COMPUTER AIDED INSTRUCTION FOR THE OPERATION OF AN INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION SPECTROMETER

by

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Submitted in Partial Fulfillment of the Requirements

for the Degree of

Master of Science

in the

Chemistry

Program

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August, 1985

YOUNGSTOWN STATE UNIVERSITY

Graduate School

THESIS

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ABSTRACT

COMPUTER AIDED INSTRUCTION FOR THE OPERATION
OF AN INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION SPECTROMETER

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Master of Science

Youngstown State University, 1985

The utilization of computers in education has greatly improved the ability to provide supplemental instruction to students. The computer has unique qualities which can make it a very efficient and patient tutor. A computer's ability to branch allows for a well organized lesson that can be taught at a pace the student chooses and at which he feels comfortable. Time is spent only on the aspects of a topic on which the student feels he needs help. Computer-aided instruction has been further supported by the recent microcomputer boom. The sharp decrease in the cost of microcomputers over the past ten years, combined with improvements in graphic quality has greatly increased the interest and support for computerized instruction. The creation of easy to use languages has removed the difficulties once associated with writing a computerized lesson.

Inductively coupled plasma atomic emission spectroscopy (ICP-AES) has developed into a highly successful

analytical technique. This success can be attributed to a continuously increasing demand for multi-element analysis of samples with widely varying concentration ranges. ICP-AES meets these demands due to its large linear dynamic range, which allows the simultaneous determination of major, minor, and trace constituents in the same sample. The extremely high temperatures generated by a plasma source allow for complete atomization and dissociation of the sample. This greatly reduces most types of chemical interferences that pose problems for other spectrometric methods.

An IBM PC/XT microcomputer employing Microsoft Advanced BASIC was used to write a CAI program explaining the operation of an Instrumentations Laboratories Plasma 200 inductively coupled plasma atomic emission spectrometer. The program outlines the procedure used to operate the instrument in two different modes. The normal system operates primarily in a quantitative mode. The Multiquant system offers both qualitative and semiquantitative information for up to twenty-nine elements in less than ten minutes. A complete discussion of the creation of analytical programs, program storage, and instrument trouble shooting is presented in the CAI lesson. A copy of the complete CAI program is included.

ACKNOWLEDGEMENTS

I would like to express my sincerest appreciation to Dr. Daryl W. Mincey for his valuable guidance throughout the course of this project. I would also like to thank Dr. Thomas N. Dobbelstein and Dr. Irwin Cohen for their helpful suggestions in reviewing this text.

In conclusion, I would like to thank my family for their continuing encouragement.

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LIST OF SYMBOLS

SYMBOL	DEFINITION	UNITS
ICP-AES	Inductively Coupled Plasma - Atomic Emission Spectroscopy	
CAI	Computer Aided Instruction	
PMT	Photomultiplier Tube	
nm	Nanometer	1×10^{-9} meter
K	Kilobytes	1,000 bytes
IL	Instrumentation Laboratories	
ASCII	American Standard Code for Information Interchange	
RF	Radio Frequency	hertz
RS232	Serial Interface Port	
CRT	Cathode Ray Tube	
I/O	Input / Output	
PPM	Parts Per Million	
PPB	Parts Per Billion	
min	Minute	
sec	Second	
%	Percent	
wt %	Weight Percent	
k	Boltzmann Constant	1.3805×10^{-16} erg/deg

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CHAPTER I

INTRODUCTION

A. CAI Lesson Modes

The underlying objective of a CAI lesson is to teach. The lesson can take the form of a tutorial offering instruction or repetitive drills. A student having difficulties in the classroom could obtain individualized help without inconveniencing others. A CAI program designed in a self-help form can be used by most individuals wishing to acquire knowledge on a particular subject (1). Programs explaining the use of various instruments are of a self-help variety. In both cases the CAI user benefits without having to wait for an instructor. The programming can be active or passive (2). The passive lesson presents ideas and concepts in an organized manner without student-to-computer interaction. An active lesson discusses a topic and poses questions to the student. Subsequent program execution depends on the student's response to the question. The lesson provides additional hints if the student asks for them.

A CAI lesson can have several different modes. When written in a text mode the lesson can be used for such tasks as reviewing grammar skills or teaching a foreign language. A mathematical mode is employed to aid in the improvement of problem-solving skills as well as other ways. Mathematics and

the sciences benefit from this format, as the efficient execution of numerical operations is one of a computer's strong points. Graphics can be employed in a computerized lesson to explain abstract concepts that are difficult to visualize. Three-dimensional objects and translational motion are easily illustrated. Recent improvements in both computer hardware and software have allowed rapid writing of programs utilizing all three modes. The applications of such programs are limitless.

B. Topics in Chemistry Addressed by CAI Programmimg

CAI programming addresses a wide range of topics in chemistry. Most of the early attention was given to general chemistry. The reasoning is two-fold: 1) it is important that all students requiring a chemistry background obtain a solid understanding of the basics, reinforced by repetitive drills, before advancing to upper- division courses, and 2) general chemistry is much easier to computerize than the more advanced topics (2,3). Stoichiometry is an ideal choice for CAI work since numerical operations are very easy to program. A system developed at the University of Illinois was a forerunner in the instruction of stoichiometry (3). Special routines were developed in the mid 1960's that allow the instructor to specify the correct answer to a problem, along with an accepted error range and the proper units. The program could indicate whether a student's answer was too high or too low, or displayed improper units. Table 1 illustrates an example of the system's responses to a

Correct Answer: 625 +/- 2 grams

Student Answers:	Computer Responses:
625	Please label your answer
625g	ok
624g	ok
6.24 * 10 E2 g	ok
628g	Your answer is too high
621g	Your answer is too low
6.24 * 10 E3 g	Your answer is too high, decimal error

Table 1. CAI Responses to a Student's Answers (3)

student's answers. The system, which is called PLATO, offers tutorial help in balancing of redox equations. An example such as

$$Cr_2O_7^{2-} + H^+ + I^- \rightarrow Cr^{3+} + I_2 + H_2O$$

could be balanced by the student with the help of the computer. The program has the ability to detect the presence or absence of a certain species and incorrectly written formulas, and to determine the proper coefficients. Programs developed at the University of Santa Barbara in the 1960's addressed problem solving involving the ideal gas laws (4). The equations could be rearranged to solve for any variable, which allowed for a great deal of flexibility. The student could choose to display curves plotting temperature, pressure, and volume against each other. In the early 1970's CAI authoring produced extensive tutorials for organic chemistry. A team of instructors at the University of Texas developed a system providing instruction on the following topics: 1) the structure and geometry of alkanes, 2) skeletal isomerism of alkanes, 3) nomenclature, 4) preparation of alkanes, and 5) stereochemistry (5). The program consisted of brief discussions of each topic, followed by repetitive drills for practice. A CAI team at Quincy College in Illinois developed a program capable of identifying organic compounds (6). The technique is based on five determinations: melting point or boiling point, elemental analysis for nitrogen, sulfur, and halogen, and the aluminum chloride-azoxybenzene test to determine the presence of inert compounds. Tables 2, 3, and 4 illustrate input and output data from the program.

An "0" denotes a negative test, and a "1" a positive test. The student performs the determinations and inputs the results of each. The program then provides the name of the correct compound, based on the matching of the five parameters.

In 1972 radiochemistry made its mark in the CAI field. Programs written in BASIC were developed at the University of Wyoming by several professors (7). Instruction was offered to undergraduate students in radiochemistry in methods collection and treatment of nuclear and spectroscopic data.

The majority of tutorials designed up to this point were in a text form. Nearly all graphic displays that did exist were of a low-resolution, two-dimensional type (8). Figure 1 is an example of plots of hydrogen orbitals that require over thirteen minutes to create. Figure 2 is a display of the output of a program that provides curves for titrations of weak acids and strong bases. The curves are generated in a textmode, as no graphics routines are utilized. With the microcomputer boom in the late 1970's came vastly improved graphics capabilities (9). High resolution, color, and animated motion allowed the creation of detailed three dimensional illustrations. Figure 3 is a curve for the titration of a 0.1 M acid with a 0.2 M base. This plot is done in a graphics mode and provides greater quality than a text mode plot. Paralleling the improvements in graphics capabilities was the introduction of improved languages which

MP/BP	Inert	Nitrogen	Halogen	Sulfer	Compound Name
122	0	0	0	0	beta-naphthol
97	0	0	0	0	allyl alcohol
83	0	0	0	0	t-butyl alcohol
156	1	0	1	0	bromobenzene
110	1	0	0	0	toluene
63	0	0	0	0	isobutyraldehyde
224	0	0	0	0	methyl salicylate
97	0	0	0	0	n-propyl alcohol
193	0	1	0	0	N,N-dimethyl aniline
132	1	0	1	0	chlorobenzene
238	0	1	0	0	phthalimide
118	0	0	0	0	acetic acid
146	0	1	0	0	anthranilic acid
118	0	0	0	0	n-butyl alcohol
122	0	0	0	0	benzoic acid

Table 2. Sample Data List (6)

MP/BP	Inert	Nitrogen	Halogen	Sulfur	Student
120	0	0	0	0	Smith
99	0	1	0	1	Jones
233	0	1	0	0	Dixon

Table 3. Sample Input by 3 Students (6)

MP/BP	Inert	Nitrogen	Halogen	Sulfur	Compound Name
120	0	0	0	0	Smith
122	0	0	0	0	beta-naphthol
118	0	0	0	0	acetic acid
118	0	0	0	0	n-butyl alcohol
122	0	0	0	0	benzoic acid
99	0	1	0	1	Jones
No compound fits your data. Run tests again.					
233	0	1	0	0	Dixon
238	0	1	0	0	phthalimide

Table 4. Program Output Based on Student Input (6)

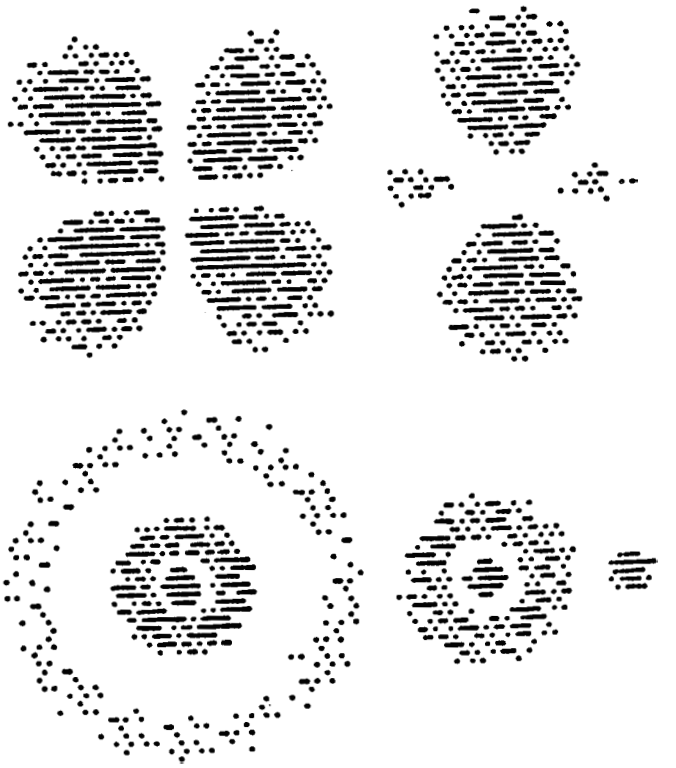


Figure 1. Low Resolution Plots of Hydrogen Orbitals (8)

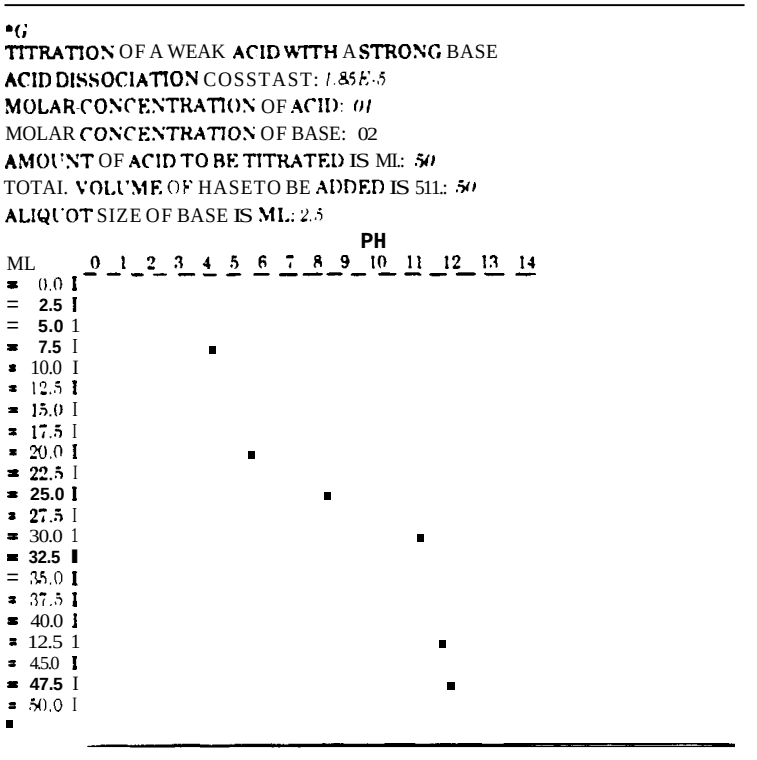


Figure 2. Text Mode Plot of a Titration Curve (8)

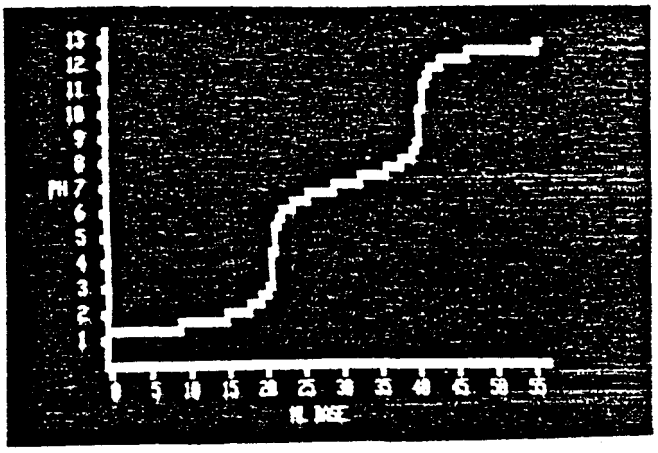


Figure **3.** Graphics Mode Plot of a Titration Curve (9)

made the creation of CAI programsmuch easier and more enjoyable (10). With these improvements in computer hardware and software came the production of higher quality chemistry tutorials. Programs have been recently developed at Oklahoma State University for the Apple II series which demonstrate proper titration techniques (11). All necessary apparatus is animated on the display screen. The student is directed to run a sample titration via the computer. The endpoint is simulated by changes in the color of the solution in the animated titration vessel. The Apple II has been used for topics in physical chemistry (9). These tutorials make extensive use of graphics to aid in explaining abstract theories such as the kinetics of particle mixing and the magnetic resonance phenomenon of Larmor precession.

The operation of instruments has been given attention by CAI programmers. A lesson has been developed for the Radio Shack TRS-80 that demonstrates the use of a pH meter (9). Included are correct procedures for handling electrodes, buffer preparation, and instrument calibration. An illustration of the animated meter is provided in figure 4. At the University of Michigan the Commodore PET 2001 has been used for the development of a program explaining how to prepare an electrochemical cell used for research (9). The PLATO system, which has kept pace with the improvements in microcomputers, offers computerized instruction on the proper use of an analytical balance, as well as laboratory equipment such as pipets and bunsen burners (12). The analytical balance program discusses the concepts of partial and full

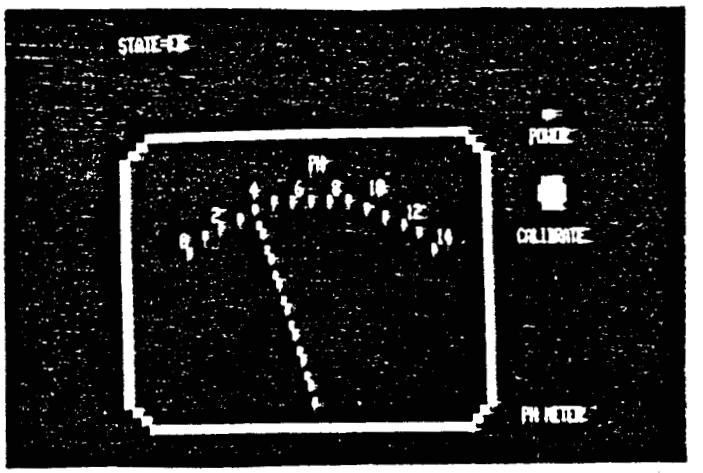


Figure 4. **Graphics** Mode Plot of a pH Meter (9)

release, and the purpose of the tare control. The animated balance informs the student when he is doing something wrong.

Today CAI programs exist for many aspects of chemistry other than the items previously discussed. Topics such as optical isomerism, nuclear reaction, enzyme kinetics, energy levels and spectra, and the naming of amino acids are well represented by computerized instruction (13). With the continuously rising popularity and availability of the microcomputer, the list of topics is becoming endless and the potential limitless.

C. Inductively Coupled Plasma Emission Spectroscopy

1. Theory of Emission Spectroscopy

Any atom or molecule can be raised to a set of excited electronic states by subjection to thermal or electrical excitation or by exposure to radiation (14). In the cases of thermal or electrical excitation, collisions with high energy electrons or molecules provide the excitation. An atom or molecule in an excited state is unstable. The excited species very quickly returns to its ground state. This is due to energy loss by collision, by entering into a chemical reaction, by dissociation, or by emission of radiation. The last process, radiation, is of interest in the field of emission spectroscopy. As an excited species returns to its ground state, radiation is emitted at characteristic frequencies. The combined set of frequencies is the species' emission spectrum. This excitation-emission process is illustrated in figure 5. The isolation and

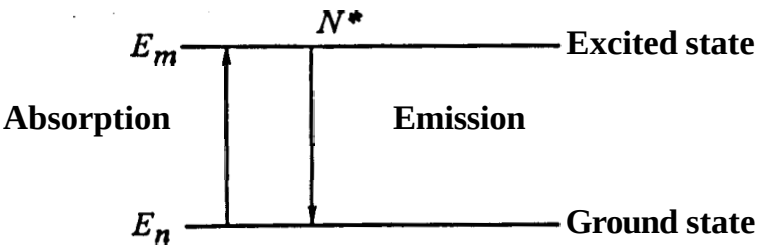


Figure 5. Excitation-Emission Process of an Excited Atom (18)

measurement of a particular emission line is the basis for analysis employing emission spectroscopy (15). Determining the frequency of the radiation provides qualitative information for a given sample. The intensity of the emitted radiation yields quantitative results. The intensity of an emission depends on the fraction of a species that is present in an excited state. This fraction, determined by the temperature of the excitation, is governed by the Boltzmann equation:

$$N/N_o = (P/P_o)\exp(-E_j/kT) \qquad (2)$$

The terms N and N_o represent the number of atoms in the excited state andground state, respectively. T is the temperature in degrees Kelvin, and k is the Boltzmann constant. E_j is the energy difference between the two states. The values P and P_Θ are factors determining the number of states having equal energy at each quantum level. The equation mathematically demonstrates the need for very high temperatures to assure complete atomization and maximum excitation of a substance. Atomization is the process by which molecular samples are broken down into atoms before excitation occurs (16). Atomization is essential to eliminate molecular emissions, which are not sharply defined. The success of an emission technique depends on the ability to generate radiation in distinct wavelengths. Several sources have been used for atomization and excitation of samples. They are combustion flames, arcs, sparks, and plasmas (16). Flames are limited by relatively low temperatures reaching 4000 degrees Kelvin at best. Arcs and sparks provide much

higher temperatures, with arcs ranging from 4000 to 7000 degrees Kelvin and sparks from 8000 to 10,000 degrees Kelvin. These sources are greatly affected by sample composition. Close matching of standards and samples is required, as slight variations in sample composition can cause significant variations in excitation conditions. Argon plasma sources are relatively new, having been used only since the early 1960's. Plasmas provide excitation temperatures up to 10,000 degrees Kelvin, and are not affected by the reproducibility problems plaguing arc and spark sources.

2. The Plasma Source

A plasma is a gaseous mixture in which a significant fraction of the atomic species present is in the form of ions (15). ICP-AES employs argon gas for its plasma, which is created by the apparatus illustrated in figure 6. The torch consists of three concentric quartz tubes. The primary argon flow passes up through the center tube. Surrounding the top of the torch is an induction coil driven by a two kilowatt radio frequency generator producing a signal of 27 MHz. The coil creates magnetic fields having lines of force indicated by the arrows in the diagram. Since argon is neutral, the plasma must be initiated by a spark from a tesla coil. The spark ionizes the argon. The resulting ions interact with the magnetic field and the ionization becomes self-sustaining. The magnetic field forces the ions to flow in closed annular paths, represented in the diagram by the cylinder. The resistance of the ions to the annular flow creates Ohmic

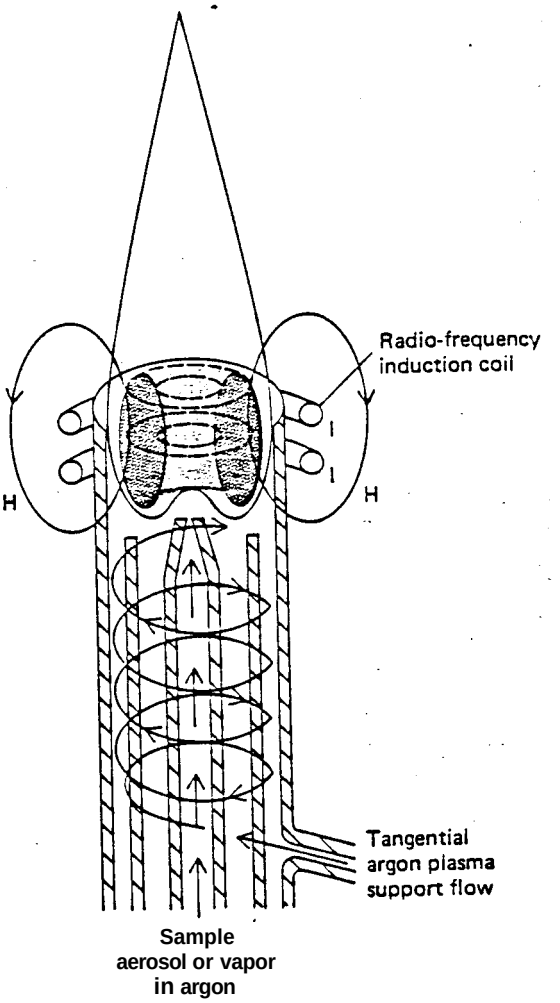


Figure 6. ICP Torch **Diagram** (15)

heating. This produces temperatures in the range of 6000 to 10,000 degrees Kelvin. Because of this intense temperature the plasma must be thermally isolated to prevent overheating of the instrument. This is achieved by introducing a secondary argon flow which flows tangentially up and around the inner tube. The secondary argon flow cools the outer quartz tube and centers the plasma radially on top of the torch. The induction coil generates heat as well, and must be cooled by a constant supply of water. Figure 7 illustrates a temperature profile of the plasma. The hottest portion is in the core of the induction region (16). In the analytical zone fifteen to twenty millimeters above the coil, the temperature is only about 8,000 degrees Kelvin. Despite the hotter temperature in the core it is not possible to analyze radiation emitting from this area because superimposed upon it is the continuous emission spectrum of the argon (15). This would interfere with determinations. In the region fifteen to twenty millimeters above, the argon atoms are relaxed, so the argon spectrum is diminished. The plasma becomes optically transparent and analysis of sample emission is possible.

3. Sample Introduction

Samples analyzed by ICP-AES can take the form of aerosols, vapors, or fine powders (15). The sample and the argon carrier stream are mixed in a pre-mix chamber prior to introduction into the plasma. The apparatus is diagrammed in figure 8. The streams of sample and argon meet at an angle of 90 degrees. This causes nebulization of the sample.

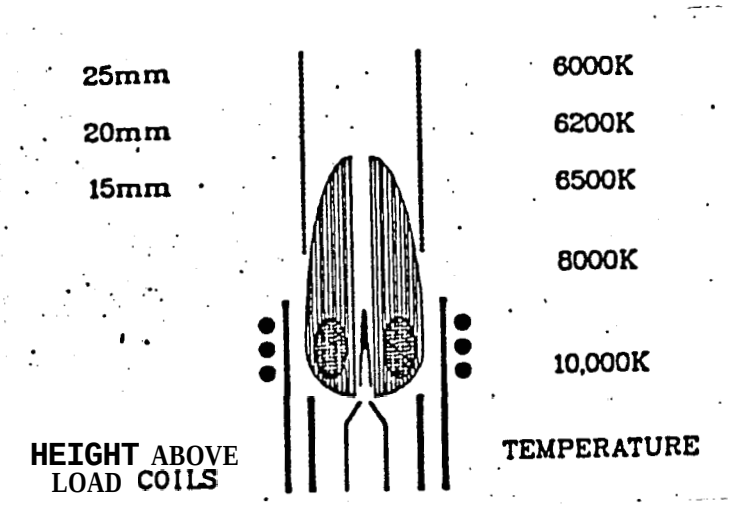


Figure 7. Plasma Temperature Profile (16)

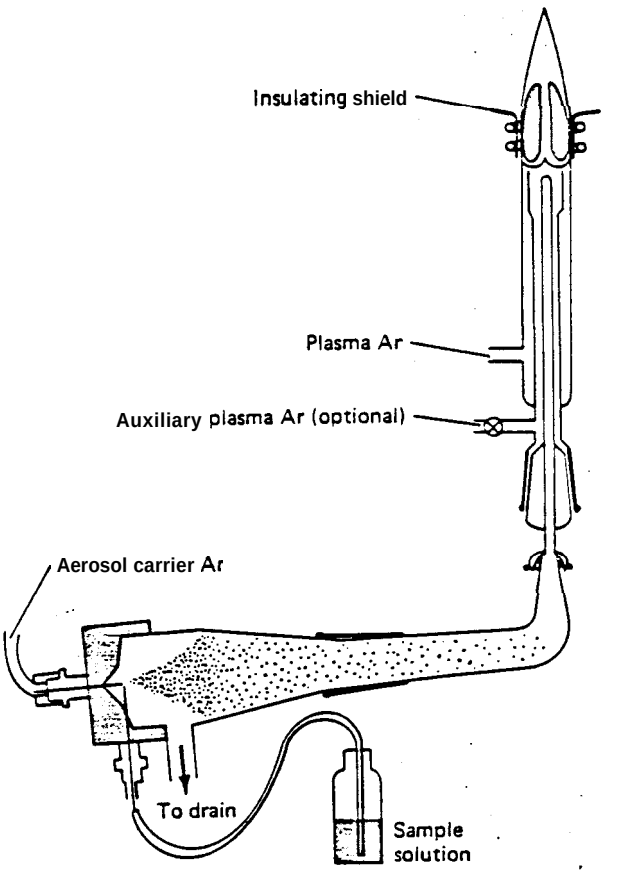


Figure 8. Sample Nebulizer (15)

Nebulization is a process by which a sample is reduced to a series of very small droplets (15). A set of baffles may also be present in the pre-mix chamber to further reduce the droplet size. Small droplet size is advantageous in that it allows for greater uniformity and distribution of the sample. The argon carries the nebulized sample out of the pre-mix chamber and into the plasma via the central quartz tube. When the sample reaches the analytical region it has resided in the plasma for about two milliseconds. This allows for a complete atomization and excitation.

4. Monochromator Design

The monochromator is the section of an atomic emission spectrometer that resolves the radiation emitted from the sample into its component wavelengths (15). Monochromators are designed in two basic arrangements, depending on whether a simultaneous or sequential process is used (17). Simultaneous ICP-AES is the older of the two methods, and involves the use of a polychromator. (See Figure 9) Determinations can be made on several elements at the same time. Radiation emitted by the sample passes through an entrance slit, and is dispersed by a diffraction grating. The resolved wavelength components pass through preset exit slits along a focal curve and strike photomultiplier (PMT) detectors.

In a sequential arrangement (Figure 10), a scanning monochromator is used. Radiation emitted by the sample passes through the entrance slit and strikes a motor-driven

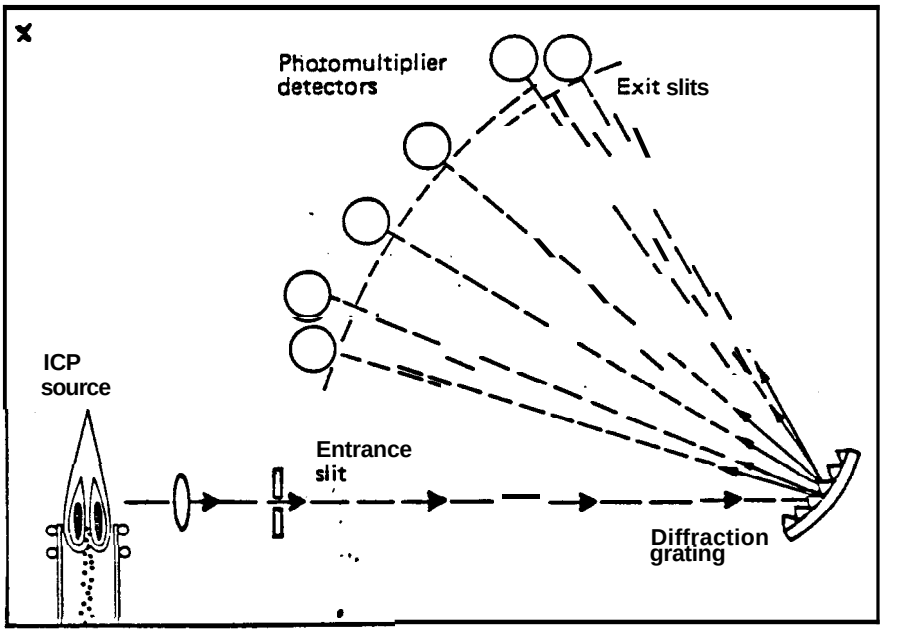


Figure 9. Simultaneous Monochromator Design (17)

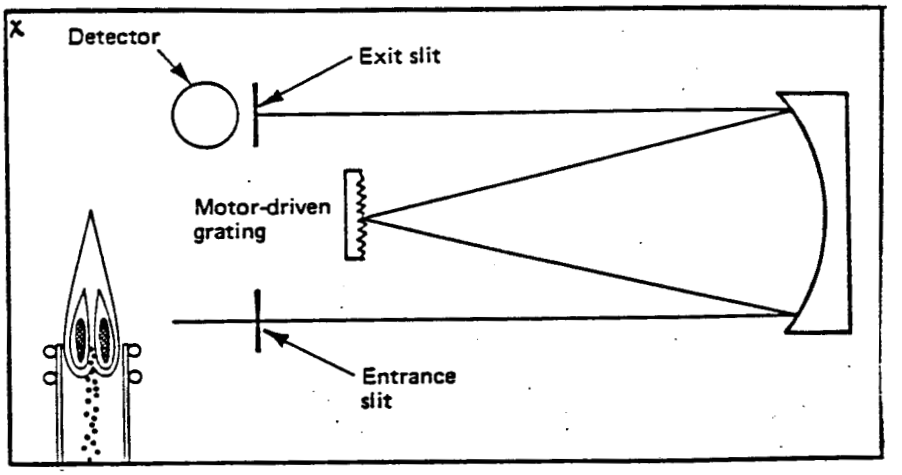


Figure 10. Sequential Monochromator Design (17)

diffraction grating. The resolved components pass through the exit slit one at a time. A single PMT is used to detect each wavelength.

The simultaneous arrangement is the faster of the two methods (16). It suffers from inflexibility in that the wavelengths chosen must be predetermined. The positions of the exit slits must be preset. Analyses are limited to determinations of samples consisting of similar composition. Sequential arrangements have no such limitations (16). Determinations can be performed on samples having a broad and changeable selection of elements. Early sequential instruments suffered from inaccuracy due to the method in which the diffraction grating was driven. The recent introduction of electromagnetically driven gratings has essentially eliminated this problem. This new system can scan through the wavelength spectrum at a rate of 2000 nanometers per second, thereby increasing the speed of the sequential technique. The improved drive system has allowed the sequential arrangement to become the method of choice during the past five years.

5. PMT Detectors

The photomultiplier used for the detection of the resolved components of radiation is a combination of a photoemissive cathode, a series of dynodes, and an anode (18). The fact that electrons are emitted from certain materials in direct proportion to the number of light quanta striking the surface containing these materials provides the basis on which the photocathode operates. Incident radiation

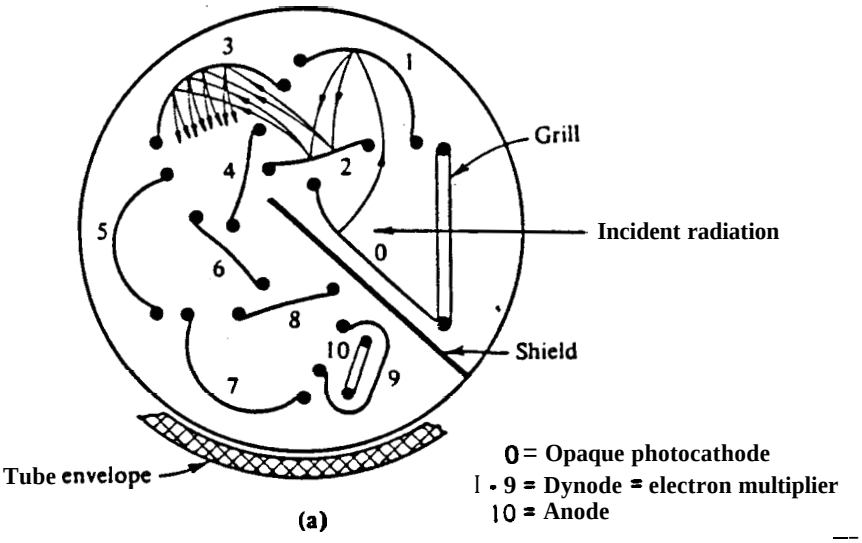


Figure 11. PMT Detector (18)

impinging on the cathode causes the ejection of photoelectrons, which are focused toward the first dynode. (see figure 11) The impact of the photoelectrons on the dynode causes the ejection of a second group of photoelectrons. The combined stream is focused toward the second dynode, where the process is repeated. Continued repetition over the entire series of dynodes causes a cascading effect. A greatly amplified current ultimately reaches the anode. The driving force behind the PMT is the constantly increasing voltage encountered as the photoelectrons pass from the cathode, through the series of dynodes, and on to the anode.

6. Processing the Signal

The current exiting the PMT via the anode is processed by a microcomputer with graphics capabilities or fed into an analog recorder (19). In either case a plot of signal intensity versus wavelength is constructed. Figure 12 illustrates a microcomputer – generated output of a determination on barium at 233.53 nm. A linear relationship exists between signal intensity and the concentration of a species (15). By setting up a calibration curve with standard solutions, the concentration of the species in an unknown can be determined.

7. Advantages of ICP-AES

A major advantage of ICP-AES involves interelement effects, which are phenomena that interfere with the intensity versus concentration relationship of the analyte

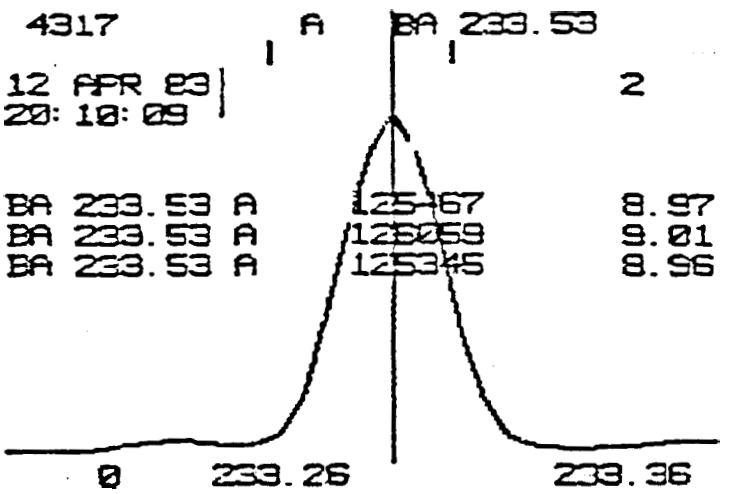


Figure 12. Microcomputer Output for a Barium Determination (19)

due to the presence of the other components in the sample (16). There are three types of interelement effects: vaporization-atomization, ionization, and spectral. Vaporization-atomization is related to processes which reduce the free atom population in the vapor phase, thereby reducing the intensity of the emission signal. The cause is attributed to the formation of metal oxides or refractory compounds. Ionization effects result from a shift in the ionization equilibrium of the analyte due to the presence of the other sample components. These two types of interference are eliminated from ICP-AES due to the sample's long residence time in the plasma and the very high excitation temperatures which allow complete atomization and dissociation.

Working curves generated by ICP-AES maintain linearity up to five orders of magnitude, indicating a high linear dynamic range (17). Determinations of major, minor, and trace constituents can be performed at the same time with the same working curve. This is not possible with flame techniques as linearity is lost as concentration varies over several orders of magnitude.

Excellent detection limits are obtained with ICP-AES (16). The general range is 0.1 to 10 parts per billion, significantly better than the value obtained with flame atomic absorption, arc emission, and spark emission.

The high plasma temperature allows determinations on refractory elements such as tungsten, uranium, phosphorous, and boron (16). ICP-AES employs no electrodes, thereby eliminating electrode contamination problems. The stable ICP

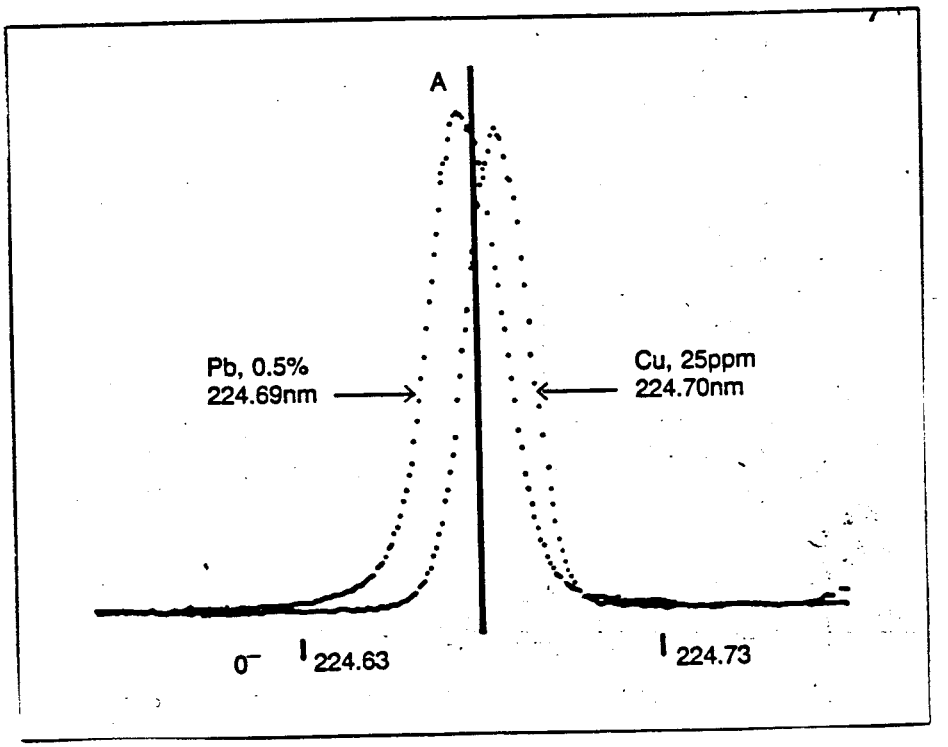


Figure 13. Spectral Interference in a Copper Determination (17)

source eliminates the need for frequent restandardization.

8. Disadvantages of ICP-AES

The major disadvantage of ICP-AES involves spectral interference, which occurs in any emission technique (17). It arises from incomplete isolation of radiation as detected by the instrument. The emission line of the analyte may be close to an emission line of another element in the sample. Figure 13 illustrates a spectral interference on a copper determination caused by the presence of lead. The emission lines differ by only 0.01 nanometers. The detector will pick up radiation from both sources and it assigns the entire signal to copper. The resulting concentration value would be erroneously high. The constant threat of spectral interference requires the use of caution in selecting analytical wavelengths. Methods development for ICP-AES is consequently more complicated than similar developments for atomic absorption. Choosing ICP-AES as an analytical method involves a cost factor (17). ICP spectrometers are two to three times more expensive than atomic absorption instrument and arc or spark emission spectrometers.

Chapter 2

History of Computer Aided Instruction

A. The Need for Computerized Instruction

For many years the teaching profession has been aware of a problem that is inherent in the education system. Frequently instructing a large class requires that a teacher become overly involved with assigning and grading homework and exams. Lectures and tutorial drills are conducted in a group fashion in an attempt to reach all students in the class. The problem arises in that each student has his own stumbling block which usually requires one-on-one assistance. Since both the student and the instructor may have inflexible time schedules, this is not always possible. A monetary factor contributes to the problem, in that many school systems and educational institutions do not have the money to pay instructors for extra time for supplemental tutoring and help sessions (20). The ideal situation is to provide each student with a "personal tutor", available whenever the student needs help. This tutor would be able to introduce ideas and concepts in a detailed and stepwise fashion. The tutor would have to be certain that the student understands each step before introducing the next item. This idealistic definition of a tutor was realized as far back as the early 1960's, when it became obvious that a properly programmed

computer had the ability to become an excellent tutor. Several institutions and universities began experimenting with computer programs designed to teach mathematics, chemistry, and foreign languages.

B. Early CAI Developments

By 1970 many CAI systems were in use across the country. The most extensively developed was PLATO, created at the University of Illinois (3). It was originally designed to tutor students in general chemistry. Such topics as the balancing of redox equations, determination of quantities from chemical equations, and the determination of chemical formulas were included in a closely studied program. Evaluations performed on freshman chemistry classes during the 1969–1970 school year clearly indicated that PLATO assisted class sections scored consistently higher on examinations than control sections prohibited from using the CAI system. Similar studies were performed the same year at the University of Santa Barbara (4). The CAI program in use there offered supplemental lessons in general chemistry, particularly on the uses of the ideal gas laws. Results of the program were favorable as students using the system did well on subsequent examinations. Other CAI systems across the country met with similar success. Experts in education and computer science concluded that there were several reasons for the promising future of CAI (2). A computer has unique branching abilities. This allows for an organized lesson execution in which the more capable students can choose to simply brush over the important points of a topic. Slower

students can ask the computer for additional help and greater detail in an attempt to gain an understanding of the same topic. In each case the student must demonstrate his knowledge of the subject matter by answering questions and solving problems presented by the computer. In some cases, only then will the program proceed to the next topic. When using a CAI program the student is interacting exclusively with the instructor. This is not possible in a classroom session. In an ideal situation, a CAI program provides the opportunity for the student to take an active part in a lesson. The CAI terminals are convenient for students. They are available for use at any time during the school day. Recent studies on the use of CAI systems indicate that these reasons continue to hold true, and disclose a few more advantages (20). The use of computers in education has improved the learning system by supplying a reliable method by which difficulties in problem solving can be eliminated, and the understanding of subject matter enhanced. The computer has unique capabilities which allow the accommodation of once time consuming tasks in a curriculum The use of CAI for tutoring has given teachers a greater degree of free time that can be used for other educational purposes.

C. The Computer Boom

1. Improvements in Computer Hardware

The success of CAI programs in the late 1960's and early 1970's was clearly sufficient to sustain an interest in

the field. This interest was further enlarged by the computer revolution that began in the mid 1970's. Improvements in computer hardware and software benefitted CAI greatly. Looking first at computer hardware, it must be pointed out that the early systems were on-line or main-frame computers (4). The University of California system employed an IBM 360-370 model. The student communicated with the computer via a keyboard console and received output on a cathode ray tube. Such on-line systems with a central computer servicing many input/output terminals have very large memory capabilities, but are very expensive. In 1970 the cost of such a system was 50,000 dollars per learner station (10). This monetary factor obviously limited the universal availability of such computers. In 1972 the CAI field also turned attention to microcomputers (8). Programmers devised CAI systems capable of being run on such small-memory computers. A system employed at Eastern Washington State University was developed for use on a 4K core memory. The program was able to perform all the functions of a similar main frame program. Commercial development of microcomputers increased dramatically throughout the 1970's. By 1980 the Radio Shack TRS-80 had become the most widely used microcomputer, accounting for nearly half the market (9). The Apple II series and Commodore PET 2001 were popular as well. These new systems employed much-improved graphics that allowed production of high resolution illustrations. The quality of CAI programs subsequently increased. The problem of "student to screen" interaction was addressed by the microcomputer with the

development of such items as the joystick, light pen, mouse, and touch panel (21). Prior educational programming was keyset oriented. In order to interact with the computer the student had to take his eyes off the screen to use the keyboard. This tended to break the concentration between the student and the lesson. Using one of the above items allows the student to continuously focus his attention on the screen. Improved concentration is the result. The joystick is the least expensive screen interaction device, costing only about ten dollars. Although it is more commonly associated with video games, it can be programmed to perform almost as many tasks as its 800 dollar counterpart, the touch panel. The most important feature of the microcomputer is its cost (10). What a mainframe computer could do in 1970 for 50,000 dollars, a microcomputer can do in 1985 for about 4,000 dollars. This sharp decrease in the price of a computer system was perhaps the single most important cause for the change in attitudes towards CAI. The evaluations on the early CAI programs had done much in the way of demonstrating the effectiveness of computers in education. Some institutions and educational systems did not have a large enough budget to implement CAI programming on a mainframe system. With the emergence of the microcomputer the cost factor was virtually eliminated.

2. Improvements in Computer Software

As widespread use of microcomputers increased, a noticeable trend shift became apparent. Early CAI was done

almost exclusively by teams consisting of experts in the particular field of interest, instructional designers, and computer programmers trained in the use of special CAI languages (22). Completion of a typical CAI program varied anywhere from a couple of weeks to several years. By the late 1970's the number of teachers wishing to do their own CAI programming had increased rapidly (10). This quickly revealed a problem with already-existing software. Many of the programming languages were very "user unfriendly". High level languages such as BASIC and PASCAL are efficient to use and easy to learn. They are not designed for CAI work, as several inconveniences will occur (22). In constructing a CAI lesson it is necessary to create the program in small sections. Each section must be tested in a regular program mode to assure proper execution, and determine if any revisions are necessary. After any required corrections are made, the next section is created and tested in a similar manner. This "create-test-revise" cycle is a rather slow and deliberate process in most forms of BASIC and other high level languages. The formation of graphics presents another problem. Although the improvements in computer hardware provided greater resolution and overall quality, the actual implementation of these features in a program was difficult. Even the simplest of diagrams required complicated subroutines and special programming techniques. Often a CAI lesson required the erasing of certain areas of the screen, while leaving the remainder intact. Existing software in the late 1970's provided no easy method by which this could be

done. Existing character sets posed a problem in that special characters and foreign alphabets needed for certain programs were not available. Programmers had to resort to the time-consuming process of drawing the needed characters using graphics commands. This problem greatly affected chemistry as existing character sets did not include superscripts and subscripts. Displaying a chemical formula required extra time and effort to graphically design each subscript. The process of judging responses to a question placed further burden on the program author. The use of existing software provided the ability to evaluate an answer to a question by using string variables. If the correct answer to a question is "sodium nitrate", the student's answer could be compared with the correct answer by assigning both to string variables and checking for equality. This process breaks down if the student capitalizes letters, or puts extra spaces between the two words in the answer. The program will then judge a correct answer as being wrong. Often a correct answer can take two different forms. The phrases "it goes down" and "it decreases" have the same meaning, but cannot be evaluated as being equal as far as string variables are concerned.

Since the 1970's, several programming languages designed for CAI authoring have become commercially available for use. Each has done much in the way of bridging the gap between CAI and existing high-level programming languages. EnBASIC is an enhanced form of BASIC designed for use on the Apple II series (22). The creators of EnBASIC addressed the

above problems by supplying the system with a vastly enlarged character set. Included are foreign alphabets, superscripts, subscripts, and special types of punctuation. Each character is called up with press of a single key. EnBASIC contains special functions which greatly improve response judging. The program author is able to specify a list of synonyms along with the correct answer to a question. The student's answer is compared with the entire list. Capital letters and the number of spaces between words no longer pose a problem. EnBASIC provides techniques by which blank spaces can be ignored, and all capital letters converted to lower case prior to variable comparison. Graphics displays in EnBASIC are relatively simple to create due to the implementation of one word commands such as "DRAW", "LINE", and "CIRCLE". Using a simple grid coordinate system in conjunction with these commands allows rapid construction of geometrical figures in just a few program steps.

IBM has released a similar authoring system called TenCORE (23). The language offers greatly enhanced character sets and response judging capabilities very similar to those of EnBASIC, and adds a few additional features. The system's graphic editor can be used in conjunction with a light pen or mouse, further simplifying display creation. Geometrical figures can be drawn free hand rather than with a series of program steps. TenCORE includes an effective debugging system by which movement between edit and test modes can be executed with a single keystroke. Statements containing errors are automatically flagged and called up for correction. TenCORE

stores each screen display or specific algorithm as a separate entity. This allows for more compact storage in memory and quicker information retrieval.

A third language receiving much attention is WISE (10). Most programmers using this system were able to learn the language and utilize its full range of features in a matter of a few days. WISE offers a debugging system similar to that of TenCORE, plus full graphics capabilities, extensive character sets, and excellent response judging techniques. It offers one additional feature not found in EnBASIC or TenCORE. WISE operates on a multi-task, multi-user operating system that can support other programming languages such as FORTRAN, COBOL, and PASCAL. When creating a lesson, the author can call up one of these languages for use in a specified section of the program. This enables the programmer to utilize the advantages of other high-level languages as well as the WISE system itself. This feature sets WISE apart from all other CAI languages, and makes it perhaps the most powerful authoring language developed to this date.

With the introduction of new authoring languages, the final hurdle impeding the progress of CAI development has been removed (21). Today microcomputers are commonplace in education. Sharp decreases in cost have made them very affordable. Many instructors have taken advantage of the potential microcomputers offer as a tutor. Early successes in CAI programming have been a source of inspiration, as these educators have dedicated much of their time to the

programming of high quality CAI lessons offering instruction in chemistry, physics, math, the foreign languages, and much more.

D. Student Reaction to CAI

Student feedback on the use of CAI has been consistently very good throughout the twenty years it has been used as a tool in education. Evaluations done on the Plato system in 1970 indicated that the students enjoyed using the computer programs (3). An overwhelming majority felt that the system provided the help needed, and did so in a manner that held the user's attention throughout the lesson. The interviewed students consistently mentioned three important features which made CAI appealing. Each was able to work at his own pace without inconveniencing others. When using a CAI lesson the students immediately knew whether an answer was right or wrong. Many enjoyed being able to work on their own, without a teacher watching over. The only negative response that seemed to arise in early evaluations was an initial apprehension towards computers. Many students had not used a computer before, and were somewhat afraid of it. This was understandable since the computer boom was not to occur for another six to eight years. As the use and popularity of the microcomputer became more widespread, the apprehensiveness towards computers faded rapidly. The recent popularity of video games has done much in the way of demonstrating the "user friendliness" of computers. Recent studies of student attitudes have shown that the appealing features of CAI in 1970 continue to hold true today (24).

Students enjoy the control in making their own decisions that is given to them by the computerized lessons. Motivation seems to center around curiosity and having fun. The ability of the programs to supply immediate answers to questions, combined with a computer's animation capabilities and special effects, provide the curiosity. This creates a "let's see what's next" attitude, which encourages further progression through a lesson. More important is the ever-present opinion that using **CAI** lessons for tutoring has helped make learning fun. This is the most important motivational factor of all, and suggests that further development of the **CAI** field is a worthwhile cause.

Chapter 3

Methodology

A. ICP-AES Analysis

The instrument used in this research is the IL - Plasma 200 Spectrometer. Analytical programs must be generated on the system's microcomputer using a high level programming language called FORTH (25). Wavelengths to be used for a determination arechosen from a library of elements stored in memory. Each wavelength entry contains a set of parameters that requires initial optimization to assure maximum signal intensity and sensitivity. With the aid of the computer's graphics routines, signal intensity versus wavelength plots are constructed to simplify the optimization process. The completed programs are stored on magnetic tape for easy access.

Analyses can be performed in two different modes (25). The regular mode is quantitatively oriented. Standard solutions are required for each element in the program. The linear relationship between signal intensity and concentration is used to establish a calibration curve for each wavelength. The calibrations are stored in memory, and used for the analysis of unknown samples. The Multiquant mode is designed for qualitative and semi-quantitative work. The instrument can be used to automatically determine twenty-

nine elements in rapid sequence in an unknown. Only one standard solution is required. It contains three different elements analyzed at four wavelengths. Emission intensities for the remaining twenty-six elements are derived from intensities of one of the four standard wavelengths and predetermined intensity ratios.

B. The CAI Program

The enclosed CAI program is written in Advanced BASIC. It was designed in a "self-instruction" mode. The programming language, though not an authoring language, is designed for text-to-graphics interconversion. A full range of graphics commands is available in the Advanced BASIC vocabulary (26).

The program is divided into fourteen segments. A diagram of the instrument is first presented to familiarize the operator with the location of the controls. A discussion of the instrument start-up procedure is followed by lessons on writing a program, running an analysis in the normal mode, running the Multiquant mode, program storage, instrument shut-down, and a few supplemental topics. Simulated CRT displays are presented as an aid in explaining the step by step procedure required to operate the IL Plasma-200. The underlying objective of the program is to teach a student with some training in chemical instrumentation how to operate the instrument and develop effective analytical programs.

Chapter 4

Apparatus

A. The Spectrometer

The IL Plasma 200 spectrometer is a sequential scanning instrument (25). The torch, nebulizer, and detection systems are identical to those discussed in the introduction. The monochromator, diagrammed in Figure 14, is an enhanced version of the sequential arrangement introduced in Chapter One. This system is a double monochromator. It provides an excellent wavelength resolution of 0.02 nanometers. The collecting optics responsible for capturing emissions from the torch consists of a lens and mirror. The arrangement is stepper motor driven, which allows effective optimization of the torch observation height. A built-in mercury lamp can be viewed by the collecting optics to enable a self calibration. This process compensates for any non-linearity in the drive mechanism. The two gratings move in unison to the vicinity of the desired wavelength and provide the coarse adjustment. The refractor plate then rotates to the exact point of peak intensity. This is the fine adjustment.

B. The Computer

The CAI program was written on an IBM-PC/XT microcomputer. The unit's memory consists of a ten megabyte hard disk, and a 256 kilobyte random access memory (26). A

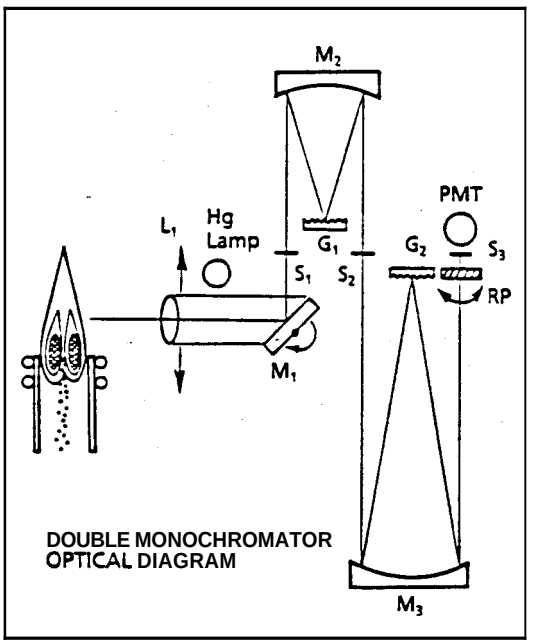


Figure 14. IL Plasma 200's Double Monochromator Design (29)

complete set of ASCII characters is accessed by the keyboard. The video screen supports color output and high resolution graphics.

Advanced BASIC and the computer's operating system are designed by Microsoft (26). Advanced BASIC employs a full screen editor, and an extensive set of commands used for text manipulation and graphics design in high and medium resolutions.

Chapter 5

Procedure, Data, and Results

A. Procedure

Each screen of information in a CAI program is called a page. Two paging formats were used. The first, illustrated in figure 15, involves text only. Many topics concerned with the operation of the instrument are straightforward and require no graphical support. The second format, illustrated in figure 16, involves a combination of text and graphics simulating output from the Plasma 200's video screen. Several routines used in the construction of an analytical program require graphical support to fully develop a concept.

The CAI program was designed, page by page, using a procedure consisting of the following five steps: 1) create a graphics display using a series of Advanced BASIC graphics commands, 2) place the display on the screen by employing a subroutine, 3) place appropriate text on the screen, 4) generate a pause to hold the page on the screen for comprehension, and 5) select a screen clearing option to initiate the next page. For pages requiring no graphics displays, steps one and two are omitted.

1. Creation of Graphics Displays

Graphics in Advanced BASIC are created by the commands "PSET", "PRESET", "LINE", "DRAW", "CIRCLE", "COLOR",

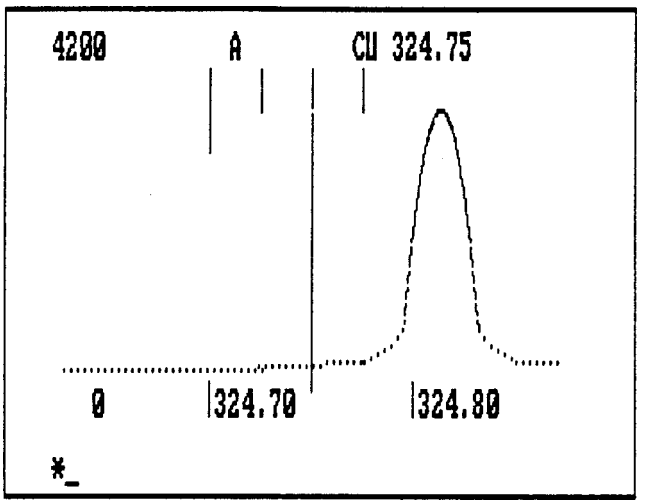
BEFORE TURNING ON THE INSTRUMENT, THE FOLLOWING 3 TASKS MUST BE PERFORMED:

(1) TURN ON THE WATER SUPPLY. THE VALVE IS ON THE PIPE THAT RUNS ALONG THE REAR LEFT CORNER OF THE INSTRUMENT.

(2) TURN ON THE ARGON SUPPLY. THERE ARE 4 VALVES ON THE ARGON TANK. OPEN THE VALVE THAT IS CONNECTED TO THE GREEN HOSE WHICH FEEDS THE ARGON TO THE ICP.

(3) TURN ON THE EXHAUST FAN. SIMPLY PLUG THE CORD MARKED 'FAN' INTO THE OUTLET ON THE WALL BEHIND THE ARGON TANK.

Figure 15. **CAI Format** *1: Text* Only



NOTE THE PEAK IS OFF CENTER, WITH THE MAXIMUM INTENSITY OCCURING AT ABOUT 324.80 NM. THE TRIM ROUTINE WILL FINE TUNE THE MONOCHROMATOR, SO THAT THE PROPER WAVELENGTH IS USED TO DETERMINE THE MAXIMUM INTENSITY.

Figure 16. CAI Format 2: Text and Graphics Display

and "PAINT" (26). The syntax for each command is illustrated in Table 5. The "PSET" command places a point on the screen at the location specified by the coordinates. "PRESET" erases such a point. The "LINE" command draws a line between the two chosen points. "DRAW" places lines on the screen in a relative manner, with each originating from the end of the preceding line. "CIRCLE" draws a circle with its center at the specified coordinates. The radius is defined by "r", and color by "c". There are two groups or palettes of colors with number codes listed in Table 6. The palette used is determined by the "b" coordinate in the "COLOR" command. The "a" coordinate calls up the background color according to Table 7. The "PAINT" command paints with the color "c", starting at the point specified by the "x" and "y" coordinates, and ending when contact is made with the color specified by "s".

2. Displaying Graphics on the Screen

A completed graphics display is stored in the program as a subroutine. This allows multiple calls of the illustration without repeating the series of commands used to create it (26). Editing is made simpler, as changes to the illustration can be made by stepping through the subroutine rather than the entire program. The command used to call a subroutine is "GOSUB x". The "x" parameter specifies the line number of the subroutine's first statement. Figure 17 illustrates a typical subroutine used in the lesson. The "RETURN" command terminates the subroutine, and sends control back to the main program sequence.

Command	Syntax	Parameter Definitions
PSET	PSET (x,y)	x = x coordinate of point y = y coordinate of point
PRESET	PRESET (x,y)	same as above
LINE	LINE (x1,y1)-(x2,y2)	(x1,y1) = origin of line (x2,y2) = end of line
DRAW	DRAW "!#"	! = line direction: U - up, D - down, L - left, R right # = length of line
CIRCLE	CIRCLE (x,y),r,c	(x,y) = center of circle r = radius c = color
COLOR	COLOR a,b	a = background color b = character color palette (consult tables 6 & 7)
PAINT	PAINT (x,y),c,s	(x,y) = paint starting point c = color s = paint stopping point

Table 5. Syntax for Advanced BASIC's Graphics Commands (26)

Color Palette 0: COLOR a,0		Color Palette 1: COLOR a,1	
c Value:	Color:	c Value:	Color:
1	green	1	cyan
2	red	2	magenta
3	yellow	3	white

Table 6. Color Palettes Available in Advanced BASIC (26)

Value of "a" in color command (COLOR a,b)	Color
0	Black
1	Blue
2	Green
3	Cyan
4	Red
5	Magenta
6	Brown
7	White
8	Gray
9	Light Blue
10	Light Green
11	Light Cyan
12	Light Red
13	Light Magenta
14	Yellow
15	High Intensity White

Table 7. Background Colors Available in Advanced BASIC (26)

```
5100 LOCATE 3,23
5101 PRINT "P 200    123450-00          4 JULY 1985"
5102 LOCATE 5,28
5103 PRINT "P#  WP PWR NAMED"
5104 LOCATE 6,29
5105 PRINT "1    0    3 COPPER"
5106 LOCATE 8,27
5107 PRINT "ML/M PDLY HG  *ANAL *RDG"
5108 LOCATE 9,28
5109 PRINT "1.0   30  1       0     0"
5110 LOCATE 11,22
5111 PRINT "# EL        NM  ORD  CH  MM  BC   SEC"
5112 LOCATE 16,23
5113 PRINT "*_"
5115 RETURN
```

Figure 17. Sample Subroutine Statements

3. Text Placement

The placement of text on the screen is quite simple. It employs the commands "LOCATE" and "PRINT" (26). The "LOCATE" command specifies the location on the screen where text is to be placed. The syntax is "LOCATE x,y", where x and y are the coordinates of the desired position. "PRINT" specifies what is to be printed at the set location.

4. Generating a Pause

When a program displays a screenful of information, execution must pause so that the information can be read. The pausing control for the program was designed by using the "INKEY" statement, which is listed below:

```
6050 A$=INKEY$:IF A$="" GOTO 6050
```

The "INKEY" statement places a character entered from the keyboard into an assigned variable, in this case "A$" (26). As long as no key is pressed, "A$" is empty and the "IF" condition is true. Control is then branched back to the same line, generating a loop which stops program execution. When any key is pressed the "IF" condition becomes false. The loop terminates, and program execution continues.

5. Screen Clearing

To smoothly page through the tutorial, special screen clearing functions were created. When a format displaying only text is used, screen clearing is achieved by use of the Advanced BASIC command "CLS"(26). Its effect is an erasing of the entire screen. When using the format employing a combination of text and graphics, clearing is obtained by

calling one of two subroutines. The first clears only the text portion, while leaving the graphics displays intact. The second subroutine clears both the text and graphics displays, leaving only the rectangular border representing the Plasma 200's video screen. In both cases, clearing is achieved by using "LOCATE" and "PRINT" commands to replace existing characters with blanks.

6. Program Linkage

Advanced BASIC allows a total program size of 64 kilobytes. A tutorial on the operation of the Plasma 200 is quite extensive, and cannot be limited to one program. This necessitated the use of multiple subprograms linked together by a master program. Each subprogram contains one chapter of the lesson. The master is essentially a table of contents that allows the student to branch to the desired chapter. Figure 18 illustrates the table of contents. The question mark at the bottom of the table is generated by the "INPUT" command (26). The program is requesting numerical input from the user. The desired chapter is viewed by subsequently entering the corresponding chapter number. A series of "IF" statements branches control to the requested chapter. Statement 134 in the master program is listed below:

```
134 IF X=5 THEN RUN "ICP-5.BAS"
```

If the user selects the fifth chapter and enters a 5, this statement will execute "ICP-5.BAS". This is the subprogram containing chapter 5. Each of the tutorial's fourteen chapters are accessed in this manner. Linkage from each

TABLE OF CONTENTS

CHAPTER NUMBER
?

Figure 18. Table of Contents for the CAI Program

subprogram back to the table of contents was designed by utilizing the "ON KEY" command, which can be found at the end of each chapter program (26). "ON KEY[1]' sets up a line number for Advanced BASIC to branch to when a specified function key is pressed. In each chapter the line

"ON KEY (1) GOSUB 200"

was used to branch control back to the table of contents. The "1" in parentheses specifies function key "F1". When the key is pressed control branches to program line 200. This line contains the command RUN "ICP-B.BAS", which displays the table of contents.

The complete procedure is the program itself. A copy of the program is presented in Appendix A.

B. Data

The instructional data used for the CAI lesson was taken from three sources: 1) the IL Plasma 200 Operator's Manual, 2) the IL Multiquant program supplement, and 3) the Facit 5000 Series Parallel Printer Manual.

1. IL Plasma 200 Operator's Manual (26)

The instruction manual begins with a diagram of the instrument, which serves to familiarize the operator with the location of the controls. Instrument power up requires that the cooling water supply, argon supply, and venting systems are activated prior to turning on the system. After the circuit breaker is turned on, the system tape is loaded into the tape deck and read. The instrument runs through a three-minute warm up period, during which an automatic mercury calibration is performed and the RF power supply is

activated. The system signifies the completion of the warm up by displaying the main program menu, illustrated in Figure 19. At this point the torch ignition sequence is called up by the operator. The sequence is computer controlled, and lights the argon torch after an 85 second countdown.

The second option on the program menu is used to bring up the 1/0 format menu while the torch is stabilizing. This menu, illustrated in figure 20, allows the operator to turn on the instrument's parallel printer, RS232, and autosampler ports. Each option must be called up and turned on separately every time the system is brought up. The parallel printer option has its own sub-menu, illustrated in Figure 21. It is used to set the format of the printer output. The diagnostic option is responsible for placement of atomic symbols, wavelengths, and signal intensity values on the CRT and printer output. The extended range routine allows the operator to extend a linear calibration curve far beyond the concentration of the highest standard. Setting of the time, date, and operator ID is controlled by the 1/0 menu. The use of these three items is strictly for convenience, and not required for program editing and analysis execution. Each option on the I/O menu is called up by entering the corresponding option number, and activated by following the instructions subsequently placed on the CRT.

An analytical program is created by entering a program number and name. The system responds by placing a series of program variables on the screen. Figure 22 illustrates a sample program. The program number and name are

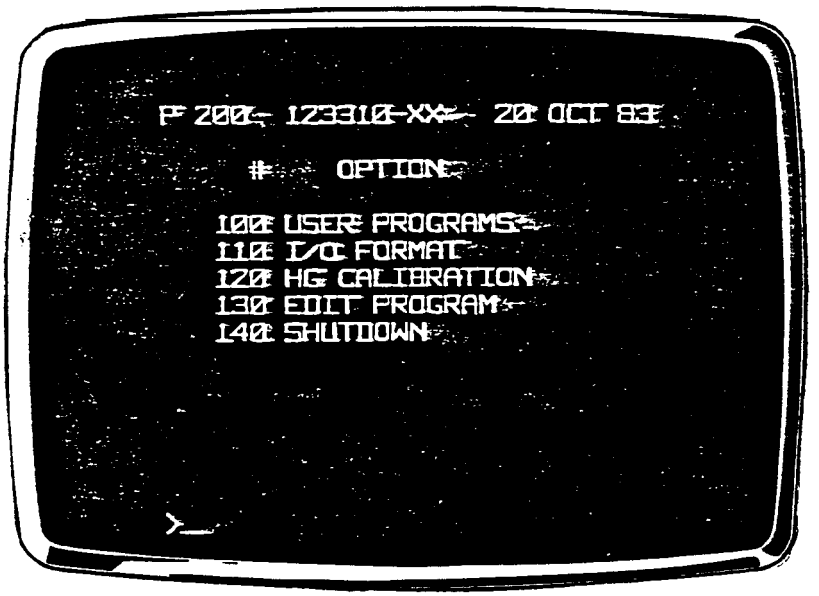


Figure 19. Main Program Menu (26)

Figure 20. I/O Menu (26)

Figure 21. I/O Printer Submenu (26)

Figure 22. Sample Program Display (25)

displayed under the "P#" and "NAMED" headings. The "PWR" variable controls the torch power level. "WP" is used to activate a write protect option which protects a program from accidental erasure. The "ML/M" and "PDLY" variable set the program's pump aspiration rate and pump delay, respectively. "HG" indicated whether the mercury lamp used for self calibration is on or off. The "*ANAL" variable sets the number of repeat analyses, and "*RDG" specifies the number of readings to be taken at each wavelength. Program variables are set using the format "x variable", where x is the desired value and "variable" is the name of the program variable being set. Table 8 itemizes the units and recommended values for each program variable.

Analytical lines are chosen from a library of wavelengths for 78 elements, located in the system's memory. Figure 23 lists lines available for copper. Each analytical line placed in a program contains a separate set of line variables which are displayed in the format illustrated in Figure 24. Several of the variables are not operator controlled. The "ORD" parameter lists the order used by the monochromator to isolate the wavelength listed under "NM". This instrument has only one monochromator, and is thereby a one channel system. This situation is denoted by the "A" found under "CH". The "SENSITIVITY" and "BLNK-SENSIT" parameters display the net signal intensity for the high standard and the total blank signal, respectively. The remaining variables, set by the operator, are defined in

Parameter	Units	Recommended Value
PWR	none	3
WP	none	0 - off, 1 - on
ML/M	milliliters/min	1.0
PDLY	seconds	30
HG	none	0 - off, 1 - on
*ANAL	none	2
*RDG	none	3

Table 8. Operator Controlled Program Variables (25)

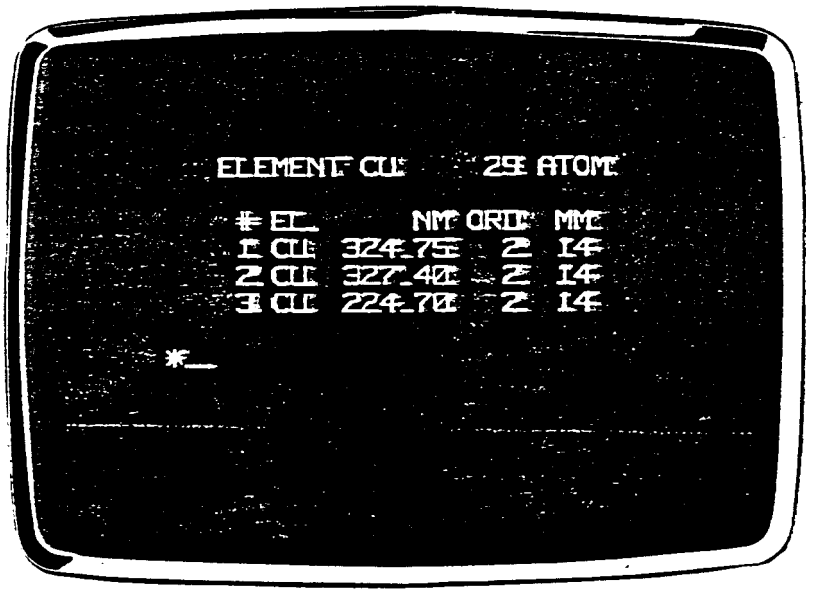


Figure 23. Available Copper Lines (25)

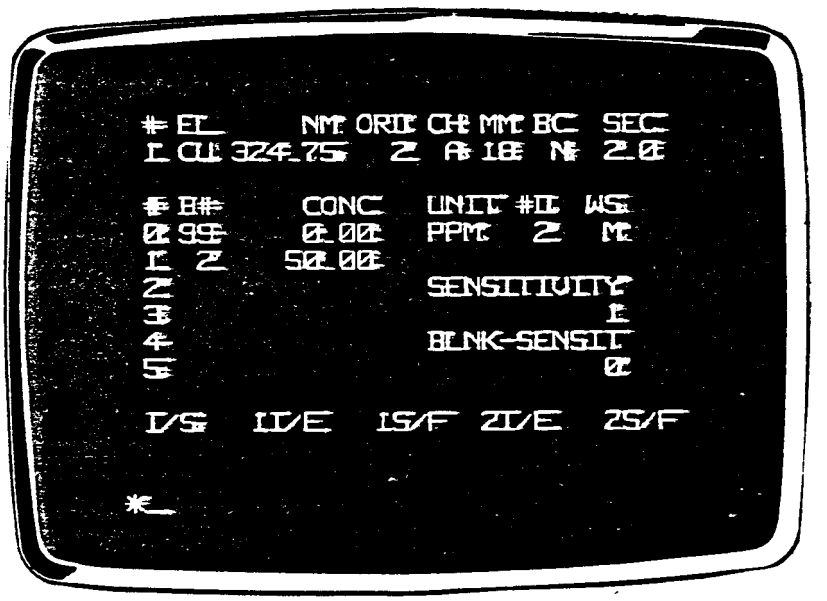


Figure 24. Sample Copper Line Report (25)

Parameter/Function	Units	Rec. Value
MM - sets torch viewing height	millimeters	variable*
BC - sets background correction	none	variable*
SEC - sets integration time	seconds	1.0
WS - sets window size for monochromator	none	medium (m)
#D - sets # of decimals held in concentration values	none	2
UNIT - sets units display for concentration values	PPM, PPB, "%", or "weight %"	PPM (0)
CONC - sets concentration value of standards	set by above command	PPM
B# - sets bottle number of each standard	none	variable (0 - 99)
I/S - sets line number of internal standard	none	N/A
1I/E - sets line number of interfering element #1	none	N/A
1S/F - sets scale factor for above element	none	N/A
2I/E - sets line number of interfering element #2	none	N/A
2S/F - sets scale factor for above element	none	N/A

* These values vary from program to program, and from element to element.

Table 9. Operator Controlled Line Variables (25)

Table 9. The desired value for each is entered using the same format as that used for entering the program variables.

An analytical program is initiated by setting the program and line variables. A trim , background-trim, and torch profile routine is then carried out for each analytical line. Figure 25 displays a typical signal intensity versus wavelength plot for copper. The trim option fine tunes the monochromator so that the instrument takes an intensity reading at the point of maximum signal intensity. The background-trim option is used to set the point at which a background reading is taken at a stable, interference-free portion of the baseline. The torch height parameter is set by the torch profile routines which generate signal intensity versus torch height plots such as the example in Figure 26.

The calibration and analysis routines are very simple and totally automated. To generate a calibration curve, the operator enters the command "CALIBRATE" and the number of solutions to be used in the process. Calibration intensities are displayed for each analytical line. To run an analysis, the operator simply enters the command "ANALYZE". At the end of the process, a report is generated for each sample. The concentration of each element present is tabulated.

Program storage and retrieval are executed from the tape menu, illustrated in Figure 27. Option two is used to store an analytical program on tape. Option six reads such a program, and places it back in the instrument's memory. System programs are stored and retrieved in a similar manner.

Instrument shut down requires a three-minute warm

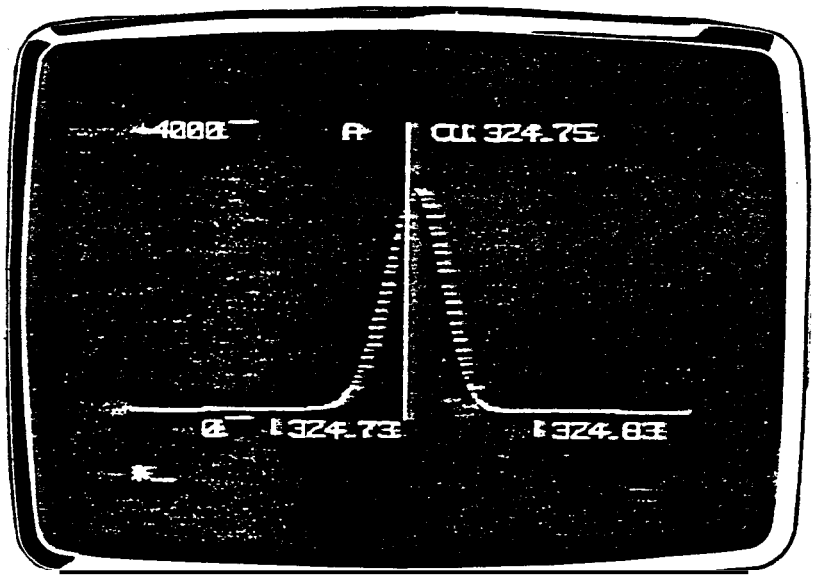


Figure 25. Sample Copper Plot (25)

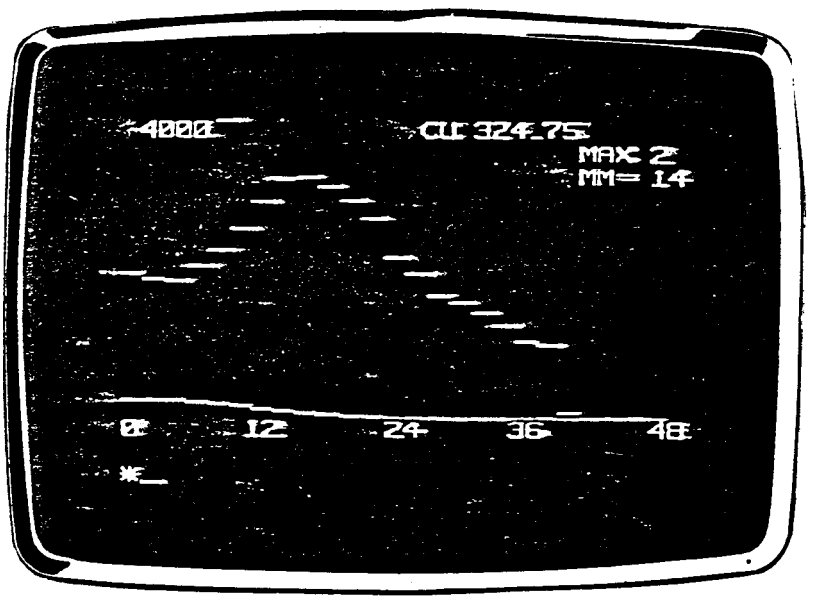


Figure 26. Sample Torch Height Plot (25)

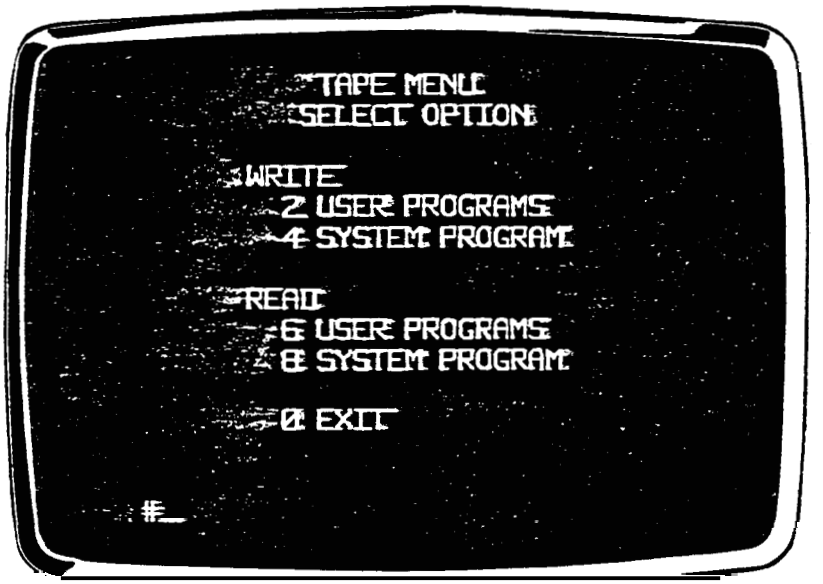


Figure 27. Tape Menu Display (25)

down before the circuit breaker can be tripped. Activating the shut down procedure turns off the torch and RF power supplies, and starts the three-minute countdown for shut down.

To utilize the internal standard option, the operator selects a reference element for each analyte. The line report number for the reference is entered in the "I/S" column on each analyte's line report. The reference element spike is added into all standards and samples and the analysis is carried out. Each analyte's concentration is corrected by the internal standardization process.

The interfering element routine allows corrections for up to two interfering elements. A known concentration of the interfering element is analyzed at the analyte's wavelength. A correction factor consisting of a ratio of the apparent concentration at the analyte's wavelength to the known concentration is calculated. The line report number of the interfering element and the correction factor are entered in the "1I/E" and "1S/F" columns on the analyte's line report. In subsequent analyses the interfering element's affect on the analyte's concentration will be subtracted out.

Errors in bringing up the system, enabling the torch, writing a program, and running analyses are diagnosted by the system in the form of error messages that appear on the CRT. The manual contains a complete list of all such error messages used by the instrument. In the CAI program the 26 most commonly occurring error messages are listed, along with

probable causes and corrective actions.

2. IL Multiquant Supplement (27)

The Multiquant mode has a separate system tape which must be read during instrument power up, or by use of the tape menu. A Multiquant program contains the same set of program variables found in a regular mode program. The system is supplied with 30 analytical lines. The operator can interchange unwanted lines with those found in the library of elements. Each line report contains line variables found in the regular system. Figure 28 illustrates a Multiquant line report. An additional operator adjusted parameter, "RATIO", is displayed at the bottom of the report. Initialization of a Multiquant program includes the setting of the program and line variables, execution of the trim and background-trim routines, a torch profile, and adjustment of the "RATIO" value. The final step in the process is necessary to allow calibration of all 30 analytical lines with a standard solution consisting only of barium, copper, and zinc. The ratio converts the signal intensity of one of these three elements into a similar value for each of the other elements. A Multiquant analysis is activated by the "ANALYZE" command. Output from the instrument includes signal intensity versus wavelength plots for each analytical line, in addition to concentration values.

3. The Facit 5000 Parallel Printer Manual (28)

Operation of the parallel printer is a two-step process. The instrument is turned on by flipping the switch

#	EL	NM	ORD	CH	MM	BC	SEC
1	AS	193.70	2	A	10	L	1.0

#	B#	CONC	UNIT	#D	WS
0	99	0.0	PPM	1	W
1	1	100.0			

SENSITIVITY	BLNK-SENSIT
1	0

CAL	RATIO
2	0.140

Figure 28. Multi-Quant Line Report (27)

on the rear panel. The printer is subsequently placed on line with the Plasma 200 by pressing the "on line" button on the control panel. Output can be torn off after switching the printer off line, and pressing the "top of forms" button once.

C. Results

The CAI program created with the preceding data is a comprehensive lesson on the operation of the Plasma 200 spectrometer. The supportive graphical displays allow a more simplified version of the instrument's operating procedure than that found in the instruction manuals.

Chapter *1* diagrams the instrument, and points out the location of the control panels. Chapter 2 offers step by step instruction on the method by which the system is brought up. Included is a discussion of the tape deck and the main program menu. The third chapter discusses the torch ignition process and explains the purpose of each phase of the countdown. The 1/0 menu is presented in chapter *4.* Figure 29 illustrates the CAI constructed representation of the menu. A detailed description of each option is included. The syntax of commands used to implement the options is presented, along with suggestions as to which should be used for routine analysis.

Chapter 5 is the most important of the lesson's *14* sections. An extensive discussion of the proper program-writing technique is found in this chapter. Figures 30 and 31 display the tutorial's re-creations of a sample program and a typical line report, respectively. The function of each

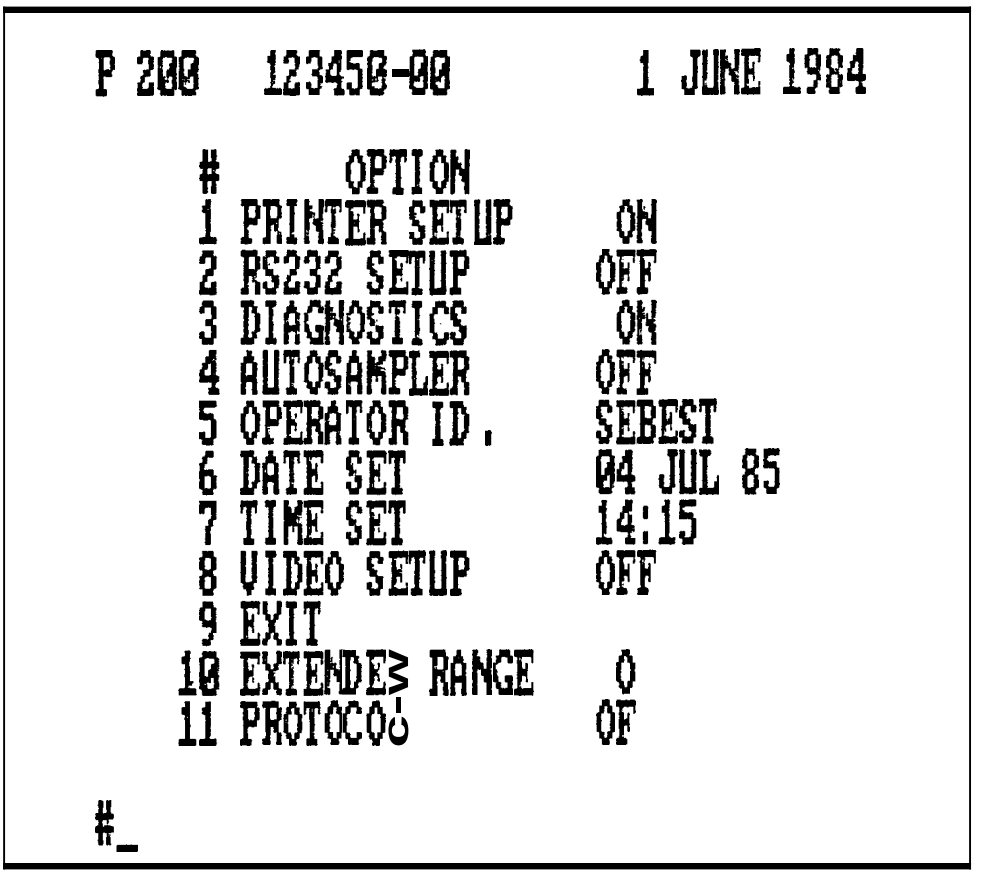


Figure 29. CAI Generated I/O Menu

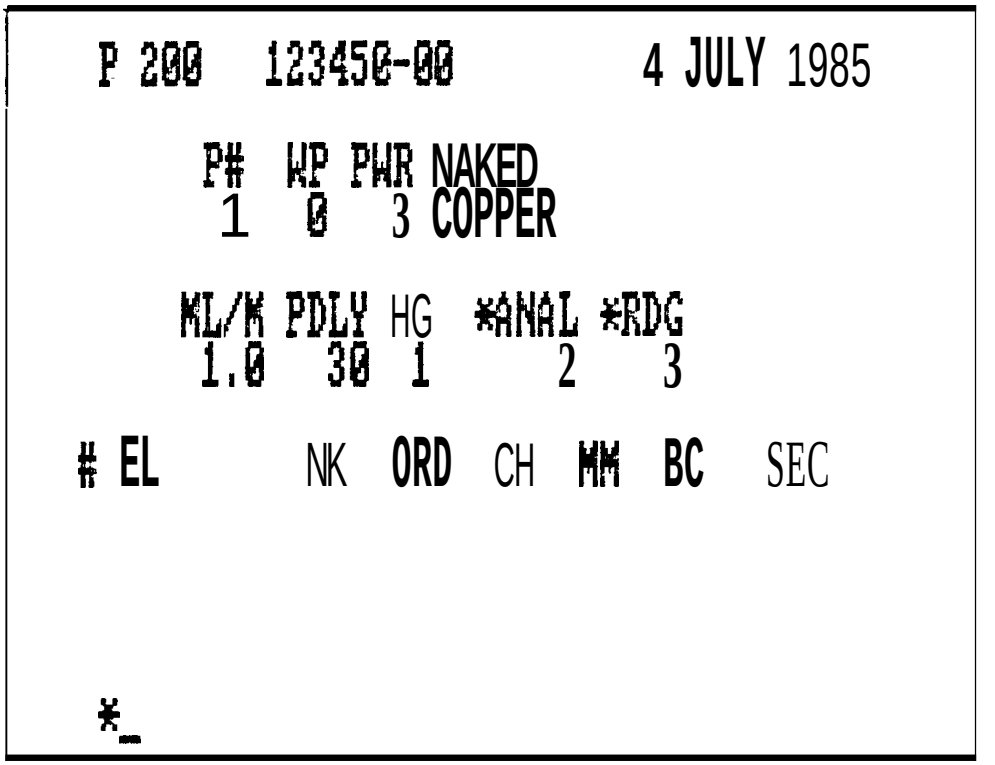


Figure 30. CAI Generated Sample Program

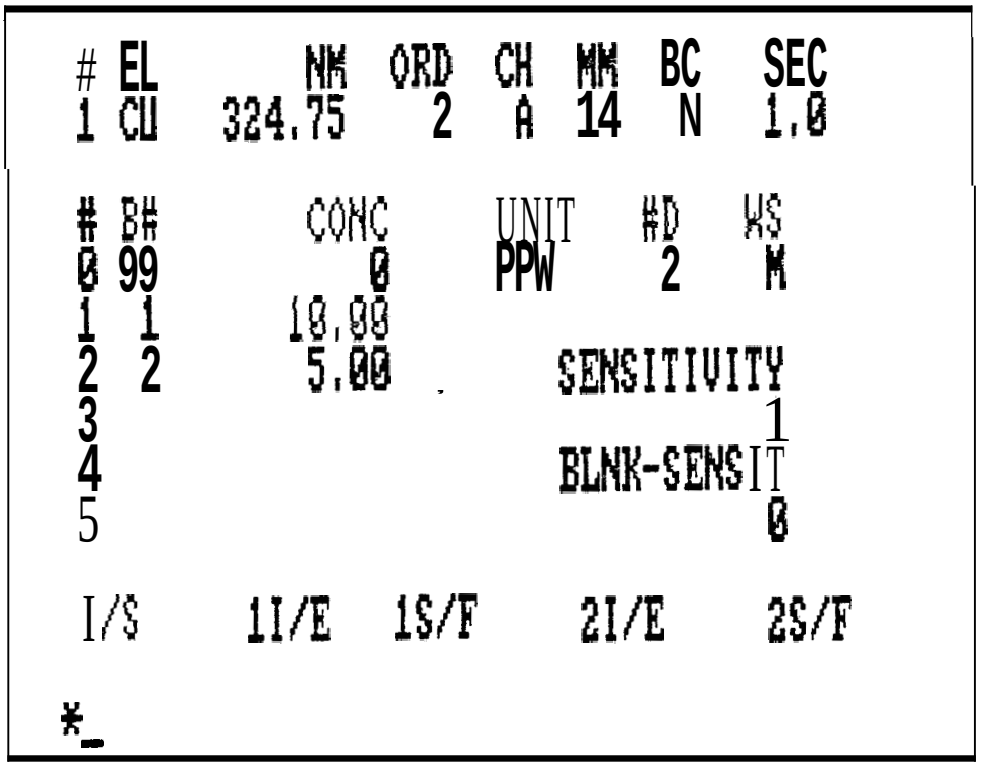


Figure 31. CAI Generated Line Report

program and line report variable is revealed, along with the proper commands used to set the corresponding values. Recommendations are made as to which values provide the best results. Figure *32* displays the program's example intensity versus wavelength plot. The purpose of each of the markings on the plot is discussed, which leads to a description of the trim, background-trim, and torch profile procedures. Figure 33 illustrates a typical torch profile.

Chapter 6 deals with the running of simple analyses. The calibration and analysis routines are explained. The tutorial offers sample CRT output for a calibration and analysis. (see figures *34* and *35)* Such illustrations are not presented in the instrument manuals.

The next two chapters deal with Multiquant. Chapter 7 introduces Multiquant and explains the method by which ratio values are obtained. Chapter 8 presents sample output from a Multiquant analysis.

Chapter 9 discusses the tape menu. Proper program storage and retrieval techniques are outlined. Chapter 10 explains the reasons for an organized shut down procedure, and reveals how the procedure is activated.

The following two chapters deal with special features available in the normal analysis mode. Chapter 11 lists the criteria used to determine whether an internal standard will be necessary. An outline of the implementation procedure is included. Chapter *12* explains the theory behind interfering elements. The process used to calculate a correction factor

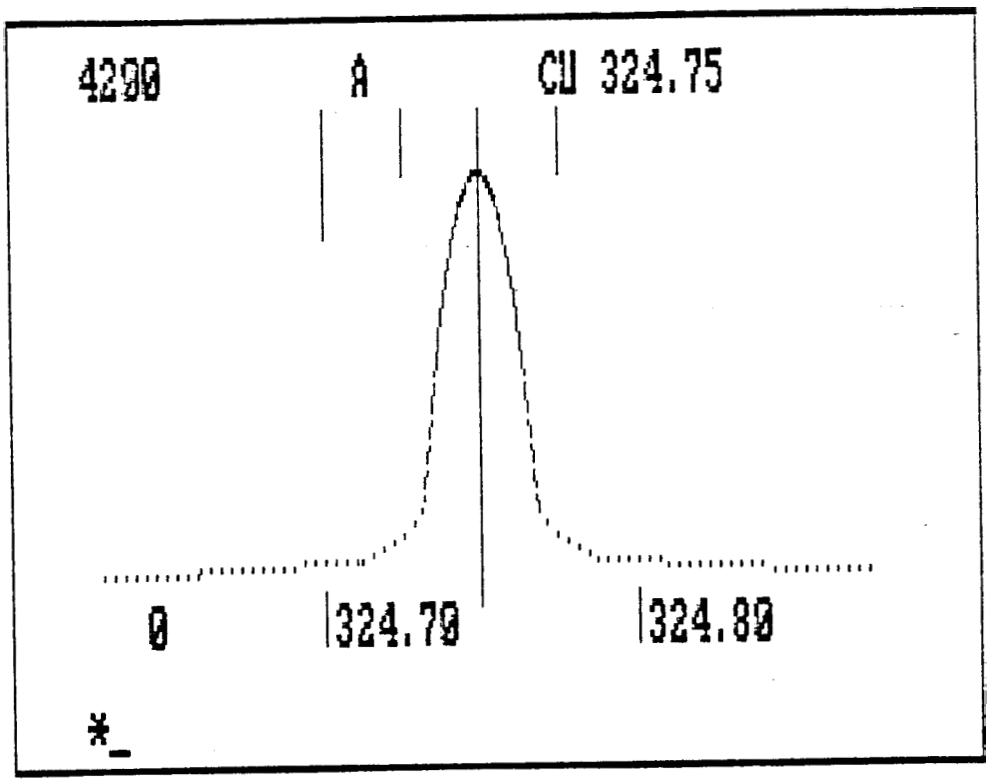


Figure 32. CAI Generated Copper Plot

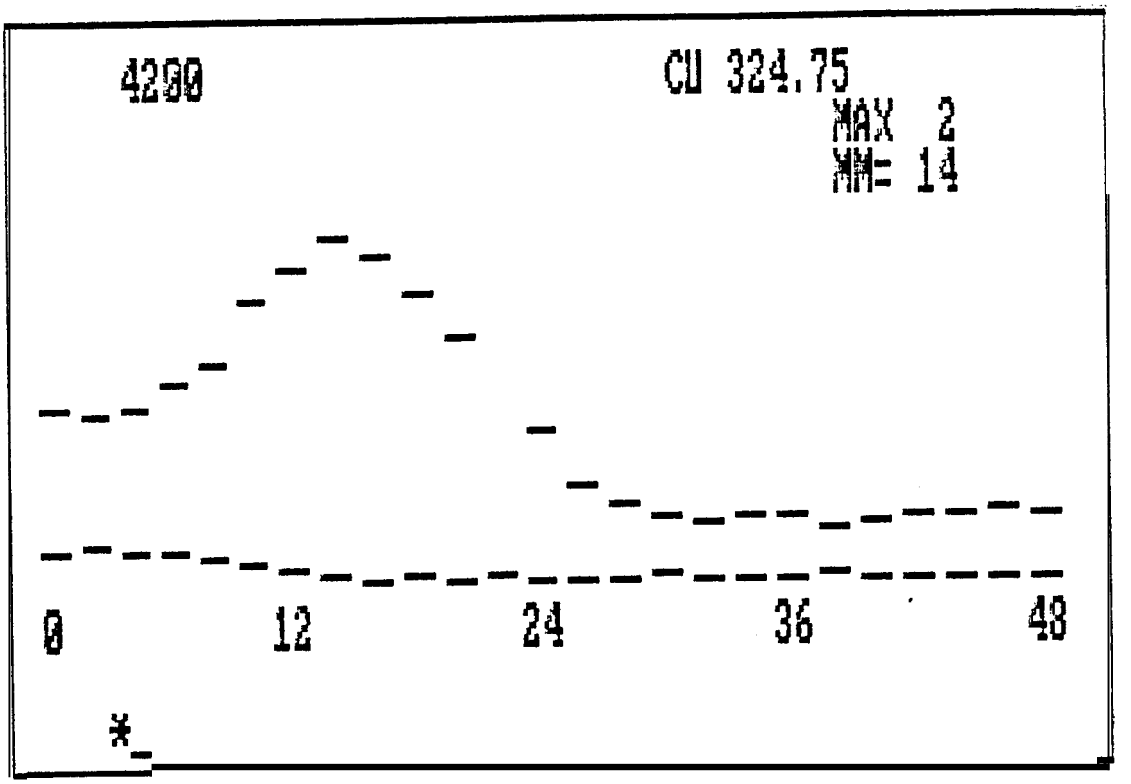


Figure 33. **CAI** Generated Torch Profile

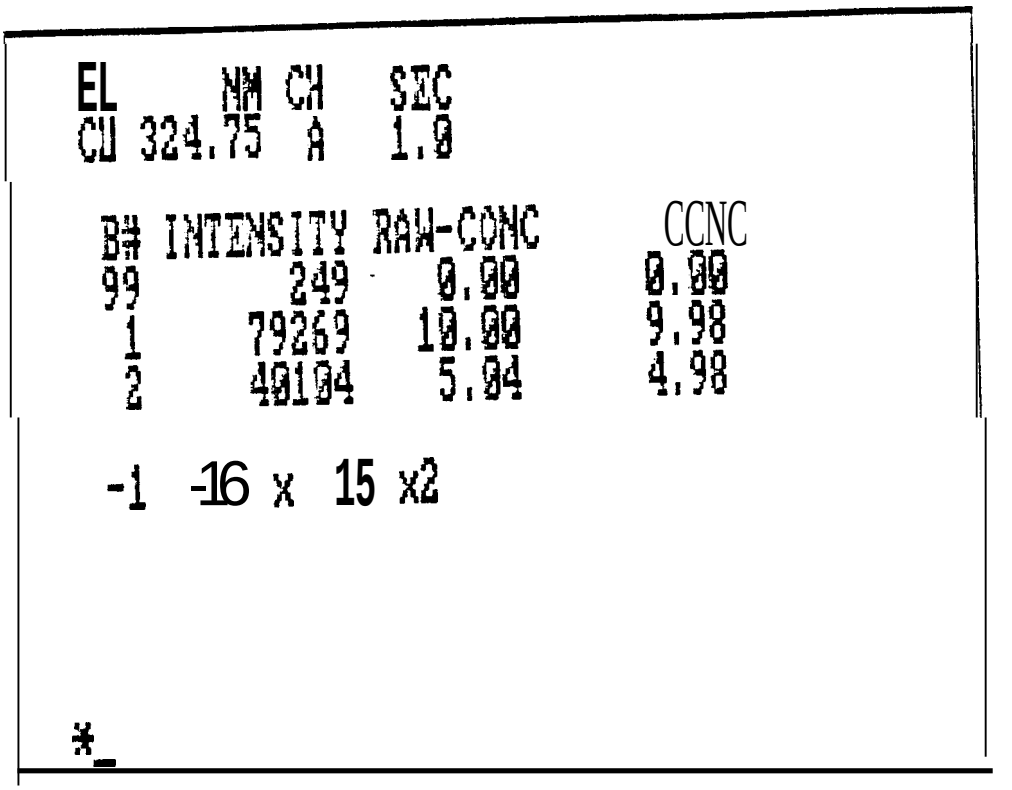


Figure 34. CAI Generated Calibration Data

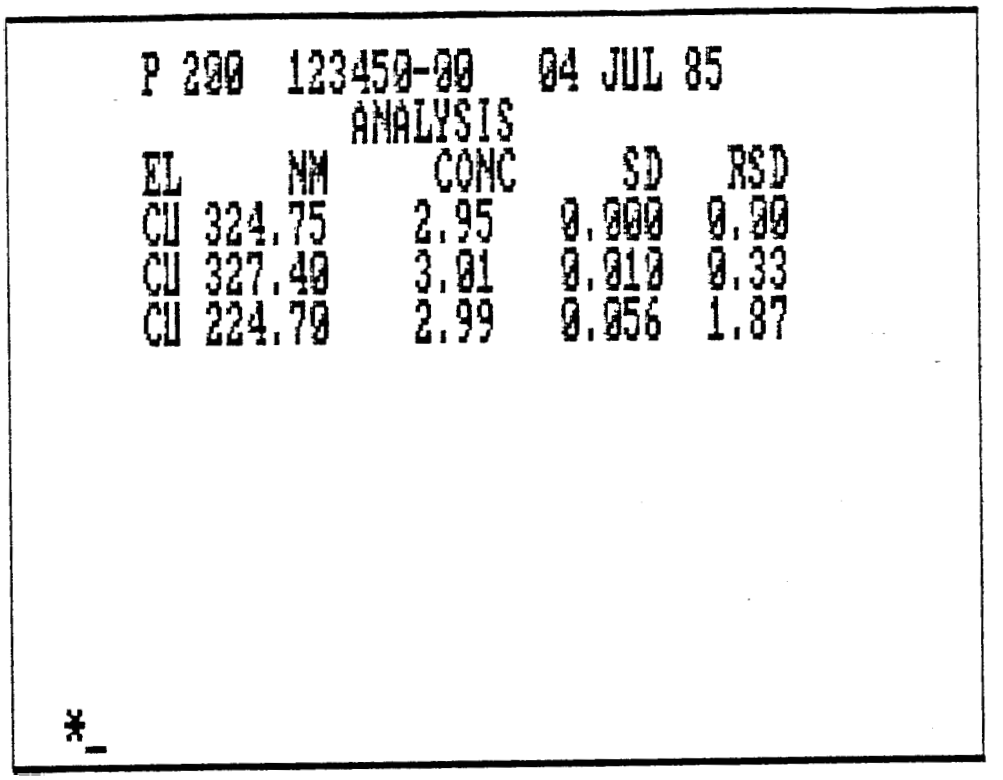


Figure 35. CAI Generated Analysis Results

is provided, along with the method by which the interfering element routine is activated.

Chapter 13 discusses the 26 most common error messages. Included are probable causes for the errors and corrective procedures. The final chapter explains how to use the parallel printer. The tutorial is designed so that the student learns how to write a program by observing the creation of a sample copper program from scratch. The program development starts in chapter 4 with a discussion of I/O, and concludes in chapter 9 with the storage of the program. There are two copies of the lesson, both of which are now available for use.

Chapter 6

Conclusions

The Advanced BASIC programming language used for the authoring of the CAI tutorial proved to be a suitable choice. The full range of graphics commands available allowed for easy recreation of diagrams and plots generated on the Plasma 200. The language's ability to quickly convert between the text and graphics modes enabled the placement of text under each illustration. Screen-clearing functions were easily implemented with the aid of subroutines. The full screen editor allowed for rapid program alterations when needed.

The objective of this research was two-fold. The first phase was to develop a procedure for writing a CAI program in Advanced BASIC. Graphics displays were created by the set of graphics commands. Subroutines were used to place the displays on the screen. Supportive text was added with the "LOCATE" and "PRINT" commands. Program pauses were invoked with the "INKEY" statement. Linkage between successive pages was achieved by generating the screen clearing functions. This procedure allowed creation of the CAI lesson which utilizes about 4000 programming lines.

The utility of computers in chemistry is well documented. The second phase of the objective was to support the literature, and more specifically, demonstrate a

computer's ability to teach students how to operate chemical instrumentation. ICP-AES is a continuously expanding field. The demand for multi-element analysis techniques has increased the popularity of ICP-AES immensely. Operation of Instrumental Laboratories' Plasma 200 spectrometer requires thorough understanding of spectrometric methods development, operation of the normal and Multiquant modes, program storage, and general instrument operating procedure. The CAI lesson breaks these topics down into 14 chapters to allow the introduction of supplemental details not found in the instrument's operating manuals.

The procedure for writing CAI in basic is now being used to write a program for the instruction of the operation of the IL Video 11 atomic absorption spectrometer. This instrument employs a microcomputer only for data and results processing. Flame ignition, fuel and oxidant regulation, and hollow cathode lamp initialization are not computer controlled in the manner utilized for components of the Plasma 200 spectrometer. This necessitates a more complex set of graphical displays, which diagram the burner and accompanying adjustment controls. Wavelength selections are controlled by the operator instead of the computer and a stepper motor. A set of diagrams illustrating proper use of the wavelength selection control is essential, as are diagrams of the fuel and oxidant meters. The Video 11 and Plasma 200 are similar in that both require methods development routines. The Video 11 can be operated in two different modes: atomic absorption or atomic emission. A CAI

program would greatly simplify the procedures involved in each mode. At the time of this publication, all graphics displays were complete. Work was turning to the authoring of the operating procedures.

APPENDIX A

ICP-AES.BAS (Main Program)

```
1 KEY OFF
2 CLS
3 SCREEN 2
5 LOCATE 5,34,1,0,7
6 PRINT "USER'S GUIDE"
7 LOCATE 8,37,1,0,7
8 PRINT "FOR THE"
9 LOCATE 11,33,1,0,7
10 PRINT "`IL PLASMA 200'"
11 LOCATE 14,30,1,0,7
12 PRINT "ICP SPECTROPHOTOMETER"
13 LOCATE 22,28,1,0,7
14 PRINT "PRESS SPACE BAR TO CONTINUE"
15 A$=INKEY$:IF A$="" GOTO 15
16 CLS
17 SCREEN 2
13 PRINT "EACH SCREENFUL OF INFORMATION REPRESENTS A 'PAGE '.
UNLESS OTHERWISE INDICATED,  PAGES ARE ADVANCED BY PRESSING
THE SPACEBAR."
20 A$=INKEY$:IF A$="" GOTO 20
21 CLS
22 SCREEN 2
23 PRINT "THIS PROGRAM WILL EXPLAIN HOW TO USE THE ICP USING
BOTH THE REGULAR AND          MULTI-QUANT SYSTEMS."
24 A$=INKEY$:IF A$="" GOTO 24
25 CLS
50 PRINT "FOLLOWING IS A TABLE OF CONTENTS. TO SELECT A
SPECIFIC CHAPTER, SIMPLY ENTER THECORRESPONDING CHAPTER
NUMBER. IT IS SUGGESTED THAT BEGINNERS READ THROUGH EACR
CHAPTER SEQUENTIALLY.
51 PRINT ""
52 PRINT "THE TABLE OF CONTENTS CAN BE CALLED UP FROM ANY
POINT IN A CHAPTER BY PRESSING  THE `F1' KEY."
53 PRINT ""
54 PRINT "THE ENTIRE PROGRAM CAN BE TERMINATED AT ANY POINT
BY PRESSING THE `F10' KEY."
55 ON KEY(1) GOSUB 1005
56 KEY(1) ON
57 ON KEY(10) GOSUB 1000
58 KEY(10) ON
62 A$=INKEY$:IF A$="" GOTO 62
63 CLS
64 LOCATE 2,32
65 PRINT "TABLE OF CONTENTS"
66 PRINT "":PRINT ""
67 PRINT "CHAPTER 1 - ICP BLOCK DIAGRAM"
```

```
68 PRINT ""
69 PRINT "CHAPTER 2 - INSTRUMENT START-UP"
70 PRINT ""
71 PRINT "CHAPTER 3 - ENABLING THE TORCH"
72 PRINT ""
73 PRINT "CHAPTER 4 - 1/O PARAMETERS"
74 PRINT ""
75 PRINT "CHAPTER 5 - WRITING A PROGRAM"
76 PRINT ""
77 PRINT "CHAPTER 6 - SIMPLE ANALYSES"
78 PRINT ""
79 PRINT "CHAPTER 7 - MULTIQUANT PROGRAMS"
80 PRINT ""
81 PRINT "CHAPTER 8 - MULTIQUANT ANALYSES"
82 PRINT ""
83 PRINT "CHAPTER 9 - PROGRAM STORAGE"
84 PRINT ""
85 LINE (317,25)-(317,170)
86 LINE (1,25)-(800,25)
87 LINE (1,170)-(800,170)
88 LOCATE 5,42
89 PRINT "CFAPTER 10 - INSTRUMENT SHUT-DOWN"
90 LOCATE 7,42
91 PRINT "CHAPTER 11 - INTERNAL STANDARDS"
92 LOCATE 9,42
93 PRINT "CHAPTER 12 - INTERFERING ELEMENTS"
94 LOCATE 11,42
95 PRINT "CHAPTER 13 - TROUBLE-SHOOTING"
96 LOCATE 13,42
97 PRINT "CHAPTER 14 - USING THE PRINTER"
109 LOCATE 23,1
110 PRINT "CHAPTER NUMBER ":INPUT X
130 IF X=1 THEN RUN "ICP-1.BAS"
131 IF X=2 THEN RUN "ICP-2.BAS"
132 IF X=3 THEN RUN "ICP-3.BAS'
133 IF X=4 THEN RUN "ICP-4.BAS"
134 IF X=5 THEN RUN "ICP-5.BAS"
135 IF X=6 THEN RUN "ICP-6.BAS"
136 IF X=7 THEN RUN "ICP-7.BAS"
137 IF X=8 THEN RUN "ICP-8.BAS"
138 IF X=9 THEN RUN "ICP-9.BAS"
139 IF X=10 THEN RUN "ICP-10.BAS"
140 IF X=11 THEN RUN "ICP-11.BAS"
141 IF X=12 THEN RUN "ICP-12.BAS"
142 IF X=13 THEN RUN "ICP-13.BAS"
143 IF X=14 THEN RUN "ICP-14.BAS"
149 GOTO 63
1000 SYSTEM
1005 RUN "ICP-B.BAS"
4999 END
5000 LINE (140,10)-(510,10)
5001 LINE (510,10)-(510,130)
5002 LINE (510,130)-(140,130)
5003 LINE (140,130)-(140,10)
5006 RETURN
```

```
5010 LINE (140,1)-(510,1)
5011 LINE (510,1)-(510,138)
5012 LINE (510,138)-(140,138)
5013 LINE (140,138)-(140,1)
5014 RETURN
5015 LINE (115,10)-(535,10)
5016 LINE (535,101-(535,130)
5017 LINE (535,130)-(115,130)
5018 LINE (115,130)-(115,10)
5019 RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
6002 PRINT "                                                    "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "

6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
6014 LOCATE E,1,1,0,7
6015 PRINT "
                                    "
6016 E=E+1
6017 IF E=23 THEN GOTO 6019
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
```

```
61 SCREEN 2
62 KEY OFF
63 CLS
64 LOCATE 2,32
65 PRINT "TABLE OF CONTENTS"
66 PRINT "":PRINT ""
67 PRINT "CHAPTER 1 - ICP BLOCK DIAGRAM"
68 PRINT ""
69 PRINT "CHAPTER 2 - INSTRUMENT START-UP"
70 PRINT ""
71 PRINT "CHAPTER 3 - ENABLING THE TORCH"
72 PRINT ""
73 PRINT "CHAPTER 4 - I/O PARAMETERS"
74 PRINT ""
75 PRINT "CHAPTER 5 - WRITING A PROGRAM"
76 PRINT ""
77 PRINT "CHAPTER 6 - SIMPLE ANALYSES"
78 PRINT ""
79 PRINT "CHAPTER 7 - MULTIQUANT PROGRAMS"
80 PRINT ""
81 PRINT "CHAPTER 8 - MULTIQUANT ANALYSES"
82 PRINT ""
83 PRINT "CHAPTER 9 - PROGRAM STORAGE"
84 PRINT ""
85 LINE (317,251-(317,170)
86 LINE (1,25)-(800,25)
87 LINE (1,170)-(800,170)
88 LOCATE 5,42
89 PRINT "CHAPTER 10 - INSTRUMENT SHUT-DOWN"
90 LOCATE 7,42
91 PRINT "CHAPTER 11 - INTERNAL STANDARDS"
92 LOCATE 9,42
93 PRINT "CHAPTER 12 - INTERFERING ELEMENTS"
94 LOCATE 11,42
95 PRINT "CHAPTER 13 - TROUBLE-SHOOTING"
96 LOCATE 13,42
97 PRINT "CHAPTER 14 - USING THE PRINTER"
109 LOCATE 23,1
110 PRINT "CHAPTER NUMBER ":INPUT X
130 IF X=1 THEN RUN "ICP-1.BAS"
131 IF X=2 THEN RUN "ICP-2.BAS"
132 IF X=3 THEN RUN "ICP-3.BAS"
133 IF X=4 THEN RUN "ICP-4.BAS"
134 IF X=5 THEN RUN "ICP-5.BAS"
135 IF X=6 THEN RUN "ICP-6.BAS"
136 IF X=7 THEN RUN "ICP-7.BAS"
137 IF X=8 THEN RUN "ICP-8.BAS"
138 IF X=9 THEN RUN "ICP-9.BAS"
139 IF X=10 THEN RUN "ICP-10.BAS"
140 IF X=11 THEN RUN "ICP-11.BAS"
141 IF X=12 THEN RUN "ICP-12.BAS"
142 IF X=13 THEN RUN "ICP-13.BAS"
```

```
143 IF X=14 THEN RUN "ICP-14.BAS"
149 GOTO 63
1000 SYSTEM
1005 RUN "ICP-B.BAS"
4999 END
5000 LINE (140,10)-(510,10)
5001 LINE (510,10)-(510,130)
5002 LINE (510,130)-(140,130)
5003 LINE (140,130)-(140,10)
5006 RETURN
5010 LINE (140,1)-(510,1)
5011 LINE (510,1)-(510,138)
5012 LINE (510,138)-(140,138)
5013 LINE (140,138)-(140,1)
5014 RETURN
5015 LINE (115,10)-(535,10)
5016 LINE (535,10)-(535,130)
5017 LINE (535,130)-(115,130)
5018 LINE (115,130)-(115,10)
5019 RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
6002 PRINT "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "

6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
6014 LOCATE E,1,1,0,7
6015 PRINT "
                                "
6016 E=E+1
6017 IF E=23 THEN GOTO 6019
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
```

```
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
```

ICP-1.BAS (Chapter 1)

```
200 CLS:KEY OFF
201 SCREEN 2
202 LOCATE 5,34
203 PRINT "CHAPTER 1"
204 LOCATE 15,29
205 PRINT "ICP BLOCK DIAGRAM"
206 A$=INKEY$:IF A$="" GOTO 206
207 CLS
208 PRINT "IN THIS CHAPTER A SIMPLE BLOCK DIAGRAM OF THE
INSTRUMENT WILL BE PRESENTED.      ALTHOUGH THE KEYBOARD IS
USED FOR NEARLY ALL OPERATIONS, ONE MUST BE FAMILIAR   WITH A
FEW OTHER ITEMS IN ORDER TO RUN THE INSTRUMENT."
209 PRINT ""
210 PRINT "THE DIAGRAM IS PRESENTED ON THE NEXT PAGE. ENTER
THE LETTER CORRESPONDING TO THESECTION FOR WHICH INFORMATION
IS NEEDED.. ...."
211 GOSUB 6050
212 GOSUB 400
213 PRINT "THE INSTRUMENT HAS 2 KEYBOARDS, LOCATED ON
OPPOSITE SIDES OF THE KEYBOARD PANEL.THE SIMPLIFIED KEYBOARD
ALLOWS LIMITED OPERATION, AND WILL NOT BE DISCUSSED IN  THIS
PROGRAM. THE FULL `ASCII' (TYPE WRITER-LIKE) KEYBOARD WILL BE
USED"
214 GOSUB 6050
215 PRINT "ALL COMMANDS ENTERED VIA THE KEYBOARD MUST BE
FOLLOWED BY PRESSING THE 'RETURN'  KEY."
216 PRINT ""
217 PRINT "ALL COMMANDS DISCUSSED IN THIS LESSON WILL BE
ENCLOSED WITH `<' & `>' MARKS TO  SEPARATE THEM FROM THE REST
OF A STATEMENT. THE MARKS ARE NOT PART OF THE
COMMAND!!!!!  AN EXAMPLE COMMAND IS <RECALIBRATE>."
218 PRINT ""
219 PRINT "THE `ESC' KEY IS USED TO CANCEL ANY COMMAND
INSTANTLY."
220 GOSUB 6050
221 PRINT "THE TYPE OF CURSOR ON THE INSTRUMENT'S  VIDEO
SCREEN INDICATES THE TYPE OF MODE  THE COMPUTER IS USING. THE
`>' MARK INDICATES THE PROGRAM MODE, AND THE `*'
MARKINDICATES THE EDIT MODE."
222 PRINT ""
223 PRINT "IT IS RECOMMENDED THAT THE EDIT MODE BE USED AT
ALL TIMES, AS GREATER           OPERATIONAL FREEDOM IS
POSSIBLE. INSTRUCTIONS ON SWITCHING TO THE EDIT MODE ARE
PRESENTED IN CHAPTER 2."
224 GOSUB 6050
225 PRINT "THIS CONCLUDES CHAPTER 1:"
226 PRINT "    PRESS THE SPACE BAR TO PROCEED TO CHAPTER 2"
227 PRINT "    PRESS THE `F1' KEY TO RETURN TO THE TABLE OF
CONTENTS"
228 PRINT "    PRESS THE `F2' KEY TO REVIEW THIS CHAPTER"
229 PRINT "    PRESS THE `F10' KEY TO TERMINATE THE LESSON"
230 ON KEY (1) GOSUB 300
```

```
231 ON KEY (2) GOSUB 301
232 ON KEY (10) GOSUB 302
233 KEY(1) ON
234 KEY(2) ON
235 KEY(10) ON
236 GOSUB 6050
237 RUN "ICP-2.BAS"
300 RUN "ICP-B.BAS"
301 RUN "ICP-1.BAS"
302 SYSTEM
400 CLS:SCREEN 1,0
401 COLOR 8,1
402 LINE (30,30)-(290,30),1
403 LINE (290,30)-(290,90),1
404 LINE (30,30)-(30,90),1
405 LINE (20,90)-(300,90),1
406 LINE (20,90)-(20,95),1
407 LINE (300,90)-(300,95),1
408 LINE (20,95)-(300,95),1
409 LINE (290,95)-(290,155),1
410 LINE (30,95)-(30,155),1
411 LINE (30,155)-(290,155),1
412 LINE (30,60)-(290,60),1
413 LINE (200,65)-(255,65),1
414 LINE (200,65)-(200,85),1
415 LINE (255,65)-(255,85),1
416 LINE (200,85)-(255,85),1
417 LINE (205,68)-(225,68),1
418 LINE (205,68)-(205,82),1
419 LINE (205,82)-(225,82),1
420 LINE (225,82)-(225,68),1
421 LINE (235,68)-(245,68),1
422 LINE (235,68)-(235,75),1
423 LINE (235,75)-(245,75),1
424 LINE (245,75)-(245,68),1
425 LINE (233,78)-(247,78),1
426 LINE (233,78)-(233,82),1
427 LINE (233,82)-(247,82),1
428 LINE (247,82)-(247,78),1
429 LINE (200,35)-(222,35),1
430 LINE (200,35)-(200,55),1
431 LINE (200,55)-(222,55),1
432 LINE (222,55)-(222,35),1
433 LINE (80,35)-(120,35),1
434 LINE (80,35)-(80,55),1
435 LINE (80,55)-(120,55),1
436 LINE (120,55)-(120,35),1
437 LINE (100,43)-(110,43),1
438 LINE (100,43)-(100,47),1
439 LINE (100,47)-(110,47),1
440 LINE (110,47)-(110,43),1
441 LINE (100,49)-(110,49),1
442 LINE (100,49)-(100,53),1
443 LINE (100,53)-(110,53),1
444 LINE (110,53)-(110,49),1
```

```
445 LINE (80,65)-(110,65),1
446 LINE (80,65)-(80,85),1
447 LINE (80,85)-(110,85),1
448 LINE (110,85)-(110,65),1
449 LINE (110,69)-(120,69),1
450 LINE (120,69)-(120,77),1
451 LINE (120,77)-(110,77),1
452 CIRCLE (115,73),2,1
453 LINE (70,30)-(70,20),1
454 LINE (70,20)-(120,20),1
455 LINE (120,20)-(120,30),1
456 LINE (100,20)-(100,10),1
457 LINE (100,10)-(110,10),1
458 LINE (110,10)-(110,20),1
459 LINE (130,30)-(130,90),1
460 CIRCLE (273,75),1,1
461 LINE (270,100)-(270,110),1
462 LINE (270,110)-(215,110),1
463 LINE (215,110)-(215,100),1
464 LINE (215,100)-(270,100),1
465 LINE (195,100)-(195,110),1
466 LINE (195,110)-(175,110),1
467 LINE (175,110)-(175,108),1
468 LINE (175,108)-(170,108),1
469 LINE (170,108)-(170,102),1
470 LINE (170,102)-(175,102),1
471 LINE (175,102)-(175,100),1
472 LINE (175,100)-(195,100),1
473 LINE (172,106)-(172,104),1
474 LINE (172,104)-(174,104),1
475 LINE (174,104)-(174,106),1
476 LINE (174,106)-(172,106),1
477 CIRCLE (220,105),2,1
478 DRAW "BR15"
479 DRAW "BU3"
480 DRAW "D6"
481 DRAW "R2"
482 DRAW "U6"
483 DRAW "L2"
484 DRAW "BR6"
485 DRAW "D6"
486 DRAW "R10"
487 DRAW "U6"
488 DRAW "L10"
489 DRAW "BR20"
490 DRAW "D6"
491 DRAW "R5"
492 DRAW "U6"
493 DRAW "L5"
494 CIRCLE (256,105),1,1
495 LINE (40,155)-(40,165),1
496 LINE (40,165)-(45,165),1
497 LINE (45,165)-(45,155),1
498 LINE (280,155)-(280,165),1
499 LINE (280,165)-(275,165),1
```

```
500 LINE (275,165)-(275,155),1
501 LOCATE 6,12
502 PRINT "A"
503 LOCATE 10,12
504 PRINT "B"
505 LOCATE 6,27
506 PRINT "C"
507 LOCATE 10,27
508 PRINT "D"
509 PAINT (35,35),3,1
510 PAINT (280,35),3,1
511 PAINT (40,120),3,1
512 PAINT (80,25),3,1
513 PAINT (105,15),3,1
514 PAINT (42,157),3,1
515 PAINT (278,157),3,1
516 LOCATE 14,24
517 PRINT "E"
518 LOCATE 14,29
519 PRINT "F"
520 PAINT (180,70),1,1
521 PAINT (35,70),1,1
522 PAINT (35,93),2,1
550 LOCATE 22,7
551 PRINT "CHOICE ? (PRESS `Z' TO EXIT)"
552 A$=INKEY$:IF A$="" GOTO 552
553 IF A$="A" GOTO 600
554 IF A$="B" GOTO 620'
555 IF A$="C" GOTO 640
556 IF A$="D" GOTO 660
557 IF A$="E" GOTO 680
558 IF A$="F" GOTO 700
559 IF A$="Z" GOTO 720
560 GOTO 400
600 CLS:SCREEN 2
601 PRINT "THIS IS THE TORCH ACCESS PANEL. DO NOT REMOVE
IT!!"
602 PRINT "THE ARGON TORCH CAN BE VIEWED SAFELY THROUGH THE
WINDOW."
603 GOSUB 6050
604 GOTO 400
620 CLS:SCREEN 2
621 PRINT "THE NEBULIZER ASSEMBLY AND ARGON PRESSURE METER
ARE BEHIND THIS DOOR. DURING OPERATION OF THE INSTRUMENT,
THE METER SHOULD READ 30 PSI. LEAVE THIS DOOR OPEN TO ALLOW
PROPER VENTILATION!!"
622 PRINT ""
623 PRINT "ADJACENT TO THE DOOR IS THE PERISTALTIC PUMP.
SAMPLES ARE ANALYZED BY PLACING THE FREE END OF TUBING INTO
THE DESIRED SOLUTION. BE SURE TO WIPE THE TUBING BETWEEN
SAMPLE CHANGES TO AVOID SOLUTION CONTAMINATION."
624 GOSUB 6050
625 GOTO 400
640 CLS:SCREEN 2
641 PRINT "THIS DOOR SHOULD BE OPENED DURING OPERATION TO
```

```
ALLOW PROPER VENTILATION. DO NOT ALTER THE MONOCHROMATOR
CONTROLS BEHIND THE DOOR FOR ANY REASON!!!!"
642 GOSUB 6050
643 GOTO 400
660 CLS:SCREEN 2
661 PRINT "THIS IS THE INSTRUMENT'S VIDEO SCREEN, WHICH WILL
SUBSEQUENTLY BE REFFERED TO ASTHE `CRT'."
662 PRINT ""
663 PRINT "ADJACENT TO THE CRT IS THE TAPE DECK AND TAPE
STORAGE AREA. THE BUTTON           UNDERNEATH THE DECK OPENS
THE DOOR. THE RED LIGHT INDICATES WHEN THE TAPE DECK  IS IN
USE. DO NOT ATTEMPT TO REMOVE A TAPE WHEN THE LIGHT IS
ON!!!!"
664 PRINT "DETAILS ON OPERATION OF THE TAPE DECK ARE
PRESENTED IN CHAPTERS 2 & 9."
665 GOSUB 6050
666 GOTO 400
680 CLS:SCREEN 2
681 PRINT "THIS IS THE CURRENT/VOLTAGE MONITOR FOR THE
INSTUMENT'S HIGH VOLTAGE SUPPLY. THEPOSITION OF THE SWITCH
DETERMINES WHICH PARAMETER IS BEING MONITORED.682 PRINT ""
683 PRINT "WHEN RUNNING ANALYSES, THE CURRENT VALUE SHOULD BE
CHECKED OCCASSIONALLY. IF A  STABLE VALUE DOES NOT REMAIN ON
THE METER, ASK A QUALIFIED PERSON TO CHECK THE  TORCH."
684 GOSUB 6050
685 GOTO 400
700 CLS:SCREEN 2
701 PRINT "THE POWER SWITCH IS LOCATED IN THIS AREA, ALONG
WITH THE ANODE BREAKER, AND A  UTILITY OUTLET. THE
AUTOSAMPLER OUTLET IS OF NO CONCERN, SINCE THIS UNIT DOES
NOT HAVE SUCH AN ATTACHMENT."
702 PRINT ""
703 PRINT "THE ANODE BREAKER IS INSIDE THE SMALL OPENING, AND
CAN BE RESET IF A TRIP OCCURSIF THE BREAKER TRIPS TWICE, ASK
A QUALIFIED PERSON TO CHECK THE INSTRUMENT      BEFORE
PROCEEDING! DETAILS ON THE ANODE BREAKER ARE PRESENTED IN
CHAPTER 13."
704 GOSUB 6050
705 GOTO 400
720 CLS:SCREEN 2:RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
6002 PRINT "                                                  "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "
                                    "
6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
```

```
6014 LOCATE E,1,1,0,7
6015 PRINT "

6016 E=E+1
6017 IF E=23 THEN GOTO 6019
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
```

```
400 CLS:KEY OFF
401 SCREEN 2
402 LOCATE 5,34
403 PRINT "CHAPTER 2"
404 LOCATE 15,29
405 PRINT "INSTRUMENT START-UP"
406 A$=INKEY$:IF A$="" GOTO 406
407 CLS
408 PRINT "THIS CHAPTER WILL EXPLAIN THE ICP'S START-UP
PROCEDURE USING THE SYSTEM TAPE."
409 A$=INKEY$:IF A$="" GOTO 409
410 CLS:PRINT "BEFORE TURNING ON THE INSTRUMENT, THE
FOLLOWING 3 TASKS MUST BE PERFORMED:"
411 PRINT ""
412 PRINT "     (1) TURN ON THE WATER SUPPLY. THE VALVE IS ON
THE PIPE THAT RUNS  ALONG THEREAR LEFT CORNER OF THE
INSTRUMENT.
413 PRINT ""
414 PRINT "     (2) TURN ON THE ARGON SUPPLY. THERE ARE 4
VALVES ON THE ARGON TANK. OPEN  THE VALVE THAT IS CONNECTED
TO THE GREEN HOSE WHICH FEEDS THE ARGON TO THE ICP."
415 PRINT ""
416 PRINT "     (3) TURN ON THE EXHAUST FAN. SIMPLY PLUG THE
CORD MARKED 'FAN'  INTO THE    OUTLET ON THE WALL BEHIND THE
ARGON TANK."
417 A$=INKEY$:IF A$="" GOTO 417
418 CLS
419 PRINT "NOW TURN ON THE INSTRUMENT BY SWITCHING ON THE
'TRIPLE BREAKER' LABELED `POWER'.(THE BREAKER IS LOCATED ON
THE FRONT OF THE INSTRUMENT, UNDERNEATH THE WORK     SHELF.)"
420 PRINT ""
421 PRINT "THE CRT WILL THEN DISPLAY THE FOLLOWING
MESSAGE.. ...."
422 A$=INKEY$:IF A$="" GOTO 422
423 CLS
424 GOSUB 5000
425 LOCATE 3,22,1,0,7
426 PRINT "123448-00                    1 JUNE 1984"
427 LOCATE 7,31,1,0,7
428 PRINT "LOADING SYSTEM PROGRAM,"
429 LOCATE 8,35,1,0,7
430 PRINT "SELECT OPTION"
431 LOCATE 10,35,1,0,7
432 PRINT "1 - TAPE LOAD"
433 LOCATE 11,35,1,0,7
434 PRINT "2 - RS232 LOAD"
435 LOCATE 16,21,1,0,7
436 PRINT "-"
437 LOCATE 19,1,1,0,7
438 PRINT "AT THIS POINT, THE SYSTEM PROGRAM WILL BE LOADED
VIA THE TAPE DECK."
439 PRINT "SIMPLY HIT THE `1' KEY. THE CRT RESPONDS
```

```
WITH.....    "
440 A$=INKEY$:IF A$="" GOTO 440
441 GOSUB 6000
442 LOCATE 7,31,1,0,7
443 PRINT "READING SYSTEM TAPE"
444 LOCATE 9,33,1,0,7
445 PRINT "1) INSERT SYSTEM TAPE"
446 LOCATE 10,33,1,0,7
447 PRINT "2) PRESS <RETURN>"
448 LOCATE 16,21,1,0,7
449 PRINT "_"
450 LOCATE 19,1,1,0,7
451 PRINT "OPEN THE TAPE DECK DOOR BY PRESSING THE EJECT
BUTTON. PLACE THE TAPE MARKED     `SYSTEM TAPE: REV 1,
123450-00' (WHITE LABEL) INTO THE DECK ON SIDE `A'.(THE
'A' SHOULD FACE YOU WITH THE TAPE HEAD DOWN)"
452 PRINT "CLOSE THE DECK DOOR AND PRESS THE 'RETURN'  KEY.
THE CRT THEN RESPONDS WITH.. ."
453 A$=INKEY$:IF A$="" GOTO 453
454 LOCATE 16,21,1,0,7
455 PRINT "TAPE"
456 GOSUB 6006
457 LOCATE 19,1,1,0,7
458 PRINT "THE SYSTEM TAPE IS NOW BEING READ."
459 A$=INKEY$:IF A$="" GOTO 459
460 CLS
461 PRINT "AFTER THE SYSTEM TAPE IS READ, IT IS REWOUND. WHEN
THE RED LIGHT GOES OUT,       REMOVE THE TAPE."
462 PRINT ""
463 PRINT "THE INSTRUMENT THEN GOES THROUGH A 190 SECOND
WARM-UP PERIOD. DURING THIS TIME  AN AUTOMATIC MERCURY LINE
CALIBRATION IS PERFORMED. WHEN THE COUNTDOWN HITS THE 10
SECOND MARK, THE HIGH VOLTAGE SUPPLY COMES ON WITH A LOUD
'CLICK'."
464 PRINT ""
465 PRINT "WHEN THE COUNTDOWN HITS ZERO, THE SYSTEM IS UP AND
THE CRT RESPONDS WITH.....    "
466 A$=INKEY$:IF A$="" GOTO 466
467 CLS
468 GOSUB 5000
469 LOCATE 3,22,1,0,7
470 PRINT "P 200   123450-00          1 JUNE 1984"
471 LOCATE 5,27
472 PRINT "   #        OPTION"
473 LOCATE 7,30
474 PRINT "100  USER PROGRAMS"
475 LOCATE 8,30
476 PRINT "110  I/O FORMAT"
477 LOCATE 9,30
478 PRINT "120  HG CALIBRATION"
479 LOCATE 10,30
480 PRINT "130  EDIT PROGRAM"
481 LOCATE 11,30
482 PRINT "140  SHUTDOWN"
483 LOCATE 16,22
```

```
484 PRINT ">_"
485 LOCATE 19,1
486 PRINT "EACH OPTION CAN BE EXECUTED BY ENTERING THE OPTION
NUMBER AND PRESSING RETURN."
487 PRINT "THE FUNCTION OF EACH OPTION IS EXPLAINED AS
FOLLOWS.. ...."
488 A$=INKEY$:IF A$="" GOTO 488
489 CLS
490 PRINT "OPTION #1; USER PROGRAMS:"
491 PRINT "     SELECTING THIS OPTION WILL PRODUCE A LISTING
OF USER PROGRAMS CURRENTLY    AVAILABLE. A PROGRAM IS CALLED
UP BY TYPING THE PROGRAM NUMBER, FOLLOWED BY THE WORD 'SEE'.
EXAMPLES EMPLOYING THIS OPTION ARE PRESENTED IN A LATER
CHAPTER."
492 PRINT ""
493 PRINT "OPTION #2; I/O FORMAT:"
494 PRINT "     THIS OPTION CALLS UP THE I/O MENU, WHICH IS
USED TO SET UP THE PRINTER AND OTHER SPECIAL FEATURES SUCH AS
THE TIME AND DATE FUNCTIONS. THE DETAILED I/O    PROCEDURE
WILL BE COVERED IN CHAPTER 4."
495 PRINT ""
496 PRINT "OPTION #3; HG CALIBRATION:"
497 PRINT "     SELECTING THIS OPTION WILL INITIATE A MERCURY
CALIBRATION. THE USE OF THIS OPTION IS USUALLY NOT NECESSARY,
HOWEVER, SINCE A MERCURY CALIBRATION IS        AUTOMATICALLY
PERFORMED DURING THE POWER-UP SEQUENCE PREVIOUSLY DISCUSSED."
498 PRINT ""
499 PRINT "OPTION #4; EDIT PROGRAM:"
500 PRINT "     THIS OPTION MUST BE USED TO PUT THE SYSTEM
INTO THE EDIT MODE. THIS ALLOWS THE USER TO CREATE NEW
ANALYSIS PROGRAMS, AS WELL AS MODIFY EXISTING PROGRAMS."
501 PRINT ""
502 PRINT "OPTION #5; SHUTDOWN:"
503 PRINT "     THIS OPTION ALLOWS THE USER TO CALL UP THE
SHUTDOWN PROCEDURE, WHICH IS    DISCUSSED IN CHAPTER 9."
506 A$=INKEY$:IF A$="" GOTO 506
507 CLS
510 PRINT "THESE PROGRAM OPTIONS ARE DISPLAYED AUTOMATICALLY
AFTER POWER-UP, BUT CAN BE    CALLED UP AT ANY TIME BY
PRESSING THE 'PROG'  BUTTON."
512 A$=INKEY$:IF A$="" GOTO 512
513 CLS
515 PRINT "THIS CONCLUDES CHAPTER 2. PRESS THE SPACE BAR TO
PROCEED TO CHAPTER 3, OR THE   `F1' KEY TO CALL UP THE TABLE
OF CONTENTS.
516 A$=INKEY$:IF A$="" GOTO 516
517 RUN "ICP-3.BAS"
4999 END
5000 LINE (140,10)-(510,10)
5001 LINE (510,lo)-(510,130)
5002 LINE (510,130)-(140,130)
5003 LINE (140,130)-(140,10)
5006 RETURN
5010 LINE (140,1)-(510,1)
5011 LINE (510,1)-(510,138)
```

```
5012 LINE (510,138)-(140,138)
5013 LINE (140,138)-(140,1)
5014 RETURN
5015 LINE (115,10)-(535,10)
5016 LINE (535,10)-(535,130)
5017 LINE (535,130)-(115,130)
5018 LINE (115,130)-(115,10)
5019 RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
6002 PRINT "                                                    "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "
                                    "
6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
6014 LOCATE E,1,1,0,7
6015 PRINT "
                                    "
6016 E=E+1
6017 IF E=23 THEN GOTO 6019                                     '
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
```

```
600 CLS:KEY OFF
601 SCREEN 2
602 LOCATE 5,34
603 PRINT "CHAPTER 3"
604 LOCATE 15,29
605 PRINT "ENABLING THE TORCH"
606 A$=INKEY$:IF A$="" GOTO 606
607 CLS
608 PRINT "THIS CHAPTER WILL EXPLAIN HOW TO ENABLE (LIGHT)
THE ARGON PLASMA TORCH."
609 A$=INKEY$:IF A$="" GOTO 609
610 CLS
611 PRINT "THE ARGON TORCH CAN BE IGNITED ANYTIME AFTER THE
HIGH VOLTAGE SUPPLY IS ON, AND THE SYSTEM IS UP. TO INITIATE
THE PROCEDURE, SIMPLY PRESS THE 'ENABLE' AND      `TORCH'
BUTTONS ON THE KEYBOARD."
612 PRINT ""
613 PRINT "THE 85 SECOND IGNITION SEQUENCE IS THEN DISPLAYED
ON THE CRT AS FOLLOWS.. ...."
616 A$=INKEY$:IF A$="" GOTO 616
617 CLS
618 GOSUB 5000
620 LOCATE 4,27
621 PRINT "* TORCH PURGE - 60 SEC"
622 LOCATE 6,29
623 PRINT "CENTER FLOW BLEED - 25 SEC"
624 LOCATE 8,29
625 PRINT "IGNITION"
626 LOCATE 11,25
627 PRINT "10 MIN STABILIZATION RECOMMENDED"
628 LOCATE 13,29
629 PRINT "TO ABORT  PRESS <ESC>
630 LOCATE 16,25
631 PRINT "85"
632 LOCATE 19,1
633 PRINT "THE IGNITION COUNTDOWN IS VISIBLE IN THE LOWER
LEFT CORNER OF THE CRT. THERE ARE3 DIFFERENT PHASES: TORCH
PURGE, CENTER FLOW BLEED, AND IGNITION. THEY ARE
EXPLAINED AS FOLLOWS.....  11
634 A$=INKEY$:IF A$="" GOTO 634
635 GOSUB 6006
636 LOCATE 19,1
637 PRINT "A 60 SEC TORCH PURGE IS CARRIED OUT TO FLUSH THE
TORCH ASSEMBLY. IT IS FOLLOWED BY A 25 SEC CENTER FLOW BLEED.
AT ABOUT THE 23 SEC MARK THE CENTER FLOW BLEED  WILL IGNITE
A SMALL 'PILOT'  PLASMA. (THE PILOT CAN BE SEEN THROUGH THE
WINDOW. )"
638 PRINT "WHEN THE COUNTDOWN HITS ZERO, THE PILOT IGNITES
THE TORCH. THE PERISTALTIC PUMP THEN BEGINS TURNING,
INDICATING A SUCCESSFUL IGNITION PROCEDURE."
639 A$=INKEY$:IF A$="" GOTO 639
640 GOSUB 6000
```

```
641 LOCATE 23,1:PRINT "
                                                                "
642 LOCATE 16,25
643 PRINT ">_"
644 LOCATE 19,1
645 PRINT "THE CRT WILL CLEAR ITSELF, AND THE PROMPT WILL
RETURN. AT THIS POINT DEIONIZED WATER SHOULD BE ASPIRATED
INTO THE TORCH BY PLACING THE TUBING WRAPPED AROUND THE
PUMP INTO A BEAKER OF THE WATER."
646 PRINT " IN 10 MINUTES THE TORCH WILL BE STABLE ENOUGH FOR
USE."
648 A$=INKEY$:IF A$="" GOTO 648
649 CLS
650 PRINT "THE TORCH IGNITION PROCEDURE CAN BE ABORTED BY
PRESSING THE `ESC' KEY. IF THE TORCH IS ALREADY LIT, IT CAN
BE SHUT OFF BY PRESSING THE 'ENABLE' AND 'TORCH' KEYS ONCE
AGAIN. THE CRT WILL THEN DISPLAY THE MESSAGE: 'TORCH OFF'."
654 A$=INKEY$:IF A$="" GOTO 654
655 CLS
656 PRINT "THIS CONCLUDES CHAPTER 3. PRESS THE SPACE BAR TO
PROCEED TO CHAPTER 4, OR THE `F1' KEY TO CALL UP THE TABLE
OF CONTENTS."
657 A$=INKEY$:IF A$="" GOTO 657
658 RUN "ICP-4.BAS"
4999 END
5000 LINE (140,10)-(510,10)
5001 LINE (510,10)-(510,130)
5002 LINE (510,130)-(140,130)
5003 LINE (140,130)-(140,10)
5006 RETURN
5010 LINE (140,1)-(510,1)
5011 LINE (510,1)-(510,138)
5012 LINE (510,138)-(140,138)
5013 LINE (140,138)-(140,1)
5014 RETURN
5015 LINE (115,10)-(535,10)
5016 LINE (535,10)-(535,130)
5017 LINE (535,130)-(115,130)
5018 LINE (115,130)-(115,10)
5019 RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
6002 PRINT "                                                    "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "
                                                                "
6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
```

```
6014 LOCATE E,1,1,0,7
6015 PRINT "
                                    "
6016 E=E+1
6017 IF E=23 THEN GOTO 6019
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
```

```
700 CLS:KEY OFF
701 SCREEN 2
702 LOCATE 5,34
703 PRINT "CHAPTER 4"
704 LOCATE 15,25
705 PRINT "SETTING THE I/O PARAMETERS"
706 A$=INKEY$:IF A$="" GOTO 706
707 CLS
708 PRINT "THIS CHAPTER WILL EXPLAIN HOW TO SET THE SYSTEM'S
1/O PARAMETERS. IT IS          RECOMMENDED THAT THIS TASK BE
CARRIED OUT WHILE THE TORCH IS STABLIZING."
709 A$=INKEY$:IF A$="" GOTO 709
710 CLS
711 PRINT "AS DISCUSSED IN CHAPTER 2, THE I/O MENU IS CALLED
UP BY SELECTING OPTION #2 ON  THE PROGRAM MENU THAT IS
DISPLAYED WHEN EITHER THE SYSTEM IS BROUGHT UP, OR THE 'PROG'
BUTTON IS PRESSED."
712 PRINT ""
713 PRINT "THE I/O MENU CONTAINS SEVERAL SECTIONS, LISTED AS
FOLLOWS.. ....."
714 A$=INKEY$:IF A$="" GOTO 714
715 CLS
716 GOSUB 5010
717 GOSUB 5020
718 LOCATE 20,1
719 PRINT "EACH OPTION IS CALLED UP BY ENTERING THE
CORRESPONDING OPTION NUMBER, FOLLOWED  BY A RETURN. OPTION #1
SETS UP THE PARALLEL PRINTER. WHEN CALLED UP, THE MENU
RESPONDS AS FOLLOWS.. .."
720 A$=INKEY$:IF A$="" GOTO 720
721 LOCATE 16,23
722 PRINT "TYPE 1 FOR PRINTING"
723 LOCATE 17,23
724 PRINT "#1_"
725 GOSUB 6013
727 LOCATE 20,1
728 PRINT "TYPING `1' AGAIN WILL TURN ON THE PARALLEL PRINTER
PORT, AND CALL UP THE PRINTER MENU. IT IS ILLUSTRATED AS
FOLLOWS.. ."
729 A$=INKEY$:IF A$="" GOTO 729
730 CLS
731 GOSUB 5000
732 GOSUB 5050
733 LOCATE 19,1
734 PRINT "THERE ARE 4 OPTIONS IN THE PRINTER MENU. THEY ARE
EXPLAINED AS FOLLOWS.. .."
735 A$=INKEY$:IF A$="" GOTO 735
736 CLS
737 PRINT "OPTION #1; PAGING:"
738 PRINT "     THIS OPTION IS USED TO FORMAT THE PRINTOUT SO
THAT EACH PAGE CONTAINS ONLY ONE SET OF READINGS. IT CAN BE
ACTIVATED BY TYPING A `1' WHILE THE PRINT MENU ISDISPLAYED ON
```

```
THE CRT. (THIS OPTION NORMALLY IS LEFT OFF TO SAVE PAPER.)"
739 PRINT ""
740 PRINT "OPTION #2; LEFT MARGIN:"
741 PRINT "     THE SECOND OPTION SETS THE POSITION OF THE
LEFT MARGIN ON THE PRINTER      PAPER. THE VALUE CHOSEN CAN
RANGE FROM 0 - 20, BUT THE DEFAULT VALUE OF '8' IS
SUFFICIENT FOR ALL PRINTING."
742 PRINT ""
743 PRINT "OPTION #3; GRAPHICS:"
744 PRINT "     IN ORDER FOR THE PRINTER TO PLOT GRAPHS, THIS
OPTION MUST BE ACTIVATED.    CALL IT UP AND ENTER A `1' TO
TURN IT ON."
745 PRINT ""
746 PRINT "OPTION #4; PLOTS PER PAGE:"
747 PRINT "     THIS OPTION SETS THE NUMBER OF PLOTS PER
PAGE, WHICH CAN RANGE FROM 1 - 3. IN ORDER TO SAVE PAPER, IT
IS BEST TO LET THIS OPTION REMAIN AT ITS DEFAULT     VALUE OF
3."
748 A$=INKEY$:IF A$="" GOTO 748
749 CLS
750 PRINT " IF ANY CHANGES ARE MADE TO ANY OF THE 4 OPTIONS,
THE 'INITIALIZE' ROUNTINE MUST BE EXECUTED BY SIMPLY ENTERING
A '6'.  THE NEW PARAMETERS ARE THEN PUT INTO      EFFECT."
751 PRINT "":PRINT ""
752 PRINT "SINCE THE GRAPHICS PARAMETER IS THE ONLY OPTION
THAT SHOULD BE CHANGED, IT IS   THE ONLY PART OF THE MENU
THAT CHANGE CONDITIONS. THE 'OFF'  WILL CHANGE TO 'ON'  AS
FOLLOWS.. .."
753 A$=INKEY$:IF A$="" GOTO 753
754 CLS
755 GOSUB 5000
756 GOSUB 5050
757 LOCATE 8,28
758 PRINT "3 GRAPHICS          ON"
759 LOCATE 19,1
760 PRINT " IT SHOULD BE OBVIOUS BY NOW THAT ANY OPTION
INVOLVING AN `ON/OFF' DECISION IS   TURNED ON BY ENTERING A
`1'. TO SHUT SUCH AN OPTION OFF, A `0' IS ENTERED."
761 A$=INKEY$:IF A$="" GOTO 761
762 GOSUB 6006
763 LOCATE 19,1
764 PRINT "TO EXIT THE PRINTER MENU AND RETURN TO THE I/O
MENU, SIMPLY ENTER A `9'."
765 A$=INKEY$:IF A$="" GOTO 765
766 CLS
767 GOSUB 5010
768 GOSUB 5020
769 LOCATE 5,28
770 PRINT "1 PRINTER SETUP     ON"
771 LOCATE 21,1
772 PRINT "SINCE THE PRINTER OPTION IS NOW ACTIVE, OPTION #1
ABOVE IS NOW FLAGGED 'ON'."
773 A$=INKEY$:IF A$="" GOTO 773
774 GOSUB 6013
775 LOCATE 21,1
```

```
776 PRINT "OPTION #2, THE RS232 SETUP, ALLOWS THE CONNECTION
OF THE INSTRUMENT WITH        EXTERNAL COMPUTERS. THIS OPTION
MUST BE LEFT OFF FOR ROUTINE ANALYSIS, HOWEVER."
777 A$=INKEY$:IF A$="" GOTO 777
778 GOSUB 6013
779 LOCATE 21,1
780 PRINT "OPTION #3 ACTIVATES THE SYSTEM'S DIAGNOSTICS MODE,
WHICH ALLOWS THE CRT TO DIS- PLAY SUCH ITEMS AS RAW
INTENSITIES, ATOMIC SYMBOLS, AND ANALYTICAL WAVELENGTHS."
781 A$=INKEY$:IF A$="" GOTO 781
782 GOSUB 6013
783 LOCATE 21,1
784 PRINT "THIS OPTION SHOULD BE ACTIVATED BY USING THE NOW
FAMILIAR PROCEDURE OF ENTERING FIRST THE OPTION NUMBER, IN
THIS CASE `3', FOLLOWED BY A `1'."
785 A$=INKEY$:IF A$="" GOTO 785
786 GOSUB 6013
787 LOCATE 7,28
788 PRINT "3 DIAGNOSTICS        ON"
789 LOCATE 21,1
790 PRINT "THE CRT NOW REFLECTS THE CHANGE..."
791 A$=INKEY$:IF A$="" GOTO 791
792 GOSUB 6013
793 LOCATE 21,1
794 PRINT "OPTION H4 ACTIVATES THE AUTOSAMPLER PORT. SINCE
THIS SYSTEM DOES NOT HAVE AN    AUTOSAMPLER, THIS OPTION MUST
BE LEFT OFF!!! !"
795 A$=INKEY$:IF A$="" GOTO 795
796 GOSUB 6013
797 LOCATE 21,1
798 PRINT "OPTION #5 ALLOWS THE OPERATOR TO TYPE IN AN EIGHT
CHARACTER ID. WHICH CAN        CONSIST OF NUMBERS AS WELL AS
LETTERS."
799 A$=INKEY$:IF A$="" GOTO 799
800 GOSUB 6013
801 LOCATE 21,1
802 PRINT "OPTION #6 SETS THE DATE ACCORDING TO THE FOLLOWING
FORMAT: JULY 4, 1985 WOULD BEENTERED AS 04.07.85
(DATE.MONTH.YEAR)."
803 A$=INKEY$:IF A$="" GOTO 803
804 GOSUB 6013
805 LOCATE 21,1
806 PRINT "OPTION #7 SETS THE TIME ACCORDING TO THE FOLLOWING
FORMAT: 2:15 PM WOULD BE      ENTERED AS 14.15 (HOUR.MINUTES -
IN 24 HOUR TIME)."
807 A$=INKEY$:IF A$="" GOTO 807
808 GOSUB 6013
809 LOCATE 21,1
810 PRINT " IF THE VALUES 'SEBEST', `04.07.85', AND `14.15'
WERE ENTERED FOR OPTIONS 5,6, & 7, RESPECTIVELY, THE CRT
WOULD RESPOND AS FOLLOWS.. ...H
811 A$=INKEY$:IF A$="" GOTO 811
812 LOCATE 9,28
813 PRINT "5 OPERATOR ID.      SEBEST"
814 LOCATE 10,28
```

```
815 PRINT "6 DATE SET          04 JUL 85"
816 LOCATE 11,28
817 PRINT "7 TIME SET          14:15"
818 GOSUB 6013
819 LOCATE 21,1
820 PRINT "OPTIONS 5,6,& 7 AID IN THE ORGANIZATION OF DATA
AND RESULTS, BUT ARE NOT        REQUIRED WHEN RUNNING AN
ANALYSIS. THEIR USE IS OPTIONAL."
821 A$=INKEY$:IF A$="" GOTO 821
822 GOSUB 6013
823 LOCATE 21,1
824 PRINT "OPTION #8 ACTIVATES THE VIDEO PRINTER PORT. SINCE
THIS SYSTEM USES A PARALLEL   PRINTER INSTEAD OF A VIDEO
PRINTER, THIS OPTION MUST BE LEFT OFF!! !"
825 A$=INKEY$:IF A$="" GOTO 825
826 GOSUB 6013
827 LOCATE 21,1
828 PRINT "OPTION 1/10 ACTIVATES THE EXTENDED RANGE FUNCTION,
WHICH ALLOWS THE EXTENSION OF A LINEAR CALIBRATION BEYOND THE
CONCENTRATION OF THE HIGHEST STANDARD."
829 A$=INKEY$:IF A$="" GOTO 829
830 GOSUB 6013
831 LOCATE 21,1
832 PRINT "THIS OPTION SHOULD BE TURNED ON BY ENTERING A '10'
AND THEN A `1'. THE CRT WILL REFLECT THE CHANGE.. ....."
833 A$=INKEY$:IF A$="" GOTO 833
834 LOCATE 14,27
835 PRINT "10 EXTENDED RANGE    ON"
836 GOSUB 6013
837 LOCATE 21,1
838 PRINT "OPTION 1/11, PROTOCOL, ALLOWS THE INTERACTION OF
THE INSTRUMENT WITH DATA STORAGESYSTEMS. FOR ROUTINE
ANALYSES, HOWEVER, THIS OPTION SHOULD BE LEFT OFF."
839 A$=INKEY$:IF A$="" GOTO 839
840 GOSUB 6013
841 LOCATE 21,1
842 PRINT "ONCE THE I/O MENU IS SET, IT CAN EXITED BY
ENTERING A '9 '...."
843 A$=INKEY$:IF A$="" GOTO 843
844 CLS
845 PRINT "IN SUMMARY; OPTIONS 1,3, & 10 MUST BE TURNED ON,
OPTIONS 2,4,8, & 11 MUST BE    LEFT OFF, AND OPTIONS 5,6, & 7
ARE OPTIONAL."
846 A$=INKEY$:IF A$="" GOTO 846
847 CLS
848 PRINT "THIS CONCLUDES CHAPTER 4. PRESS THE SPACE BAR TO
PROCEED TO CHAPTER 5, OR THE   `F1' KEY TO CALL UP THE TABLE
OF CONTENTS."
849 A$=INKEY$:IF A$="" GOTO 849
850 RUN "ICP-5.BAS"
4999 END
5000 LINE (140,10)-(510,10)
5001 LINE (510,10)-(510,130)
5002 LINE (510,130)-(140,130)
5003 LINE (140,130)-(140,10)
```

```
5006 RETURN
5010 LINE (140,1)-(510,1)
5011 LINE (510,1)-(510,138)
5012 LINE (510,138)-(140,138)
5013 LINE (140,138)-(140,1)
5014 RETURN
5015 LINE (115,10)-(535,10)
5016 LINE (535,101-(535,130)
5017 LINE (535,130)-(115,130)
5018 LINE (115,130)-(115,10)
5019 RETURN
5020 LOCATE 2,23
5021 PRINT "P 200   123450-00          1 JUNE 1984"
5022 LOCATE 4,28
5023 PRINT "#       OPTION"
5024 LOCATE 5,28
5025 PRINT "1 PRINTER SETUP     OFF"
5026 LOCATE 6,28
5027 PRINT "2 RS232 SETUP       OFF"
5028 LOCATE 7,28
5029 PRINT "3 DIAGNOSTICS       OFF"
5030 LOCATE 8,28
5031 PRINT "4 AUTOSAMPLER       OFF"
5032 LOCATE 9,28
5033 PRINT "5 OPERATOR ID."
5034 LOCATE 10,28
5035 PRINT "6 DATE SET          01 JUN 84"
5036 LOCATE 11,28
5037 PRINT "7 TIME SET          01:07"
5038 LOCATE 12,28
5039 PRINT "8 VIDEO SETUP       OFF"
5040 LOCATE 13,28
5041 PRINT "9 EXIT"
5042 LOCATE 14,27
5043 PRINT "10 EXTENDED RANGE   OFF"
5044 LOCATE 15,27
5045 PRINT "11 PROTOCOL         OFF"
5046 LOCATE 17,23
5047 PRINT "#_"
5048 RETURN
5050 LOCATE 3,23
5051 PRINT "P 200   123450-00          1 JUNE 1984"
5052 LOCATE 5,28
5053 PRINT "#       OPTION"
5054 LOCATE 6,28
5055 PRINT "1 PAGING            OFF"
5056 LOCATE 7,28
5057 PRINT "2 LEFT MARGIN         8"
5058 LOCATE 8,28
5059 PRINT "3 GRAPHICS          OFF"
5060 LOCATE 9,28
5061 PRINT "4 PLOTS PER PAGE      3"
5062 LOCATE 10,28
5063 PRINT "6 INITIALIZE"
5064 LOCATE 11,28
```

```
5065 PRINT "9 EXIT"
5066 LOCATE 16,23
5067 PRINT "#_"
5068 RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
6002 PRINT "                                                    "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "
                                        "
6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
6014 LOCATE E,1,1,0,7
6015 PRINT "
                                        "
6016 E=E+1
6017 IF E=23 THEN GOTO 6019
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
```

ICP-5.BAS (Chapter 5)

```
900 CLS:KEY OFF
901 SCREEN 2
902 LOCATE 5,34
903 PRINT "CHAPTER 5"
904 LOCATE 15,30
905 PRINT "WRITING A PROGRAM"
906 A$=INKEY$:IF A$="" GOTO 906
907 CLS
908 PRINT "THIS CHAPTER WILL EXPLAIN HOW TO WRITE A SIMPLE
ANALYSIS PROGRAM USING THE EDIT MODE."
909 GOSUB 6050
910 PRINT "LET US BEGIN BY ASSUMING THAT A PROGRAM IS NEEDED
THAT WILL ANALYZE FOR THE      ELEMENT COPPER AT 3 DIFFERENT
WAVELENGTHS."
911 PRINT ""
912 PRINT "THE INSTRUMENT MUST FIRST BE PLACED IN THE EDIT
MODE BY SELECTING OPTION #130 ONTHE PROGRAM MENU. (THE 'PROG'
BUTTON WILL CALL UP THIS MENU.) THE EDIT PROMPT ` `*_' WILL
THE APPEAR IN THE BOTTOM LEFT CORNER OF THE CRT."
913 GOSUB 6050
914 PRINT "THE NEXT STEP IS TO ASSIGN A NAME AND NUMBER TO
THE PROGRAM USING THE COMMAND  `# ENTER name', WHERE # IS A
NUMBER FROM 1-99 AND name IS A 1-18 CHARACTER LONG
NAME.":PRINT ""
915 PRINT "FOR THE SAMPLE PROGRAM THE FOLLOWING WOULD BE
ENTERED:  1 ENTER COPPER":PRINT ""
916 PRINT "AFTER HITTING RETURN, THE CRT WILL RESPOND
WITH.....  "
917 GOSUB 6050
918 GOSUB 5000
919 GOSUB 5100
920 LOCATE 19,1
921 PRINT "THE VALUES UNDER `P#' AND 'NAMED'  ARE THE PROGRAM
NUMBER AND NAME JUST PUNCHED  IN USING THE 'ENTER'  COMMAND."
922 GOSUB 6060
923 PRINT "THIS PROGRAM LISTING CAN BE CALLED UP AT ANY TIME
USING THE COMMAND: 1 SEE "
924 GOSUB 6060
925 PRINT "THE `WP' REFERS TO 'WRITE  PROTECT'. WHEN
ACTIVATED, ALL PROGRAM PARAMETERS ARE  LOCKED, AND CAN NOT BE
ACCIDENTALLY CHANGED."
926 PRINT "IT IS ADVISABLE TO USE THIS FEATURE AFTER WRITING
A PROGAM."
927 GOSUB 6060
928 PRINT "IT IS ACTIVATED BY THE COMMAND: 1 WP  ,WHICH WILL
REPLACE THE `0' UNDER `WP'    WITH A `1'. THE WRITE PROTECT
IS REMOVED BY THE COMMAND: 0 WP
929 GOSUB 6060
930 PRINT "THE 'PWR'  PARAMETER REFERS TO THE POWER LEVEL AT
WHICH THE TORCH IS OPERATED.  THE DEFAULT VALUE IS 3, AND IS
SUFFICIENT FOR NEARLY ALL TYPES OF ANALYSIS."
931 GOSUB 6060
```

```
932 PRINT "THE POWER LEVEL VALUE CAN BE CHANGED, IF
NECESSARY, BY THE COMMAND: n POWER ,  WHERE n RANGES FROM 1
(LOWEST VALUE) TO 6. POWER LEVEL 6 REQUIRES SPECIAL
CONSIDERATIONS, AND SHOULD NOT BE USED FOR ROUTINE
ANALYSIS!!!"
933 GOSUB 6060
934 PRINT "THE `ML/M' PARAMETER SETS THE ASPIRATION RATE,
WHICH CAN RANGE FROM 0.1 - 2.2  ML/MIN. IT CAN BE SET USING
THE COMMAND: n ML/M , WITH n BEING THE CHOSEN VALUE.THE
DEFAULT VALUE OF 1.0 ML/MIN IS SUFFICIENT FOR ALL ANALYSES,
HOWEVER."
935 GOSUB 6060
936 PRINT "THE 'PDLY' PARAMETER REFERS TO PUMP DELAY, AND
SETS THE WASHOUT TIME ALLOTED  BEFORE READINGS ON A
SOLUTION ARE TAKEN. THE COMMAND: n PDLY  SETS THE DELAY,
WITH n RANGING FROM 0 - 120 SECONDS."
937 GOSUB 6060
938 PRINT "FOR ROUTINE ANALYSIS THE DEFAULT VALUE OF 30
SECONDS IS RECOMMENDED."
939 GOSUB 6060
940 PRINT "THE PARAMETER 'HG'  SETS THE CONDITION OF THE
MERCURY CALIBRATION LAMP, WITH 1  MEANING 'LAMP  ON' AND 0
MEANING 'LAMP  OFF'."
941 GOSUB 6060
942 PRINT "THE DEFAULT CONDITION FOR THIS PARAMETER IS '1'
(LAMP ON). ONLY WHEN A MERCURY  ANALYSIS IS TO BE PERFORMED
SHOULD THE LAMP BE TURNED OFF. THE 'HG'  COMMAND IS:  n HG
WHERE N = 0 OR 1."
943 GOSUB 6060
944 PRINT "THE '*ANAL¹  PARAMETER SETS THE NUMBER OF REPEAT
ANALYSES. THE DEFAULT VALUE IS  `0', WHICH ACTUALLY DOES 1
ANALYSIS. IT IS RECOMMENDED THAT 2 ANALYSES BE DONE. THE
COMMAND IS:  2 *ANAL  ."
945 GOSUB 6060
946 PRINT "THE `*RDG' PARAMETER SETS THE NUMBER OF READINGS
FOR EACH ELEMENT. THE DEFAULT  VALUE IS `0', WHICH ACTUALLY
TAKES 1 READING. FOR BEST RESULTS THIS PARAMETER  SHOULD BE
CHANGED TO `3' USING THE COMMAND:  3 *RDG  ."
947 GOSUB 6060
948 PRINT "WHEN THE '*ANAL¹  AND `*RDG' VALUES ARE CHANGED
USING THE APPROPRIATE COMMANDS,  THE CRT WILL NOT REFLECT THE
CHANGES UNTIL THE ABOVE MENU IS RECALLED USING THE COMMAND: 1
SEE  . THE CRT WILL THEN REFLECT THE CHANGES AS
FOLLOWS.. ...."
949 GOSUB 6060
950 LOCATE 9,28
951 PRINT "1.0   30  1      2     3"
952 LOCATE 19,1
953 PRINT "NOW THAT THE PROGRAM PARAMETERS ARE SET, THE NEXT
STEP IS TO SELECT THE          ANALYTICAL WAVELENGTHS."
954 GOSUB 6060
955 PRINT "A LIBRARY OF ANALYTICAL WAVELENGTHS FOR 78
ELEMENTS IS IN MEMORY. TO CALL UP A  LIST OF AVAILABLE LINES
FOR A PARTICULAR ELEMENT, USE THE COMMAND: ELEMENT el . THE
VARIABLE 'el'  REFERS TO THE ELEMENT OF CHOICE."
```

```
956 GOSUB 6060
957 PRINT "FOR THE SAMPLE COPPER PROGRAM, THE PROPER COMMAND
WOULD BE:  ELEMENT CU  .       THE CRT WOULD THEN LIST THE
COPPER LINES AS FOLLOWS.. .."
958 GOSUB 6065
960 GOSUB 5125
961 LOCATE 19,1
962 PRINT "THE ANALYTICAL LINES ARE LISTED FROM 'MOST
SENSITIVE' TO 'LEAST SENSITIVE'.      A PARTICULAR LINE IS
IMPLEMENTED INTO A PROGRAM USING THE COMMAND:  n USE ,
WHERE n IS THE LINE NUMBER INDICATED UNDER THE 'I!' COLUMN."
963 GOSUB 6060
964 PRINT " IF THE SAMPLE PROGRAM USED ONLY THE FIRST LINE,
THE COMMAND WOULD BE <1 USE>.   SINCE WE WISH TO USE ALL 3
LINES, HOWEVER, THE PROPER COMMAND IS <1 USE 2 USE 3 USE>."
965 GOSUB 6060
966 PRINT "ALL 3 LINES ARE NOW PLACED INTO THE PROGRAM, AND A
LINE REPORT IS GENERATED FOR EACH. THE FIRST LINE REPORT IS
AUTOMATICALLY DISPLAYED ON THE CRT AS FOLLOWS.. ."
967 GOSUB 6065
968 GOSUB 5150
969 LOCATE 19,1
970 PRINT "THE FIRST 3 HEADINGS AT THE TOP LEFT ('I!',  'EL',  &
`NM') LIST THE LINE REPORT  NUMBER, THE ELEMENT TO BE
ANALYZED, AND THE WAVELENGTH (IN NANOMETERS) TO BE
DETERMINED."
971 GOSUB 6060
972 PRINT "ANY LINE REPORT IN A PROGRAM CAN BE CALLED UP
USING THE COMMAND <n TH>, WHERE n IS THE LINE REPORT NUMBER.
THEREFORE, THE COMMAND <1 TH> WOULD CALL UP THE ABOVELINE
REPORT FROM ANY POINT IN THE SAMPLE PROGRAM."
973 GOSUB 6060
974 PRINT "ALL LINE REPORTS EMPLOYED IN A PROGRAM ARE LISTED
IN THE PROGRAM'S PRIMARY MENU."
975 GOSUB 6065
976 GOSUB 5100
977 LOCATE 9,28
978 PRINT "1.0   30  1      2     3"
979 LOCATE 19,1
980 PRINT " THIS IS THE SAMPLE PROGRAM'S PRIMARY MENU BEFORE
ANALYTICAL LINES WERE CHOSEN.  AFTER THE 3 LINE REPORTS ARE
PLACED IN THE PROGRAM USING THE <n USE> COMMANDS,  THE
PRIMARY MENU WILL LIST THEM WHEN IT IS RECALLED USING THE <1
SEE> COMMAND.. ."
981 GOSUB 6060
982 GOSUB 5200
983 LOCATE 19,1
984 PRINT "LINE REPORT NUMBERS CAN EASILY BE DETERMINED FROM
THIS LIST."
985 GOSUB 6065
986 GOSUB 5150
987 LOCATE 19,1
988 PRINT "GETTING BACK TO LINE REPORT #1, THE NUMBER UNDER
THE HEADING 'ORD' INDICATES    WHICH ORDER THE MONOCHROMATOR
WILL BE USING FOR THE CHOSEN WAVELENGTH."
```

```
989 GOSUB 6060
990 PRINT "SECOND ORDER IS USED BETWEEN 190 & 361 NM, AND
FIRST ORDER BETWEEN 365 & 800 NM.THE PROPER ORDER IS ENTERED
BY THE COMPUTER, AND CANNOT BE CHANGED BY THE
OPERATOR."
991 GOSUB 6060
992 PRINT "THE LETTER UNDER THE HEADING `CH' INDICATES WHICH
CHANNEL WILL BE USED FOR THE  DETERMINATION. SINCE THIS
INSTRUMENT HAS ONLY 1 CHANNEL, THERE IS NO REASON TO  EVER
CHANGE THE DEFAULT VALUE `A'!!!!"
993 GOSUB 6060
994 PRINT "THE PARAMETER `MM' SETS THE TORCH OBSERVATION
HEIGHT. EACH ANALYTICAL LINE      CALLED UP FROM THE LIBRARY
HAS A DEFAULT VALUE FOR `MM', WHICH IN MOST CASES IS THE
PROPER VALUE TO BE USED FOR THIS PARTICULAR INSTRUMENT."
995 GOSUB 6060
996 PRINT " IT IS RECOMMENDED, HOWEVER, THAT THE TORCH HEIGHT
BE OPTIMIZED FOR EACH          WAVELENGTH BY THE OPERATOR
BEFORE RUNNING ANALYSES. THE OPTIMIZATION PROCEDURE  IS
DISCUSSED LATER IN THIS CHAPTER."
997 GOSUB 6060
998 PRINT "THE COMMAND USED TO CHANGE TORCH HEIGHT SETTINGS
IS <n MM>, WHERE n CAN RANGE   FROM 0 - 48 MILLIMETERS."
999 GOSUB 6060
1000 PRINT "THE PARAMETER `BC' SETS THE BACKGROUND
CORRECTION, WHICH IS USED TO COMPENSATE  FOR BASELINE CHANGES
BETWEEN STANDARDS AND SAMPLES. THE DEFAULT CONDITION IS
NONE, AND IS SIGNIFIED BY AN `N'."
1001 GOSUB 6060
1002 PRINT " IT IS RECOMMENDED, HOWEVER, THAT THE BACKGROUND
CORRECTION PROCEDURE BE CARRIED OUT FOR EACH LINE REPORT.
DETAILS FOR THE PROCEDURE ARE PRESENTED LATER IN THE
CHAPTER."
1003 GOSUB 6060
1004 PRINT "THE 'SEC'  PARAMETER SETS THE INTEGRATION TIME.
THE DEFAULT VALUE OF 1.0 SECOND  IS THE STANDARD VALUE."
1005 GOSUB 6060
1006 PRINT "HOWEVER, IF DETERMINATIONS ARE BEING DONE ON
CONCENTRATIONS IN THE PARTS PER    BILLION RANGE, OR IF A
PARTICULAR ELEMENT HAS A POOR DETECTION LIMIT (UNDER
PARTS PER MILLION), IT WILL BE NECESSARY TO INCREASE THE
INTEGRATION TIME."
1007 GOSUB 6060
1008 PRINT "INCREASES TO 6.0 OR 10.0 SECONDS ARE RECOMMENDED.
THE COMMAND IS <n SEC>, WHERE n CAN RANGE FROM 0.1 - 25.5
SECONDS."
1009 GOSUB 6060
1010 PRINT "THE `#D' PARAMETER SETS THE NUMBER OF DECIMAL
PLACES THAT WILL BE CARRIED IN ALLCONCENTRATION VALUES. THE
DEFAULT VALUE IS `0', NO DECIMAL PLACES. FOR BEST
RESULTS, THIS PARAMETER SHOULD CHANGED TO 2 DECIMAL PLACES."
1011 GOSUB 6060
1012 PRINT "THE PROPER COMMAND IS <2 #D>. PLEASE NOTE,
HOWEVER, THAT THE CRT WILL NOT       REFLECT THIS CHANGE OR
ANY OTHERS MADE TO THE LINE REPORT UNLESS IT IS RECALLED
```

```
USING THE COMMAND <1 TH>!!!"
1013 GOSUB 6060
1014 PRINT "THE 'UNIT' PARAMETER SETS THE UNITS IN WHICH THE
CONCENTRATIONS ARE TO BE REPORTED IN. THE DEFAULT VALUE
OF PPM (PARTS PER MILLION) IS THE STANDARD CHOICE."
1015 GOSUB 6060
1016 PRINT "THERE ARE 4 POSSIBLE CONCENTRATION UNITS IN ALL.
THEY ARE CALLED UP USING THE FOLLOWING COMMANDS: <0 UNIT)
FOR PPM, <1 UNIT> FOR PERCENT, <2 UNIT> FOR WEIGHT PERCENT,
AND <3 UNIT> FOR PPB (PARTS PER BILLION."
1017 GOSUB 6060
1018 PRINT "THE `WS' PARAMETER SETS THE SIZE OF THE PEAK
SEARCH WINDOW. THERE ARE 3 SIZES: NARROW(N) - .033nm,
MEDIUM(M) - .066nm, AND WIDE(W) - .100nm. THE STANDARD SIZE
IS THE DEFAULT SIZE, `M'."
1019 GOSUB 6060
1020 PRINT "THE WINDOW SIZE CAN CHANGED USING THE COMMAND <WS
x>, WHERE x CAN BE N, M, OR W.(NOTE THE COMMAND'S REVERSE
SYNTAX!). REASONS FOR CHANGING THE WINDOW SIZE ARE DISCUSSED
IN A LATER CHAPTER. SIZE `M' WILL BE SUFFICIENT FOR MOST
ANALYSES."
1021 GOSUB 6060
1022 PRINT "THE `#', `B#', & `CONC' OPTIONS IN THE CENTER
LEFT PORTION OF THE CRT ARE FOR GENERATING A CALIBRATION
CURVE. THE INSTRUMENT WILL ACCEPT FROM 1 - 5 STANDARDS PLUS A
BLANK."
1023 GOSUB 6060
1024 PRINT "THE `#' HEADING REFERS TO STANDARD NUMBER.
STANDARD #0 MUST ALWAYS BE THE BLANK,AND STANDARD #1 MUST
ALWAYS CONTAIN THE HIGHEST CONCENTRATION OF THE ANALYTE!!
THE `B#' REFERS TO BOTTLE NUMBER, AND IS ASSIGNED BY THE
OPERATOR."
1025 GOSUB 6060
1026 PRINT "VALUES ASSIGNED FOR `B#' CAN RANGE FROM 1 - 99.
BY CONVENSION, THE BLANK IS ASSIGNED AS B# 99. THE VALUES
UNDER 'CONC' ARE THE CONCENTRATIONS OF THE STANDARDS,
AND MUST ASSIGNED AS WELL. THE BLANK VALUE, HOWEVER, MUST BE
`0'."
1027 GOSUB 6060
1028 PRINT "THE COMMAND USED TO ENTER THE STANDARDS IS <# B#
c CONC>, WHERE `#' IS THE CORRESPONDING STANDARD NUMBER,
`B#' IS AN ASSIGNED BOTTLE NUMBER, AND c IS THE
CONCENTRATION VALUE."
1029 GOSUB 6060
1030 PRINT "FOR THE SAMPLE PROGRAM, 2 STANDARDS WILL BE USED,
HAVING CONCENTRATION VALUES OF 5.00 AND 10.00 PPM COPPER.
THEY ARE ENTERED AS FOLLOWS: <1 1 10.00 CONC> AND <2 2 5.00
CONC>."
1031 GOSUB 6060
1032 PRINT " IF THE LINE REPORT IS RECALLED USING THE COMMAND
<1 TH>, ALL VALUES ENTERED TO THIS POINT WILL BE
INDICATED.. ..."
1033 GOSUB 6060
1034 GOSUB 5220
1035 LOCATE 19,1
```

```
1036 PRINT "IF IT SHOULD BECOME NECESSARY TO ERASE A
STANDARD, THE PROPER COMMAND IS        <# 0 0 CONC>, WHERE
`#' IS THE STANDARD NUMBER TO BE ERASED."
1037 GOSUB 6060
1038 PRINT "THE 'SENSITIVITY' PARAMETER IS THE NET SIGNAL
MEASURED FOR THE HIGHEST STANDARD.(TOTAL HIGH STANDARD SIGNAL
- BLANK SIGNAL) THE 'BLNK- SENSIT' PARAMETER IS THE  BLANK
SIGNAL MEASURED."
1039 GOSUB 6060
1040 PRINT "BOTH OF THESE PARAMETERS ARE ENTER AUTOMATICALLY
BY THE INSTRUMENT DURING       CALIBRATION, AND ARE NOT
OPERATOR CONTROLLED!!!"
1041 GOSUB 6060
1042 PRINT "THE HEADINGS AT THE BOTTOM OF THE LINE REPORT ARE
RELATED TO THE INTERNAL        STANDARD AND INTERFERRING
ELEMENT OPTIONS, WHICH ARE NOT NEEDED FOR ROUTINE
ANALYSES. THESE 2 PROCEDURES WILL BE EXPLAINED IN LATER
CHAPTERS."
1043 GOSUB 6060
1044 PRINT "AT THIS POINT IN THE OPTIMIZATION PROCEDURE, A
'TRIM' ROUTINE SHOULD BE CARRIED OUT. IN ORDER TO FULLY
UNDERSTAND THE PURPOSE OF THE 'TRIM' FUNCTION, ONE MUST  BE
ABLE TO INTERPRET A TYPICAL INTENSITY VERSES WAVELENGTH
PLOT.. .."
1045 GOSUB 6065
1046 GOSUB 5390
1047 LOCATE 19,1
1048 PRINT "THIS IS A SAMPLE PLOT FOR COPPER. THE WAVELENGTH
CHOSEN FOR ANALYSIS, 324.75 NM,IS INDICATED AT THE TOP OF THE
SCREEN. ITS POSITION ON THE PLOT IS MARKED BY THELONG HASH-
MARK RUNNING DOWN THE CENTER OF THE CRT SCREEN."
1049 GOSUB 6060
1050 PRINT "THE NUMBER '4200' IN THE TOP LEFT CORNER OF THE
CRT IS THE INTENSITY VALUE      MEASURED AT THE CHOSEN
WAVELENGTH."
1051 GOSUB 6060
1052 PRINT "THE 2 SMALL HASH-MARKS ON EITHER SIDE OF THE PEAK
(NOW MARKED WITH AN 'X'),      INDICATE THE PEAK SEARCH WINDOW
SIZE PREVIOUSLY DISCUSSED. THE WINDOW IS        CURRENTLY SET
AT THE MEDIUM POSITION. THE WIDE POSITION WOULD LOOK LIKE
THIS..."
1053 LOCATE 5,36
1054 PRINT "X"
1055 LOCATE 5,45
1056 PRINT "X"
1057 GOSUB 6060
1058 GOSUB 5400
1059 LOCATE 19,1
1060 PRINT "SIMULARLY, THE NARROW POSITION WOULD LOOK LIKE
THIS.....  "
1061 GOSUB 6060
1062 GOSUB 5420
1063 LOCATE 19,1
1064 PRINT "THE REMAINING HASH-MARK (NOW MARKED WITH AN `X')
INDICATES THE WAVELENGTH        POSITION AT WHICH A BACKGROUND
```

```
INTENSITY READING IS TAKEN. THE VALUE OBTAINED, IN THIS CASE
'0', IS INDICATED IN THE BOTTOM LEFT CORNER OF THE CRT."
1065 LOCATE 7,32
1066 PRINT "X"
1067 GOSUB 6060
1068 GOSUB 5435
1069 GOSUB 5447
1070 LOCATE 19,1
1071 PRINT "THE 'A' AT THE TOP CENTER OF THE CRT INDICATES
THAT THE PLOT WAS DONE USING THE CHANNEL A MONOCHROMETER,
WHICH IS THE ONLY MONOCHROMETER THIS INSTRUMENT HAS. ASA
RESULT, AN 'A' WILL ALWAYS APPEAR ON EACH PLOT!!!"
1072 GOSUB 6060
1073 PRINT "THE WAVELENGTH NUMBERS AT THE BOTTOM OF THE CRT
ARE LABELS FOR THE WAVELENGTH AXIS."
1074 GOSUB 6060
1075 PRINT "GETTING BACK TO THE PURPOSE OF THE 'TRIM'
ROUTINE, OFTEN THERE IS A WAVELENGTH DIFFERENCE BETWEEN
WHERE A PEAK INTENSITY SHOULD BE AND WHERE THE INSTRUMENT
ACTUALLY FINDS IT. A PLOT OF SUCH A SITUATION MAY LOOK LIKE
THIS..... "
1076 GOSUB 6060
1077 GOSUB 5600
1078 GOSUB 5700
1079 LOCATE 19,1
1080 PRINT "NOTE THE PEAK IS OFF CENTER, WITH THE MAXIMUM
INTENSITY OCCURING AT ABOUT 324.80NM. THE TRIM ROUTINE WILL
FINE TUNE THE MONOCHROMATOR, SO THAT THE PROPER
WAVELENGTH IS USED TO DETERMINE THE MAXIMUM INTENSITY."
1081 GOSUB 6065
1082 GOSUB 5150
1083 GOSUB 5220
1084 LOCATE 19,1
1085 PRINT "TO ACTIVATE THE TRIM ROUTINE FOR EACH WAVELENGTH,
THE LINE REPORT MUST FIRST BE CALLED UP. THEN SIMPLY ASPIRATE
A SOLUTION CONTAINING THE ELEMENT OF INTEREST (50R 10 PPM IS
SUFFICIENT), AND ENTER THE COMMAND <TRIM>."
1086 GOSUB 6065
1087 GOSUB 5700
1088 GOSUB 5381
1089 GOSUB 5365
1090 GOSUB 5670
1091 LOCATE 19,1
1092 PRINT "THE CRT WILL DISPLAY A PLOT SIMULAR TO THE ONE
ILLUSTRATED ABOVE, THE CENTER HASH-MARK IS NOW MUCH
SMALLER, AND THE BACKGROUND HASH-MARK IS NOT DISPLAYED. THE
OPERATOR NOW TRIMS THE WAVELENGTH BY MOVING THE HASH-MARK."
1093 GOSUB 6060
1094 PRINT "THE FOLLOWING COMMANDS ARE USED: <L> - LEFT, <R>
- RIGHT, <U> - UP, <D> - DOWN, <F> - FINE INCREMENTS, AND <C>
- COARSE INCREMENTS. THE UP AND DOWN CONTROLS AREFOR
CONVENIENCE, AS ONLY THE HORIZONTAL POSITION MUST BE
ADJUSTED."
1095 GOSUB 6060
1096 PRINT "THE HASH-MARK IS MOVED IN COARSE INCREMENTS,
```

```
UNLESS THE `F' KEY IS PRESSED,      WHICH ALLOWS FINER
MOVEMENT. THE OPERATOR SIMPLY ALLIGNS THE HASH-MARK WITH THE
TOP OF THE PEAK, AND THEN PRESSES THE RETURN KEY TO LOCK IN
THE NEW POSITION."
1097 GOSUB 6060
1098 GOSUB 5760
1099 LOCATE 19,1
2000 PRINT "THE PROPER POSITION OF THE HASH-MARK IS
ILLUSTRATED ABOVE. ONCE A PARTICULAR     WAVELENGTH IS
TRIMMED, IT NEED NOT BE RE-TRIMMED. RESULTS OF A TRIM CAN BE
OBSERVED BY ENTERING THE COMMAND <RESTPEAK>. THE CRT WILL
DISPLAY THE FOLLOWING"
2001 GOSUB 6065
2002 GOSUB 5300
2003 GOSUB 5379
2004 GOSUB 5381
2005 GOSUB 5770
2006 LOCATE 19,1
2007 PRINT "THE TRIMMED PEAK IS NOW DISPLAYED. NOTE THE
WAVELENGTH VALUE LISTED AT THE TOP  OF CRT IS NOW CHANGED TO
ITS NEW AND PROPER VALUE. THIS TRIM ROUTINE MUST BE
CARRIED OUT FOR ALL ANALYTICAL LINES IN A PROGRAM TO ASSURE
ACCURATE RESULTS."
2008 GOSUB 6060
2009 PRINT "THE OPERATOR MUST NOW DETERMINE IF A BACKGROUND
CORRECTION WILL BE NECESSARY.    THE DEFAULT POSITION OF THE
BACKGROUND HASH-MARK IS ALWAYS .05 NM TO THE LEFT OFTHE
PEAK."
2010 LOCATE 7,32
2011 PRINT "X"
2012 GOSUB 6060
2013 PRINT "IN THE ABOVE EXAMPLE, THE BACKGROUND IS VERY
STABLE AT THE DEFAULT POSITION. IN FACT, THE ENTIRE BASELINE
AROUND THE PEAK IS STABLE. THEREFORE, NO BACKGROUND
CORRECTION WOULD BE NECESSARY.
2014 GOSUB 6060
2015 GOSUB 5800
2016 GOSUB 5447
2017 LOCATE 19,1
2018 PRINT "THE SITUATION NOW ILLUSTRATED ABOVE REQUIRES A
BACKGROUND CORRECTION DUE TO THE PRESENCE OF AN INTERFERENCE
PEAK IN THE AREA OF THE CORRECTION."
2019 GOSUB 6060
2020 PRINT "A FURTHER EXAMPLE WOULD BE A SITUATION IN WHICH
THE BASELINE IS STABLE FOR A    SHORT DISTANCE, AND THEN
BEGINS A STEADY RISE ACROSS THE DEFAULT CORRECTION
POSITION."
2021 GOSUB 5835
2022 GOSUB 5860
2023 GOSUB 6060
2024 PRINT "IN GENERAL, ANY PLOT IN WHICH THE BASELINE AROUND
THE DEFAULT CORRECTION        LOCATION DEVIATES FROM A
STRAIGHT HORIZONTAL ARRANGEMENT WILL REQUIRE A
BACKGROUND CORRECTION."
2025 GOSUB 6065
```

```
2026 GOSUB 5150
2027 GOSUB 5220
2028 LOCATE 19,1
2029 PRINT "TO ACTIVATE THE BACKGROUND CORRECTION ROUTINE,
THE LINE REPORT ILLUSTRATED ABOVEMUST FIRST BE CALLED UP (1
TH). AFTERWARDS, THE TEST SOLUTION USED FOR THE TRIM ROUTINE
IS ASPIRATED, AND THE COMMAND <BKG-TRIM> IS ENTERED.. .."
2030 GOSUB 6065
2031 GOSUB 5300
2032 GOSUB 5770
2033 GOSUB 5800
2034 GOSUB 5900
2035 LOCATE 19,1
2036 PRINT "THE OPERATOR MUST NOW ENTER ONE OF THE FOLLOWING
COMMANDS: <N>, <L>, <R>, OR <B>CORRESPONDING TO THE 4 CHOICES
LISTED ON THE CRT. SINCE MOST CORRECTING IS DONE ON THE LEFT
SIDE OF A PEAK, THE COMMAND <L> SHOULD BE ENTERED.. .."
2037 GOSUB 6060
2038 GOSUB 5910
2039 LOCATE 19,1
2040 PRINT "THE BACKGROUND HASH-MARK MUST NOW BE MOVED TO
ANOTHER POSITION ON THE LEFT SIDE OF THE PEAK WHERE THE
BACKGROUND IS STABLE."
2041 GOSUB 6060
2042 PRINT "THE FOLLOWING COMMANDS ARE USED: <L> - LEFT, <R>
- RIGHT, <U> - UP, <D> - DOWN, <F> - FINE INCREMENTS, AND <C>
- COARSE INCREMENTS. THE UP AND DOWN CONTROLS AREFOR
CONVENIENCE, AS ONLY THE HORIZONTAL POSITION MUST BE
ADJUSTED."
2043 GOSUB 6060
2044 PRINT "THE HASH-MARK IS MOVED IN COARSE INCREMENTS,
UNLESS THE `F' KEY IS PRESSED,     WHICH ALLOWS FINER
MOVEMENT. THE OPERATOR SIMPLY MOVES THE HASH-MARK TO A
STABLEPOSITION, AND THEN PRESSES THE RETURN KEY TO LOCK IN
THE NEW POSITION."
2045 GOSUB 6060
2046 GOSUB 5925
2047 LOCATE 19,1
2048 PRINT "THE NEW POSITION FOR BACKGROUND CORRECTION IS
ILLUSTRATED ABOVE."
2049 GOSUB 6060
2050 PRINT " IF A SITUATION EVER ARISES WHERE NO PORTION OF
THE LEFT SIDE BASELINE IS STABLE,CORRECTION CAN BE MADE BY
ENTERING THE <R> (Right) OPTION. THE NEW POSITION IS  THEN
LOCKED IN USING THE SAME METHOD."
2051 GOSUB 6060
2052 PRINT "THE <B> (Both) OPTION IS USED FOR ANALYSES RUN
NEAR AN ELEMENT'S DETECTION      LIMITS. IT IS SELDOM USED
FOR ROUTINE ANALYSIS."
2053 GOSUB 6060
2054 PRINT "THE BACKGROUND CORRECTION STATUS IS CHANGED ON
THE LINE REPORT.. ..."
2055 GOSUB 6065
2056 GOSUB 5150
2057 GOSUB 5220
```

```
2058 GOSUB 5935
2059 LOCATE 19,1
2060 PRINT "NOTE THE 'BC' COLUMN ABOVE NOW HAS AN 'L' FLAG
INSTEAD OF AN `N'."
2061 GOSUB 6060
2062 PRINT "THE FINAL PARAMETER REQUIRING ATTENTION IS THE
TORCH HEIGHT. (THE VALUE UNDER `MM' ABOVE) EACH ELEMENT IN
THE LIBRARY HAS A DEFAULT VALUE FOR `MM',WHICH IN MANY
CASES IS THE PROPER VALUE."
2063 GOSUB 6060
2064 PRINT "FOR BEST RESULTS, HOWEVER, THE TORCH HEIGHT
ROUTINE SHOULD BE USED TO VERIFY THAT THE PROPER VALUE IS
SELECTED. TO INITIATE THE ROUTINE, ASPIRATE THE TEST
SOLUTION ONCE AGAIN AND ENTER THE COMMAND <TPROFILE>. THE CRT
RESPONDS WITH.. ..."
2065 GOSUB 6050
2066 GOSUB 5249
2067 LOCATE 19,1
2068 PRINT "THE ABOVE IS A PLOT OF SIGNAL INTENSITY VERSUS
TORCH HEIGHT IN MILLIMETERS. EACHLINE SEGMENT REPRESENTS A
DISTANCE OF 2 MM. THE MAXIMUM INTENSITY OCCURS AT 14 MM."
2069 GOSUB 6060
2070 PRINT "THE MAXIMUM VALUE IS DISPLAYED IN THE UPPER RIGHT
CORNER OF THE CRT, ALONG WITH THE RECOMMENDED `MM' VALUE FOR
THE LINE REPORT. TO COMPLETE THE ROUTINE, A BLANKSOLUTION IS
ASPIRATED AND THE COMMAND <ASPIRATE TPLOT> IS ENTERED."
2071 GOSUB 6060
2072 GOSUB 5500
2073 LOCATE 19,1
2074 PRINT "THE INTENSITY VERSES TORCH HEIGHT PLOT FOR THE
BLANK IS NOW ILLUSTRATED ON THE CRT AS WELL."
2075 GOSUB 6060
2076 PRINT "THE MAXIMUM SIGNAL INTENSITY FOR THE ANALYTE IN
THE BLANK OCCURS AT 2 MM. THE VALUE LISTED FOR MM IN THE
UPPER RIGHT CORNER REMAINS AT 14, HOWEVER."
2077 GOSUB 6060
2078 PRINT "THE VALUE THAT SHOULD BE CHOSEN FOR THE TORCH
HEIGHT IS THE POINT AT WHICH A MAXIMUM DIFFERENCE OCCURS
BETWEEN THE SIGNAL INTENSITIES OF THE ANALYTE IN THE
STANDARD (TEST SOLUTION) AND THE BLANK."
2079 GOSUB 6060
2080 PRINT "IN THE ABOVE EXAMPLE, AND IN THE MAJORITY OF ALL
OTHER DETERMINATIONS, THE POINTOF MAXIMUM DIFFERENCE IS
SIMPLY THE VALUE AT THE PEAK. THE TORCH HEIGHT VALUE IS
PLACED INTO THE LINE REPORT WITH THE COMMAND <n MM>. (n =
PEAK VALUE)"
2081 GOSUB 6060
2082 PRINT "NOW ILLUSTRATED ABOVE IS A SITUATION IN WHICH THE
TORCH HEIGHT VALUE WOULD NOT BE THE VALUE AT THE PEAK. HERE
THE MAXIMUM DIFFERENCE OCCURS AT 16 MM, INSTEAD OF 14 MM.
THEREFORE, 16 WOULD BE THE PROPER TORCH HEIGHT VALUE."
2083 GOSUB 5940
2084 GOSUB 6050
2085 PRINT "AFTER SETTING THE TORCH HEIGHT PARAMETER, THE
FIRST LINE REPORT IN THE SAMPLE PROGRAM IS COMPLETE. LINE
```

```
REPORTS 2 & 3 MUST THEN BE CALLED UP AND INITIALIZED IN THE
SAME MANNER."
2086 GOSUB 6050
2087 PRINT "TO REVIEW THIS CHAPTER IN DETAIL, PRESS THE `F2'
KEY. TO REVIEW THE LINE REPORT SECTION ONLY, PRESS THE `F3'
KEY."
2088 ON KEY (2) GOSUB 6021
2089 KEY(2) ON
2090 ON KEY (3) GOSUB 6022
2091 KEY(3) ON
2092 GOSUB 6050
2093 RUN "ICP-6.BAS"
4999 END
5000 LINE (140,10)-(510,10)
5001 LINE (510,10)-(510,130)
5002 LINE (510,130)-(140,130)
5003 LINE (140,130)-(140,10)
5006 RETURN
5010 LINE (140,1)-(510,1)
5011 LINE (510,1)-(510,138)
5012 LINE (510,138)-(140,138)
5013 LINE (140,138)-(140,1)
5014 RETURN
5015 LINE (115,lo)-(535,10)
5016 LINE (535,10)-(535,130)
5017 LINE (535,130)-(115,130)
5018 LINE (115,130)-(115,10)
5019 RETURN
5020 LOCATE 2,23
5021 PRINT "P 200   123450-00          1 JUNE 1984"
5022 LOCATE 4,28
5023 PRINT "#       OPTION"
5024 LOCATE 5,28
5025 PRINT "1 PRINTER SETUP     OFF"
5026 LOCATE 6,28
5027 PRINT "2 RS232 SETUP       OFF"
5028 LOCATE 7,28
5029 PRINT "3 DIAGNOSTICS       OFF"
5030 LOCATE 8,28
5031 PRINT "4 AUTOSAMPLER       OFF"
5032 LOCATE 9,28
5033 PRINT "5 OPERATOR ID."
5034 LOCATE 10,28
5035 PRINT "6 DATE SET          01 JUN 84"
5036 LOCATE 11,28
5037 PRINT "7 TIME SET          01:07"
5038 LOCATE 12,28
5039 PRINT "8 VIDEO SETUP       OFF"
5040 LOCATE 13,28
5041 PRINT "9 EXIT"
5042 LOCATE 14,27
5043 PRINT "10 EXTENDED RANGE    OFF"
5044 LOCATE 15,27
5045 PRINT "11 PROTOCOL          OFF"
5046 LOCATE 17,23
```

```
5047 PRINT "#_"
5048 RETURN
5050 LOCATE 3,23
5051 PRINT " P 200   123450-00          1 JUNE 1984"
5052 LOCATE 5,28
5053 PRINT "#       OPTION"
5054 LOCATE 6,28
5055 PRINT "1 PAGING             OFF"
5056 LOCATE 7,28
5057 PRINT "2 LEFT MARGIN          8"
5058 LOCATE 8,28
5059 PRINT "3 GRAPHICS           OFF"
5060 LOCATE 9,28
5061 PRINT "4 PLOTS PER PAGE       3"
5062 LOCATE 10,28
5063 PRINT "6 INITIALIZE"
5064 LOCATE 11,28
5065 PRINT "9 EXIT"
5066 LOCATE 16,23
5067 PRINT "#_"
5068 RETURN
5100 LOCATE 3,23
5101 PRINT "P 200   123450-00          4 JULY 1985"
5102 LOCATE 5,28
5103 PRINT "P#  WP PWR NAMED"
5104 LOCATE 6,29
5105 PRINT "1   0   3 COPPER"
5106 LOCATE 8,27
5107 PRINT "ML/M PDLY HG  *ANAL  *RDG"
5108 LOCATE 9,28
5109 PRINT "1.0   30  1       0     0"
5110 LOCATE 11,22
5111 PRINT "# EL        NM  ORD  CH  MM  BC   SEC"
5112 LOCATE 16,23
5113 PRINT "*_"
5115 RETURN
5125 LOCATE 4,30
5126 PRINT "ELEMENT CU      29 ATOM"
5127 LOCATE 6,31
5128 PRINT "# EL       NM ORD  MM"
5129 LOCATE 7,31
5130 PRINT "1 CU  324.75    2  14"
5131 LOCATE 8,31
5132 PRINT "2 CU  327.40    2  14"
5133 LOCATE 9,31
5134 PRINT "3 CU  224.70    2  14"
5135 LOCATE 11,28
5136 PRINT "*_"
5140 RETURN
5150 LOCATE 3,22
5151 PRINT "# EL        NM  ORD  CH  MM  BC   SEC"
5152 LOCATE 4,22
5153 PRINT "1 CU   324.75     2   A 1 4   N   1.0"
5154 PRINT ""
5155 LOCATE 6,22
```

```
5156 PRINT "1 B#          CONC        UNIT    I D    WS"
5157 LOCATE 7,22
5158 PRINT "0 99             0        PPM      0     M"
5159 LOCATE 8,22
5160 PRINT "1"
5161 LOCATE 9,22
5162 PRINT "2                                SENSITIVITY"
5163 LOCATE 10,22
5164 PRINT "3                                        1"
5165 LOCATE 11,22
5166 PRINT "4                              BLNK-SENSIT"
5167 LOCATE 12,22
5168 PRINT "5                                        0"
5169 PRINT ""
5170 LOCATE 14,22
5171 PRINT "I/S      1I/E    1S/F      2I/E      2S/F"
5172 PRINT ""
5173 PRINT ""
5174 LOCATE 16,21
5175 PRINT "*_"
5180 RETURN
5200 LOCATE 9,28
5201 PRINT "1.0    30  1       2     3"
5202 LOCATE 12,22
5203 PRINT "1 CU    324.75      2    A  14    N    1.0"
5204 LOCATE 13,22
5205 PRINT "2 CU    327.40      2    A  14    N    1.0"
5206 LOCATE 14,22
5207 PRINT "3 CU    224.70      2    A  14    N    1.0"
5210 RETURN
5220 LOCATE 7,50
5221 PRINT "2"
5222 LOCATE 8,22
5223 PRINT "1  1       10.00"
5224 LOCATE 9,22
5225 PRINT "2  2        5.00"
5230 RETURN
5248 CLS
5249 GOSUB 5015
5250 LOCATE 3,21
5251 PRINT "4200                          CU 324.75"
5252 LOCATE 4,55
5253 PRINT "MAX 14"
5254 LOCATE 5,55
5255 PRINT "MM= 14"
5256 LOCATE 14,17
5257 PRINT "0           12           24           36
48"
5258 LINE (127,72)-(138,72)
5259 LINE (143,73)-(153,73)
5260 LINE (158,72)-(168,72)
5261 LINE (173,68)-(183,68)
5262 LINE (188,65)-(198,65)
5263 LINE (203,55)-(213,55)
5264 LINE (218,50)-(229,50)
```

```
5265 LINE (234,45)-(245,45)
5266 LINE (250,48)-(261,48)
5267 LINE (266,54)-(277,54)
5268 LINE (282,61)-(293,61)
5269 LINE (298,70)-(309,70)
5270 LINE (314,76)-(324,76)
5271 LINE (329,85)-(340,85)
5272 LINE (345,88)-(356,88)
5273 LINE (361,90)-(372,90)
5274 LINE (377,91)-(388,91)
5275 LINE (393,90)-(404,90)
5276 LINE (409,90)-(420,90)
5277 LINE (425,92)-(436,92)
5278 LINE (441,911-(452,911
5279 LINE (457,90)-(468,90)
5280 LINE (473,90)-(484,90)
5281 LINE (489,89)-(500,89)
5282 LINE (505,901-(516,901
5283 LOCATE 16,20
5284 PRINT "*_"
5285 RETURN
5300 X=175
5301 Y=99
5302 FOR Q=1 TO 10
5303 PSET (X,Y)
5304 X=X+4
5305 NEXT Q
5306 X=212
5307 Y=98
5308 FOR Q=1 TO 10
5309 PSET (X,Y)
5310 X=X+4
5311 NEXT Q
5312 X=252
5313 Y=97
5314 FOR Q=1 TO 6
5315 PSET (X,Y)
5316 X=X+4
5317 NEXT Q
5318 PSET (274,971
5319 PSET (278,961
5320 PSET (282,951
5321 PSET (286,941
5322 PSET (290,93)
5323 PSET (294,91)
5324 PSET (297,891
5325 A=-7.2:C=0
5326 FOR Z=1 TO 145
5327 B=A*A
5328 X=A+305
5329 Y=B+35
5330 X=X+C
5331 C=C+.2
5332 PSET (X,Y)
5333 A=A+.1
```

```
5334 NEXT Z
5335 PSET (342,881
5336 PSET (342,89)
5337 PSET (345,911
5338 PSET (349,931
5339 PSET (353,941
5340 PSET (357,951
5341 PSET (361,961
5342 PSET (364,971
5343 X=368
5344 Y=97
5345 FOR Q=1TO 6
5346 PSET (X,Y)
5347 X=X+4
5348 NEXT Q
5349 X=391
5350 Y=98
5351 FOR Q=1 TO 10
5352 PSET (X,Y)
5353 X=X+4
5354 NEXT Q
5355 X=432
5356 Y=99
5357 FOR Q=1 TO 10
5358 PSET (X,Y)
5359 X=X+4
5360 NEXT Q
5361 RETURN
5365 LINE (320,251-(320,104)
5366 LOCATE 3,22
5367 PRINT "4200          A          CU 324.75"
5368 LINE (260,102)-(260,110)
5369 LINE (380,102)-(380,110)
5370 LOCATE 14,25
5371 PRINT "0"
5372 LOCATE 14,34
5373 PRINT "324.70"
5374 LOCATE 14,49
5375 PRINT "324.80"
5376 LOCATE 16,22
5377 PRINT "*_"
5378 RETURN
5379 LINE (260,251-(260,451
5380 RETURN
5381 LINE (290,25)-(290,35)
5382 LINE (350,251-(350,351
5383 RETURN
5390 GOSUB 5300
5391 GOSUB 5365
5392 GOSUB 5379
5393 GOSUB 5381
5394 RETURN
5400 LOCATE 5,36
5401 PRINT " "
5402 LOCATE 5,45
```

```
5403 PRINT " "
5404 X=290
5405 FOR Y=25 TO 35
5406 PRESET (X,Y)
5407 NEXT Y
5408 X=350
5409 FOR Y=25 TO 35
5410 PRESET (X,Y)
5411 NEXT Y
5412 LINE (280,25)-(280,351
5413 LINE (360,25)-(360,35)
5414 RETURN
5420 X=280
5421 FOR Y=25 TO 35
5422 PRESET (X,Y)
5423 NEXT Y
5424 X=360
5425 FOR Y=25 TO 35
5426 PRESET (X,Y)
5427 NEXT Y
5428 LINE (300,25)-(300,351
5429 LINE (340,251-(340,351
5430 RETURN
5435 X=300
5436 FOR Y=25 TO 35
5437 PRESET (X,Y)
5438 NEXT Y
5439 X=340
5440 FOR Y=25 TO 35
5441 PRESET (X,Y)
5442 NEXT Y
5443 GOSUB 5381
5444 RETURN
5447 LOCATE 7,32
5448 PRINT " "
5449 RETURN
5500 LOCATE 4,59
5501 PRINT " 2"
5502 LINE (127,951-(138,951
5503 LINE (143,941-(153,941
5504 LINE (158,951-(168,951
5505 LINE (173,951-(183,951
5506 LINE (188,961-(198,961
5507 LINE (203,97)-(213,97)
5508 LINE (218,981-(229,981
5509 LINE (234,991-(245,991
5510 LINE (250,100)-(261,100)
5511 LINE (266,991-(277,991
5512 LINE (282,100)-(293,100)
5513 LINE (298,991-(309,991
5514 LINE (314,100)-(324,100)
5515 LINE (329,100)-(340,100)
5516 LINE (345,100)-(356,100)
5517 LINE (361,991-(372,991
5518 LINE (377,100)-(388,100)
```

```
5519 LINE (393,100)-(404,100)
5520 LINE (409,100)-(420,100)
5521 LINE (425,99)-(436,99)
5522 LINE (441,100)-(452,100)
5523 LINE (457,100)-(468,100)
5524 LINE (473,100)-(484,100)
5525 LINE (489,100)-(500,100)
5526 LINE (505,100)-(516,100)
5527 RETURN
5600 X=175
5601 Y=99
5602 FOR Q=1 TO 10
5603 PRESET (X,Y)
5604 X=X+4
5605 NEXT Q
5606 X=212
5607 Y=98
5608 FOR Q=1 TO 10
5609 PRESET (X,Y)
5610 X=X+4
5611 NEXT Q
5612 X=252
5613 Y=97
5614 FOR Q=1 TO 6
5615 PRESET (X,Y)
5616 X=X+4
5617 NEXT Q
5618 PRESET (274,97)
5619 PRESET (278,96)
5620 PRESET (282,95)
5621 PRESET (286,94)
5622 PRESET (290,93)
5623 PRESET (294,91)
5624 PRESET (297,89)
5625 A=-7.2:C=0
5626 FOR Z=1 TO 145
5627 B=A*A
5628 X=A+305
5629 Y=B+35
5630 X=X+C
5631 C=C+.2
5632 PRESET (X,Y)
5633 A=A+.1
5634 NEXT Z
5635 PRESET (342,88)
5636 PRESET (342,89)
5637 PRESET (345,91)
5638 PRESET (349,93)
5639 PRESET (353,94)
5640 PRESET (357,95)
5641 PRESET (361,96)
5642 PRESET (364,97)
5643 X=368
5644 Y=97
5645 FOR Q=1 TO 6
```

```
5646 PRESET (X,Y)
5647 X=X+4
5648 NEXT Q
5649 X=391
5650 Y=98
5651 FOR Q=1 TO 10
5652 PRESET (X,Y)
5653 X=X+4
5654 NEXT Q
5655 X=432
5656 Y=99
5657 FOR Q=1 TO 10
5658 PRESET (X,Y)
5659 X=X+4
5660 NEXT Q
5661 RETURN
5670 X=320
5671 FOR Y=25 TO 30
5672 PRESET (X,Y)
5673 NEXT Y
5674 FOR Y=51 TO 104
5675 PRESET (X,Y)
5676 NEXT Y
5677 LOCATE 16,22
5678 PRINT "_ "
5679 RETURN
5700 X=175
5701 Y=99
5702 FOR Q=1 TO 30
5703 PSET (X,Y)
5704 X=X+4
5705 NEXT Q
5706 X=289
5707 Y=98
5708 FOR Q=1 TO 10
5709 PSET (X,Y)
5710 X=X+4
5711 NEXT Q
5712 X=329
5713 Y=97
5714 FOR Q=1 TO 6
5715 PSET (X,Y)
5716 X=X+4
5717 NEXT Q
5718 PSET (351,97)
5719 PSET (355,961
5720 PSET (359,95)
5721 PSET (363,94)
5722 PSET (367,93)
5723 PSET (371,91)
5724 PSET (374,89)
5725 A=-7.2:C=0
5726 FOR Z=1 TO 145
5727 B=A*A
5728 X=A+382
```

```
5729 Y=B+35
5730 X=X+C
5731 C=C+.2
5732 PSET (X,Y)
5733 A=A+.1
5734 NEXT Z
5735 PSET (419,88)
5736 PSET (419,89)
5737 PSET (422,91)
5738 PSET (426,93)
5739 PSET (430,94)
5740 PSET (434,95)
5741 PSET (438,96)
5742 PSET (441,97)
5743 X=445
5744 Y=97
5745 FOR Q=ITO 6
5746 PSET (X,Y)
5747 X=X+4
5748 NEXT Q
5749 RETURN
5760 X=320
5761 FOR Y=31 TO 50
5762 PRESET (X,Y)
5763 NEXT Y
5764 LINE (397,31)-(397,50)
5765 RETURN
5770 LINE (320,25)-(320,104)
5771 LOCATE 3,22
5772 PRINT "4200          A          CU 324.80"
5773 LINE (260,102)-(260,110)
5774 LINE (380,102)-(380,110)
5775 LOCATE 14,25
5776 PRINT "0"
5777 LOCATE 14,34
5778 PRINT "324.75"
5779 LOCATE 14,49
5780 PRINT "324.85"
5781 LOCATE 16,22
5782 PRINT "*_"
5783 RETURN
5800 PRESET (236,98)
5801 PRESET (240,98)
5802 PRESET (244,98)
5803 PRESET (248,98)
5804 X=252
5805 Y=97
5806 FOR Q=l TO 6
5807 PRESET (X,Y)
5808 X=X+4
5809 NEXT Q
5810 PRESET (274,97)
5811 PSET (236,98)
5812 PSET (238,97)
5813 PSET (240,96)
```

```
5814 PSET (242,95)
5815 PSET (242,94)
5816 A=-4.2:C=0
5817 FOR Z=1 TO 85
5818 B=A*A
5819 X=A+248
5820 Y=B+76
5821 X=X+C
5822 C=C+.2
5823 PSET (X,Y)
5824 A=A+.1
5825 NEXT Z
5826 PSET (269,95)
5827 PSET (271,96)
5828 PSET (274,96)
5830 RETURN
5835 PRESET (236,98)
5836 PRESET (238,971
5837 PRESET (240,96)
5838 PRESET (242,95)
5839 PRESET (242,94)
5840 A=-4.2:C=0
5841 FOR Z=1 TO 85
5842 B=A*A
5843 X=A+248
5844 Y=B+76
5845 X=X+C
5846 C=C+.2
5847 PRESET (X,Y)
5848 A=A+.1
5849 NEXT Z
5850 PRESET (269,95)
5851 PRESET (271,96)
5852 PRESET (274,96)
5855 RETURN
5860 X=212
5861 Y=98
5862 FOR Q=1 TO 10
5863 PRESET (X,Y)
5864 X=X+4
5865 NEXT Q
5866 PRESET (278,96):PRESET (282,951
5867 PRESET (286,94)
5868 PRESET (290,93)
5869 PRESET (294,91)
5870 PRESET (297,89)
5871 X=212
5872 Y=98
5873 FOR Q=1 TO 22
5874 PSET (X,Y)
5875 X=X+4
5876 Y=Y-.5
5877 NEXT Q
5878 RETURN
5880 X=212
```

```
5881 Y=98
5882 FOR Q=l TO 22
5883 PRESET (X,Y)
5884 X=X+4
5885 Y=Y-.5
5886 NEXT Q
5887 GOSUB 5300
5888 RETURN
5900 LOCATE 15,22
5901 PRINT "ENTER BC - None Left Right Both"
5902 LOCATE 16,22
5903 PRINT "_ "
5905 RETURN
5910 GOSUB 5379
5911 LOCATE 15,22
5912 PRINT "L
5913 LOCATE 16,22
5914 PRINT "TRIM LEFT_ "
5915 X=320
5916 FOR Y=25 TO 104
5917 PRESET (X,Y)
5918 NEXT Y
5920 RETURN
5925 X=260
5926 FOR Y=25 TO 45
5927 PRESET (X,Y)
5928 ,NEXT Y
5929 LINE (200,25)-(200,45)
5930 RETURN
5935 LOCATE 4,51
5936 PRINT "L"
5937 RETURN
5940 Y=97
5941 FOR X=203 TO 213
5942 PRESET (X,Y)
5943 NEXT X
5944 Y=98
5945 FOR X=218 TO 229
5946 PRESET (X,Y)
5947 NEXT X
5948 Y=99
5949 FOR X=234 TO 245
5950 PRESET (X,Y)
5951 NEXT X
5952 Y=99
5953 FOR X=266 TO 277
5954 PRESET (X,Y)
5955 NEXT X
5956 LINE (203,96)-(213,96)
5957 LINE (218,96)-(229,96)
5958 LINE (234,95)-(245,95)
5959 LINE (266,98)-(277,98)
5960 RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
```

```
6002 PRINT "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "
                                    "
6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
6014 LOCATE E,1,1,0,7
6015 PRINT "

6016 E=E+1
6017 IF E=23 THEN GOTO 6019
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
6100 LOCATE 15,22
6101 PRINT "NO. OF READINGS TO STANDARDIZE?"
6104 RETURN
6105 LOCATE 15,22
6106 PRINT "                                    "
6107 LOCATE 15,22
6108 PRINT "RUN BOTTLE #1"
6109 RETURN
6110 LOCATE 15,22
6111 PRINT "                          "
6112 LOCATE 15,22
6113 PRINT "READING BOTTLE #1"
6114 RETURN
6120 LOCATE 3,22
6121 PRINT "EL      NM CH    SEC"
6122 LOCATE 4,22
```

```
6123 PRINT "CU 324.75   A   1.0"
6124 LOCATE 6,23
6125 PRINT "B# INTENSITY RAW-CONC       CONC"
6126 LOCATE 7,23
6127 PRINT "99        249     0.00        0.00"
6128 LOCATE 8,23
6129 PRINT " 1      79269    10.00        9.98"
6130 LOCATE 9,23
6131 PRINT " 2      40104     5.04        4.98"
6132 LOCATE 11,23
6133 PRINT "-1  -16 x  15 x2"
6134 LOCATE 16,21
6135 PRINT "*_"
6139 RETURN
6140 LOCATE 3,25
6141 PRINT "P 200  123450-00   04 JUL 85"
6142 LOCATE 4,35
6143 PRINT "ANALYSIS"
6144 LOCATE 5,25
6145 PRINT "EL      NM      CONC       SD    RSD"
6146 LOCATE 6,25
6147 PRINT "CU 324.75     2.95    0.000   0.00"
6148 LOCATE 7,25
6149 PRINT "CU 327.40     3.01    0.010   0.33"
6150 LOCATE 8,25
6151 PRINT "CU 224.70     2.99    0.056   1.87"
6152 LOCATE 16,21
6153 PRINT "*_"
6154 RETURN
6155 LOCATE 6,28
6156 PRINT "2 ANALYZE PLOTS     OFF"
6157 RETURN
6160 LOCATE 2,23
6161 PRINT "P 200   123569-00          4 JULY 1985"
6162 LOCATE 4,28
6163 PRINT "P#  WP PWR NAMED"
6164 LOCATE 5,29
6165 PRINT "1   0   3 MULTIQUANT"
6166 LOCATE 7,27
6167 PRINT "ML/M PDLY HG  *ANAL *RDG"
6168 LOCATE 8,28
6169 PRINT "1.0   30  1       0     0"
6170 LOCATE 10,22
6171 PRINT "# EL        NM  ORD  CH  MM  BC   SEC"
6172 LOCATE 11,22
6173 PRINT "1 AS   193.70     2   A  12   N   1.0"
6174 LOCATE 12,22
6175 PRINT "2 ZN   213.86     2   A  12   N   1.0"
6176 LOCATE 13,22
6177 PRINT "3 CD   214.44     2   A 1 2   N   1.0"
6178 LOCATE 14,22
6179 PRINT "4 PB   220.35     2   A  12   N   1.0"
6180 LOCATE 15,22
6181 PRINT "5 NI   231.60     2   A  12   N   1.0"
6182 LOCATE 17,22
```

```
6183 PRINT "PRESS <RETURN> TO CONTINUE"
6184 RETURN
6185 CLS
6186 GOSUB 5000
6187 GOSUB 5100
6188 GOTO 954
6189 RETURN
6190 LOCATE 3,22
6191 PRINT "# EL        NM   ORD   CH   MM   BC    SEC"
6192 LOCATE 4,22
6193 PRINT "1 AS    193.70      2    A  12    N    1.0"
6194 LOCATE 6,22
6195 PRINT "# B#        CONC       UNIT    #D    WS"
6196 LOCATE 7,22
6197 PRINT "0 99            0       PPM      1     M"
6198 LOCATE 8,22
6199 PRINT "1  1       100.0"
6200 LOCATE 10,22
6201 PRINT "SENSITIVITY           BLNK-SENS IT"
6202 LOCATE 11,22
6203 PRINT "           1                        0"
6204 LOCATE 13,22
6205 PRINT "CAL    RATIO"
6206 LOCATE 14,22
6207 PRINT "  2    0.107"
6208 LOCATE 16,22
6209 PRINT "*_"
6210 RETURN
6215 CLS
6216 GOSUB 5000
6217 GOTO 986
6218 RETURN
```

```
2100 CLS:KEY OFF
2101 SCREEN 2
2102 LOCATE 5,34
2103 PRINT "CHAPTER 6"
2104 LOCATE 15,31
2105 PRINT "SIMPLE ANALYSES"
2106 GOSUB 6050
2108 PRINT "THIS CHAPTER WILL EXPLAIN HOW TO RUN A SIMPLE
ANALYSIS EMPLOYING A PROGRAM SUCH AS THE EXAMPLE IN THE
PRECEEDING CHAPTER."
2109 GOSUB 6050
2111 PRINT "TO RUN A COPPER ANALYSIS USING THE SAMPLE
PROGRAM. IT MUST FIRST BE CALLED UP  USING THE COMMAND <1
SEE>. (NOTE: THE SYSTEM MUST BE IN THE EDIT MODE!)"
2112 GOSUB 6050
2113 GOSUB 5000
2114 GOSUB 5100
2115 GOSUB 5200
2116 LOCATE 19,1
2117 PRINT "THE COMPLETED PROGRAM IS DISPLAYED ABOVE. TO
BEGIN THE ANALYSIS. IT WILL FIRST  BE NECESSARY TO GENERATE A
CALIBRATION CURVE. THE COMMAND <CALIBRATE> IS ENTEREDCAUSING
THE CRT TO RESPOND AS FOLLOWS.. ..."
2118 GOSUB 6060
2119 GOSUB 6100
2120 LOCATE 19,1
2121 PRINT "THE TOTAL NUMBER OF READINGS IS EOUAL TO THE
NUMBER OF STANDARDS PLUS THE BLANK.IN THE SAMPLE PROGRAM.
THERE ARE 2 STANDARDS (5.00 & 10.00 PPM) AND THE BLANK.
THEREFORE A '3' SHOULD BE ENTERED. CAUSING THE CRT TO DISPLAY
THE FOLLOWING.. ."
2122 GOSUB 6060
2123 GOSUB 6105
2124 LOCATE 19,1
2125 PRINT "AT THIS POINT. STANDARD #1 IS ASPIRATED. AND THE
'READ' BUTTON IS PRESSED. THE  MESSAGE 'READING BOTTLE #1'
WILL DISPLAY ON THE SCREEN."
2126 GOSUB 6060
2127 GOSUB 6110:LOCATE 19,1
2128 PRINT "AFTER READING STANDARD #1, THE SYSTEM WILL ASK
FOR BOTTLE #99 (BLANK).          ASPIRATE THE SOLUTION AND
PRESS THE 'READ'  BUTTON."
2129 GOSUB 6060
2130 PRINT "AFTER BOTTLE #99 IS READ. THE SYSTEM WILL THEN
ASK FOR BOTTLE #2 (STANDARD #2). ASPIRATE AND READ THIS
SOLUTION IN THE SAME MANNER."
2131 GOSUB 6065
2132 GOSUB 6120
2133 LOCATE 19,1
2134 PRINT "UPON COMPLETION OF THE CALIBRAION PROCESS.
CALIBRATION INFORMATION IS DISPLAYED ON THE CRT FOR EACH
ANALYTICAL WAVELENGTH IN THE PROGRAM. (NOTE: IF THE PRINTER
```

```
IS BEING USED, THE CALIBRATION INFORMATION WILL NOT BE
DISPLAYED ON THE CRT.)"
2135 GOSUB 6060
2136 PRINT "ILLUSTRATED ABOVE IS CALIBRATION INFORMATION FOR
THE 324.75 NM LINE IN THE       SAMPLE PROGRAM. SIMULAR
REPORTS WOULD BE ISSUED FOR THE OTHERS 2 LINES. THREE
VARIABLES ARE LISTED FOR EACH OF THE 3 BOTTLES. (LISTED IN
THE B# COLUMN)"
2137 GOSUB 6060
2138 PRINT "THE FIRST COLUMN. 'INTENSITY'. LISTS THE SIGNAL
INTENSITY OF THE ELEMENT.        COLUMN 2, 'RAW-CONC', LISTS
THE CONCENTRATION AS DETERMINED FROM THE INTENSITY. THE THIRD
COLUMN, `CONC', DISPLAYS THE CORRECTED CONCENTRATION."
2139 GOSUB 6060
2140 PRINT "THE CORRECTED VALUES ARE DERRIVED FROM A LEAST
SOUARES TREATMENT OF THE RAW      CONCENTRATION VALUES.THUS
PROVIDING A BEST STRAIGHT LINE OR LINEAR RELATIONSHIP.THE
CORRECTED VALUES ARE USED TO DETERMINE CONCENTRATIONS OF
UNKNOWNS."
2141 GOSUB 6060
2142 PRINT "THE NUMBERS UNDER THE TABLE ARE THE COEFFICIENTS
USED IN THE LEAST SOUARES       TREATMENT."
2143 GOSUB 6060
2144 PRINT "ONCE A CALIBRATION IS PERFORMED ON A PARTICULAR
PROGRAM. SUBSEOUENT USE OF THE  PROGRAM REOUIRES ONLY A
'RECALIBRATION'.  THIS EMPLOYS THE COMMAND <RECALIBRATE>
INSTEAD OF <CALIBRATE>. AND REOUIRES ONLY THE BLANK AND
STANDARD #1."
2145 GOSUB 6060
2146 PRINT "TO RUN AN ANALYSIS ON AN UNKNOWN. SIMPLY ASPIRATE
THE UNKNOWN AND ENTER THE       COMMAND <ANALYZE>."
2147 GOSUB 6060
2148 PRINT "SINCE THE SAMPLE PROGRAM CALLS FOR 3 READINGS AND
2 REPEAT ANALYSES ( 3 *RDG &  2 *ANAL). THE SYSTEM WILL TAKE
3 READINGS AT EACH WAVELENGTH. AND THEN PROVIDE  AVERAGE
CONCENTRATION VALUES. THIS IS RUN #1."
2149 GOSUB 6060
2150 PRINT "THE ENTIRE PROCESS IS THEN REPEATED. ULTIMATELY
PROVIDING A SECOND SET OF       AVERAGE CONCENTRATION VALUES.
THIS IS RUN #2."
2151 GOSUB 6060
2152 PRINT "AS THE 2 RUNS ARE BEING EXECUTED. NUMEROUS
WAVELENGTH AND CONCENTRATION VALUES  SCROLL UP THE SCREEN.
WHEN THE SECOND RUN IS COMPLETE. THE AVERAGE
CONCENTRATIONVALUES FROM RUNS #1 & #2 ARE IN TURN AVERAGED.
PROCUCING THE FINAL RESULTS."
2153 GOSUB 6065
2154 GOSUB 6140:LOCATE 19,1
2155 PRINT "THE FINAL RESULTS ARE DISPLAYED ON THE CRT IN THE
FORM ILLUSTRATED ABOVE. THE   CONCENTRATION OF THE UNKNOWN IS
PROVIDED AT EACH WAVELENGTH. ALONG WITH VALUES  FOR STANDARD
DEVIATION (SD) AND RELATIVE STANDARD DEVIATION (RSD)."
2156 GOSUB 6050
2157 PRINT "IN THIS SAMPLE PROGRAM, ONLY 1 ELEMENT WAS USED.
IF MORE THAN 1 ELEMENT IS       PLACED IN A PROGRAM. THEN THE
```

```
STANDARDS MUST CONTAIN A MIXTURE OF ALL ELEMENTS  IN THE
PROGRAM!!!"
2158 GOSUB 6050
2159 PRINT "TO REVIEW THIS CHAPTER. PRESS THE `F4' KEY"
2160 ON KEY (4) GOSUB 6023
2161 KEY(4) ON
2162 GOSUB 6050
2163 RUN "ICP-7.BAS"
4999 END
5000 LINE (140,10)-(510,10)
5001 LINE (510,10)-(510,130)
5002 LINE (510,130)-(140,130)
5003 LINE (140,130 )-(140,10)
5006 RETURN
5010 LINE (140,1)-(510,1)
5011 LINE (510,1)-(510,138)
5012 LINE (510,138)-(140,138)
5013 LINE (140,138)-(140,1)
5014 RETURN
5015 LINE (115,10)-(535,10)
5016 LINE (535,10)-(535,130)
5017 LINE (535,130)-(115,130)
5018 LINE (115,130)-(115,10)
5019 RETURN
5020 LOCATE 2,23
5021 PRINT "P 200   123450-00          1 JUNE 1984"
5022 LOCATE 4,28
5023 PRINT "#       OPTION"
5024 LOCATE 5,28
5025 PRINT "1 PRINTER SETUP     OFF"
5026 LOCATE 6,28
5027 PRINT "2 RS232 SETUP       OFF"
5028 LOCATE 7,28
5029 PRINT "3 DIAGNOSTICS       OFF"
5030 LOCATE 8,28
5031 PRINT "4 AUTOSAMPLER       OFF"
5032 LOCATE 9,28
5033 PRINT "5 OPERATOR ID."
5034 LOCATE 10,28
5035 PRINT "6 DATE SET          01 JUN 84"
5036 LOCATE 11,28
5037 PRINT "7 TIME SET          01:07"
5038 LOCATE 12,28
5039 PRINT "8 VIDEO SETUP       OFF"
5040 LOCATE 13,28
5041 PRINT "9 EXIT"
5042 LOCATE 14,27
5043 PRINT "10 EXTENDED RANGE    OFF"
5044 LOCATE 15,27
5045 PRINT "11 PROTOCOL          OFF"
5046 LOCATE 17,23
5047 PRINT "#_"
5048 RETURN
5050 LOCATE 3,23
5051 PRINT "P 200   123450-00          1 JUNE 1984"
```

```
5052 LOCATE 5,28
5053 PRINT "#       OPTION"
5054 LOCATE 6,28
5055 PRINT "1 PAGING              OFF"
5056 LOCATE 7,28
5057 PRINT "2 LEFT MARGIN           8"
5058 LOCATE 8,28
5059 PRINT "3 GRAPHICS            OFF"
5060 LOCATE 9,28
5061 PRINT "4 PLOTS PER PAGE    . 3"
5062 LOCATE 10,28
5063 PRINT "6 INITIALIZE"
5064 LOCATE 11,28
5065 PRINT "9 EXIT"
5066 LOCATE 16,23
5067 PRINT "#_"
5068 RETURN
5100 LOCATE 3,23
5101 PRINT "P 200    123450-00          4 JULY 1985"
5102 LOCATE 5,28
5103 PRINT "P#  WP PWR NAMED"
5104 LOCATE 6,29
5105 PRINT "1    0    3 COPPER"
5106 LOCATE 8,27
5107 PRINT "ML/M PDLY HG  *ANAL *RDG"
5108 LOCATE 9,28
5109 PRINT "1.0    30  1       0     0"
5110 LOCATE 11.22
5111 PRINT "# EL        NM  ORD  CH  MM  BC   SEC"
5112 LOCATE 16,23
5113 PRINT "* "
5115 RETURN
5125 LOCATE 4,30
5126 PRINT "ELEMENT CU      29 ATOM"
5127 LOCATE 6,31
5128 PRINT "# EL       NM ORD  MM"
5129 LOCATE 7,31
5130 PRINT "1 CU  324.75    2  14"
5131 LOCATE 8,31
5132 PRINT "2 CU  327.40    2  14"
5133 LOCATE 9,31
5134 PRINT "3 CU  224.70    2  14"
5135 LOCATE 11,28
5136 PRINT "*_"
5140 RETURN
5150 LOCATE 3,22
5151 PRINT "# EL        NM  ORD  CH  MM  BC   SEC"
5152 LOCATE 4,22
5153 PRINT "1 CU   324.75     2   A 1 4   N   1.0"
5154 PRINT ""
5155 LOCATE 6,22
5156 PRINT "# B#        CONC      UNIT   #D   WS"
5157 LOCATE 7,22
5158 PRINT "0 99           0      PPM      0    M"
5159 LOCATE 8,22
```

```
5160 PRINT "1"
5161 LOCATE 9,22
5162 PRINT "2                          SENSITIVITY"
5163 LOCATE 10,22
5164 PRINT "3                                    1"
5165 LOCATE 11,22
5166 PRINT "4                          BLNK-SENSIT"
5167 LOCATE 12,22
5168 PRINT "5                                    0"
5169 PRINT ""
5170 LOCATE 14,22
5171 PRINT "I/S      1I/E    1S/F      2I/E      2S/F"
5172 PRINT ""
5173 PRINT ""
5174 LOCATE 16,21
5175 PRINT "* "
5180 RETURN
5200 LOCATE 9,28
5201 PRINT "1.0    30   1        2     3"
5202 LOCATE 12,22
5203 PRINT "1 CU    324.75      2    A  14    N    1.0"
5204 LOCATE 13,22
5205 PRINT "2 CU    327.40      2    A 1 4    N    1.0"
5206 LOCATE 14,22
5207 PRINT "3 CU    224.70      2    A 1 4    N    1.0"
5210 RETURN
5220 LOCATE 7,50
5221 PRINT "2"
5222 LOCATE 8,22
5223 PRINT "1   1        10.00"
5224 LOCATE 9,22
5225 PRINT "2   2         5.00"
5230 RETURN
5248 CLS
5249 GOSUB 5015
5250 LOCATE 3,21
5251 PRINT "4200                          CU 324.75"
5252 LOCATE 4,55
5253 PRINT "MAX 14"
5254 LOCATE 5,55
5255 PRINT "MM= 14"
5256 LOCATE 14,17
5257 PRINT "0           12           24           36
48"
5258 LINE (127,72)-(138,72)
5259 LINE (143,73)-(153,73)
5260 LINE (158,72)-(168,72)
5261 LINE (173,68)-(183,68)
5262 LINE (188,65)-(198,65)
5263 LINE (203,55)-(213,55)
5264 LINE (218,50)-(229,50)
5265 LINE (234,45)-(245,45)
5266 LINE (250,48)-(261,48)
5267 LINE (266,54)-(277,54)
5268 LINE (282,61)-(293,61)
```

```
5269 LINE (298,70)-(309,70)
5270 LINE (314,76)-(324,76)
5271 LINE (329,85)-(340,85)
5272 LINE (345,88)-(356,88)
5273 LINE (361,90)-(372,90)
5274 LINE (377,91)-(388,91)
5275 LINE (393,90)-(404,90)
5276 LINE (409,90)-(420,90)
5277 LINE (425,92)-(436,92)
5278 LINE (441,91)-(452,91)
5279 LINE (457,90)-(468,90)
5280 LINE (473,90)-(484,90)
5281 LINE (489,89)-(500,89)
5282 LINE (505,90)-(516,90)
5283 LOCATE 16,20
5284 PRINT "* "
5285 RETURN
5300 X=175
5301 Y=99
5302 FOR 0=1 TO 10
5303 PSET (X,Y)
5304 X=X+4
5305 NEXT 0
5306 X=212
5307 Y=98
5308 FOR 0=1 TO 10
5309 PSET (X,Y)
5310 X=X+4
5311 NEXT 0
5312 X=252
5313 Y=97
5314 FOR 0=1 TO 6
5315 PSET (X,Y)
5316 X=X+4
5317 NEXT 0
5318 PSET (274,97)
5319 PSET (278,961
5320 PSET (282,951
5321 PSET (286,94)
5322 PSET (290,931
5323 PSET (294,911
5324 PSET (297,89)
5325 A=-7.2:C=0
5326 FOR Z=1 TO 145
5327 B=A*A
5328 X=A+305
5329 Y=B+35
5330 X=X+C
5331 C=C+.2
5332 PSET (X,Y)
5333 A=A+.1
5334 NEXT Z
5335 PSET (342,881
5336 PSET (342,891
5337 PSET (345,911
```

```
5338 PSET (349,93)
5339 PSET (353,941
5340 PSET (357,951
5341 PSET (361,961
5342 PSET (364,971
5343 X=368
5344 Y=97
5345 FOR 0=1 TO 6
5346 PSET (X,Y)
5347 X=X+4
5348 NEXT O
5349 X=391
5350 Y=98
5351 FOR O=1 TO 10
5352 PSET (X,Y)
5353 X=X+4
5354 NEXT O
5355 X=432
5356 Y=99
5357 FOR 0=1 TO 10
5358 PSET (X,Y)
5359 X=X+4
5360 NEXT O
5361 RETURN
5365 LINE (320,251-(320,104)
5366 LOCATE 3,22
5367 PRINT "4200          A          CU 324.75"
5368 LINE (260,102)-(260,110)
5369 LINE (380,102)-(380,110)
5370 LOCATE 14,25
5371 PRINT "0"
5372 LOCATE 14,34
5373 PRINT "324.70"
5374 LOCATE 14,49
5375 PRINT "324.80"
5376 LOCATE 16,22
5377 PRINT "*_"
5378 RETURN
5379 LINE (260,25)-(260,45)
5380 RETURN
5381 LINE (290,25)-(290,35)
5382 LINE (350,25)-(350,35)
5383 RETURN
5390 GOSUB 5300
5391 GOSUB 5365
5392 GOSUB 5379
5393 GOSUB 5381
5394 RETURN
5400 LOCATE 5,36
5401 PRINT " "
5402 LOCATE 5,45
5403 PRINT " "
5404 X=290
5405 FOR Y=25 TO 35
5406 PRESET (X,Y)
```

```
5407 NEXT Y
5408 X=350
5409 FOR Y=25 TO 35
5410 PRESET (X,Y)
5411 NEXT Y
5412 LINE (280,25)-(280,35)
5413 LINE (360,25)-(360,35)
5414 RETURN
5420 X=280
5421 FOR Y=25 TO 35
5422 PRESET (X,Y)
5423 NEXT Y
5424 X=360
5425 FOR Y=25 TO 35
5426 PRESET (X,Y)
5427 NEXT Y
5428 LINE (300,25)-(300,35)
5429 LINE (340,25)-(340,35)
5430 RETURN
5435 X=300
5436 FOR Y=25 TO 35
5437 PRESET (X,Y)
5438 NEXT Y
5439 X=340
5440 FOR Y=25 TO 35
5441 PRESET (X,Y)
5442 NEXT Y
5443 GOSUB 5381
5444 RETURN
5447 LOCATE 7,32
5448 PRINT " "
5449 RETURN
5500 LOCATE 4,59
5501 PRINT " 2"
5502 LINE (127,95)-(138,95)
5503 LINE (143,94)-(153,94)
5504 LINE (158,95)-(168,95)
5505 LINE (173,95)-(183,95)
5506 LINE (188,96)-(198,96)
5507 LINE (203,97)-(213,97)
5508 LINE (218,98)-(229,98)
5509 LINE (234,99)-(245,99)
5510 LINE (250,100)-(261,100)
5511 LINE (266,99)-(277,99)
5512 LINE (282,100)-(293,100)
5513 LINE (298,99)-(309,99)
5514 LINE (314,100)-(324,100)
5515 LINE (329,100)-(340,100)
5516 LINE (345,100)-(356,100)
5517 LINE (361,99)-(372,99)
5518 LINE (377,100)-(388,100)
5519 LINE (393,100)-(404,100)
5520 LINE (409,100)-(420,100)
5521 LINE (425,99)-(436,99)
5522 LINE (441,100)-(452,100)
```

```
5523 LINE (457,100)-(468,100)
5524 LINE (473,100)-(484,100)
5525 LINE (489,100)-(500,100)
5526 LINE (505,100)-(516,100)
5527 RETURN
5600 X=175
5601 Y=99
5602 FOR 0=1 TO 10
5603 PRESET (X,Y)
5604 X=X+4
5605 NEXT 0
5606 X=212
5607 Y=98
5608 FOR 0=1 TO 10
5609 PRESET (X,Y)
5610 X=X+4
5611 NEXT 0
5612 X=252
5613 Y=97
5614 FOR 0=1 TO 6
5615 PRESET (X,Y)
5616 X=X+4
5617 NEXT 0
5618 PRESET (274,97)
5619 PRESET (278,96)
5620 PRESET (282,95)
5621 PRESET (286,94)
5622 PRESET (290,93)
5623 PRESET (294,91)
5624 PRESET (297,89)
5625 A=-7.2:C=0
5626 FOR Z=1 TO 145
5627 B=A*A
5628 X=A+305
5629 Y=B+35
5630 X=X+C
5631 C=C+.2
5632 PRESET (X,Y)
5633 A=A+.1
5634 NEXT Z
5635 PRESET (342,88)
5636 PRESET (342,89)
5637 PRESET (345,91)
5638 PRESET (349,93)
5639 PRESET (353,94)
5640 PRESET (357,95)
5641 PRESET (361,96)
5642 PRESET (364,97)
5643 X=368
5644 Y=97
5645 FOR 0=1 TO 6
5646 PRESET (X,Y)
5647 X=X+4
5648 NEXT 0
5649 X=391
```

```
5650 Y=98
5651 FOR 0=1 TO 10
5652 PRESET (X,Y)
5653 X=X+4
5654 NEXT O
5655 X=432
5656 Y=99
5657 FOR 0=1 TO 10
5658 PRESET (X,Y)
5659 X=X+4
5660 NEXT O
5661 RETURN
5670 X=320
5671 FOR Y=25 TO 30
5672 PRESET (X,Y)
5673 NEXT Y
5674 FOR Y=51 TO 104
5675 PRESET (X,Y)
5676 NEXT Y
5677 LOCATE 16.22
5678 PRINT "  "
5679 RETURN
5700 X=175
5701 Y=99
5702 FOR 0=1 TO 30
5703 PSET (X,Y)
5704 X=X+4
5705 NEXT O
5706 X=289
5707 Y=98
5708 FOR O=l TO 10
5709 PSET (X,Y)
5710 X=X+4
5711 NEXT O
5712 X=329
5713 Y=97
5714 FOR 0=1 TO 6
5715 PSET (X,Y)
5716 X=X+4
5717 NEXT O
5718 PSET (351,97)
5719 PSET (355,96)
5720 PSET (359,95)
5721 PSET (363,94)
5722 PSET (367,93)
5723 PSET (371,91)
5724 PSET (374,89)
5725 A=-7.2:C=0
5726 FOR Z=l TO 145
5727 B=A*A
5728 X=A+382
5729 Y=B+35
5730 X=X+C
5731 C=C+.2
5732 PSET (X,Y)
```

```
5733 A=A+.1
5734 NEXT Z
5735 PSET (419,881
5736 PSET (419,891
5737 PSET (422,911
5738 PSET (426,931
5739 PSET (430,941
5740 PSET (434,951
5741 PSET (438,961
5742 PSET (441,971
5743 X=445
5744 Y=97
5745 FOR O=1 TO 6
5746 PSET (X,Y)
5747 X=X+4
5748 NEXT O
5749 RETURN
5760 X=320
5761 FOR Y=31 TO 50
5762 PRESET (X,Y)
5763 NEXT Y
5764 LINE (397,311-(397,501
5765 RETURN
5770 LINE (320,25)-(320,104)
5771 LOCATE 3,22
5772 PRINT "4200          A          CU 324.80"
5773 LINE (260,102)-(260,110)
5774 LINE (380,102)-(380,110)
5775 LOCATE 14,25
5776 PRINT "0"
5777 LOCATE 14,34
5778 PRINT "324.75"
5779 LOCATE 14.49
5780 PRINT "324.85"
5781 LOCATE 16,22
5782 PRINT "*_"
5783 RETURN
5800 PRESET (236,98)
5801 PRESET (240,981
5802 PRESET (244,98)
5803 PRESET (248,981
5804 X=252
5805 Y=97
5806 FOR 0=1 TO 6
5807 PRESET (X,Y)
5808 X=X+4
5809 NEXT O
5810 PRESET (274,97)
5811 PSET (236,981
5812 PSET (238,971
5813 PSET (240,961
5814 PSET (242,951
5815 PSET (242,941
5816 A=-4.2:C=0
5817 FOR Z=l TO 85
```

```
5818 B=A*A
5819 X=A+248
5820 Y=B+76
5821 X=X+C
5822 C=C+.2
5823 PSET (X,Y)
5824 A=A+.1
5825 NEXT Z
5826 PSET (269,95)
5827 PSET (271,96)
5828 PSET (274,96)
5830 RETURN
5835 PRESET(236,98)
5836 PRESET (238,97)
5837 PRESET (240,96)
5838 PRESET (242,951
5839 PRESET (242,94)
5840 A=-4.2: C=0
5841 FOR Z=1 TO 85
5842 B=A*A
5843 X=A+248
5844 Y=B+76
5845 X=X+C
5846 C=C+.2
5847 PRESET (X,Y)
5848 A=A+.1
5849 NEXT Z
5850 PRESET (269,951
5851 PRESET (271,961
5852 PRESET (274,96)
5855 RETURN
5860 X=212
5861 Y=98
5862 FOR O=1 TO 10
5863 PRESET (X,Y)
5864 X=X+4
5865 NEXT O
5866 PRESET (278,96):PRESET (282,95)
5867 PRESET (286,941
5868 PRESET (290,93)
5869 PRESET (294,91)
5870 PRESET (297,89)
5871 X=212
5872 Y=98
5873 FOR O=1 TO 22
5874 PSET (X,Y)
5875 X=X+4
5876 Y=Y-.5
5877 NEXT O
5878 RETURN
5880 X=212
5881 Y=98
5882 FOR O=1 TO 22
5883 PRESET (X,Y)
5884 X=X+4
```

```
5885 Y=Y-.5
5886 NEXT O
5887 GOSUB 5300
5888 RETURN
5900 LOCATE 15,22
5901 PRINT "ENTER BC - None Left Right Both"
5902 LOCATE 16,22
5903 PRINT "  "
5905 RETURN
5910 GOSUB 5379
5911 LOCATE 15,22
5912 PRINT "L
5913 LOCATE 16,22
5914 PRINT "TRIM LEFT  "
5915 X=320
5916 FOR Y=25 TO 104
5917 PRESET (X,Y)
5918 NEXT Y
5920 RETURN
5925 X=260
5926 FOR Y=25 TO 45
5927 PRESET (X,Y)
5928 NEXT Y
5929 LINE (200,25)-(200,45)
5930 RETURN
5935 LOCATE 4,51
5936 PRINT "L"
5937 RETURN
5940 Y=97
5941 FOR X=203 TO 213
5942 PRESET (X,Y)
5943 NEXT X
5944 Y=98
5945 FOR X=218 TO 229
5946 PRESET (X,Y)
5947 NEXT X
5948 Y=99
5949 FOR X=234 TO 245
5950 PRESET (X,Y)
5951 NEXT X
5952 Y=99
5953 FOR X=266 TO 277
5954 PRESET (X,Y)
5955 NEXT X
5956 LINE (203,96)-(213,96)
5957 LINE (218,961-(229,96)
5958 LINE (234,95)-(245,95)
5959 LINE (266,98)-(277,98)
5960 RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
6002 PRINT "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
```

```
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "
                                    "
6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
6014 LOCATE E,1,1,0,7
6015 PRINT "
                                    "
6016 E=E+1
6017 IF E=23 THEN GOTO 6019
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
6100 LOCATE 15,22
6101 PRINT "NO. OF READINGS TO STANDARDIZE?"
6104 RETURN
6105 LOCATE 15,22
6106 PRINT "                                    "
6107 LOCATE 15,22
6108 PRINT "RUN BOTTLE #1"
6109 RETURN
6110 LOCATE 15,22
6111 PRINT "                                    "
6112 LOCATE 15,22
6113 PRINT "READING BOTTLE #1"
6114 RETURN
6120 LOCATE 3,22
6121 PRINT "EL      NM CH    SEC"
6122 LOCATE 4,22
6123 PRINT "CU 324.75   A    1.0"
6124 LOCATE 6,23
6125 PRINT "B# INTENSITY RAW-CONC       CONC"
6126 LOCATE 7,23
```

```
6127 PRINT "99        249     0.00        0.00"
6128 LOCATE 8,23
6129 PRINT " 1      79269    10.00        9.98"
6130 LOCATE 9,23
6131 PRINT " 2      40104     5.04        4.98"
6132 LOCATE 11,23
6133 PRINT "-1  -16 x  15 x2"
6134 LOCATE 16,21
6135 PRINT "* "
6139 RETURN
6140 LOCATE 3,25
6141 PRINT "P 200  123450-00   04 JUL 85"
6142 LOCATE 4,35
6143 PRINT "ANALYSIS"
6144 LOCATE 5,25
6145 PRINT "EL      NM      CONC       SD    RSD"
6146 LOCATE 6,25
6147 PRINT "CU 324.75     2.95    0.000   0.00"
6148 LOCATE 7,25
6149 PRINT "CU 327.40     3.01    0.010   0.33"
6150 LOCATE 8,25
6151 PRINT "CU 224.70     2.99    0.056   1.87"
6152 LOCATE 16,21
6153 PRINT "* "
6154 RETURN
6155 LOCATE 6,28
6156 PRINT "2 ANALYZE PLOTS     OFF"
6157 RETURN
6160 LOCATE 2,23
6161 PRINT "P 200   123569-00          4 JULY 1985"
6162 LOCATE 4,28
6163 PRINT "P#  WP PWR NAMED"
6164 LOCATE 5,29
6165 PRINT "1   0   3 MULTIOUANT"
6166 LOCATE 7,27
6167 PRINT "ML/M PDLY HG  *ANAL  *RDG"
6168 LOCATE 8,28
6169 PRINT "1.0   30  1       0     0"
6170 LOCATE 10,22
6171 PRINT "# EL        NM   ORD   CH   MM   BC    SEC"
6172 LOCATE 11,22
6173 PRINT "1 AS    193.70     2    A 1 2    N    1.0"
6174 LOCATE 12,22
6175 PRINT "2 ZN    213.86     2    A  12    N    1.0"
6176 LOCATE 13,22
6177 PRINT "3 CD    214.44     2    A  12    N    1.0"
6178 LOCATE 14,22
6179 PRINT "4 PB    220.35     2    A  12    N    1.0"
6180 LOCATE 15,22
6181 PRINT "5 NI    231.60     2    A  12    N    1.0"
6182 LOCATE 17,22
6183 PRINT "PRESS <RETURN> TO CONTINUE"
6184 RETURN
6185 CLS
6186 GOSUB 5000
```

```
6187 GOSUB 5100
6188 GOTO 954
6189 RETURN
6190 LOCATE 3,22
6191 PRINT "# EL        NM   ORD   CH   MM   BC    SEC"
6192 LOCATE 4,22
6193 PRINT "1 AS    193.70      2    A 1 2    N    1.0"
6194 LOCATE 6,22
6195 PRINT "# B#         CONC        UNIT    #D    WS"
6196 LOCATE 7,22
6197 PRINT "0 99              0        PPM       1     M"
6198 LOCATE 8,22
6199 PRINT "1  1        100.0"
6200 LOCATE 10,22
6201 PRINT "SENSITIVITY             BLNK-SENSIT"
6202 LOCATE 11,22
6203 PRINT "            1                        0"
6204 LOCATE 13,22
6205 PRINT "CAL    RATIO"
6206 LOCATE 14,22
6207 PRINT "  2    0.107"
6208 LOCATE 16.22
6209 PRINT "* "
6210 RETURN
6215 CLS
6216 GOSUB 5000
6217 GOTO 986
6218 RETURN
```

```
2200 CLS
2201 SCREEN 2
2202 LOCATE 5,34
2203 PRINT "CHAPTER 7"
2204 LOCATE 15,29
2205 PRINT "MULTIOUANT PROGRAMS"
2206 GOSUB 6050
2208 PRINT " THIS CHAPTER WILL EXPLAIN HOW TO WRITE A
MULTIOUANT PROGRAM."
2209 GOSUB 6050
2211 PRINT "MULTIOUANT I S AN ANALYTICAL PROGRAM DESIGNED FOR
THE ICP THAT ALLOWS RAPID      OUALITATIVE AND OUANTITATIVE
DETERMINATIONS ON UP TO 29 ELEMENTS IN A SINGLE
ANALYSIS.":PRINT ""
2212 PRINT "RUNNING SUCH AN ANALYSIS USING THE REGULAR SYSTEM
WOULD REOUIRE A STANDARD FOR  ALL 29 ELEMENTS! MULTIOUANT
REOUIRES A STANDARD EMPLOYING ONLY 3 ELEMENTS:      COPPER.
ZINC. AND BARIUM.":PRINT ""
2213 PRINT "CALIBRATION CURVES ARE GENERATED FOR THE
FOLLOWING LINES: CU 324.75 NM.          ZN 213.86 NM, BA
233.53 NM, & BA 455.40 NM. THESE FOUR WAVELENGTHS ARE CALLED
'HEADER WAVELENGTHS'. AND MUST BE PRESENT IN EVERY MULTIOUANT
PROGRAM.":PRINT ""
2214 PRINT "WHEN RUNNING AN ANALYSIS. AN INTENSITY VERSUS
WAVELENGTH PLOT I S DISPLAYED FOR  EACH ELEMENT. THIS WILL
PROVIDE OUALITATIVE CONFIRMATION OF A POSSIBLE
ANALYTE.":PRINT ""
2215 PRINT "FOR EACH POSITIVE IDENTIFICATION. A CONCENTRATION
VALUE I S PROVIDED BY COMPARINGTHE SIGNAL INTENSITY OF THE
ANALYTE WITH THAT OF ONE OF THE HEADER ELEMENTS."
2216 GOSUB 6050
2217 PRINT "TO USE MULTIOUANT. THE MULTIOUANT SYSTEM TAPE
(BLUE LABEL: # 123569-00) MUST BE READ DURING INSTRUMENT
POWER-UP. THE POWER-UP PROCEDURE I S COVERED IN CHAPTER
#2PRESS THE `F5' KEY TO RETURN TO CHAPTER #2 I F HELP I S
NEEDED."
2218 ON KEY (5) GOSUB 2370
2219 KEY(5) ON
2220 GOSUB 6050
2221 PRINT "AFTER THE SYSTEM I S BROUGHT UP. CALL UP THE 1/O
MENU.. ..."
2222 GOSUB 6050
2223 GOSUB 5010
2224 GOSUB 5020
2225 GOSUB 6155
2226 LOCATE 20,1
2227 PRINT "NOTICE THAT OPTION #2 HAS A DIFFERENT FUNCTION
FOR THE MULTIOUANT SYSTEM.      ('ANALYZE PLOTS' REPLACES
`RS232 SETUP')"
2228 GOSUB 6070
2229 PRINT " THIS OPTION MUST BE TURNED ON WHEN USING
MULTIOUANT. TO REVIEW THE I/O SETUP.   PRESS THE `F6' KEY."
```

```
2230 ON KEY (6) GOSUB 2371
2231 KEY(6) ON
2232 GOSUB 6070
2233 PRINT "AFTER SETTING UP THE I/O MENU. PUT THE SYSTEM IN
THE EDIT MODE AND CALL UP THE  MULTIOUANT PROGRAM WITH THE
COMMAND <1 SEE>. ......."
2234 GOSUB 6050
2235 GOSUB 5010
2236 GOSUB 6160
2237 LOCATE 20.1
2238 PRINT "THE PROGRAM VARIABLES (*ANAL. *RDG. HG. ETC.)
HAVE THE SAME MEANINGS HERE AS IN A REGULAR SYSTEM PROGRAM."
2239 GOSUB 6070
2240 PRINT "THE '*ANAL' & `*RDG' VARIABLES MUST BE CHANGED TO
`2' & `3', RESPECTIVELY.      AS BEFORE. TO REVIEW THE
PROGRAM VARIABLE SECTION. PRESS THE `F7' KEY."
2241 ON KEY (7) GOSUB 2372
2242 KEY(7) ON
2243 GOSUB 6070
2244 PRINT "UNDER THE PROGRAM VARIABLES ARE LISTED THE FIRST
5 ANALYTICAL LINES. PRESSING  THE INSTRUMENT'S RETURN KEY
WILL DISPLAY THE REMAINING 25 LINES."
2245 GOSUB 6050
2246 PRINT "SINCE THE OPERATOR MAY NOT NEED TO USE ALL 30
LINES IN THE MULTIOUANT PROGRAM.  THE COMMAND <n DELETE> CAN
BE USED TO REMOVE UNWANTED LINES. THE VARIABLE 'n' ISTHE
NUMBER OF THE LINE TO BE DELETED."
2247 PRINT ""
2248 PRINT "BUT REMEMBER: DO NOT DELETE ANY OF THE 4 HEADER
WAVELENGTHS FOR COPPER. ZINC. ORBARIUM!!! (LINE NUMBERS 2. 6.
12. OR 14)"
2249 PRINT ""
2250 PRINT "WHEN DELETING A SERIES OF LINES. DO SO IN REVERSE
NUMERICAL ORDER. (START WITH #30 AND PROCEED BACKWARDS.) IF
DELETIONS ARE DONE IN NORMAL ORDER. NEEDED LINES MAY BE
ACCIDENTALLY ERASED!!!!"
2251 PRINT ""
2252 PRINT "TO ADD LINES TO THE PROGRAM FROM THE LIBRARY. USE
THE <ELEMENT el> AND <n USE>  COMMANDS AS DESCRIBED IN
CHAPTER #5. TO REVIEW THE PROCEDURE. PRESS THE `F8' KEY"
2253 PRINT ""
2254 PRINT "WHEN ADDING LINES. REMEMBER THAT THE MAXIMUM
NUMBER OF LINES ALLOWED IS 30. IT  MAY BE NECESSARY TO DELETE
A FEW OF THE EXISTING LINES!!!"
2255 ON KEY (8) GOSUB 2373
2256 KEY(8) ON
2257 GOSUB 6050
2258 GOSUB 5010
2259 GOSUB 6160
2260 LOCATE 20.1
2261 PRINT "AFTER THE PROPER ANALYTICAL LINES ARE PLACED IN
THE PROGRAM. EACH MUST BE       INITIALIZED AS IN THE REGULAR
SYSTEM. TAKING LINE #1 AS AN EXAMPLE.. ..."
2262 GOSUB 6050
2263 GOSUB 5000
```

```
2264 GOSUB 6190
2265 LOCATE 19,1
2266 PRINT "THIS IS THE LINE REPORT FOR ARSENIC AT 193.70 NM.
NOTICE THAT IT IS SOMEWHAT  DIFFERENT THAN A LINE REPORT IN
THE REGULAR MODE. ONLY 1 STANDARD IS USED.  AND ITS VALUE
AND `#D' ARE ALREADY SPECIFIED."
2267 GOSUB 6060
2268 PRINT "TWO NEW PARAMETERS. `CAL' & 'RATIO' APPEAR AT THE
BOTTOM OF THE SCREEN. THE  NUMBER UNDER 'CAL' IS THE LINE
REPORT NUMBER OF THE HEADER ELEMENT WHOSE  WAVELENGTH
IS CLOSEST TO THE DISPLAYED ELEMENT'S WAVELENGTH."
2269 GOSUB 6060
2270 PRINT "THE `2' IN THE ABOVE EXAMPLE INDICATES THAT
ZINC'S WAVELENGTH OF 213.86 NM IS  CLOSEST TO 193.70 NM.
(ZINC IS LINE REPORT #2)"
2271 GOSUB 6060
2272 PRINT "THE VALUE UNDER 'RATIO' WILL BE MULTIPLIED BY THE
ZINC STANDARD'S SIGNAL  INTENSITY VALUE. THEREBY
PROVIDING A SIMULAR VALUE FOR ARSENIC. THIS ALLOWS THE
CREATION OF AN ARSENIC CALIBRATION CURVE WITHOUT THE USE OF
AN ARSENIC SOLUTION."
2273 GOSUB 6060
2274 PRINT "VALUES FOR THE CONCENTRATION OF BOTTLE #1, `#D',
`CAL'. AND 'RATIO' ARE PROVIDEDFOR ALL LINES IN THE ORIGINAL
MULTIOUANT PROGRAM. IF A LINE IS ADDED FROM THE  LIBRARY.
THESE PARAMETERS MUST BE ENTERED AS FOLLOWS.. .."
2275 GOSUB 6050
2276 PRINT "VALUES FOR BOTTLE #1 CONCENTRATION AND `#D' ARE
ENTERED USING THE COMMANDS  <# B# c CONC> & <n #D>. WHICH
ARE EXPLAINED IN CHAPTER #5."
2277 PRINT ""
2278 PRINT "TO DETERMINE 'CAL' COMPARE THE NEW LINE'S
WAVELENGTH WITH THE 4 HEADER  WAVELENGTHS: 2 ZN
213.86 NM, 6 BA 233.53 NM, 12 CU 324.75. & 14 BA 455.40 NM."
2279 PRINT "THE NUMBER IN FRONT OF EACH CHEMICAL SYMBOL IS
THE WAVELENGTH'S LINE REPORT  NUMBER. USING THE COMMAND <n
CAL>. ENTER THE LINE NUMBER OF THE WAVELENGTH THAT COMES
CLOSEST TO THE NEW WAVELENGTH."
2280 PRINT ""
2281 PRINT "GIVE 'RATIO' AN INITIAL VALUE OF `.500' BY USING
THE COMMAND <O.500 RATIO>."
2282 GOSUB 6050
2283 GOSUB 5000
2284 GOSUB 6190:LOCATE 19,1
2285 PRINT "CONTINUE ON BY SETTING ANY OTHER PARAMETERS THAT
REOUIRE ADJUSTMENT ACCORDING  TO THE GUIDELINES SET IN
CHAPTER #5."
2286 GOSUB 6060
2287 PRINT "NEXT. PERFORM THE <TRIM>. <BKG-TRIM>. <TPROFILE>.
AND <ASPIRATE TPLOT>  FUNCTIONS. FOR A REVIEW. PRESS
THE `F9' KEY."
2288 ON KEY (9) GOSUB 2374
2289 KEY(9) ON
2290 GOSUB 6060
2291 PRINT "THE FINAL STEP IN INITIALIZING A MULTIOUANT LINE
```

```
REPORT IS THE 'RATIO'            ADJUSTMENT PROCEDURE. THIS
MUST ALWAYS BE DONE LAST!!!!"
2292 GOSUB 6060
2293 PRINT "REFER TO APPENDIX   OF THE MULTIOUANT MANUEL FOR
INSTRUCTIONS ON THE PREPARING  OF RATIO ADJUSTMENT
SOLUTIONS."
2294 GOSUB 6060
2295 PRINT "THE ADJUSTMENT PROCEDURE WILL REOUIRE A SOLUTION
FOR EACH ELEMENT IN THE PROGRAMONCE RATIOS ARE SET. HOWEVER.
ONLY THE 3 ELEMENT STANDARD AND A BLANK ARE       REOUIRED
FOR SUBSEOUENT ANALYSES."
2296 GOSUB 6060
2297 PRINT "INSTRUCTIONS FOR PREPARATION OF THE MULTIOUANT 3
ELEMENT STANDARD AND BLANK ARE ALSO FOUND IN THE APPENDIX."
2298 GOSUB 6060
2299 PRINT "TO BEGIN THE RATIO ADJUSTMENT PROCESS. RUN A
RECALIBRATION ROUTINE BY ENTERING  THE COMMAND <RECALIBRATE>.
THE SYSTEM WILL ASK FOR THE NUMBER READINGS TO
STANDARDIZE. AS IN THE CALIBRATION ROUTINE DISCUSSED IN THE
LAST CHAPTER."
2300 GOSUB 6060
2301 PRINT "RESPOND BY ENTERING A '2' . SINCE MULTIOUANT
EMPLOYS ONLY A 3 ELEMENT STANDARD AND A BLANK  FOR ALL
RECALIBRATIONS."
2302 GOSUB 6060
2303 PRINT "THE SYSTEM WILL RUN A CALIBRATION SIMULAR TO THAT
DISCUSSED IN THE PREVIOUS     CHAPTER. AFTERWARDS CALIBRATION
DATA WILL BE DISPLAYED FOR EACH OF THE 4 HEADER
WAVELENGTHS.... "
2304 GOSUB 6065
2305 GOSUB 6220
2306 LOCATE 19.1
2307 PRINT "SINCE THERE ARE ONLY 2 SOLUTIONS. BOTTLE #1 &
BOTTLE #99, THE 'RAW-CONC' AND    'CONC' VALUES ARE THE SAME.
NO LEAST SOUARES TREATMENT IS REOUIRED."
2308 GOSUB 6060
2309 PRINT "AFTER THE RECALIBRATION IS COMPLETE. CALL UP THE
FIRST LINE REPORT. (IN THIS    CASE ARSENIC)"
2310 GOSUB 6065
2311 GOSUB 6190
2312 LOCATE 19.1
2313 PRINT "ASPIRATE THE ARSENIC RATIO ADJUSTMENT SOLUTION.
AND ENTER THE COMMAND <RESTCONC>THE SYSTEM WILL THEN ANALYZE
THE SOLUTION. A CONCENTRATION VALUE WILL BE        DISPLAYED
IN THE LOWER RIGHT CORNER OF THE SCREEN.. ..."
2314 GOSUB 6060
2315 GOSUB 6235
2316 LOCATE 19.1
2317 PRINT "THE VALUE '54360' IS THE SOLUTION'S SIGNAL
INTENSITY. THE APPARENT CONCENTRATIONIS 9.60 PPM."
2318 GOSUB 6050
2319 PRINT "THE TRUE CONCENTRATION OF THE ARSENIC SOLUTION.
AS DESCRIBED IN THE APPENDIX. IS10 PPM. THE DISCREPANCY IS
CAUSED BY INACCURACY OF THE CURRENT RATIO VALUE,   WHICH IS
0.107"
```

```
2322 PRINT""
2321 PRINT "THE CORRECTED VALUE FOR THE RATIO IS GIVEN BY THE
EQUATION:                                   (APPARENT CONC / TRUE
CONC) * CURRENT RATIO"
2322 PRINT ""
2323 PRINT "THE NEW VALUE FOR THE ARSENIC LINE IS CALCULATED
AS FOLLOWS:                                 (9.60 / 10.00) * 0.107
= 0.103"
2324 PRINT "ENTER THE NEW VALUE WITH THE COMMAND <0.103
RATIO>"
2325 PRINT ""
2326 PRINT "CHECK THE NEW RATIO BY REPEATING THE
<RECALIBRATE> & <RESTCONC> ROUTINES. AN    ACCEPTABLE
CONCENTRATION SHOULD DIFFER FROM THE TRUE VALUE BY NO MORE
THAN      10 PERCENT! REPEAT THE RATIO ADJUSTMENT PROCEDURE
IF NECESSARY."
2327 GOSUB 6050
2328 GOSUB 5000
2329 GOSUB 6190
2330 GOSUB 6240
2331 LOCATE 19,1
2332 PRINT "WITH THE ADJUSTING OF THE RATIO, THE INITIALIZING
OF THE FIRST LINE REPORT IS   COMPLETE! EACH LINE IN THE
PROGRAM MUST BE INITIALIZED IN THE SAME MANNER."
2333 GOSUB 6060
2334 PRINT "REMEMBER WHEN ADJUSTING SUBSEOUENT RATIOS THAT
THE <RECALIBRATE> ROUTINE MUST   PRECEED EACH USE OF THE
<RESTCONC> ROUTINE !!!!!!"
2335 GOSUB 6060
2336 PRINT "THE 4 HEADER WAVELENGTHS DO NOT REQUIRE A RATIO.
THE 'RATIO'  HEADING IS LEFT    BLANK ON EACH OF THE 4 HEADER
LINE REPORTS. DO NOT ATTEMPT TO ASSIGN A RATIO    VALUE!! !"
2337 GOSUB 6050
2338 PRINT "THIS CONCLUDES CHAPTER 7. PRESS THE SPACE BAR TO
PROCEED TO CHAPTER 8, OR THE   `F1' KEY TO CALL UP THE TABLE
OF CONTENTS."
2339 ON KEY (1) GOSUB 2350
2340 KEY(1) ON
2341 GOSUB 6050
2342 RUN "ICP-9.BAS"
2350 RUN "ICP-B.BAS"
2370 RUN "ICP-2.BAS"
2371 RUN "ICP-4.BAS"
2372 RUN "ICP-5.BAS"
2373 RUN "ICP-5.BAS"
2374 RUN "ICP-5.BAS"
4999 END
5000 LINE (140,10)-(510,10)
5001 LINE (510,10)-(510,130)
5002 LINE (510,130)-(140,130)
5003 LINE (140,130)-(140,10)
5006 RETURN
5010 LINE (140,1)-(510,1)
5011 LINE (510,1)-(510,138)
5012 LINE (510,138)- (140,138)
```

```
5013 LINE (140,138)-(140,1)
5014 RETURN
5015 LINE (115,10)-(535,10)
5016 LINE (535,10)-(535,130)
5017 LINE (535,130)-(115,130)
5018 LINE (115,130)-(115,10)
5019 RETURN
5020 LOCATE 2,23
5021 PRINT "P 200    123450-00          1 JUNE 1984"
5022 LOCATE 4,28
5023 PRINT "#       OPTION"
5024 LOCATE 5,28
5025 PRINT "1 PRINTER SETUP     OFF"
5026 LOCATE 6,28
5027 PRINT "2 RS232 SETUP       OFF"
5028 LOCATE 7,28
5029 PRINT "3 DIAGNOSTICS       OFF"
5030 LOCATE 8,28
5031 PRINT "4 AUTOSAMPLER       OFF"
5032 LOCATE 9,28
5033 PRINT "5 OPERATOR ID."
5034 LOCATE 10,28
5035 PRINT "6 DATE SET          01 JUN 84"
5036 LOCATE 11,28
5037 PRINT "7 TIME SET          01:07"
5038 LOCATE 12,28
5039 PRINT "8 VIDEO SETUP       OFF"
5040 LOCATE 13,28
5041 PRINT "9 EXIT"
5042 LOCATE 14,27
5043 PRINT "10 EXTENDED RANGE    OFF"
5044 LOCATE 15,27
5045 PRINT "11 PROTOCOL          OFF"
5046 LOCATE 17,23
5047 PRINT "# "
5048 RETURN
5050 LOCATE 3,23
5051 PRINT "P 200    123450-00          1 JUNE 1984"
5052 LOCATE 5,28
5053 PRINT "#       OPTION"
5054 LOCATE 6,28
5055 PRINT "1 PAGING            OFF"
5056 LOCATE 7,28
5057 PRINT "2 LEFT MARGIN         8"
5058 LOCATE 8,28
5059 PRINT "3 GRAPHICS          OFF"
5060 LOCATE 9,28
5061 PRINT "4 PLOTS PER PAGE      3"
5062 LOCATE 10,28
5063 PRINT "6 INITIALIZE"
5064 LOCATE 11,28
5065 PRINT "9 EXIT"
5066 LOCATE 16,23
5067 PRINT "# "
5068 RETURN
```

```
5100 LOCATE 3,23
5101 PRINT "P 200   123450-00          4 JULY 1985"
5102 LOCATE 5,28
5103 PRINT "P#  WP  PWR  NAMED"
5104 LOCATE 6,29
5105 PRINT "1    0    3 COPPER"
5106 LOCATE 8,27
5107 PRINT "ML/M PDLY HG  *ANAL *RDG"
5108 LOCATE 9,28
5109 PRINT "1.0    30   1        0      0"
5110 LOCATE 11,22
5111 PRINT "# EL        NM   ORD   CH   MM   BC    SEC"
5112 LOCATE 16,23
5113 PRINT "*_"
5115 RETURN
5125 LOCATE 4,30
5126 PRINT "ELEMENT CU      29 ATOM"
5127 LOCATE 6,31
5128 PRINT "# EL       NM ORD   MM"
5129 LOCATE 7,31
5130 PRINT "1 CU  324.75    2   14"
5131 LOCATE 8,31
5132 PRINT "2 CU  327.40    2   14"
5133 LOCATE 9,31
5134 PRINT "3 CU  224.70    2   14"
5135 LOCATE 11,28
5136 PRINT "*_"
5140 RETURN
5150 LOCATE 3,22
5151 PRINT "# EL        NM   ORD   CH   MM   BC    SEC"
5152 LOCATE 4,22
5153 PRINT "1 CU   324.75     2    A 1 4    N    1.0"
5154 PRINT ""
5155 LOCATE 6,22
5156 PRINT "# B#        CONC       UNIT    #D    WS"
5157 LOCATE 7,22
5158 PRINT "0 99            0       PPM       0     M"
5159 LOCATE 8,22
5160 PRINT "1"
5161 LOCATE 9,22
5162 PRINT "2                          SENSITIVITY"
5163 LOCATE 10,22
5164 PRINT "3                                    1"
5165 LOCATE 11,22
5166 PRINT "4                          BLNK-SENSIT"
5167 LOCATE 12,22
5168 PRINT "5                                    0"
5169 PRINT ""
5170 LOCATE 14,22
5171 PRINT "I/S      1I/E    1S/F      2I/E      2S/F"
5172 PRINT ""
5173 PRINT ""
5174 LOCATE 16,21
5175 PRINT "*_"
5180 RETURN
```

```
5200 LOCATE 9,28
5201 PRINT "1.0    30   1        2     3"
5202 LOCATE 12,22
5203 PRINT "1 CU    324.75      2    A 1 4    N    1.0"
5204 LOCATE 13,22
5205 PRINT "2 CU    327.40      2    A 1 4    N    1.0"
5206 LOCATE 14,22
5207 PRINT "3 CU    224.70      2    A  14    N    1.0"
5210 RETURN
5220 LOCATE 7,50
5221 PRINT "2"
5222 LOCATE 8,22
5223 PRINT "1  1        10.00"
5224 LOCATE 9,22
5225 PRINT "2  2         5.00"
5230 RETURN
5248 CLS
5249 GOSUB 5015
5250 LOCATE 3,21
5251 PRINT "4200                          CU 324.75"
5252 LOCATE 4,55
5253 PRINT "MAX 14"
5254 LOCATE 5,55
5255 PRINT "MM= 14"
5256 LOCATE 14,17
5257 PRINT "0           12           24           36
48"
5258 LINE (127,72)-(138,72)
5259 LINE (143,73)-(153,73)
5260 LINE (158,72)-(168,72
5261 LINE (173,68)-(183,68)
5262 LINE (188,65)-(198,65)
5263 LINE (203,55)-(213,55)
5264 LINE (218,50)-(229,50)
5265 LINE (234,45)-(245,45)
5266 LINE (250,48)-(261,48)
5267 LINE (266,54)-(277,54)
5268 LINE (282,61)-(293,61)
5269 LINE (298,70)-(309,70)
5270 LINE (314,76)-(324,76)
5271 LINE (329,85)-(340,85)
5272 LINE (345,88)-(356,88)
5273 LINE (361,90)-(372,90)
5274 LINE (377,91)-(388,91)
5275 LINE (393,90)-(404,90)
5276 LINE (409,90)-(420,90)
5277 LINE (425,92)-(436,92)
5278 LINE (441,91)-(452,91)
5279 LINE (457,90)-(468,90)
5280 LINE (473,90)-(484,90)
5281 LINE (489,89)-(500,89)
5282 LINE (505,90)-(516,90)
5283 LOCATE 16,20
5284 PRINT "* "
5285 RETURN
```

```
5300 X=175
5301 Y=99
5302 FOR O=1 TO 10
5303 PSET (X,Y)
5304 X=X+4
5305 NEXT O
5306 X=212
5307 Y=98
5308 FOR O=1 TO 10
5309 PSET (X,Y)
5310 X=X+4
5311 NEXT O
5312 X=252
5313 Y=97
5314 FOR O=1 TO 6
5315 PSET (X,Y)
5316 X=X+4
5317 NEXT O
5318 PSET (274,97)
5319 PSET (278,961
5320 PSET (282,951
5321 PSET (286,94)
5322 PSET (290,93)
5323 PSET (294,911
5324 PSET (297,89)
5325 A=-7.2:C=0
5326 FOR Z=1 TO 145
5327 B=A*A
5328 X=A+305
5329 Y=B+35
5330 X=X+C
5331 C=C+.2
5332 PSET (X,Y)
5333 A=A+.1
5334 NEXT Z
5335 PSET (342,881
5336 PSET (342,89)
5337 PSET (345,91)
5338 PSET (349,93)
5339 PSET (353,941
5340 PSET (357,951
5341 PSET (361,961
5342 PSET (364,97)
5343 X=368
5344 Y=97
5345 FOR O=1 TO 6
5346 PSET (X,Y)
5347 X=X+4
5348 NEXT O
5349 X=391
5350 Y=98
5351 FOR O=1 TO 10
5352 PSET (X,Y)
5353 X=X+4
5354 NEXT O
```

```
5355 X=432
5356 Y=99
5357 FOR 0=1 TO 10
5358 PSET (X,Y)
5359 X=X+4
5360 NEXT O
5361 RETURN
5365 LINE (320,251-(320,104)
5366 LOCATE 3.22
5367 PRINT "4200          A          CU 324.75"
5368 LINE (260,102)-(260,110)
5369 LINE (380,102)-(380,110)
5370 LOCATE 14.25
5371 PRINT "0"
5372 LOCATE 14,34
5373 PRINT "324.70"
5374 LOCATE 14,49
5375 PRINT "324.80"
5376 LOCATE 16,22
5377 PRINT "* "
5378 RETURN
5379 LINE (260,25)-(260,45)
5380 RETURN
5381 LINE (290,25)-(290,35)
5382 LINE (350,25)-(350,35)
5383 RETURN
5390 GOSUB 5300
5391 GOSUB 5365
5392 GOSUB 5379
5393 GOSUB 5381
5394 RETURN
5400 LOCATE 5,36
5401 PRINT " "
5402 LOCATE 5,45
5403 PRINT " "
5404 X=290
5405 FOR Y=25 TO 35
5406 PRESET (X,Y)
5407 NEXT Y
5408 X=350
5409 FOR Y=25 TO 35
5410 PRESET (X,Y)
5411 NEXT Y
5412 LINE (280,25)-(280,35)
5413 LINE (360,25)-(360,35)
5414 RETURN
5420 X=280
5421 FOR Y=25 TO 35
5422 PRESET (X,Y)
5423 NEXT Y
5424 X=360
5425 FOR Y=25 TO 35
5426 PRESET (X,Y)
5427 NEXT Y
5428 LINE (300,25)-(300,35)
```

```
5429 LINE (340,25)-(340,35)
5430 RETURN
5435 X=300
5436 FOR Y=25 TO 35
5437 PRESET (X,Y)
5438 NEXT I
5439 X=340
5440 FOR Y=25 TO 35
5441 PRESET (X,Y)
5442 NEXT Y
5443 GOSUB 5381
5444 RETURN
5447 LOCATE 7,32
5448 PRINT " "
5669 RETURN
5500 LOCATE 4,59
5501 PRINT " 2"
5502 LINE (127,95)-(138,95)
5503 LINE (143,94)-(153,94)
5504 LINE (158,95)-(168,95)
5505 LINE (173,95)-(183,95)
5506 LINE (188,96)-( 198,96)
5507 LINE (203,97)-(213,97)
5508 LINE (218,98)-(229,98)
5509 LINE (234,99)-(245,99)
5510 LINE (250,100)-(261,100)
5511 LINE (266,99)-(277,99)
5512 LINE (282,100)-(293,100)
5513 LINE (298,99)-(309,99)
5514 LINE (314,100)-(324,100)
5515 LINE (329,100)-(340,100)
5516 LINE (345,100)-(356,100)
5517 LINE (361,99)-(372,99)
5518 LINE (377,100)-(388,100)
5519 LINE (393,100)-(404,100)
5520 LINE (409,100)-(420,100)
5521 LINE (425,99)-(436,99)
5522 LINE (441,100)-(452,100)
5523 LINE (457,100)-(468,100)
5524 LINE (473,100)-(484,100)
5525 LINE (489,100)-(500,100)
5526 LINE (505,100)-(516,100)
5527 RETURN
5600 X=175
5601 Y=99
5602 FOR O=1 TO 10
5603 PRESET (X,Y)
5608 X=X+4
5605 NEXT O
5606 X=212
5607 Y=98
5608 FOR O=1 TO 10
5609 PRESET (X,Y)
5610 X=X+4
5611 NEXT O
```

```
5612 X=252
5613 Y=97
5614 FOR 0=1 TO 6
5615 PRESET (X,Y)
5516 X=X+4
5617 NEXT O
5618 PRESET (274,97)
5619 PRESET (278,96)
5620 PRESET (282,95)
5621 PRESET (286,94)
5622 PRESET (290,93)
5623 PRESET (294,91)
5624 PRESET (297,89)
5625 A=-7.2:C=0
5626 FOR Z=l TO 145
5627 B=A*A
5628 X=A+305
5629 Y=B+35
5630 X=X+C
5631 C=C+.2
5632 PRESET (X,Y)
5633 A=A+.1
5634 NEXT Z
5635 PRESET (342,88)
5636 PRESET (342,89)
5637 PRESET (345,91)
5638 PRESET (349,93)
5639 PRESET (353,94)
5640 PRESET (357,95)
5641 PRESET (361,96)
5642 PRESET (364,97)
5643 X=368
5644 Y=97
5645 FOR O=l TO 6
5646 PRESET (X,Y)
5647 X=X+4
5648 NEXT 0
5649 X=391
5650 Y=98
5651 FOR 0=1 TO 10
5652 PRESET (X,Y)
5653 X=X+4
5654 NEXT O
5655 X=432
5656 Y=99
5657 FOR 0=1 TO 10
5658 PRESET (X,Y)
5659 X=X+4
5660 NEXT O
5661 RETURN
5670 X=320
5671 FOR Y=25 TO 30
5672 PRESET (X,Y)
5673 NEXT Y
5674 FOR Y=51 TO 104
```

```
5675 PRESET (X,Y)
5676 NEXT Y
5677 LOCATE 16,22
5678 PRINT "  "
5679 RETURN
5700 X=175
5701 Y=99
5702 FOR O=1 TO 30
5703 PSET (X,Y)
5704 X=X+4
5705 NEXT O
5706 X=289
5707 Y=98
5708 FOR O=1 TO 10
5709 PSET (X,Y)
5710 X=X+4
5711 NEXT O
5712 X=329
5713 Y=97
5714 FOR O=1 TO 6
5715 PSET (X,Y)
5716 X=X+4
5717 NEXT O
5718 PSET (351,971
5719 PSET (355,96)
5720 PSET (359,95)
5721 PSET (363,94)
5722 PSET (367,93)
5723 PSET (371,911
5724 PSET (374,891
5725 A=-7.2:C=0
5726 FOR Z=l TO 145
5727 B=A*A
5728 X=A+382
5729 Y=B+35
5730 X=X+C
5731 C=C+.2
5732 PSET (X,Y)
5733 A=A+.1
5734 NEXT Z
5735 PSET (419,881
5736 PSET (419,89)
5737 PSET (422,911
5738 PSET (426,93)
5739 PSET (430,94)
5740 PSET (434,95)
5741 PSET (438,96)
5742 PSET (441,97)
5743 X=445
5744 Y=97
5745 FOR O=1 TO 6
5746 PSET (X,Y)
5747 X=X+4
5748 NEXT O
5749 RETURN
```

```
5760 X=320
5761 FOR Y=31 TO 50
5762 PRESET (X,Y)
5763 NEXT Y
5764 LINE (397,31)-(397,50)
5765 RETURN
5770 LINE (320,25)-(320,104)
5771 LOCATE 3,22
5772 PRINT "4200          A          CU 324.80"
5773 LINE (260,102)-(260,110)
5774 LINE (380,102)-(380,110)
5775 LOCATE 14,25
5776 PRINT "0"
5777 LOCATE 14,34
5778 PRINT "324.75"
5779 LOCATE 14,49
5780 PRINT "324.85"
5781 LOCATE 16,22
5782 PRINT "* "
5783 RETURN
5800 PRESET (236,98)
5801 PRESET (240,98)
5802 PRESET (244,98)
5803 PRESET (248,981
5804 X=252
5805 Y=97
5806 FOR O=1 TO 6
5807 PRESET (X,Y)
5808 X=X+4
5809 NEXT O
5810 PRESET (274,97)
5811 PSET (236,981
5812 PSET (238,971
5813 PSET (240,96)
5814 PSET (242,951
5815 PSET (242,941
5816 A=-4.2:C=0
5817 FOR Z=1 TO 85
5818 B=A*A
5819 X=A+248
5820 Y=B+76
5821 X=X+C
5822 C=C+.2
5823 PSET (X,Y)
5824 A=A+.1
5825 NEXT Z
5826 PSET (269,951
5827 PSET (271,961
5828 PSET (274,961
5830 RETURN
5835 PRESET (236,981
5836 PRESET (238,971
5837 PRESET (240,961
5838 PRESET (242,95)
5839 PRESET (242,941
```

```
5840 A=-4.2: C=0
5841 FOR Z=1 TO 85
5842 B=A*A
5843 X=A+248
5844 Y=B+76
5845 X=X+C
5846 C=C+.2
5847 PRESET (X,Y)
5848 A=A+.1
5849 NEXT Z
5850 PRESET (269,95)
5851 PRESET (271,96)
5852 PRESET (274,96)
5855 RETURN
5860 X=212
5861 Y=98
5862 FOR O=1 TO 10
5863 PRESET (X,Y)
5864 X=X+4
5865 NEXT O
5866 PRESET (278,96):PRESET (282,95)
5867 PRESET (286,94)
5868 PRESET (290,93)
5869 PRESET (294,91)
5870 PRESET (297,89)
5871 X=212
5872 Y=98
5873 FOR O=1 TO 22
5874 PSET (X,Y)
5875 X=X+4
5876 Y=Y-.5
5877 NEXT O
5878 RETURN
5880 X=212
5881 Y=98
5882 FOR O=1 TO 22
5883 PRESET (X,Y)
5884 X=X+4
5885 Y=Y-.5
5886 NEXT O
5887 GOSUB 5300
5888 RETURN
5900 LOCATE 15,22
5901 PRINT "ENTER BC - None Left Right Both"
5902 LOCATE 16,22
5903 PRINT "  "
5905 RETURN
5910 GOSUB 5379
5911 LOCATE 15,22
5912 PRINT "L                                    "
5913 LOCATE 16,22
5914 PRINT "TRIM LEFT  "
5915 X=320
5916 FOR Y=25 TO 104
5917 PRESET (X,Y)
```

```
5918 NEXT Y
5920 RETURN
5925 X=260
5926 FOR Y=25 TO 45
5927 PRESET (X,Y)
5928 NEXT Y
5929 LINE (200,25)-(200,45)
5930 RETURN
5935 LOCATE 4,51
5936 PRINT "L"
5937 RETURN
5940 Y=97
5941 FOR X=203 TO 213
5942 PRESET (X,Y)
5943 NEXT X
5944 Y=98
5945 FOR X=218 TO 229
5946 PRESET (X,Y)
5947 NEXT X
5948 Y=99
5949 FOR X=234 TO 245
5950 PRESET (X,Y)
5951 NEXT X
5952 Y=99
5953 FOR X=266 TO 277
5954 PRESET (X,Y)
5955 NEXT X
5956 LINE (203,96)-(213,96)
5957 LINE (218,96)-(229,96)
5958 LINE (234,95)-(245,95)
5959 LINE (266,98)-(277,98)
5960 RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
6002 PRINT "                                                    "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "
                                    "
6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
6014 LOCATE E,1,1,0,7
6015 PRINT "
                                    "
6016 E=E+1
6017 IF E=23 THEN GOTO 6019
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
```

```
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
6100 LOCATE 15,22
6101 PRINT "NO. OF READINGS TO STANDARDIZE?"
6104 RETURN
6105 LOCATE 15,22
6106 PRINT "                                    "
6107 LOCATE 15,22
6108 PRINT "RUN BOTTLE #1"
6109 RETURN
6110 LOCATE 15,22
6111 PRINT "
6112 LOCATE 15,22
6113 PRINT "READING BOTTLE #1"
6114 RETURN
6120 LOCATE 3,22
6121 PRINT "EL     NM CH    SEC"
6122 LOCATE 4,22
6123 PRINT "CU 324.75  A   1.0"
6124 LOCATE 6,23
6125 PRINT "B# INTENSITY RAW-CONC      CONC"
6126 LOCATE 7,23
6127 PRINT "99        249    0.00       0.00"
6128 LOCATE 8,23
6129 PRINT " 1      79269   10.00       9.98"
6130 LOCATE 9,23
6131 PRINT " 2      40104    5.04       4.98"
6132 LOCATE 11,23
6133 PRINT "-1  -16 x  15 x2"
6134 LOCATE 16,21
6135 PRINT "* "
6139 RETURN
6140 LOCATE 3,25
6141 PRINT "P 200  123450-00   04 JUL 85"
6142 LOCATE 4,35
6143 PRINT "ANALYSIS"
6144 LOCATE 5,25
6145 PRINT "EL     NM      CONC      SD   RSD"
6146 LOCATE 6,25
```

```
6147 PRINT "CU 324.75      2.95     0.000    0.00"
6148 LOCATE 7,25
6149 PRINT "CU 327.40      3.01     0.010    0.33"
6150 LOCATE 8,25
6151 PRINT "CU 224.70      2.99     0.056    1.87"
6152 LOCATE 16,21
6153 PRINT "* "
6154 RETURN
6155 LOCATE 6,28
6156 PRINT "2 ANALYZE PLOTS     OFF"
6157 RETURN
6160 LOCATE 2,23
6161 PRINT "P 200    123569-00          4 JULY 1985"
6162 LOCATE 4,28
6163 PRINT "P#  WP PWR NAMED"
6164 LOCATE 5,29
6165 PRINT "1    0    3 MULTIQUANT"
6166 LOCATE 7,27
6167 PRINT "ML/M PDLY HG  *ANAL *RDG"
6168 LOCATE 8,28
6169 PRINT "1.0    30   1        0     0"
6170 LOCATE 10,22
6171 PRINT "# EL        NM   ORD   CH   MM   BC    SEC"
6172 LOCATE 11,22
6173 PRINT "1 AS    193.70      2    A 1 2    N    1.0"
6174 LOCATE 12,22
6175 PRINT "2 ZN    213.86      2    A 1 2    N    1.0"
6176 LOCATE 13,22
6177 PRINT "3 CD    214.44      2    A  12    N    1.0"
6178 LOCATE 14,22
6179 PRINT "4 PB    220.35      2    A  12    N    1.0"
6180 LOCATE 15,22
6181 PRINT "5 NI    231.60      2    A 1 2    N    1.0"
6182 LOCATE 17,22
6183 PRINT "PRESS <RETURN> TO CONTINUE"
6184 RETURN
6185 CLS
6186 GOSUB 5000
6187 GOSUB 5100
6188 GOTO 954
6189 RETURN
6190 LOCATE 3,22
6191 PRINT "# EL        NM   ORD   CH   MM   BC    SEC"
6192 LOCATE 4,22
6193 PRINT "1 AS    193.70      2    A 1 2    N    1.0"
6194 LOCATE 6,22
6195 PRINT "# B#        CONC       UNIT    #D    WS"
6196 LOCATE 7,22
6197 PRINT "0 99           0       PPM       1     M"
6198 LOCATE 8,22
6199 PRINT "1  1        100.0"
6200 LOCATE 10,22
6201 PRINT "SENSITIVITY          BLNK-SENSIT"
6202 LOCATE 11,22
6203 PRINT "           1                    0"
```

```
6204 LOCATE 13,22
6205 PRINT "CAL   RATIO"
6206 LOCATE 14,22
6207 PRINT "  Z    0.107"
6208 LOCATE 16,22
6209 PRINT "*_"
6210 RETURN
6215 CLS
6216 GOSUB 5000
6217 ƐOIO 986
6218 RETURN
6220 LOCATE 3,22
6221 PRINT "EL      NM CH    SEC"
6222 LOCATE 4,22
6223 PRINT "CU 324.75  Λ    1.0"
6224 LOCATE 6,23
6225 PRINT "B# INTENSITY RAW-CONC       CONC"
6226 LOCATE 7,23
6227 PRINT II99         Zd9     0.00       0.00"
6228 LOCATE 8,23
6229 PRINT " 1      79269    I0.00      10.00"
6230 LOCATE 11,23
6231 PRINT " 0     0 x      x2"
6232 LOCATE 16,21
6233 PRINT "*_"
6234 RETURN
6235 LOCATE 15,22
6236 PRINT "AS 193.70    Λ    54360    9.60"
6237 RETURN
6240 LOCATE 14,22
6241 PRINT " Z    0.103"
6242 RETURN
```

ICP-8.BAS (Chapter 8)

```
1 CLS:KEY OFF
2 SCREEN 2
3 LOCATE 5,34
4 PRINT "CHAPTER 8"
5 LOCATE 15,29
6 PRINT "MULTIQUANT ANALYSES"
7 GOSUB 6050
8 PRINT "THIS CHAPTER WILL EXPLAIN HOW TO RUN A MULTIQUANT
ANALYSIS."
9 GOSUB 6050
10 PRINT "CALL UP THE MULTIOUANT PROGRAM WITH THE COMMAND <1
SEE). THE CRT RESPONDS WITH.."
11 GOSUB 6050
12 GOSUB 5010
13 GOSUB 6160
14 LOCATE 20,1
15 PRINT "PRESS THE SPACE BAR TO STOP THE CONTINUE OPTION.
AND THEN ENTER THE COMMAND      <RECALIBRATE>.THE CRT
RESPONDS WITH.....  "
16 GOSUB 6070
17 GOSUB 6250
18 LOCATE 20,1
19 PRINT "ENTER THE NUMBER `2', AND THEN ASPIRATE THE 3
ELEMENT STANDARD AND THE BLANK AS THE SYSTEM CALLS FOR THEM."
20 GOSUB 6050:GOSUB 5000
21 GOSUB 6220
22 LOCATE 20,1
23 PRINT "AFTER THE RECALIBRATION IS COMPLETE, DATA SIMULAR
TO THE SAMPLE DISPLAYED ABOVE WILL BE PRINTED FOR EACH OF THE
4 HEADER WAVELENGTHS. THE FORMAT OF THE ABOVE   DATA WAS
DISCUSSED IN THE PREVIOUS CHAPTER."
24 GOSUB 6050
25 PRINT "TO RUN AN ANALYSIS, ASPIRATE THE SAMPLE AND ENTER
THE COMMAND <ANALYZE>."
26 PRINT ""
27 PRINT "THE INSTRUMENT WILL PROCEED THROUGH EACH WAVELENGTH
IN THE PROGRAM. AN INTENSITYVERSUS WAVELENGTH PLOT WILL BE
SUPPLIED FOR EACH. IF A PEAK OCCURS, THE ELEMENT IN QUESTION
IS PRESENT IN THE SAMPLE,"
28 PRINT ""
29 PRINT "AN EXAMPLE OF SUCH A PLOT IS NOW
ILLUSTRATED.. ......."
30 GOSUB 6050
31 GOSUB 5000
32 GOSUB 5300
33 GOSUB 5379
34 GOSUB 5381
35 GOSUB 6255
36 LOCATE 19,1
37 PRINT "THIS IS A MULTIOUANT REPORT FOR ARSENIC. IN
ADDITION TO THE ITEMS DISPLAYED FOR A PLOT IN THE REGULAR
MODE? A FEW OTHER PARAMETERS ARE PROVIDED.. ..."
```

```
38 GOSUB 6060
39 PRINT "THE TIME AND DATE IS DISPLAYED IN THE UPPER LEFT
CORNER OF EACH PLOT."
40 GOSUB 6060
41 PRINT "THE NUMBER '27180' IS THE SIGNAL INTENSITY, AND THE
NUMBER '5.05' IS THE CONCENTRATION IN PPM. THE `2' IN
THE UPPER RIGHT CORNER IS THE SAMPLE NUMBER, WHICH STARTS
AT `1' AND IS AUTOMATICALLY INCREMENTED BETWEEN SAMPLES."
42 GOSUB 6060
43 PRINT "THE SAMPLE NUMBER CAN BE SET MANUALLY WITH THE
COMMAND <n S/N>, WHERE n CAN RANGE FROM 1 - 99."
44 GOSUB 6060
45 PRINT "AFTER PLOTS FOR EACH LINE IN THE PROGRAM ARE
DISPLAYED AND PRINTED, A FINAL REPORT IS PRINTED........"
46 GOSUB 6050
47 GOSUB 6325
48 GOSUB 6275
49 LOCATE 21,1
50 PRINT "THE REPORT DISPLAYS THE CONCENTRATIONS FOUND FOR
EACH ELEMENT. ALONG WITH STANDARD DEVIATION (`SD') AND
RELATIVE STANDARD DEVIATION (`RSD')."
51 GOSUB 6070
52 PRINT "SEVERAL PROGRAM AND LINE REPORT VARIABLES ARE ALSO
INCLUDED."
53 GOSUB 6070
54 PRINT "A `d' PRINTED AFTER A CONCENTRATION VALUE (BA & CU)
INDICATES A DEFAULT. THE SYSTEM WAS NOT ABLE TO LOCATE A
PEAK STANDING OUT OVER THE BASELINE."
55 GOSUB 6050
56 PRINT "SINCE MULTIOUANT IS A LENGTHY ANALYSIS (UP TO 15
MINUTES PER SAMPLE). A RECALIBRATION SHOULD BE
PERFORMED BEFORE EACH ANALYSIS!!!"
57 GOSUB 6050
58 PRINT "THIS CONCLUDES CHAPTER 8:"
59 PRINT " PRESS THE SPACE BAR TO PROCEED TO CHAPTER 9"
60 PRINT " PRESS THE `F1' KEY TO RETURN TO THE TABLE OF
CONTENTS"
61 PRINT " PRESS THE `F2' KEY TO REVIEW THIS CHAPTER"
62 PRINT " PRESS THE `F10' KEY TO TERMINATE THE LESSON"
63 ON KEY (1) GOSUB 200
64 ON KEY (2) GOSUB 201
65 ON KEY (10) GOSUB 202
66 KEY(1) ON
67 KEY(2) ON
68 KEY(10) ON
69 GOSUB 6050
70 RUN "ICP-9.BAS"
200 RUN "ICP-B.BAS"
201 RUN "ICP-8.BAS"
202 SYSTEM
4999 END
5000 LINE (140,10)-(510,10)
5001 LINE (510,10)-(510,130)
5002 LINE (510,130)-(140,130)
5003 LINE (140,130)-(140,10)
```

```
5006 RETURN
5010 LINE (140,1)-(510,1)
5011 LINE (510,1)-(510,138)
5012 LINE (510,138)-(140,138)
5013 LINE (140,138)-(140,1)
5014 RETURN
5015 LINE (115,10)-(535,10)
5016 LINE (535,101-(535,130)
5017 LINE (535,130)-(115,130)
5018 LINE (115,130)-(115,10)
5019 RETURN
5020 LOCATE 2,23
5021 PRINT "P 200   123450-00          1 JUNE 1984"
5022 LOCATE 4,28
5023 PRINT "#       OPTION"
5024 LOCATE 5,28
5025 PRINT "1 PRINTER SETUP     OFF"
5026 LOCATE 6,28
5027 PRINT "2 RS232 SETUP       OFF"
5028 LOCATE 7,28
5029 PRINT "3 DIAGNOSTICS       OFF"
5030 LOCATE 8,28
5031 PRINT "4 AUTOSAMPLER       OFF"
5032 LOCATE 9,28
5033 PRINT "5 OPERATOR ID."
5034 LOCATE 10,28
5035 PRINT "6 DATE SET          01 JUN 84"
5036 LOCATE 11,28
5037 PRINT "7 TIME SET          01:07"
5038 LOCATE 12,28
5039 PRINT "8 VIDEO SETUP       OFF"
5040 LOCATE 13,28
5041 PRINT "9 EXIT"
5042 LOCATE 14,27
5043 PRINT "10 EXTENDED RANGE    OFF"
5044 LOCATE 15,27
5045 PRINT "11 PROTOCOL          OFF"
5046 LOCATE 17,23
5047 PRINT "#_"
5048 RETURN
5050 LOCATE 3,23
5051 PRINT "P 200   123450-00          1 JUNE 1984"
5052 LOCATE 5,28
5053 PRINT "#       OPTION"
5054 LOCATE 6,28
5055 PRINT "1 PAGING            OFF"
5056 LOCATE 7,28
5057 PRINT "2 LEFT MARGIN         8"
5058 LOCATE 8,28
5059 PRINT "3 GRAPHICS          OFF"
5060 LOCATE 9,28
5061 PKINT "4 PLOTS PER PAGE      3"
5062 LOCATE 10,28
5063 PRINT "6 INITIALIZE''
5064 LOCATE 11,28
```

```
5065 PRINT "9 EXIT"
5066 LOCATE 16,23
5067 PRINT "# "
5068 RETURN
5100 LOCATE 3,23
5101 PRINT "P 200    123450-00          4 JULY 1985"
5102 LOCATE 5,28
5103 PRINT "P#  WP  PWR  NAMED"
5104 LOCATE 6,29
5105 PRINT "1    0    3 COPPER"
5106 LOCATE 8,27
5107 PRINT "ML/M PDLY HG  *ANAL *RDG"
5108 LOCATE 9,28
5109 PRINT "1.0    30  1       0     0"
5110 LOCATE 11,22
5111 PRINT "# EL        NM  ORD  CH  MM  BC    SEC"
5112 LOCATE 16,23
5113 PRINT "* "
5115 RETURN
5125 LOCATE 4,30
5126 PRINT "ELEMENT CU      29 ATOM"
5127 LOCATE 6,31
5128 PRINT "# EL       NM ORD  MM"
5129 LOCATE 7,31
5130 PRINT "1 CU  324.75    2  14"
5131 LOCATE 8,31
5132 PRINT "2 CU  327.40    2  14"
5133 LOCATE 9,31
5134 PRINT "3 CU  224.70    2  14"
5135 LOCATE 11,28
5136 PRINT "* "
5140 RETURN
5150 LOCATE 3,22
5151 PRINT "# EL        NM  ORD  CH  MM  BC    SEC"
5152 LOCATE 4,22
5153 PRINT "1 CU   324.75     2   A 1 4   N   1.0"
5154 PRINT ""
5155 LOCATE 6,22
5156 PRINT "# B#        CONC       UNIT    #D    WS"
5157 LOCATE 7,22
5158 PRINT "0 99           0       PPM      0     M"
5159 LOCATE 8,22
5160 PRINT "1"
5161 LOCATE 9,22
5162 PRINT "2                          SENSITIVITY"
5163 LOCATE 10,22
5164 PRINT "3                                    1"
5165 LOCATE 11,22
5166 PRINT "4                          BLNK-SENSIT"
5167 LOCATE 12,22
5168 PRINT "5                                    0"
5169 PRINT ""
5170 LOCATE 14,22
5171 PRINT "I/S      1I/E    1S/F      2I/E      2S/F"
5172 PRINT ""
```

```
5173 PRINT "" .
5174 LOCATE 16.21
5175 PRINT "* "
5180 RETURN
5200 LOCATE 9,28
5201 PRINT "1.0    30  1       2     3"
5202 LOCATE 12.22
5203 PRINT "1 CU    324.75     2    A  14    N    1.0"
5204 LOCATE 13.22
5205 PRINT "2 CU    327.40     2    A 1 4    N    1.0"
5206 LOCATE 14.22
5207 PRINT "3 CU    224.70     2    A 1 4    N    1.0"
5210 RETURN
5220 LOCATE 7.50
5221 PRINT "2"
5222 LOCATE 8.22
5223 PRINT "1  1       10.00"
5224 LOCATE 9.22
5225 PRINT "2  2        5.00"
5230 RETURN
5248 CLS
5249 GOSUB 5015
5250 LOCATE 3.21
5251 PRINT "4200                          CU 324.75"
5252 LOCATE 4.55
5253 PRINT "MAX 14"
5254 LOCATE 5.55
5255 PRINT "MM= 14"
5256 LOCATE 14.17
5257 PRINT "0           12           24           36
48"
5258 LINE (127.72)-(138.72)
5259 LINE (143.73)-(153.73)
5260 LINE (158,72)-(168,72)
5261 LINE (173,68)-(183,68)
5262 LINE (188.65)-(198.65)
5263 LINE (203,55)-(213,55)
5264 LINE (218,50)-(229,50)
5265 LINE (234.45)-(245.45)
5266 LINE (250,48)-(261,48)
5267 LINE (266,54)-(277,54)
5268 LINE (282.61)-(293.61)
5269 LINE (298.70)-(309.70)
5270 LINE (314.76)-(324.76)
5271 LINE (329,85)-(340,85)
5272 LINE (345.88)-(356.88)
5273 LINE (361,90)-(372,90)
5274 LINE (377.91)-(388.91)
5275 LINE (393.90)-(404.90)
5276 LINE (409,90)-(420,90)
5277 LINE (425.92)-(436,92)
5278 LINE (441.91)-(452,91)
5279 LIKE (457,90)-(468,90)
5280 LINE (473,90)-(484,90)
5281 LINE (489.89)-(500.89)
```

```
5282 LINE (505.90)-(516.90)
5283 LOCATE 16.20
5284 PRINT "* "
5285 RETURN
5300 X=175
5301 Y=99
5302 FOR Q=1 TO 10
5303 PSET (X,Y)
5304 X=X+4
5305 NEXT Q
5306 X=212
5307 Y=98
5308 FOR Q=1TO 10
5309 PSET (X,Y)
5310 X=X+4
5311 NEXT Q
5312 X=252
5313 Y=97
5314 FOR Q=1TO 6
5315 PSET (X,Y)
5316 X=X+4
5317 NEXT Q
5318 PSET (274,97)
5319 PSET (278,96)
5320 PSET (282.95)
5321 PSET (286.94)
5322 PSET (290,93)
5323 PSET (294.91)
5324 PSET (297.89)
5325 A=-7.2:C=0
5326 FOR Z=1 TO 145
5327 B=A*A
5328 X=A+305
5329 Y=B+35
5330 X=X+C
5331 C=C+.2
5332 PSET (X,Y)
5333 A=A+.1
5334 NEXT Z
5335 PSET (342.88)
5336 PSET (342.89)
5337 PSET (345.91)
5338 PSET (349.93)
5339 PSET (353,94)
5340 PSET (357.95)
5341 PSET (361,96)
5342 PSET (364.97)
5343 X=368
5344 Y=97
5345 FOR 0=1 TO 6
5346 PSET (X,Y)
5347 X=X+4
5348 NEXT 0
5349 X=391
5350 Y=98
```

```
5351 FOR 0=1 TO 10
5352 PSET (X,Y)
5353 X=X+4
5354 NEXT Q
5355 X=432
5356 Y=99
5357 FOR 0=1 TO 10
5358 PSET (X,Y)
5359 X=X+4
5360 NEXT Q
5361 RETURN
5365 LINE (320.25)-(320.104)
5366 LOCATE 3.22
5367 PRINT "4200          A          CU 324.75"
5368 LINE (260.102)-(260,110)
5369 LINE (380.102)-(380.110)
5370 LOCATE 14.25
5371 PRINT "0"
5372 LOCATE 14.34
5373 PRINT "324.70"
5374 LOCATE 14.49
5375 PRINT "324.80"
5376 LOCATE 16.22
5377 PRINT "* "
5378 RETURN
5379 LINE (260.25)-(260.45)
5380 RETURN
5381 LINE (290,25)-(290,35)
5382 LINE (350.25)-(350.35)
5383 RETURN
5390 GOSUB 5300
5391 GOSUB 5365
5392 GOSUB 5379
5393 GOSUB 5381
5394 RETURN
5400 LOCATE 5.36
5401 PRINT " "
5402 LOCATE 5.45
5403 PRINT " "
5404 X=290
5405 FOR Y=25 TO 35
5406 PRESET (X,Y)
5407 NEXT Y
5408 X=350
5409 FOR Y=25 TO 35
5410 PRESET (X,Y)
5411 NEXT Y
5412 LINE (280,25)-(280,35)
5413 LINE (360,25)-(360,35)
5414 RETURN
5420 X=280
5421 FOR Y=25 TO 35
5422 PRESET (X,Y)
5423 NEXT Y
5424 X=360
```

```
5425 FOR Y=25 TO 35
5426 PRESET (X,Y)
5427 NEXT Y
5428 LINE (300,25)-(300,35)
5429 LINE (340,25)-(340,35)
5430 RETURN
5435 X=300
5436 FOR Y=25 TO 35
5437 PRESET (X,Y)
5438 NEXT Y
5439 X=340
5440 FOR Y=25 TO 35
5441 PRESET (X,Y)
5442 NEXT Y
5443 GOSUB 5381
5444 RETURN
5447 LOCATE 7.32
5448 PRINT " "
5449 RETURN
5500 LOCATE 4.59
5501 PRINT " 2"
5502 LINE (127,95)-(138,95)
5503 LINE (143.94)-(153.94)
5504 LINE (158,95)-(168,95)
5505 LINE (173,95)-(183,95)
5506 LINE (188,96)-(198,96)
5507 LINE (203.97)-(213,97)
5508 LINE (218,98)-(229,98)
5509 LINE (234,99)-(245,99)
5510 LINE (250.100)-(261.100)
5511 LINE (266,99)-(277,99)
5512 LINE (282.100)-(293.100)
5513 LINE (298.99)-(309.99)
5514 LINE (314,100)-(324,100)
5515 LINE (329.100)-(340.100)
5516 LINE (345.100)-(356,100)
5517 LINE (361.99)-(372.99)
5518 LINE (377,100)-(388,100)
5519 LINE (393,100)-(404.100)
5520 LINE (409,100)-(420,100)
5521 LINE (425.99)-(436,99)
5522 LINE (441.100)-(452,100)
5523 LINE (457.100)-(468.100)
5524 LINE (473,100)-(484.100)
5525 LINE (489.100)-(500.100)
5526 LINE (505.100)-(516.100)
5527 RETURN
5600 X=175
5601 Y=99
5602 FOR Q=1TO 10
5603 PRESET (X,Y)
5604 X=X+4
5605 NEXT Q
5606 X=212
5607 Y=98
```

```
5608 FOR Q=1 TO 10
5609 PRESET (X,Y)
5610 X=X+4
5611 NEXT Q
5612 X=252
5613 Y=97
5614 FOR Q=1 TO 6
5615 PRESET (X,Y)
5616 X=X+4
5617 NEXT Q
5618 PRESET (274.97)
5619 PRESET (278.96)
5620 PRESET (282.95)
5621 PRESET (286.94)
5622 PRESET (290,93)
5623 PRESET (294.91)
5624 PRESET (297.89)
5625 A=-7.2: C=0
5626 FOR Z=1 TO 145
5627 B=A*A
5628 X=A+305
5629 Y=B+35
5630 X=X+C
5631 C=C+.2
5632 PRESET (X,Y)
5633 A=A+.1
5634 NEXT Z
5635 PRESET (342.88)
5636 PRESET (342,89)
5637 PRESET (345,91)
5638 PRESET (349,93)
5639 PRESET (353,94)
5640 PRESET (357.95)
5641 PRESET (361,96)
5642 PRESET (364,97)
5643 X=368
5644 Y=97
5645 FOR Q=1 TO 6
5646 PRESET (X,Y)
5647 X=X+4
5648 NEXT Q
5649 X=391
5650 Y=98
5651 FOR Q=1TO 10
5652 PRESET (X,Y)
5653 X=X+4
5654 NEXT Q
5655 X=432
5656 Y=99
5657 FOR Q=1TO 10
5658 PRESET (X,Y)
5659 X=X+4
5660 NEXT Q
5661 RETURN
5670 X=320
```

```
5671 FOR Y=25 TO 30
5672 PRESET (X,Y)
5673 NEXT Y
5674 FOR Y=51 TO 104
5675 PRESET (X,Y)
5676 NEXT Y
5677 LOCATE 16,22
5678 PRINT "  "
5679 RETURN
5700 X=175
5701 Y=99
5702 FOR Q=1TO 30
5703 PSET (X,Y)
5704 X=X+4
5705 NEXT Q
5706 X=289
5707 Y=98
5708 FOR Q=1 TO 10
5709 PSET (X,Y)
5710 X=X+4
5711 NEXT Q
5712 X=329
5713 Y=97
5714 FOR Q=1TO 6
5715 PSET (X,Y)
5716 X=X+4
5717 NEXT Q
5718 PSET (351,97)
5719 PSET (355,96)
5720 PSET (359,95)
5721 PSET (363,94)
5722 PSET (367,93)
5723 PSET (371,91)
5724 PSET (374,891
5725 A=-7.2:C=0
5726 FOR Z=1 TO 145
5727 B=A*A
5728 X=A+382
5729 Y=B+35
5730 X=X+C
5731 C=C+.2
5732 PSET (X,Y)
5733 A=A+.1
5734 NEXT Z
5735 PSET (419,881
5736 PSET (419.89)
5737 PSET (422,911
5738 PSET (426,93)
5739 PSET (430,94)
5740 PSET (434,95)
5741 PSET (438,96)
5742 PSET (441,971
5743 X=445
5744 Y=97
5745 FOR Q=1 TO 6
```

```
5746 PSET (X,Y)
5747 X=X+4
5748 NEXT Q
5749 RETURN
5760 X=320
5761 FOR Y=31 TO 50
5762 PRESET (X,Y)
5763 NEXT Y
5764 LINE (397,31)-(397,50)
5765 RETURN
5770 LINE (320,251-(320,104)
5771 LOCATE 3,22
5772 PRINT "4200          A          CU 324.80"
5773 LINE (260,102)-(260,110)
5774 LINE (380,102)-(380,110)
5775 LOCATE 14,25
5776 PRINT "0"
5777 LOCATE 14,34
5778 PRINT "324.75"
5779 LOCATE 14,49
5780 PRINT "324.85"
5781 LOCATE 16,22
5782 PRINT "* "
5783 RETURN
5800 PRESET (236,98)
5801 PRESET (240,98)
5802 PRESET (244,98)
5803 PRESET (248,981
5804 X=252
5805 Y=97
5806 FOR Q=1TO 6
5807 PRESET (X,Y)
5808 X=X+4
5809 NEXT Q
5810 PRESET (274,97)
5811 PSET (236,98)
5812 PSET (238,97)
5813 PSET (240,96)
5814 PSET (242,951
5815 PSET (242,94)
5816 A=-4.2:C=0
5817 FOR Z=1 TO 85
5818 B=A*A
5819 X=A+248
5820 Y=B+76
5821 X=X+C
5822 C=C+.2
5823 PSET (X,Y)
5824 A=A+.1
5825 NEXT Z
5826 PSET (269,951
5827 PSET (271,961
5828 PSET (274,96)
5830 RETURN
5835 PRESET (236,98)
```

```
5836 PRESET (238,971
5837 PRESET (240,961
5838 PRESET (242,951
5839 PRESET (242,94)
5840 A=-4.2: C=0
5841 FOR Z=1 TO 85
5842 B=A*A
5843 X=A+248
5844 Y=B+76
5845 X=X+C
5846 C=C+.2
5847 PRESET (X,Y)
5848 A=A+.1
5849 NEXT Z
5850 PRESET (269,95)
5851 PRESET (271,961
5852 PRESET (274,961
5855 RETURN
5860 X=212
5861 Y=98
5862 FOR Q=1TO 10
5863 PRESET (X,Y)
5864 X=X+4
5865 NEXT Q
5866 PRESET (278,96):PRESET (282,951
5867 PRESET (286,941
5868 PRESET (290,931
5869 PRESET (294,911
5870 PRESET (297,89)
5871 X=212
5872 Y=98
5873 FOR Q=1TO 22
5874 PSET (X,Y)
5875 X=X+4
5876 Y=Y-.5
5877 NEXT Q
5878 RETURN
5880 X=212
5881 Y=98
5882 FOR Q=1TO 22
5883 PRESET (X,Y)
5884 X=X+4
5885 Y=Y-.5
5886 NEXT Q
5887 GOSUB 5300
5888 RETURN
5900 LOCATE 15,22
5901 PRINT "ENTER BC - None Left Right Both"
5902 LOCATE 16,22
5903 PRINT "  "
5905 RETURN
5910 GOSUB 5379
5911 LOCATE 15,22
5912 PRINT "L
5913 LOCATE 16,22
```

```
5914 PRINT "TRIM LEFT  "
5915 X=320
5916 FOR Y=25 TO 104
5917 PRESET (X,Y)
5918 NEXT Y
5920 RETURN
5925 X=260
5926 FOR Y=25 TO 45
5927 PRESET (X,Y)
5928 NEXT Y
5929 LINE (200,251-(200,451
5930 RETURN
5935 LOCATE 4,51
5936 PRINT "L"
5937 RETURN
5940 Y=97
5941 FOR X=203 TO 213
5942 PRESET (X,Y)
5943 NEXT X
5944 Y=98
5945 FOR X=218 TO 229
5946 PRESET (X,Y)
5947 NEXT X
5948 Y=99
5949 FOR X=234 TO 245
5950 PRESET (X,Y)
5951 NEXT X
5952 Y=99
5953 FOR X=266 TO 277
5954 PRESET (X,Y)
5955 NEXT X
5956 LINE (203,961-(213,961
5957 LINE (218,961-(229,961
5958 LINE (234,95)-(245,95)
5959 LINE (266,981-(277,981
5960 RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
6002 PRINT "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "

6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
6014 LOCATE E,1,1,0,7
6015 PRINT "

6016 E=E+1
```

```
6017 IF E=23 THEN GOTO 6019
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
6100 LOCATE 15,22
6101 PRINT "NO. OF READINGS TO STANDARDIZE?"
6104 RETURN
6105 LOCATE 15,22
6106 PRINT "                                    "
6107 LOCATE 15,22
6108 PRINT "RUN BOTTLE #1"
6109 RETURN
6110 LOCATE 15,22
6111 PRINT "                          "
6112 LOCATE 15,22
6113 PRINT "READING BOTTLE #1"
6114 RETURN
6120 LOCATE 3,22
6121 PRINT "EL     NM CH    SEC"
6122 LOCATE 4,22
6123 PRINT "CU 324.75   A    1.0"
6124 LOCATE 6,23
6125 PRINT "B# INTENSITY RAW-CONC       CONC"
6126 LOCATE 7,23
6127 PRINT "99        249     0.00       0.00"
6128 LOCATE 8,23
6129 PRINT " 1      79269    10.00       9.98"
6130 LOCATE 9,23
6131 PRINT " 2      40104     5.04       4.98"
6132 LOCATE 11,23
6133 PRINT "-1  -16 x  15 x2"
6134 LOCATE 16,21
6135 PRINT "* "
6139 RETURN
6140 LOCATE 3,25
6141 PRINT "P 200  123450-00   04 JUL 85"
6142 LOCATE 4,35
```

```
6143 PRINT "ANALYSIS"
6144 LOCATE 5,25
6145 PRINT "EL      NM       CONC       SD     RSD"
6146 LOCATE 6,25
6147 PRINT "CU 324.75      2.95     0.000    0.00"
6148 LOCATE 7,25
6149 PRINT "CU 327.40      3.01     0.010    0.33"
6150 LOCATE 8,25
6151 PRINT "CU 224.70      2.99     0.056    1.87"
6152 LOCATE 16,21
6153 PRINT "* "
6154 RETURN
6155 LOCATE 6,28
6156 PRINT "2 ANALYZE PLOTS     OFF"
6157 RETURN
6160 LOCATE 2,23
6161 PRINT "P 200    123569-00          4 JULY 1985"
6162 LOCATE 4,28
6163 PRINT "P#  WP PWR NAMED"
6164 LOCATE 5,29
6165 PRINT "1    0    3 MULTIQUANT"
6166 LOCATE 7,27
6167 PRINT "ML/M PDLY HG  *ANAL  *RDG"
6168 LOCATE 8,28
6169 PRINT "1.0    30   1        0      0"
6170 LOCATE 10,22
6171 PRINT "# EL         NM   ORD   CH   MM   BC    SEC"
6172 LOCATE 11,22
6173 PRINT "1 AS    193.70      2    A 1 2    N    1.0"
6174 LOCATE 12,22
6175 PRINT "2 ZN    213.86      2    A  12    N    1.0"
6176 LOCATE 13,22
6177 PRINT "3 CD    214.44      2    A  12    N    1.0"
6178 LOCATE 14,22
6179 PRINT "4 PB    220.35      2    A  12    N    1.0"
6180 LOCATE 15,22
6181 PRINT "5 NI    231.60      2    A  12    N    1.0"
6182 LOCATE 17,22
6183 PRINT "PRESS <RETURN> TO CONTINUE"
6184 RETURN
6185 CLS
6186 GOSUB 5000
6187 GOSUB 5100
6188 GOTO 954
6189 RETURN
6190 LOCATE 3,22
6191 PRINT "# EL         NM   ORD   CH   MM   BC    SEC"
6192 LOCATE 4,22
6193 PRINT "1 AS    193.70      2    A 1 2    N    1.0"
6194 LOCATE 6,22
6195 PRINT "# B#         CONC       UNIT    #D    WS"
6196 LOCATE 7,22
6197 PRINT "0 99            0       PPM       1     M"
6198 LOCATE 8,22
6199 PRINT "1  1        100.0"
```

```
6200 LOCATE 10,22
6201 PRINT "SENSITIVITY          BLNK-SENSIT"
6202 LOCATE 11,22
6203 PRINT "          1                    0"
6204 LOCATE 13,22
6205 PRINT "CAL    RATIO"
6206 LOCATE 14,22
6207 PRINT "  2    0.107"
6208 LOCATE 16,22
6209 PRINT "* "
6210 RETURN
6215 CLS
6216 GOSUB 5000
6217 GOTO 986
6218 RETURN
6220 LOCATE 3,22
6221 PRINT "EL      NMCH    SEC"
6222 LOCATE 4,22
6223 PRINT "CU 324.75   A    1.0"
6224 LOCATE 6,23
6225 PRINT "B# INTENSITY  RAW-CONC       CONC"
6226 LOCATE 7,23
6227 PRINT "99        249     0.00        0.00"
6228 LOCATE 8,23
6229 PRINT " 1      79269    10.00       10.00"
6230 LOCATE 11,23
6231 PRINT " 0     0 x      x2"
6232 LOCATE 16,21
6233 PRINT "* "
6234 RETURN
6250 LOCATE 17,22
6251 PRINT "NUMBER OF READINGS TO STANDARDIZE?"
6252 RETURN
6255 LINE (320,251-(320,104)
6256 LOCATE 3,22
6257 PRINT "2718          A          AS 193.70"
6258 LOCATE 4,22
6259 PRINT "4 JUL 85                          2"
6260 LOCATE 5,22
6261 PRINT "11:15"
6262 LOCATE 7,22
6263 PRINT "AS 193.70 A         27180        5.05"
6264 LINE (260,102)-(260,110)
6265 LINE (380,102)-(380,110)
6266 LOCATE 14,25
6267 PRINT "0"
6268 LOCATE 14,34
6269 PRINT "193.65"
6270 LOCATE 14,49
6271 PRINT "193.75"
6272 LOCATE 16,22
6273 PRINT "* "
6274 RETURN
6275 LOCATE 2,17
6276 PRINT "P 200   123569-00          4 JUL 1985"
```

```
6277 LOCATE 4,17
6278 PRINT "SAMPLE   OPERATOR   PWR    TIME    NAME"
6279 LOCATE 5,17
6280 PRINT "      2  **DON**        3   11:30    MULTIQUANT"
6281 LOCATE 7,17
6282 PRINT "EL      NM  CH        CONC   UNIT        SD       RSD
SEC"
6284 LOCATE 8,17
6285 PRINT "AS 193.70   A       5.05    PPM     0.040     0.98
1.0"
6290 LOCATE 9,17
6291 PRINT "ZN 213.86   A       7.06    PPM     0.010     0.50
1.0"
6292 LOCATE 10,17
6293 PRINT "NI 231.60   A       3.22    PPM     0.055     1.07
1.0"
6294 LOCATE 11,17
6295 PRINT "BA 233.53   A       0.01d   PPM     0.000     0.00
1.0"
6296 LOCATE 12,17
6297 PRINT "V  290.80   A       8.90    PPM     0.033     0.76
1.0"
6298 LOCATE 13,17
6299 PRINT "CU 324.75   A       0.03d   PPM     0.000     0.00
1.0"
6300 LOCATE 14,17
6301 PRINT "BA 455.40   A       0.00    PPM     0.000     0.00
1.0"
6302 LOCATE 17,17
6303 PRINT "*_"
6304 RETURN
6325 LINE (115,1)-(535,1)
6326 LINE (535,1)-(535,138)
6327 LINE (535,138)-(115,138)
6328 LINE (115,138)-(115,1)
6329 RETURN
```

```
1 CLS:KEY OFF
2 SCREEN 2
3 LOCATE 5,34
4 PRINT "CHAPTER 9"
5 LOCATE 15,31
6 PRINT "PROGRAM STORAGE"
7 GOSUB 6050
8 PRINT " THIS PROGRAM WILL EXPLAIN HOW TO STORE PROGRAMS ON
TAPE, AND RETRIEVE THEM AT A LATER TIME."
9 GOSUB 6050
10 PRINT "THE TAPE ROUTINE IS ACTIVATED AT ANY TIME AFTER THE
SYSTEM IS BROUGHT UP BY     PRESSING THE 'ENABLE'  AND 'TAPE'
BUTTONS IN SEQUENCE. THE CRT RESPONDS WITH.. .."
11 GOSUB 6050
12 GOSUB 5000
13 GOSUB 400
14 LOCATE 19,1
15 PRINT "THE OPTION DESIRED IS SELECTED BY ENTERING THE
CORRESPONDING OPTION NUMBER."
16 GOSUB 6060
17 PRINT "ENTERING A `0' WILL EXIT THE TAPE MENU. OPTION #10,
THE RS232 MENU IS NOT USED  FOR ROUTINE OPERATION OF THE
INSTRUMENT."
18 GOSUB 6060
19 PRINT "TO SAVE AN ANALYSIS PROGRAM USING THE REGULAR OR
MULTIQUANT MODE, OPTION #2 MUSTBE SELECTED. THE OBJECTIVE IS
TO WRITE A USER PROGRAM. ENTERING A `2' CAUSES THECRT TO
RESPOND AS FOLLOWS.. ..."
20 GOSUB 6065
21 GOSUB 430
22 LOCATE 19,1
23 PRINT "LOAD A BLANK TAPE AND PRESS THE 'RETURN'  KEY. THE
FOLLOWING MESSAGE IS          DISPLAYED.....  "
24 GOSUB 6060
25 GOSUB 440
26 LOCATE 19,1
27 PRINT "WHEN THE STORAGE ROUTINE IS COMPLETE, THE CRT WILL
CLEAR AND THE PROMPT WILL    RETURN."
28 GOSUB 6065
29 GOSUB 400
30 LOCATE 19,1
31 PRINT "STORED PROGRAMS CAN BE READ ANYTIME AFTER THE
SYSTEM IS BROUGHT UP. SIMPLY CALL UP THE ABOVE MENU, AND
SELECT OPTION #6 (READ USER PROGRAMS). THE FOLLOWING
MESSAGE IS DISPLAYED.. ...."
32 GOSUB 6065
33 GOSUB 445
34 LOCATE 19,1
35 PRINT "INSERT THE APPROPRIATE USER TAPE AND PRESS THE
RETURN KEY.. ...."
36 GOSUB 6060
37 GOSUB 440
```

```
38 LOCATE 19,1
39 PRINT "AFTER THE ROUTINE IS COMPLETE, THE DESIRED PROGRAM
CAN BE CALLED UP WITH THE    <n SEE> COMMAND. A LISTING OF
ALL PROGRAMS ON THE TAPE CAN BE DISPLAYED BY      ENTERING
THE COMMAND <ALL>."
40 GOSUB 6050
41 PRINT "WHEN RECALLING USER PROGRAMS THE CORRESPONDING
SYSTEM MUST ALREADY BE LOADED.   (REGULAR SYSTEM FOR REGULAR
PROGRAMS & MULTIQUANT SYSTEM FOR MULTIQUANT
PROGRAMS.)"
42 PRINT ""
43 PRINT "SYSTEMS CAN BE INTERCHANGED BY USING OPTION #8
(READ SYSTEM PROGRAM) AND THE    APPROPRIATE SYSTEM TAPE.
SIMPLY LOAD THE PROPER SYSTEM PRIOR TO THE USER
PROGRAMS."
44 GOSUB 6050
45 PRINT "THIS CONCLUDES CHAPTER 9:"
46 PRINT "    PRESS THE SPACE BAR TO PROCEED TO CHAPTER 10"
47 PRINT "    PRESS THE `F1' KEY TO RETURN TO THE TABLE OF
CONTENTS"
48 PRINT "    PRESS THE `F2' KEY TO REVIEW THIS CHAPTER"
49 PRINT "    PRESS THE `F10' KEY TO TERMINATE THE LESSON"
50 ON KEY (1) GOSUB 200
51 ON KEY (2) GOSUB 201
52 ON KEY (10) GOSUB 202
53 KEY(1) ON
54 KEY(2) ON
55 KEY(10) ON
56 GOSUB 6050
57 RUN "ICP-10.BAS"
200 RUN "ICP-B.BAS"
201 RUN "ICP-9.BAS"
202 SYSTEM
399 END
400 LOCATE 3,37
401 PRINT "TAPE MENU"
402 LOCATE 4,35
403 PRINT "SELECT OPTION"
404 LOCATE 6,32
405 PRINT "WRITE"
406 LOCATE 7,34
407 PRINT "2 USER PROGRAMS"
408 LOCATE 8,34
409 PRINT "4 SYSTEM PROGRAM"
410 LOCATE 10,32
411 PRINT "READ"
412 LOCATE 11,34
413 PRINT "6 USER PROGRAMS"
414 LOCATE 12,34
415 PRINT "8 SYSTEM PROGRAM"
416 LOCATE 14,34
417 PRINT "10 RS232 MENU"
418 LOCATE 15,34
419 PRINT "0 EXIT"
420 LOCATE 16,21
```

```
421 PRINT "#_"
422 RETURN
430 LOCATE 4,31
431 PRINT "WRITING USER PROGRAMS"
432 LOCATE 6,31
433 PRINT "1) INSERT BLANK TAPE"
434 LOCATE 7,31
435 PRINT "2) PRESS <RETURN>"
436 LOCATE 15,21
437 PRINT " "
438 RETURN
440 LOCATE 15,21
441 PRINT "TAPE"
442 RETURN
445 LOCATE 4,31
446 PRINT "READING USER TAPE"
447 LOCATE 6,31
448 PRINT "1) INSERT USER TAPE"
449 LOCATE 7,31
450 PRINT "2) PRESS <RETURN>"
451 LOCATE 15,21
452 PRINT " "
453 RETURN
4999 END
5000 LINE (140,10)-(510,10)
5001 LINE (510,10)-(510,130)
5002 LINE (510,130)-(140,130)
5003 LINE (140,130)-(140,10)
5006 RETURN
5010 LINE (140,1)-(510,1)
5011 LINE (510,1)-(510,138)
5012 LINE (510,138)-(140,138)
5013 LINE (140,138)-(140,1)
5014 RETURN
5015 LINE (115,10)-(535,10)
5016 LINE (535,10)-(535,130)
5017 LINE (535,130)-(115,130)
5018 LINE (115,130)-(115,10)
5019 RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
6002 PRINT "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "

6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
6014 LOCATE E,1,1,0,7
```

```
6015 PRINT "
                                        "
6016 E=E+1
6017 IF E=23 THEN GOTO 6019
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
```

```
1 CLS:KEY OFF
2 SCREEN 2
3 LOCATE 5,34
4 PRINT "CHAPTER 10"
5 LOCATE 15,29
6 PRINT "INSTRUMENT SHUT-DOWN"
7 GOSUB 6050
8 PRINT "THIS CHAPTER WILL EXPLAIN HOW TO SHUT DOWN THE
INSTRUMENT."
9 GOSUB 6050
10 PRINT "UNDER NO CIRCUMSTANCES IS THE INSTRUMENT TO BE SHUT
OFF BY SIMPLY SHUTING OFF  THE BREAKER!!!!  SERIOUS DAMAGE
WILL RESULT!!!!"
11 PRINT ""
12 PRINT "A SHUT DOWN PROCEDURE IS REQUIRED. IT IS ACTIVATED
AT ANY TIME BY PRESSING THE `ENABLE' AND `0' (ZERO) BUTTONS
IN SEQUENCE. THE TORCH AND HIGH VOLTAGE  SUPPLIES ARE
IMMEDIATELY SHUT OFF, AND CRT DISPLAYS THE FOLLOWING
MESSAGE.. ..."
13 GOSUB 6050
14 GOSUB 5000
15 LOCATE 5,28
16 PRINT "WAIT 3 MINUTES FOR SHUTDOWN"
17 LOCATE 19,1
18 PRINT "AFTER THE 3 MINUTE COOL DOWN PERIOD, THE ABOVE
MESSAGE CHANGES TO.....  "
19 GOSUB 6065
20 LOCATE 5,28
21 PRINT "TURN OFF CIRCUIT BREAKER"
22 LOCATE 19,1
23 PRINT "THE INSTRUMENT CAN NOW BE TURNED OFF."
24 GOSUB 6060
25 PRINT "THESE SHUT DOWN INSTRUCTIONS CAN BE CALLED UP BY
SELECTING OPTION #140 ON THE  PROGRAM MENU."
26 GOSUB 6060
27 PRINT "AFTER THE INSTRUMENT IS TURNED OFF, REMEMBER TO
SHUT OFF THE WATER AND ARGON  SUPPLIES AND TURN OFF THE
FAN."
28 GOSUB 6050
29 PRINT "THE SHUT DOWN PROCEDURE CAN BE ABORTED BY PRESSING
THE 'ESC' BUTTON. ALL  PROGRAMS PRESENT IN MEMORY ARE
NOT LOST UNLESS THE INSTRUMENT WAS TURNED OFF.  THE HIGH
VOLTAGE CAN BE TURNED BACK ON BY ENTERING THE COMMAND
<SUPPLIES>."
30 PRINT "SHOULD IT EVER BE NECESSARY TO SHUT OFF THE HIGH
VOLTAGE SUPPLY WITHOUT SHUTTINGOFF THE INSTRUMENT, THE
COMMAND <- SUPPLIES> IS USED."
31 GOSUB 6050
32 PRINT "THIS CONCLUDES CHAPTER 10:"
33 PRINT "   PRESS THE SPACE BAR TO PROCEED TO CHAPTER 11"
34 PRINT "   PRESS THE `F1' KEY TO RETURN TO THE TABLE OF
CONTENTS"
```

```
35 PRINT "     PRESS THE `F2' KEY TO REVIEW THIS CHAPTER"
36 PRINT "     PRESS THE `F10' KEY TO TERMINATE THE LESSON"
37 ON KEY (1) GOSUB 200
38 ON KEY (2) GOSUB 201
39 ON KEY (10) GOSUB 202
40 KEY(1) ON
41 KEY(2) ON
42 KEY(10) ON
43 GOSUB 6050
44 RUN "ICP-11.BAS"
200 RUN "ICP-B.BAS"
201 RUN "ICP-10.BAS"
202 SYSTEM
399 END
4999 END
5000 LINE (140,10)-(510,10)
5001 LINE (510,10)-(510,130)
5002 LINE (510,130)-(140,130)
5003 LINE (140,130)-(140,10)
5006 RETURN
5010 LINE (140,1)-(510,1)
5011 LINE (510,1)-(510,138)
5012 LINE (510,138)-(140,138)
5013 LINE (140,138)-(140,1)
5014 RETURN
5015 LINE (115,10)-(535,10)
5016 LINE (535,10)-(535,130)
5017 LINE (535,130)-(115,130)
5018 LINE (115,130)-(115,10)
5019 RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
6002 PRINT "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "

6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
6014 LOCATE E,1,1,0,7
6015 PRINT "
                                "
6016 E=E+1
6017 IF E=23 THEN GOTO 6019
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
```

```
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
```

ICP-11.BAS (Chapter 11)

```
1 CLS:KEY OFF
2 SCREEN 2
3 LOCATE 5,34
4 PRINT "CHAPTER 11"
5 LOCATE 15,30
6 PRINT "INTERNAL STANDARDS"
7 GOSUB 6050
8 PRINT "THIS CHAPTER WILL EXPLAIN HOW TO USE THE INTERNAL
STANDARD OPTION."
9 GOSUB 6050
10 PRINT "WHEN RUNNING AN ANALYSIS ON A SERIES OF SAMPLES
DIFFERING IN MATRIX COMPOSITION OR SOLUTION VISCOSITY, AN
INTERNAL STANDARD IS REQUIRED."
11 PRINT ""
12 PRINT "ALL STANDARDS AND SAMPLES ARE SPIKED WITH A KNOWN
CONCENTRATION OF AN INTERNAL STANDARD. THE CONCENTRATIONS OF
ALL ANALYTES IN EACH SAMPLE ARE THEN CORRECTED USING THE
FOLLOWING EQUATION:":PRINT ""
13 PRINT "FINAL ANALYTE CONC = OBSERVED ANALYTE CONC *
(ACTUAL INTERNAL STANDARD CONC / OBSERVED INTERNAL STANDARD
CONC)"
14 GOSUB 6050
15 PRINT "THE INTERNAL STANDARD CORRECTION CAN BE USED ONLY
IN THE REGULAR OPERATING MODE."
16 PRINT ""
17 PRINT "THE ELEMENT CHOSEN AS THE STANDARD MUST DIFFER IN
WAVELENGTH FROM THE ANALYTE(S)BY NO MORE THAN 50 NM."
18 PRINT ""
19 PRINT "IT MUST BE PLACED IN THE PROGRAM AHEAD OF THE LINE
REPORTS FOR THE ELEMENTS     REQUIRING CORRECTION. (`TH' NO.
FOR STANDARD < `TH' NO. FOR ANALYTES)"
20 PRINT "IF THE TITANIUM 334.94 NM LINE WAS TO BE USED FOR
AN INTERNAL STANDARD FOR A    DETERMINATION OF COPPER AT
324.75, THE Ti LINE WOULD BE `1 TH' AND THE Cu LINE '2
TH'.....  "
21 GOSUB 6050
22 GOSUB 5000
23 GOSUB 5150
24 GOSUB 5220
25 LOCATE 4,22
26 PRINT "2"
27 LOCATE 19,1
28 PRINT "TO ACTIVATE THE ROUTINE, ENTER THE LINE REPORT
NUMBER OF THE STANDARD UNDER THE `I/S' COLUMN IN EACH
ANALYTE'S LINE REPORT."
29 GOSUB 6060
30 PRINT "IN THE ABOVE EXAMPLE A `1' WOULD BE ENTERED IN THE
CU LINE REPORT BY USING THE  COMMAND  <1 I/S>......."
31 GOSUB 6060
32 LOCATE 15,24
33 PRINT "1"
34 LOCATE 19,1
```

```
35 PRINT "ALL COPPER STANDARDS AND SAMPLES MUST BE SPIKED
WITH TITANIUM AT THE SAME        CONCENTRATION. IF 10 PPM IS
THE CHOSEN CONCENTRATION, THEN THE TITANIUM LINE    REPORT
MUST BE SET SO THAT BOTTLE #1'S CONCENTRATION IS 10 PPM."
36 GOSUB 6060
37 PRINT "CALIBRATE AND ANALYZE IN THE SAME MANNER DICUSSED
PREVIOUSLY. WHEN THE          CALIBRATION IS PERFORMED THE
SYSTEM WILL OBTAIN A VALUE OF 10 PPM FOR THE        TITANIUM'S
ACTUAL CONCENTRATION."
38 GOSUB 6060
39 PRINT "WHEN THE ANALYSIS IS EXECUTED, OBSERVED VALUES FOR
THE CONCENTRATIONS OF         TITANIUM AND COPPER ARE
DETERMINED. USING THE CORRECTION EQUATION, THE SYSTEM   WILL
AUTOMATICALLY CORRECT THE COPPER VALUE."
40 GOSUB 6060
41 PRINT "THE CORRECTED VALUE FOR THE COPPER CONCENTRATION
WILL APPEAR IN THE FINAL        RESULTS TABLE DISPLAYED AT THE
END OF THE ANALYSIS. NO INFORMATION WILL APPEAR  FOR
TITANIUM, SINCE IT IS USED ONLY AS THE INTERNAL STANDARD!!"
42 GOSUB 6050
43 PRINT "THE INTERNAL STANDARD ROUTINE CAN BE DISABLED BY
ENTERING THE COMMAND <0 I/S>   FOR THE LINE REPORT OF EACH
ANALYTE."
44 GOSUB 6050
45 PRINT " THIS CONCLUDES CHAPTER 11:"
46 PRINT "    PRESS THE SPACE BAR TO PROCEED TO CHAPTER 12"
47 PRINT "    PRESS THE `F1' KEY TO RETURN TO THE TABLE OF
CONTENTS"
48 PRINT "    PRESS THE `F2' KEY TO REVIEW THIS CHAPTER"
49 PRINT "    PRESS THE `F10' KEY TO TERMINATE THE LESSON"
50 ON KEY (1) GOSUB 200
51 ON KEY (2) GOSUB 201
52 ON KEY (10) GOSUB 202
53 KEY(1) ON
54 KEY(2) ON
55 KEY(10) ON
56 GOSUB 6050
57 RUN "ICP-12.BAS"
200 RUN "ICP-B.BAS"
201 RUN "ICP-11.BAS'
202 SYSTEM
4999 END
5000 LINE (140,10)-(510,10)
5001 LINE (510,10)-(510,130)
5002 LINE (510,130)-(140,130)
5003 LINE (140,130)-(140,10)
5006 RETURN
5010 LINE (140,1)-(510,1)
5011 LINE (510,1)-(510,138)
5012 LINE (510,138)- (140,138)
5013 LINE (140,138)-(140,1)
5014 RETURN
5015 LINE (115,10)-(535,10)
5016 LINE (535,10)-(535,130)
5017 LINE (535,130)- (115,130)
```

```
5018 LINE (115,130)-(115,10)
5019 RETURN
5020 LOCATE 2,23
5021 PRINT "P 200   123450-00          1 JUNE 1984"
5022 LOCATE 4,28
5023 PRINT "#       OPTION"
5024 LOCATE 5,28
5025 PRINT "1 PRINTER SETUP     OFF"
5026 LOCATE 6,28
5027 PRINT "2 RS232 SETUP       OFF"
5028 LOCATE 7,28
5029 PRINT "3 DIAGNOSTICS       OFF"
5030 LOCATE 8,28
5031 PRINT "4 AUTOSAMPLER       OFF"
5032 LOCATE 9,28
5033 PRINT "5 OPERATOR ID."
5034 LOCATE 10,28
5035 PRINT "6 DATE SET          01 JUN 84"
5036 LOCATE 11,28
5037 PRINT "7 TIME SET          01:07"
5038 LOCATE 12,28
5039 PRINT "8 VIDEO SETUP       OFF"
5040 LOCATE 13,28
5041 PRINT "9 EXIT"
5042 LOCATE 14,27
5043 PRINT "10 EXTENDED RANGE    OFF"
5044 LOCATE 15,27
5045 PRINT "11 PROTOCOL          OFF"
5046 LOCATE 17,23
5047 PRINT "# "
5048 RETURN
5050 LOCATE 3,23
5051 PRINT "P 200   123450-00          1 JUNE 1984"
5052 LOCATE 5,28
5053 PRINT "#       OPTION"
5054 LOCATE 6,28
5055 PRINT "1 PAGING            OFF"
5056 LOCATE 7,28
5057 PRINT "2 LEFT MARGIN         8"
5058 LOCATE 8,28
5059 PRINT "3 GRAPHICS          OFF"
5060 LOCATE 9,28
5061 PRINT "4 PLOTS PER PAGE      3"
5062 LOCATE 10,28
5063 PRINT "6 INITIALIZE"
5064 LOCATE 11,28
5065 PRINT "9 EXIT"
5066 LOCATE 16,23
5067 PRINT "# "
5068 RETURN
5100 LOCATE 3,23
5101 PRINT "P 200   123450-00          4 JULY 1985"
5102 LOCATE 5,28
5103 PRINT "P#  WP PWR NAMED"
5104 LOCATE 6,29
```

```
5105 PRINT "1    0    3 COPPER"
5106 LOCATE 8,27
5107 PRINT "ML/M PDLY HG  *ANAL *RDG"
5108 LOCATE 9,28
5109 PRINT "1.0    30   1        0      0"
5110 LOCATE 11,22
5111 PRINT "# EL         NM   ORD   CH   MM   BC    SEC"
5112 LOCATE 16,23
5113 PRINT "* "
5115 RETURN
5125 LOCATE 4,30
5126 PRINT "ELEMENT CU       29 ATOM"
5127 LOCATE 6,31
5128 PRINT "# EL        NM ORD   MM"
5129 LOCATE 7,31
5130 PRINT "1 CU   324.75    2   14"
5131 LOCATE 8,31
5132 PRINT "2 CU   327.40    2   14"
5133 LOCATE 9,31
5134 PRINT "3 CU   224.70    2   14"
5135 LOCATE 11,28
5136 PRINT "*_"
5140 RETURN-
5150 LOCATE 3,22
5151 PRINT "# EL         NM   ORD   CH   MM   BC    SEC"
5152 LOCATE 4,22
5153 PRINT "1 CU    324.75      2    A 1 4    N    1.0"
5154 PRINT ""
5155 LOCATE 6,22
5156 PRINT "# B#         CONC        UNIT    #D    WS"
5157 LOCATE 7,22
5158 PRINT "0 99             0       PPM       0     M"
5159 LOCATE 8,22
5160 PRINT "1"
5161 LOCATE 9,22
5162 PRINT "2                          SENSITIVITY"
5163 LOCATE 10,22
5164 PRINT "3                                    1"
5165 LOCATE 11,22
5166 PRINT "4                          BLNK-SENSIT"
5167 LOCATE 12,22
5168 PRINT "5                                    0"
5169 PRINT ""
5170 LOCATE 14,22
5171 PRINT "I/S      1I/E    1S/F      2I/E      2S/F"
5172 PRINT ""
5173 PRINT ""
5174 LOCATE 16,21
5175 PRINT "* "
5180 RETURN
5200 LOCATE 9,28
5201 PRINT "1.0    30   1        2      3"
5202 LOCATE 12,22
5203 PRINT "1 CU    324.75      2    A 1 4    N    1.0"
5204 LOCATE 13,22
```

```
5205 PRINT "2 CU    327.40      2    A 1 4    N    1.0"
5206 LOCATE 14,22
5207 PRINT "3 CU    224.70      2    A 1 4    N    1.0"
5210 RETURN
5220 LOCATE 7,50
5221 PRINT "2"
5222 LOCATE 8,22
5223 PRINT "1  1       10.00"
5230 RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
6002 PRINT "                                                    "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "
                                    "
6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
6014 LOCATE E,1,1,0,7
6015 PRINT "
                                    "
6016 E=E+1
6017 IF E=23 THEN GOTO 6019
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
```

```
1 CLS:KEY OFF
2 SCREEN 2
3 LOCATE 5,34
4 PRINT "CHAPTER 12"
5 LOCATE 15,30
6 PRINT "INTERFERING ELEMENTS"
7 GOSUB 6050
8 PRINT "THIS CHAPTER WILL EXPLAIN THE OPTIONS AVAILABLE WHEN
AN INTERFERING ELEMENT     OCCURS."
9 GOSUB 6050
10 GOSUB 5000
11 GOSUB 5300
12 GOSUB 5800
13 GOSUB 5365
14 GOSUB 5381
15 GOSUB 5379
16 LOCATE 19,1
17 PRINT " THE ABOVE SITUATION ILLUSTRATES AN EMISSION PEAK
AT A WAVELENGTH OF ABOUT       324.70 NM, CAUSED BY ANOTHER
ELEMENT PRESENT IN THE COPPER SAMPLE."
18 GOSUB 6060
19 PRINT "AT ITS PRESENT LOCATION THE PEAK POSSES NO THREAT
TO THE DETERMINATION OF THE   COPPER INTENSITY."
20 GOSUB 6060
21 LOCATE 19,1
22 PRINT "IF THE LOCATION OF THE SMALLER PEAK WAS CLOSER TO
THE COPPER PEAK, IT WOULD     ENTER THE WINDOW AND CAUSE AN
INTERFERENCE. THE SYSTEM WOULD ASSIGN RADIATION   FROM BOTH
SOURCES TO COPPER, YIELDING AN ERRONEOUSLY HIGH CONCENTRATON
VALUE."
23 GOSUB 6050
24 PRINT "THE SEPARATION BETWEEN THE 2 PEAKS CAN BE SO SMALL
THAT THE INTERFERING PEAK MAYAPPEAR ONLY AS A BUMP ON THE
SIDE OF THE COPPER PEAK. IN GENERAL, ANY ANALYTE   PEAK THAT
HAS A NON-SYMMETRIC APPEARANCE SHOULD BE CHECKED FOR
INTERFERENCES."
25 PRINT ""
26 PRINT "IN EXTREME CASES THE 2 PEAKS MAY EVEN BE COMPLETELY
SUPERIMPOSED!!!"
27 GOSUB 6050
28 PRINT "THERE ARE 3 OPTIONS AVAILABLE TO ELIMINATE
INTEREFERENCE EFFECTS:"
29 PRINT "     1) CHOOSE ANOTHER WAVELENGTH FOR ANALYSIS"
30 PRINT "     2) REDUCE THE WINDOW SIZE: THE DISTANCE
BETWEEN THE 2 PEAKS MAY BE LARGE                    ENOUGH
TO PERMIT USE OF THE NARROW WINDOW SIZE TO ELIMINATE
THE INTERFERENCE"
31 PRINT "     3) AS A LAST RESORT, USE THE INTEREFERING
ELEMENT CORRECTION ROUTINE"
32 GOSUB 6050
33 PRINT "THE INTERFERING ELEMENT CORRECTION CAN BE USED ONLY
IN THE REGULAR MODE."
34 PRINT ""
35 PRINT "IT IS PREPARED AS FOLLOWS.. ...."
```

```
36 GOSUB 6050 .
37 PRINT "SELECT A KNOWN CONCENTRATION OF THE INTERFERING
ELEMENT, AND ANALYZE IT AT THE  ANALYTE'S WAVELENGTH. SUPPOSE
THAT Fe WAS THE INTERFERING ELEMENT IN THE COPPER PLOT
PREVIOUSLY ILLUSTRATED. IF A 400 PPM Fe SOLUTION YIELDS A
VALUE OF 40 PPM"
38 PRINT "WHEN ANALYZED AT THE COPPER WAVELENGTH (324.75 NM),
A SCALE FACTOR IS  THEN     CALCULATED FROM THE FOLLOWING
EQUATION:"
39 PRINT "SCALE FACTOR = APPARENT ANALYTE CONC / ACTUAL
INTERFERENT CONC"
40 PRINT ""
41 PRINT "FOR THE EXAMPLE: 40 PPM / 400 PPM = .0100"
42 PRINT ""
43 PRINT "NOTE: THE CALCULATION OF THE SCALE FACTOR MUST BE
DONE BY THE OPERATOR!!!!!"
44 GOSUB 6050
45 PRINT "PREPARE THE PROGRAM IN A MANNER THAT HAS THE LINE
REPORT FOR Fe, THE             INTERFERENT, BEFORE THE LINE
REPORT FOR Cu, THE ANALYTE."
46 PRINT ""
47 PRINT "AFTER INITIALIZING ALL PROGRAM AND LINE REPORT
VARIABLES, CALL UP THE COPPER    LINE REPORT AND ENTER IN THE
FOLLOWING PARAMETERS.....  "
48 GOSUB 6050
49 GOSUB 5000
50 GOSUB 5150
51 GOSUB 5220:LOCATE 4,22
52 PRINT "2"
53 LOCATE 19,1
54 PRINT "ENTER THE LINE REPORT NUMBER FOR THE INTERFERENT
WITH THE COMMAND <n 1I/E>      SINCE THE NUMBER FOR Fe IS
`1', THE COMMAND IS <1 1I/E>....."
55 GOSUB 6060
56 LOCATE 15,33
57 PRINT "1"
58 LOCATE 19,1
59 PRINT "NEXT, ENTER THE SCALE FACTOR WITH THE COMMAND <f
1S/F>. IN THIS EXAMPLE THE     VALUE ENTERED WOULD BE
`.0100'. THE CRT RESPONDS AS FOLLOWS.. ...."
60 GOSUB 6060
61 LOCATE 15,36
62 PRINT "0.0100"
63 LOCATE 19,1
64 PRINT "THE PROGRAM WILL NOW SUBTRACT OUT THE CONTRIBUTING
PORTION OF Fe TO THE COPPER'SCONCENTRATION IN ALL SAMPLES."
65 GOSUB 6060
66 PRINT "THE `2I/E' & `2S/F' PARAMETERS ALLOW THE CORRECTION
FOR A SECOND INTERFERING    ELEMENT IF NECESSARY."
67 GOSUB 6060
68 PRINT "THE INTERFERING ELEMENT ROUTINE CAN BE DISABLED BY
ENTERING THE COMMAND <0 1I/E>"
69 GOSUB 6060
70 PRINT " IF THE INTERFERING ELEMENT AND INTERNAL STANDARD
ROUTINES ARE USED AT THE  SAME TIME, THEN BOTH THE ANALYTE
```

```
AND INTERFERENT MUST BE CORRECTED BY THE INTERNAL
STANDARDIZATION."
71 GOSUB 6050
72 PRINT "THIS CONCLUDES CHAPTER 12:"
73 PRINT "     PRESS THE SPACE BAR TO PROCEED TO CHAPTER 13"
74 PRINT "     PRESS THE `F1' KEY TO RETURN TO THE TABLE OF
CONTENTS"
75 PRINT "     PRESS THE `F2' KEY TO REVIEW THIS CHAPTER"
76 PRINT "     PRESS THE `F10' KEY TO TERMINATE THE LESSON"
77 ON KEY (1) GOSUB 200
78 ON KEY (2) GOSUB 201
79 ON KEY (10) GOSUB 202
80 KEY(1) ON
81 KEY(2) ON
82 KEY(10) ON
83 GOSUB 6050
84 RUN "ICP-13.BAS"
200 RUN "ICP-B.BAS"
201 RUN "ICP-12.BAS"
202 SYSTEM
4999 END
5000 LINE (140,10)-(510,10)
5001 LINE (510,10)-(510,130)
5002 LINE (510,130)-(140,130)
5003 LINE (140,130)-(140,10)
5006 RETURN
5010 LINE (140,1)-(510,1)
5011 LINE (510,1)-(510,138)
5012 LINE (510,138)-(140,138)
5013 LINE (140,138)-(140,1)
5014 RETURN
5015 LINE (115,10)-(535,10)
5016 LINE (535,10)-(535,130)
5017 LINE (535,130)-(115,130)
5018 LINE (115,130)-(115,10)
5019 RETURN
5020 LOCATE 2,23
5021 PRINT "P 200    123450-00          1 JUNE 1984"
5022 LOCATE 4,28
5023 PRINT "#       OPTION"
5024 LOCATE 5,28
5025 PRINT "1 PRINTER SETUP     OFF"
5026 LOCATE 6,28
5027 PRINT "2 RS232 SETUP       OFF"
5028 LOCATE 7,28
5029 PRINT "3 DIAGNOSTICS       OFF"
5030 LOCATE 8,28
5031 PRINT "4 AUTOSAMPLER       OFF"
5032 LOCATE 9,28
5033 PRINT "5 OPERATOR ID."
5034 LOCATE 10,28
5035 PRINT "6 DATE SET          01 JUN 84"
5036 LOCATE 11,28
5037 PRINT "7 TIME SET          01:07"
5038 LOCATE 12,28
```

```
5039 PRINT "8 VIDEO SETUP       OFF"
5040 LOCATE 13,28
5041 PRINT "9 EXIT"
5042 LOCATE 14,27
5043 PRINT "10 EXTENDED RANGE    OFF"
5044 LOCATE 15,27
5045 PRINT "11 PROTOCOL          OFF"
5046 LOCATE 17,23
5047 PRINT "# "
5048 RETURN
5050 LOCATE 3,23
5051 PRINT "P 200   123450-00          1 JUNE 1984"
5052 LOCATE 5,28
5053 PRINT "#       OPTION"
5054 LOCATE 6,28
5055 PRINT "1 PAGING             OFF"
5056 LOCATE 7,28
5057 PRINT "2 LEFT MARGIN          8"
5058 LOCATE 8,28
5059 PRINT "3 GRAPHICS           OFF"
5060 LOCATE 9,28
5061 PRINT "4 PLOTS PER PAGE       3"
5062 LOCATE 10,28
5063 PRINT "6 INITIALIZE"
5064 LOCATE 11,28
5065 PRINT "9 EXIT"
5066 LOCATE 16,23
5067 PRINT "# "
5068 RETURN
5100 LOCATE 3,23
5101 PRINT "P 200   123450-00          4 JULY 1985"
5102 LOCATE 5,28
5103 PRINT "P#  WP PWR NAMED"
5104 LOCATE 6,29
5105 PRINT "1   0   3 COPPER"
5106 LOCATE 8,27
5107 PRINT "ML/M PDLY HG  *ANAL  *RDG"
5108 LOCATE 9,28
5109 PRINT "1.0   30  1       0     0"
5110 LOCATE 11,22
5111 PRINT "# EL        NM  ORD  CH  MM  BC   SEC"
5112 LOCATE 16,23
5113 PRINT "* "
5115 RETURN
5125 LOCATE 4,30
5126 PRINT "ELEMENT CU      29 ATOM"
5127 LOCATE 6,31
5128 PRINT "# EL       NM ORD  MM"
5129 LOCATE 7,31
5130 PRINT "1 CU  324.75   2  14"
5131 LOCATE 8,31
5132 PRINT "2 CU  327.40   2  14"
5133 LOCATE 9,31
5134 PRINT "3 CU  224.70   2  14"
5135 LOCATE 11,28
```

```
5136 PRINT "* "
5140 RETURN
5150 LOCATE 3,22
5151 PRINT "# EL        NM   ORD   CH   MM   BC    SEC"
5152 LOCATE 4,22
5153 PRINT "1 CU    324.75      2    A 1 4    N    1.0"
5154 PRINT ""
5155 LOCATE 6,22
5156 PRINT "# B#        CONC        UNIT    #D    WS"
5157 LOCATE 7,22
5158 PRINT "0 99             0       PPM       0     M"
5159 LOCATE 8,22
5160 PRINT "1"
5161 LOCATE 9,22
5162 PRINT "2                          SENSITIVITY"
5163 LOCATE 10,22
5164 PRINT "3                                    1"
5165 LOCATE 11,22
5166 PRINT "4                          BLNK-SENSIT"
5167 LOCATE 12,22
5168 PRINT "5                                    0"
5169 PRINT ""
5170 LOCATE 14,22
5171 PRINT "I/S      1I/E    1S/F      2I/E      2S/F"
5172 PRINT ""
5173 PRINT ""
5174 LOCATE 16,21
5175 PRINT "* "
5180 RETURN
5200 LOCATE 9,28
5201 PRINT "1.0    30   1        2     3"
5202 LOCATE 12,22
5203 PRINT "1 CU    324.75      2    A 1 4    N    1.0"
5204 LOCATE 13,22
5205 PRINT "2 CU    327.40      2    A 1 4    N    1.0"
5206 LOCATE 14,22
5207 PRINT "3 CU    224.70      2    A 1 4    N    1.0"
5210 RETURN
5220 LOCATE 7,50
5221 PRINT "2"
5222 LOCATE 8,22
5223 PRINT "1  1        10.00"
5224 LOCATE 9,22
5225 PRINT "2  2         5.00"
5230 RETURN
5248 CLS
5249 GOSUB 5015
5250 LOCATE 3,21
5251 PRINT "4200                          CU 324.75"
5252 LOCATE 4,55
5253 PRINT "MAX 14"
5254 LOCATE 5,55
5255 PRINT "MM= 14"
5256 LOCATE 14,17
5257 PRINT "0
```

```
48"
5258 LINE (127,72)-(138,721
5259 LINE (143,731-(153,731
5260 LINE (158,72)-(168,721
5261 LINE (173,68)-(183,681
5262 LINE (188,651-(198,651
5263 LINE (203,551-(213,551
5264 LINE (218,501-(229,501
5265 LINE (234,451-(245,451
5266 LINE (250,481-(261,48)
5267 LINE (266,541-(277,541
5268 LINE (282,61)-(293,61)
5269 LINE (298,701-(309,701
5270 LINE (314,761-(324,761
5271 LINE (329,85)-(340,85)
5272 LINE (345,88)-(356,88)
5273 LINE (361,901-(372,901
5274 LINE (377,91)-(388,91)
5275 LINE (393,901-(404,901
5276 LINE (409,901-(420,901
5277 LINE (425,921-(436,921
5278 LINE (441,911-(452,911
5279 LINE (457,901-(468,901
5280 LINE (473,901-(484,901
5281 LINE (489,891-(500,891
5282 LINE (505,901-(516,901
5283 LOCATE 16,20
5284 PRINT "* "
5285 RETURN
5300 X=175
5301 Y=99
5302 FOR Q=1 TO 10
5303 PSET (X,Y)
5304 X=X+4
5305 NEXT Q
5306 X=212
5307 Y=98
5308 FOR Q=1 TO 10
5309 PSET (X,Y)
5310 X=X+4
5311 NEXT Q
5312 X=252
5313 Y=97
5314 FOR Q=1 TO 6
5315 PSET (X,Y)
5316 X=X+4
5317 NEXT Q
5318 PSET (274,971
5319 PSET (278,961
5320 PSET (282,951
5321 PSET (286,941
5322 PSET (290,93)
5323 PSET (294,91)
5324 PSET (297,891
5325 A=-7.2:C=0
```

```
5326 FOR Z=1 TO 145
5327 B=A*A
5328 X=A+305
5329 Y=B+35
5330 X=X+C
5331 C=C+.2
5332 PSET (X,Y)
5333 A=A+.1
5334 NEXT Z
5335 PSET (342,881
5336 PSET (342,891
5337 PSET (345,911
5338 PSET (349,931
5339 PSET (353,941
5340 PSET (357,951
5341 PSET (361,961
5342 PSET (364,971
5343 X=368
5344 Y=97
5345 FOR Q=1 TO 6
5346 PSET (X,Y)
5347 X=X+4
5348 NEXT Q
5349 X=391
5350 Y=98
5351 FOR Q=1 TO 10
5352 PSET (X,Y)
5353 X=X+4
5354 NEXT Q
5355 X=432
5356 Y=99
5357 FOR Q=1 TO 10
5358 PSET (X,Y)
5359 X=X+4
5360 NEXT Q
5361 RETURN
5365 LINE (320,251-(320,104)
5366 LOCATE 3,22
5367 PRINT "4200          A          CU 324 75"
5368 LINE (260,102)-(260,110)
5369 LINE (380,102)-(380,110)
5370 LOCATE 14,25
5371 PRINT "0"
5372 LOCATE 14,34
5373 PRINT "324.70"
5374 LOCATE 14,49
5375 PRINT "324.80"
5376 LOCATE 16,22
5377 PRINT "* "
5378 RETURN
5379 LINE (260,251-(260,451
5380 RETURN
5381 LINE (290,251-(290,351
5382 LINE (350,25)-(350,35)
5383 RETURN
```

```
5390 GOSUB 5300
5391 GOSUB 5365
5392 GOSUB 5379
5393 GOSUB 5381
5394 RETURN
5400 LOCATE 5,36
5401 PRINT " "
5402 LOCATE 5,45
5403 PRINT " "
5404 X=290
5405 FOR Y=25 TO 35
5406 PRESET (X,Y)
5407 NEXT Y
5408 X=350
5409 FOR Y=25 TO 35
5410 PRESET (X,Y)
5411 NEXT Y
5412 LINE (280,25)-(280,35)
5413 LINE (360,25)-(360,35)
5414 RETURN
5420 X=280
5421 FOR Y=25 TO 35
5422 PRESET (X,Y)
5423 NEXT Y
5424 X=360
5425 FOR Y=25 TO 35
5426 PRESET (X,Y)
5427 NEXT Y
5428 LINE (300,25)-(300,35)
5429 LINE (340,25)-(340,35)
5430 RETURN
5435 X=300
5436 FOR Y=25 TO 35
5437 PRESET (X,Y)
5438 NEXT Y
5439 X=340
5440 FOR Y=25 TO 35
5441 PRESET (X,Y)
5442 NEXT Y
5443 GOSUB 5381
5444 RETURN
5447 LOCATE 7,32
5448 PRINT " "
5449 RETURN
5500 LOCATE 4,59
5501 PRINT " 2"
5502 LINE (127,95)-(138,95)
5503 LINE (143,94)-(153,94)
5504 LINE (158,95)-(168,95)
5505 LINE (173,951-(183,951
5506 LINE (188,96)-(198,96)
5507 LINE (203,97)-(213,97)
5508 LINE (218,98)-(229,98)
5509 LINE (234,99)-(245,99)
5510 LINE (250,100)-(261,100)
```

```
5511 LINE (266,99)-(277,99)
5512 LINE (282,100)-(293,100)
5513 LINE (298,99)-(309,99)
5514 LINE (314,100)-(324,100)
5515 LINE (329,100)-(340,100)
5516 LINE (345,100)-(356,100)
5517 LINE (361,99)-(372,99)
5518 LINE (377,100)-(388,100)
5519 LINE (393,100)-(404,100)
5520 LINE (409,100)-(420,100)
5521 LINE (425,99)-(436,99)
5522 LINE (441,100)-(452,100)
5523 LINE (457,100)-(468,100)
5524 LINE (473,100)-(484,100)
5525 LINE (489,100)-(500,100)
5526 LINE (505,100)-(516,100)
5527 RETURN
5600 X=175
5601 Y=99
5602 FOR Q=1 TO 10
5603 PRESET (X,Y)
5604 X=X+4
5605 NEXT Q
5606 X=212
5607 Y=98
5608 FOR Q=1 TO 10
5609 PRESET (X,Y)
5610 X=X+4
5611 NEXT Q
5612 X=252
5613 Y=97
5614 FOR Q=1 TO 6
5615 PRESET (X,Y)
5616 X=X+4
5617 NEXT Q
5618 PRESET (274,97)
5619 PRESET (278,96)
5620 PRESET (282,95)
5621 PRESET (286,94)
5622 PRESET (290,93)
5623 PRESET (294,91)
5624 PRESET (297,89)
5625 A=-7.2:C=0
5626 FOR Z=1 TO 145
5627 B=A*A
5628 X=A+305
5629 Y=B+35
5630 X=X+C
5631 C=C+.2
5632 PRESET (X,Y)
5633 A=A+.1
5634 NEXT Z
5635 PRESET (342,881
5636 PRESET (342,89)
5637 PRESET (345,911
```

```
5638 PRESET (349,931
5639 PRESET (353,941
5640 PRESET (357,951
5641 PRESET (361,96)
5642 PRESET. (364,971
5643 X=368
5644 Y=97
5645 FOR Q=1 TO 6
5646 PRESET (X,Y)
5647 X=X+4
5648 NEXT Q
5649 X=391
5650 Y=98
5651 FOR Q=1 TO 10
5652 PRESET (X,Y)
5653 X=X+4
5654 NEXT Q
5655 X=432
5656 Y=99
5657 FOR Q=1 TO 10
5658 PRESET (X,Y)
5659 X=X+4
5660 NEXT Q
5661 RETURN
5670 X=320
5671 FOR Y=25 TO 30
5672 PRESET (X,Y)
5673 NEXT Y
5674 FOR Y=51 TO 104
5675 PRESET (X,Y)
5676 NEXT Y
5677 LOCATE 16,22
5678 PRINT "  "
5679 RETURN
5700 X=175
5701 Y=99
5702 FOR Q=1 TO 30
5703 PSET (X,Y)
5704 X=X+4
5705 NEXT Q
5706 X=289
5707 Y=98
5708 FOR Q=1 TO 10
5709 PSET (X,Y)
5710 X=X+4
5711 NEXT Q
5712 X=329
5713 Y=97
5714 FOR Q=1 TO 6
5715 PSET (X,Y)
5716 X=X+4
5717 NEXT Q
5718 PSET (351,971
5719 PSET (355,961
5720 PSET (359,95)
```

```
5721 PSET (363,94)
5722 PSET (367,931
5723 PSET (371,911
5724 PSET (374,89)
5725 A=-7.2:C=0
5726 FOR Z=1 TO 145
5727 B=A*A
5728 X=A+382
5729 Y=B+35
5730 X=X+C
5731 C=C+.2
5732 PSET (X,Y)
5733 A=A+.1
5734 NEXT Z
5735 PSET (419,881
5736 PSET (419,891
5737 PSET (422,91)
5738 PSET (426,931
5739 PSET (430,941
5740 PSET (434,951
5741 PSET (438,961
5742 PSET (441,971
5743 X=445
5744 Y=97
5745 FOR Q=1 TO 6
5746 PSET (X,Y)
5747 X=X+4
5748 NEXT Q
5749 RETURN
5760 X=320
5761 FOR Y=31 TO 50
5762 PRESET (X,Y)
5763 NEXT Y
5764 LINE (397,31)-(397,50)
5765 RETURN
5770 LINE (320,25)-(320,104)
5771 LOCATE 3,22
5772 PRINT "4200          A          CU 324.80"
5773 LINE (260,102)-(260,110)
5774 LINE (380,102)-(380,110)
5775 LOCATE 14,25
5776 PRINT "0"
5777 LOCATE 14,34
5778 PRINT "324.75"
5779 LOCATE 14,49
5780 PRINT "324.85"
5781 LOCATE 16,22
5782 PRINT "*_"
5783 RETURN
5800 PRESET (236,981
5801 PRESET (240,981
5802 PRESET (244,98)
5803 PRESET (248,981
5804 X=252
5805 Y=97
```

```
5806 FOR Q=1 TO 6
5807 PRESET (X,Y)
5808 X=X+4
5809 NEXT Q
5810 PRESET (274,971
5811 PSET (236,981
5812 PSET (238,971
5813 PSET (240,961
5814 PSET (242,951
5815 PSET (242,941
5816 A=-4.2: C=0
5817 FOR Z=1 TO 85
5818 B=A*A
5819 X=A+248
5820 Y=B+76
5821 X=X+C
5822 C=C+.2
5823 PSET (X,Y)
5824 A=A+.1
5825 NEXT Z
5826 PSET (269,95)
5827 PSET (271,961
5828 PSET (274,961
5830 RETURN
5835 PRESET (236,981
5836 PRESET (238,971
5837 PRESET (240,96)
5838 PRESET (242,951
5839 PRESET (242,941
5840 A=-4.2:C=0
5841 FOR Z=1 TO 85
5842 B=A*A
5843 X=A+248
5844 Y=B+76
5845 X=X+C
5846 C=C+.2
5847 PRESET (X,Y)
5848 A=A+.1
5849 NEXT Z
5850 PRESET (269,951
5851 PRESET (271,961
5852 PRESET (274,961
5855 RETURN
5860 X=212
5861 Y=98
5862 FOR Q=1 TO 10
5863 PRESET (X,Y)
5864 X=X+4
5865 NEXT Q
5866 PRESET (278,96):PRESET (282,951
5867 PRESET (286,94)
5868 PRESET (290,931
5869 PRESET (294,911
5870 PRESET (297,89)
5871 X=212
```

```
5872 Y=98
5873 FOR Q=l TO 22
5874 PSET (X,Y)
5875 X=X+4
5876 Y=Y-.5
5877 NEXT Q
5878 RETURN
5880 X=212
5881 Y=98
5882 FOR Q=1 TO 22
5883 PRESET (X,Y)
5884 X=X+4
5885 Y=Y-.5
5886 NEXT Q
5887 GOSUB 5300
5888 RETURN
5900 LOCATE 15,22
5901 PRINT "ENTER BC - None Left Right Both"
5902 LOCATE 16,22
5903 PRINT "  "
5905 RETURN
5910 GOSUB 5379
5911 LOCATE 15,22
5912 PRINT "L                                    "
5913 LOCATE 16,22
5914 PRINT "TRIM LEFT  "
5915 X=320
5916 FOR Y=25 TO 104
5917 PRESET (X,Y)
5918 NEXT Y
5920 RETURN
5925 X=260
5926 FOR Y=25 TO 45
5927 PRESET (X,Y)
5928 NEXT Y
5929 LINE (200,25)-(200,45)
5930 RETURN
5935 LOCATE 4,51
5936 PRINT "L"
5937 RETURN
5940 Y=97
5941 FOR X=203 TO 213
5942 PRESET (X,Y)
5943 NEXT X
5944 Y=98
5945 FOR X=218 TO 229
5946 PRESET (X,Y)
5947 NEXT X
5948 Y=99
5949 FOR X=234 TO 245
5950 PRESET (X,Y)
5951 NEXT X
5952 Y=99
5953 FOR X=266 TO 277
5954 PRESET (X,Y)
```

```
5955 NEXT X
5956 LINE (203,961-(213,961
5957 LINE (218,96)-(229,96)
5958 LINE (234,951-(245,951
5959 LINE (266,981-(277,981
5960 RETURN
6000 C=3
6001 LOCATE C,20,1,0,7
6002 PRINT "                                                    "
6003 C=C+1
6004 IF C=17 THEN GOTO 6006
6005 GOTO 6001
6006 D=19
6007 LOCATE D,1,1,0,7
6008 PRINT "
                                    "
6009 D=D+1
6010 IF D=23 THEN GOTO 6012
6011 GOTO 6007
6012 RETURN
6013 E=20
6014 LOCATE E,1,1,0,7
6015 PRINT "
                                    "
6016 E=E+1
6017 IF E=23 TPEN GOTO 6019
6018 GOTO 6014
6019 RETURN
6020 GOTO 63
6021 CLS:GOTO 910
6022 CLS:GOSUB 5000:GOTO 968
6023 CLS:GOTO 2111
6025 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 CLS
6052 RETURN
6060 A$=INKEY$:IF A$="" GOTO 6060
6061 GOSUB 6006
6062 LOCATE 19,1
6063 RETURN
6065 A$=INKEY$:IF A$="" GOTO 6065
6066 GOSUB 6000
6067 RETURN
6070 A$=INKEY$:IF A$="" GOTO 6070
6071 GOSUB 6013
6072 LOCATE 20,1
6073 RETURN
```

ICP-13.BAS (Chapter 13)

```
1 CLS:KEY OFF
2 SCREEN 2
3 LOCATE 5,34
4 PRINT "CHAPTER 13"
5 LOCATE 15,31
6 PRINT "TROUBLE SHOOTING"
7 GOSUB 6050
8 PRINT " THIS CHAPTER EXPLAINS THE 26 MOST COMMON ERROR
MESSAGES THAT MAY APPEAR ON THE  INSTRUMENT'S CRT."
9 GOSUB 6050
10 PRINT "THE ERROR MESSAGES ARE LISTED ON THE NEXT PAGE.
ENTER THE CORRESPONDING LETTER  TO DISPLAY INFORMATION ABOUT
A SPECIFIC MESSAGE, AND A COURSE OF ACTION NEEDED  TO
ELIMINATE THE PROBLEM."
11 PRINT ""
12 PRINT "ERROR MESSAGES NOT APPEARING ON THIS LIST ARE OF A
MORE SERIOUS NATURE. IF SUCH A MESSAGE SHOULD DISPLAY ON THE
CRT, STOP ALL PROCEDURES AND GO FOR HELP!!!!!"
13 GOSUB 6050
14 LOCATE 1,32
15 PRINT "ERROR MESSAGES"
16 LOCATE 4,1
17 PRINT "A) TAPE LENGTH"
18 LOCATE 6,1
19 PRINT "B) CHECK SUM"
20 LOCATE 8,1
21 PRINT "C) TAPE EMPTY"
22 LOCATE 10,1
23 PRINT "D) TAPE PROTECTED"
24 LOCATE 12,1
25 PRINT "E) CABINET INTERLOCKS"
26 LOCATE 14,1
27 PRINT "F) AIRFLOW"
28 LOCATE 16,1
29 PRINT "G) ARGON PRESSURE"
30 LOCATE 18,1
31 PRINT "H) WATERFLOW"
32 LOCATE 20,1
33 PRINT "I) TORCH OUT"
34 LOCATE 20,25
35 PRINT "* F1 KEY - TABLE OF CONTENTS *"
36 LOCATE 4,28
37 PRINT "J) TORCH DIDN'T IGNITE
38 LOCATE 6,28
39 PRINT "K) NOT FOUND"
40 LOCATE 8,28
41 PRINT "L) ILLEGAL ENTRY"
42 LOCATE 10,28
43 PRINT "M) STACK EMPTY"
44 LOCATE 12,28
45 PRINT "N) WAITING FOR PRINTER"
46 LOCATE 14,28
```

```
47 PRINT "O) POWER INTERRUPT/RESET"
48 LOCATE 16,28
49 PRINT "P) HG CALIBRATION FAILED"
50 LOCATE 18,28
51 PRINT "Q) OVERFLOW"
52 LOCATE 4,58
53 PRINT "R) OVER RANGE"
54 LOCATE 6,58
55 PRINT "S) BLNK > HI STD"
56 LOCATE 8,58
57 PRINT "T) DERIV ERROR"
58 LOCATE 10,58
59 PRINT "U) HAS I/S"
60 LOCATE 12,58
61 PRINT "V) USED AS I/S"
62 LOCATE 14,58
63 PRINT "W) IMPROPERLY NESTED"
64 LOCATE 16,58
65 PRINT "X) ALREADY USED BY I/S"
66 LOCATE 18,58
67 PRINT "Y) CHOICE USES I/S"
68 LOCATE 20,58
69 PRINT "Z) CHOICE USES I/E"
70 LOCATE 23,35
71 PRINT "CHOICE ?"
72 ON KEY (1) GOSUB 1000
73 KEY(1) ON
74 A$=INKEY$:IF A$="" GOTO 74:IF A$="A" GOTO 200
75 IF A$="B" GOTO 210
76 IF A$="C" GOTO 220
77 IF A$="D" GOTO 230
78 IF A$="E" GOTO 240
79 IF A$="F" GOTO 250
80 IF A$="G" GOTO 260
81 IF A$="H" GOTO 270
82 IF A$="I" GOTO 280
83 IF A$="J" GOTO 290
84 IF A$="K" GOTO 300
85 IF A$="L" GOTO 310
86 IF A$="M" GOTO 320
87 IF A$="N" GOTO 330
88 IF A$="O" GOTO 340
89 IF A$="P" GOTO 350
90 IF A$="Q" GOTO 360
91 IF A$="R" GOTO 370
92 IF A$="S" GOTO 380
93 IF A$="T" GOTO 390
94 IF A$="U" GOTO 400
95 IF A$="V" GOTO 410
96 IF A$="W" GOTO 420
97 IF A$="X" GOTO 430
98 IF A$="Y" GOTO 440
99 IF A$="Z" GOTO 450
100 CLS:GOTO 14
200 CLS
```

```
201 PRINT "A USER TAPE HAS BEEN LOADED WHEN A SYSTEM TAPE IS
REQUIRED, AND VISA VERSA. LOADTHE PROPER TAPE AND PRESS THE
`CLR' KEY."
202 GOSUB 6060
210 CLS
211 PRINT "THE TAPE HEAD MUST BE CLEANED WITH ALCOHOL AND
CLOTH. AFTER DOING SO, PRESS THE `CLR' KEY."
212 GOSUB 6060
220 CLS
221 PRINT "A TAPE HAS NOT BEEN LOADED INTO THE TAPE DECK.
LOAD THE PROPER CASSETTE, AND    PRESS THE `CLR' KEY."
222 GOSUB 6060
230 CLS
231 PRINT "AN ATTEMPT HAS BEEN MADE TO WRITE ON A TAPE WITH
THE WRITE PROTECT TAB REMOVED. LOAD ANOTHER CASSETTE, AND
PRESS THE 'CLR'  KEY."
232 GOSUB 6060
240 CLS
241 PRINT "1) MAKE SURE THE ANODE BREAKER UNDERNEATH THE WORK
SHELF IS IN THE ON POSITION  2) MAKE SURE THE INSTRUMENT'S
COVERS ARE ALL IN PLACE"
242 PRINT "3) IF CONDITION PERSISTS, GO FOR HELP"
243 GOSUB 6060
250 CLS
251 PRINT "HAVE A QUALIFIED INDIVIDUAL CHECK THE INSTRUMENT'S
AIR FILTERS"
252 GOSUB 6060
260 CLS
261 PRINT "1) MAKE SURE THE GAUGE ON THE ARGON TANK IS
READING 60 PSI                          2) HAVE A QUALIFIED
PERSON CHECK THE ARGON CONNECTIONS"
262 GOSUB 6060
270 CLS
271 PRINT "1) MAKE SURE THE WATER SUPPLY IS ON
2) HAVE QUALIFIED PERSON CHANGE THE WATER FILTER AND CHECK
THE WATER PRESSURE"
272 GOSUB 6060
280 CLS
281 PRINT "THE COMPUTER HAS SHUT OFF THE TORCH. VERIFY THAT
THE ARGON AND WATER SUPPLIES   ARE ON, AND RE-ENABLE THE
TORCH. IF THE CONDITION PERSISTS, GO FOR HELP."
282 GOSUB 6060
290 CLS
291 PRINT "VERIFY THAT THE ARGON AND WATER SUPPLIES ARE ON,
AND ATTEMPT IGNITION ONCE AGAINIF CONDITION PERSISTS, GO FOR
HELP!"
292 GOSUB 6060
300 CLS
301 PRINT "REQUESTED PROGRAM IS NOT IN MEMORY. MAKE SURE THE
PROGRAM HAS BEEN READ FROM THECASSETTE PROPERLY."
302 GOSUB 6060
310 CLS
311 PRINT "THE VALUE ENTERED EXCEEDS THE ALLOWED RANGE.
(EXAMPLE: <2 WP> IS ILLEGAL SINCE  `WP' CAN ONLY HAVE A VALUE
OF 0 OR 1.) ENTER AN ACCEPTABLE VALUE."
```

```
312 GOSUB 6060
320 CLS
321 PRINT "THE DESIRED PROGRAM HAS NOT BEEN CALLED UP. USE
THE <n SEE> COMMAND TO CALL UP  THE PROGRAM."
322 GOSUB 6060
330 CLS
331 PRINT "THE PRINTER HAS NOT BEEN PLACED ON LINE. REFER TO
CHAPTER 14 FOR DETAILED       OPERATION OF THE PRINTER."
332 GOSUB 6060
340 CLS
341 PRINT "THE BREAK KEYS HAVE BEEN USED, OR POWER
INTERRUPTION HAS OCCURRED. COMPUTER     MEMORY IS INTACT. USE
THE <SUPPLIES> COMMAND TO RESET THE HIGH VOLTAGE SUPPLY."
342 GOSUB 6060
350 CLS
351 PRINT "THE AUTOMATIC MERCURY CALIBRATION HAS FAILED.
REPEAT THE CALIBRATION BY CALLING UP OPTION #120 ON THE
PROGRAM MENU. IF THE CONDITION PERSISTS, GO FOR HELP!! !!"
352 GOSUB 6060
360 CLS
361 PRINT "THE CONCENTRATION INTENSITY OF THE STANDARD OR
SAMPLE EXCEEDS THE DYNAMIC RANGE OF THE INSTRUMENT. DILUTIONS
WILL BE NECESSARY."
362 GOSUB 6060
370 CLS
371 PRINT "1) IN A CALIBRATION, STANDARD #1 IS NOT THE
HIGHEST STANDARD. CORRECT THE ORDER OF THE STANDARDS."
372 PRINT "2) IN AN ANALYSIS, SIGNAL INTENSITY OF THE SAMPLE
IS GREATER THAN 125PERCENT OF THE HIGHEST STANDARD. DILUTE
THE SAMPLE OR PREPARE A NEW CALIBRATION CURVE WITH A MORE
CONCENTRATED STANDARD #1."
373 GOSUB 6060
380 CLS
381 PRINT "1) MAKE SURE THE SOLUTIONS ARE ASPIRATED IN THE
CORRECT SEQUENCE"
382 PRINT "2) THE NEBULIZER IS CLOGGED; GO FOR HELP"
383 GOSUB 6060
390 CLS
391 PRINT "1) MAKE SURE THE SOLUTIONS ARE ASPIRATED IN THE
CORRECT SEQUENCE"
392 PRINT "2) AN ERROR HAS OCCURRED IN SOLUTION PREP; RE-MAKE
THE STANDARDS"
393 GOSUB 6060
400 CLS
401 PRINT "AN ELEMENTAL LINE HAS BEEN SELECTED AS ITS OWN
INTERNAL STANDARD OR INTERFERING ELEMENT. REFER TO CHAPTERS
11 & 12 AND RE-WRITE THE PROGRAM."
402 GOSUB 6060
410 CLS
411 PRINT "THE ELEMENT CHOSEN AS AN INTERNAL STANDARD IS
ITSELF CORRECTED BY AN INTERNAL  STANDARD. REFER TO CHAPTER
11, AND ASSIGN A NEW INTERNAL STANDARD."
412 GOSUB 6060
420 CLS
421 PRINT "THE ELEMENT DESIGNATED AS AN INTERNAL STANDARD OR
```

```
INTERFERING ELEMENT OCCUPIES APROGRAM LINE PRIOR TO THE
ELEMENTS REQUIRING CORRECTION. REFER TO CHAPTERS 11  AND 12,
AND CHANGE THE ORDER OF THE PROGRAM LINES."
422 GOSUB 6060
430 ƐTS
431 PRINT "THE ELEMENT TO BE USSᑭ AS AN INTERNAL STANDARD IS
ITSELF CORRECTED BY INTERNAL  STANDARDIZATION. 8Ɛ9Ɛ8 TO
CHAPTER ㄩI AND ALTER THE PROGRAM."
432 GOSUB 6060
440 CLS
441 PRINT "THE ELEMENT TO BE USED AS AN INTERNAL STANDARD IS
ITSELF CORRECTED BY INTERNAL  STANDARDIZATION OR BY
INTERFERING ELEMENTS. REFER ㄖO CHAPTERS ㄩI & 12, AND
CHANGE THE PROGRAM."
442 GOSUB 6060
450 ƐTS
451 PRINT "THE ELEMENT TO BE USᑭᑭ ΛS ΛN INTERNAL STANDARD IS
ITSELF CORRECTED BY INTERNAL  STANDARDIZATION OR 0∀
INTERFERING ELEMENTS. REFER TO CHAPTERS 11 & 12, AND
CHANGE THE PROGRAM."
452 GOSUB 6060
ㄖ000 RUN "ICP-B.BAS"
6050 A$=INKEY$:IF A$="" ƐOㄖO 6050
6051 ƐTS
6052 RETURN
6060 A$=INKEY$:IF A$="" ƐOㄖO 6060
6061 ƐTS
6062 GOTO 14
6063 RETURN
```

ICP-14.BAS (Chapter 14)

```
1 CLS:KEY OFF
2 SCREEN 2
3 LOCATE 5,34
4 PRINT "CHAPTER 14"
5 LOCATE 15,31
6 PRINT "USING THE PRINTER"
7 GOSUB 6050
8 PRINT "THIS CHAPTER WILL EXPLAIN HOW TO USE THE PARALLEL
PRINTER."
9 GOSUB 6050
10 PRINT "TO TURN ON POWER FOR THE PRINTER, INTERFACE
SELECTOR, AND BUFFER, FLIP THE       SWITCH ON THE POWER STRIP
LABELED 'PRINTER'.  THE STRIP IS ON THE FLOOR
UNDERNEATH THE PRINTER STAND."
11 PRINT ""
12 PRINT "CHECK THE INTERFACE SELECTOR LOCATED ON THE TABLE
BEHIND THE INSTRUMENT. THE     TOGGLE SWITCH SHOULD BE- IN THE
POSITION LABELED 'ICP'."
13 PRINT ""
14 PRINT "THE PRINTER BUFFER, LOCATED UNDERNEATH THE
INTERFACE SELECTOR, SHOULD BE         INITIALIZED BY PRESSING
THE CLEAR BUTTON."
15 PRINT ""
16 PRINT "NOW PRESS THE 'ON  LINE' BUTTON ON THE PRINTER'S
FRONT PANEL. THE RED LIGHTS      ABOVE THE 'ON  LINE' AND
'PRINT  ENABLE' BUTTONS WILL COME ON."
17 GOSUB 6050
18 PRINT "THE PRINTER IS NOW READY TO ACCEPT INPUT FROM THE
INSTRUMENT. TO TEAR OFF THE    OUTPUT, PRESS THE 'ON  LINE'
BUTTON TO TAKE THE PRINTER OFF LINE. THEN PRESS THE 'TOP  OF
FORMS' BUTTON TO ADVANCE THE OUTPUT TO A POSITION WHERE IT
CAN BE TORN  OFF.
19 PRINT ""
20 PRINT "PRESSING THE 'TOP  OF FORMS' BUTTON SHOULD LINE UP
THE PRINTER HEAD WITH THE TOP OF A PAGE. IF THIS IS NOT THE
CASE, TURN THE LARGE KNOB ON THE SIDE OF THE       PRINTER
UNTIL PROPER ALIGNMENT IS ACHEIVED."
21 PRINT ""
22 PRINT "THE REMAINING CONTROLS ON THE PRINTER ARE NOT
NEEDED FOR ROUTINE OPERATION, AND SHOULD NOT BE TOUCHED!! !"
23 GOSUB 6050
24 PRINT "THE COPY BUTTON ON THE BUFFER IS USED TO MAKE
COPIES OF THE INSTRUMENT'S OUTPUT. SIMPLY PRESS THE BUTTON
EACH TIME A COPY IS DESIRED. THE PAUSE BUTTON STOPS THE
PRINTING ROUTINE UNTIL THE PAUSE BUTTON IS PRESSED AGAIN."
25 GOSUB 6050
26 PRINT "THE 'WAITING  FOR PRINTER ERROR MESSAGE THAT MAY
APPEAR ON THE INSTRUMENT'S CRT  IS CAUSED BY 2 SITUATIONS:"
27 PRINT "     1) THE INTERFACE SELECTOR SWITCH IS NOT IN THE
`ICP' POSITION''
28 PRINT "     2) THE PRINTER HAS NOT BEEN PLACED ON LINE"
29 GOSUB 6050
```

```
30 PRINT "THIS CONCLUDES CHAPTER 14 AND THE ENTIRE LESSON:"
31 PRINT "    PRESS THE SPACE BAR TO REPEAT THE LESSON"
32 PRINT "    PRESS THE `F1' KEY TO RETURN TO THE TABLE OF
CONTENTS"
33 PRINT "    PRESS THE `F2' KEY TO REVIEW THIS CHAPTER"
34 PRINT "    PRESS THE `F10' KEY TO TERMINATE THE LESSON"
35 ON KEY (1) GOSUB 200
36 ON KEY (2) GOSUB 201
37 ON KEY (10) GOSUB 202
38 KEY(1) ON
39 KEY(2) ON
40 KEY(10) ON
41 GOSUB 6050
42 RUN "ICP-AES.BAS"
200 RUN "ICP-B.BAS"
201 RUN "ICP-14.BAS"
202 SYSTEM
6050 A$=INKEY$:IF A$="" GOTO 6050
6051 RETURN
6052 RETURN
```

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