01010	05.998	00.4270
0002	00.1118	01.336	00.7855	01.6770	00.01020	05.996	00.4270
0003	00.1117	01.336	00.7851	01.6770	00.01030	05.994	00.4270
0004	00.1117	01.336	00.7848	01.6780	00.01040	05.992	00.4270
0005	00.1116	01.336	00.7844	01.6780	00.01050	05.990	00.4270
0006	00.1116	01.336	00.7841	01.6780	00.01060	05.988	00.4270
0007	00.1115	01.336	00.7837	01.6790	00.01070	05.986	00.4270
0008	00.1115	01.336	00.7834	01.6790	00.01080	05.984	00.4269
0009	00.1114	01.336	00.7831	01.6790	00.01090	05.982	00.4269
0010	00.1114	01.336	00.7828	01.6800	00.01100	05.980	00.4269
0011	00.1113	01.336	00.7824	01.6800	00.01110	05.978	00.4269
0012	00.1113	01.336	00.7821	01.6800	00.01120	05.976	00.4269
0013	00.1112	01.336	00.7818	01.6810	00.01130	05.974	00.4269
0014	00.1112	01.336	00.7815	01.6810	00.01140	05.972	00.4269
0015	00.1111	01.336	00.7812	01.6810	00.01150	05.970	00.4269
0016	00.1111	01.336	00.7809	01.6820	00.01160	05.968	00.4269
0017	00.1110	01.336	00.7805	01.6820	00.01170	05.966	00.4268
0018	00.1110	01.336	00.7802	01.6020	00.01180	05.964	00.4268
0019	00.1109	01.336	00.7799	01.6830	00.01190	05.962	00.4268
0020	00.1109	01.336	00.7796	01.6830	00.01200	05.960	00.4268
0021	00.1108	01.336	00.7793	01.6830	00.01210	05.958	00.4268
0022	00.1108	01.336	00.7791	01.6840	00.01220	05.956	00.4268
0023	00.1108	01.336	00.7788	01.6840	00.01230	05.954	00.4268
0024	00.1107	01.336	00.7785	01.6840	00.01240	05.952	00.4268
0025	00.1107	01.336	00.7782	01.6850	00.01250	05.950	00.4267
0026	00.1106	01.336	00.7779	01.6850	00.01260	05.948	00.4267
0027	00.1106	01.336	00.7776	01.6850	00.01270	05.947	00.4267
0028	00.1105	01.336	00.7773	01.6860	00.01280	05.945	00.4267
0029	00.1105	01.336	00.7771	01.6860	00.01290	05.943	00.4267
0030	00.1105	01.336	00.7768	01.6860	00.01300	05.941	00.4267
0031	00.1104	01.336	00.7765	01.6870	00.01310	05.939	00.4267
0032	00.1104	01.336	00.7762	01.6870	00.01320	05.937	00.4266
0033	00.1103	01.336	00.7760	01.6870	00.01330	05.935	00.4266
0034	00.1103	01.336	00.7757	01.6870	00.01340	05.933	00.4266
0035	00.1102	01.336	00.7754	01.6880	00.01350	05.931	00.4266
0036	00.1102	01.336	00.7752	01.6880	00.01360	05.929	00.4266
0037	00.1102	01.335	00.7749	01.6680	00.01370	05.927	00.4266
0038	00.1101	01.335	00.7746	01.6890	00.01380	05.925	00.4266
0039	00.1101	01.335	00.7744	01.6890	00.01390	05.923	00.4265
0040	00.1100	01.335	00.7741	01.6890	00.01400	05.921	00.4265
0041	00.1100	01.335	00.7739	01.6890	00.01410	05.919	00.4265
0042	00.1100	01.335	00.7736	01.6900	00.01420	05.917	00.4265
0043	00.1099	01.335	00.7734	01.6900	00.01429	05.915	00.4265
0044	00.1099	01.335	00.7731	01.6900	00.01439	05.913	00.4264
0045	00.1098	01.335	00.7729	01.6900	00.01449	05.912	00.4264
0046	00.1098	01.335	00.7726	01.6910	00.01459	05.910	00.4264
0047	00.1098	01.335	00.7724	01.6910	00.01469	05.908	00.4264
0048	00.1097	01.335	00.7721	01.6910	00.01479	05.906	00.4264
0049	00.1097	01.335	00.7719	01.6920	00.01489	05.904	00.4264
0050	00.1096	01.335	00.7716	01.6920	00.01499	05.902	00.4263
0051	00.1096	01.335	00.7714	01.6920	00.01509	05.900	00.4263
0052	00.1096	01.335	00.7712	01.6920	00.01519	05.898	00.4263
0053	00.1095	01.335	00.7709	01.6930	00.01528	05.896	00.4263
0054	00.1095	01.335	00.7707	01.6930	00.01538	05.894	00.4263
0055	00.1094	01.335	00.7705	01.6930	00.01548	05.892	00.4262
0056	00.1094	01.335	00.7702	01.6930	00.01558	05.890	00.4262
0057	00.1094	01.335	00.7700	01.6940	00.01568	05.888	00.4262
0058	00.1093	01.335	00.7698	01.6940	00.01578	05.886	00.4262
0059	00.1093	01.335	00.7695	01.6940	00.01588	05.884	00.4262
0060	00.1093	01.335	00.7693	01.6940	00.01598	05.883	00.4261
0061	00.1092	01.335	00.7691	01.6950	00.01607	05.881	00.4261
0062	00.1092	01.335	00.7689	01.6950	00.01617	05.879	00.4261
0063	00.1091	01.335	00.7687	01.6950	00.01627	05.877	00.4261
0064	00.1091	01.335	00.7684	01.6950	00.01637	05.875	00.4261
0065	00.1091	01.335	00.7682	01.6960	00.01647	05.873	00.4260
0066	00.1090	01.335	00.7680	01.6960	00.01657	05.871	00.4260
0067	00.1090	01.335	00.7678	01.6960	00.01666	05.869	00.4260
0068	00.1090	01.335	00.7676	01.6960	00.01676	05.867	00.4260
0069	00.1089	01.335	00.7673	01.6960	00.01686	05.865	00.4259
0070	00.1089	01.335	00.7671	01.6970	00.01696	05.863	00.4259
0071	00.1089	01.335	00.7669	01.6970	00.01706	05.861	00.4259
0072	00.1088	01.335	00.7667	01.6970	00.01716	05.859	00.4259
0073	00.1088	01.335	00.7665	01.6970	00.01725	05.857	00.4259
0074	00.1087	01.335	00.7663	01.6980	00.01735	05.856	00.4258
0075	00.1087	01.335	00.7661	01.6980	00.01745	05.854	00.4258
0076	00.1087	01.335	00.7659	01.6980	00.01755	05.852	00.4258
0077	00.1086	01.335	00.7657	01.6980	00.01765	05.850	00.4258
0078	00.1086	01.335	00.7655	01.6980	00.01774	05.848	00.4257
0079	00.1086	01.335	00.7653	01.6990	00.01784	05.846	00.4257
0080	00.1085	01.335	00.7651	01.6990	00.01794	05.844	00.4257
0081	00.1085	01.335	00.7649	01.6990	00.01804	05.842	00.4257
0082	00.1085	01.335	00.7647	01.6990	00.01814	05.840	00.4256
0083	00.1084	01.335	00.7645	01.7000	00.01823	05.838	00.4256
0084	00.1084	01.335	00.7643	01.7000	00.01833	05.836	00.4256
0085	00.1084	01.335	00.7641	01.7000	00.01843	05.835	00.4256
0086	00.1083	01.335	00.7639	01.7000	00.01853	05.833	00.4256
0087	00.1083	01.335	00.7637	01.7000	00.01862	05.831	00.4255
0088	00.1083	01.335	00.7635	01.7010	00.01872	05.829	00.4255
0089	00.1082	01.335	00.7633	01.7010	00.01882	05.827	00.4255
0090	00.1082	01.334	00.7631	01.7010	00.01892	05.825	00.4255
0091	00.1082	01.334	00.7629	01.7010	00.01902	05.823	00.4254
0092	00.1081	01.334	00.7627	01.7010	00.01911	05.821	00.4254
0093	00.1081	01.334	00.7625	01.7020	00.01921	05.819	00.4254
0094	00.1081	01.334	00.7624	01.7020	00.01931	05.817	00.4254
0095	00.1080	01.334	00.7622	01.7020	00.01941	05.815	00.4253
0096	00.1080	01.334	00.7620	01.7020	00.01950	05.814	00.4253
0097	00.1080	01.334	00.7618	01.7020	00.01960	05.812	00.4253
0098	00.1079	01.334	00.7616	01.7030	00.01970	05.810	00.4252
0099	00.1079	01.334	00.7614	01.7030	00.01979	05.808	00.4252
0100	00.1079	01.334	00.7612	01.7030	00.01989	05.806	00.4252
AVG	00.10974	01,3357	00.77223	01,6916	,	,	,

NOMENCLATURE

Symbol	Definition
	English Letters
a	Activity
b	Thickness of laminar cathode diffusion layer (cm)
C	Concentration in aqueous solution (mol/cm^3)
D	Diffusion coefficient (cm^2/sec)
d	Distance between electrodes (cm)
E	Potential (v)
$-E_A$	Anode potential (v)
E_C	Cathode potential (v)
E_R	Ohmic potential drop in electrolyte (v)
E_T	Total applied cell potential (v)
F	Effectiveness factor for operating parameters
$\mathfrak{F}$	Faraday constant (96,500 coul/equiv)
f	Activity coefficient in sodium amalgam
G	Rate of transfer of sodium chloride from brine (mol/sec)
I	Current density (amp/cm^2)
K	Relative conductivity
k	Conductivity (ohm^{-1}cm^{-1})
L	Cell length (cm)
M	Molecular weight
m	Sodium chloride concentration in brine (mol/1000 gm H_2O)
N	Sodium concentration in amalgam (wt % sodium)
p	General symbol for operating parameter
Q	Brine flow rate (gm H_2O/sec)

Symbol	Definition
R	Gas constant (8.313 joules/mol ^{o}K)
S	Mol fraction sodium in amalgam
T	Temperature (^{o}C or ^{o}K)
t_+	Transference number of positive ion
U	Velocity of flowing mercury cathode (cm/sec)
x	Distance along length of cell from inlet (cm)
	Greek Letters
α, β, γ	Regression constants in Eq. (20)
δ	Boundary layer thickness (cm)
δ_*	Displacement thickness (cm)
η	Current efficiency
λ, μ, ξ	Regression constants in Eq. (24)
ν	Kinematic viscosity (cm^2/sec)
P	Resistivity (ohm cm)
ω	Total electrode overvoltage (v)
	Subscripts
av	Average
Cl	Pertaining to chlorine (gas or solute)
e	Pure electrolyte
L	Conditions at outlet end of cell
m	Electrolyte with entrained gas
o	Conditions at inlet end of cell
NaHg	Pertaining to sodium in amalgam
sat	Saturated
wall	Pertaining to conditions at electrode surface

Symbol	Definition
1, 2, . . .	General indices
±	Mean ionic value
	Superscripts
o	Standard value for electrode potentials
*	Base example value

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