

2

This is the last issue of the Newsletter you will receive unless you renew your subscription by sending in the subscription renewal form by mid-July. Those who have already renewed their subscription will have the subscription expiration date appear on the first line of the mailing label (8609 is September 1986).

Two C. C. C. E. National Workshops have been planned for this summer. Workshop - East will be held at Clarkson University in Potsdam, NY from July 28 to August 1. Workshop - West will be held at Truckee Meadows Community College in Sparks, NV from August 11 to 14. An announcement of the Workshops - West appears elsewhere in this issue. The eastern workshops currently have over 100 registrants and several of the workshops are rapidly becoming filled. The Microcomputer Interfacing workshop has been filled for several months. If you're interested in interfacing apply to the western workshops.

We hope to organize a rather full program of contributed papers on computer uses in chemical education for the National Meeting to be held in New York City from April 6 to April 11, 1986. We are interested in activities at the high school, first two years of college and advanced course level. Those of you who are willing to contribute papers or have suggestions for the high school program should contact Paul Cauchon, Canterbury School, New Milford, CT 06776, (203) 355-3103. Professor Patricia Flath, Paul Smith's College, Paul Smith, NY 12970, (518) 327-6264 will handle the first two years of college. I will help organize papers concerning the use of computers in advanced courses. (Professor Donald Rosenthal, Department of Chemistry, Clarkson University, Potsdam, NY 13676, (315) 268-2389). A symposium involving "Applications Software for Lecture and Laboratory Courses" is planned. The symposium would involve the use of substantial program packages in education, i.e. the use of word processing, electronic spread sheets, data bases, statistical, numerical methods and graphics packages in courses. I would like to hear from anyone interested in participating in the symposium. For a variety of reasons it will not be possible to use computers, monitors or video projectors. Only overhead projectors and slide projectors will be available.

Anyone having suggestions for programs at future National Meetings (fall 1986 - Anaheim, CA and beyond) should contact Paul Cauchon.

An article by Tim Eckert describing a short Basic program or subroutine which can be used to automatically scale the axes in plotting data is found in this issue. The routine requires less than 20 lines of code. If you have a short routine which is of general interest, please send it to me for publication in a future issue of this Newsletter.

## **LAB CHECKER**

### **A PROGRAM TO HELP STUDENTS IMPROVE LAB REPORTS**

**by Paul Cauchon\***

In carrying out laboratory assignments, students make many types of errors as they collect, record and process their data. To help students improve their skills, conscientious teachers devote considerable time and effort going over laboratory reports, making a variety of notes and comments. Credit is "taken off" for a variety of failures such as incorrect or missing units, an improper number of significant digits or arithmetic mistakes. Correcting a laboratory report in such a manner that the student can tell whether points were subtracted for conceptual, manipulative, or format errors is a tedious and all too frequently unrewarding task, since it only works if the student is willing to go over the corrected paper thoughtfully. Unfortunately, the elapsed time between submitting a report and getting it back seldom serves as a positive catalyst for self-evaluation. Since the goal of "correcting" papers is to improve student performance by identifying weaknesses and making suggestions, it would seem to be far better if as many errors as possible are brought to the student's attention BEFORE reports are handed in, so that the report can be dealt with in a positive manner, i.e., corrected, instead of merely noted.

At Canterbury School we have developed a series of computer programs keyed to our laboratory manuals that seem to be effective in helping students improve their laboratory reports. These programs provide students with a quick, individualized method of checking laboratory results prior to submitting their final report. A computer is normally available in the laboratory so the check can be made soon enough to repeat a step, or even the whole experiment, when results are too far off. Since each "run" requires only two or three minutes, one machine is ample for a 16 student lab section. These programs reveal what the students are doing wrong without taking off any points. It is then possible to distinguish errors in arithmetic from those in format or overall approach. Appropriate corrections can thus be made in a "real time" sense. The potential for raising laboratory grades offered by these programs is quickly apparent to the students and they need little encouragement to run them. Another result of using these programs is that the teacher has much more time available for evaluating the substance of the report.

Here is a typical dialog illustrating the program which accompanies an experiment on the determination of percent oxygen in potassium chlorate:

PLEASE ENTER EACH ITEM AS CALLED FOR.  
WATCH YOUR UNITS AND SIG FIGS!!

MASS OF CRUCIBLE AND COVER? 20 g

YOU DON'T HAVE ENOUGH DIGITS.  
MASS OF CRUCIBLE AND COVER? 20.00

YOU FORGOT THE UNITS.

MASS OF CRUCIBLE AND COVER? 20.00 g

MASS OF CRUCIBLE, COVER, CONTENTS BEFORE HEATING? 2.20 g

THAT SEEMS VERY LOW...ARE YOU SURE? N

MASS OF CRUCIBLE, COVER, CONTENTS BEFORE HEATING? 22.20 g

MASS OF CRUCIBLE, COVER, AND RESIDUE AFTER HEATING? 21.12 g

WHAT DO YOU GET FOR THE MASS OF POTASSIUM CHLORATE? 2.20 g

I AGREE...

WHAT DO YOU GET FOR THE MASS OF OXYGEN RELEASED? 1.12 g

HMMM...I GET SOMETHING DIFFERENT.

WANT SOME HELP? Y

SINCE OXYGEN HAS LEFT THE CRUCIBLE, ITS MASS IS EQUAL TO THE LOSS OF MASS BETWEEN YOUR SECOND AND THIRD MEASUREMENTS.

WHAT DO YOU GET FOR THE MASS OF OXYGEN RELEASED? 1.08 g

THAT'S WHAT I GET.

WHAT DO YOU GET FOR THE PERCENT OXYGEN IN POTASSIUM CHLORATE? 49.1%

I AGREE...

WELL, YOUR CALCULATIONS ARE DONE CORRECTLY BUT YOUR ANSWER IS OUTSIDE OF THE ACCEPTABLE RANGE...BETTER TRY THE EXPERIMENT AGAIN.

During the past year, the programs were standardized through restructuring in order to develop LAB CHECKER, a utility program organized to support most quantitative laboratory experiments. It is set up to ask for the measured data, and check each entry for proper significant figures, units, and reasonableness. It then asks for the calculated results, and checks format as before but now it also checks for accuracy to see if the data entered were properly processed.

Before LAB CHECKER can be used for a particular experiment, certain items of information unique to that experiment must be coded at appropriate places in the program. For each item of data, there must be a label (text to be displayed when the item is requested), units, number of digits after the decimal point, lowest reasonable value, and highest reasonable value. Entering a "0" for any of these will simply bypass the check for that characteristic. For each calculated result one must enter the same information, except that in place of a "reasonableness check", the error tolerance must be specified, along with the explanatory text to be provided when a result is incorrect. In addition, algorithms for calculating each result must be entered in the program. Exactly what must be entered, how, and where is all explained in the documentation. It takes only about an hour to prepare LAB CHECKER for a new experiment.

LAB CHECKER is written in BASIC and runs on the Apple II family of computers. However, it is easily translated onto any other computer which can be programmed in BASIC. For a copy of the Apple II program with supporting documentation, send me a disk and a large, self-addressed envelope with \$.90 worth of stamps...or pick up a copy at the software exchange at the Seventh C.C.C.E. National Computer Workshops or at the SWAP SHOP at CHEM ED '85 in Montclair.

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