

St. Olaf College

Northfield, Minnesota

DEPARTMENT OF
CHEMISTRY

Conference of College Chemistry Teachers
November 14 and 15, 1952
Monmouth College, Monmouth, Illinois

REPORT OF Discussion Group -- Analytical Chemistry

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~~Discussion Group -- Analytical Chemistry~~
SUMMARY OF DISCUSSION

The discussion Group in Analytical Chemistry gave their consideration to a variety of problems related to the teaching and course work of both Quantitative and Qualitative Analysis. In many instances no definite conclusions could be reached. Nevertheless, the value of the opportunity to share experiences and opinions was sincerely appreciated by all who took part in the discussions. In the following summary, the principle topics discussed and certain pertinent comments relative to each topic will be listed.

1. "The place for qualitative analysis in the chemistry curriculum." -- The Group represented many opinions as to the proper sequence of course work, including a course in qualitative analysis for chemistry majors. However, it was the general opinion that, in order to do justice to the training that qualitative analysis can provide the chemistry major, it would be most desirable to offer this course as a separate unit of one semester to be given during the sophomore year. In this way the theoretical and mathematical aspects of qualitative analysis could be adequately treated. When qualitative analysis is given as a part of first-year general chemistry, the time allowed for class discussion and lecture periods does not allow for adequate treatment of both the descriptive chemistry of the elements and the theory of qualitative analysis. Although a separate, one-semester course in qualitative analysis would be most desirable for the chemistry major, the non-major would be adequately trained in qualitative analysis with a brief course included as a part of the general chemistry course.

2. "To what extent may microscopy or spectroscopy be introduced into the qualitative analysis course?" -- These techniques, while important, are generally not suited to sophomore level work. They might be introduced in advanced courses in instrumental analysis or possibly be offered as special courses -- otherwise best left to the graduate program.

3. "Qualitative methods and techniques which may be utilized to stimulate interest." -- Two interesting alternate testing methods were suggested. One: a fluorescent test for zinc and sodium utilizing the fluorescent characteristics of precipitated sodium zinc uranyl acetate when viewed under UV illumination. These tests were reported by White (U. of Maryland) in J. Chem. Educ. (1949?).

Second: a qualitative separation by chromatographic techniques. A brief manual of this technique has been prepared by (Miss) Fillinger, Hollins College, Hollins College, Virginia.

The utilization of spot test techniques was deemed of little value in teaching qualitative analysis, both because the tests do not, by example, teach much chemistry of the compounds or elements, and also because of the student's lack of experience in organic chemistry.

4. "The relative merits of thioacetamide reagent and hydrogen sulfide." --Those who were using thioacetamide were enthusiastic in their praise of it and considered it superior to H_2S .

5. "The relative merits of macro and semi-micro methods." --Those using the semi-micro method preferred that method to the macro method, claiming the technique to be more rapid (enabling more analyses to be run), less expensive of reagents, and capable of giving cleaner separations.

6. "The relative merits of the centrifuge and pressure bulb techniques." --Very few had tried the pressure bulb method in class teaching, but were aware of its possibilities.

7. "The preparation, distribution and grading of qualitative unknowns." --Again the Group offered several individual methods for the handling of student unknowns. In general, the student was penalized equally for all errors, either for failure to report an element or anion actually present or for reporting a substance not actually present. Most of the Group indicated that they required the confirmatory tests to be shown along with the final report on an analysis. In most cases, also, a student was allowed a second report with a chance to raise his grade if his first report was grossly in error.

8. "Should students learn the analytical schemes and be responsible for equations for the reactions?" --Practically unanimously --yes.

9. "Should commercial products be included as unknowns?" --Not all were incorporating commercial products among their list of unknowns. Some were using them successfully. Among the commercial products suggested were table salt, cleansers and water softeners, and baking powders.

10. One member described his plan of having students, working in pairs, make up synthetic practice unknowns for each other. The student is not graded on this unknown but it serves as a practice sample before he begins work on his issued unknown.

The following topics deal with the teaching of Quantitative Analysis.

10. "Should laboratory hours be strictly regulated?" --apparently, in practice, many people did not strictly limit the amount of time a student may spend in the laboratory. Nevertheless, all agreed that if the student is aware that the prescribed work can and must be completed within the scheduled laboratory periods he will usually do so. This will obviate the necessity of providing either supervised or non-supervised extra laboratory time. Students should not be permitted to work in the laboratory without supervision, although this probable not as serious in quantitative laboratories as in the organic lab because of the less-hazardous nature of the work being done. Several indicated that they provide an extra, or make-up, period, scheduled at a definite time each week.

11. "What instruments should be included in a course in instrumental methods?" -- In general, the following, in order of decreasing necessity:

- a. Potentiometric titration assembly, pH meter, glass electrode, or its equivalent.
- b. Electroanalysis.
- c. Colorimeter (Coleman preferred).
- d. Spectrophotometer (Beckman Model DU).
- e. Polarograph.
- f. Spectrograph.

In no cases were radioactivity methods being taught, it being felt that this subject, at least as far as laboratory experience is concerned, should be left to the graduate program.

12. "How many unknowns should be required per semester?" -- The number here varied from seven to fourteen. Where fewer unknowns were required, however, there were other assigned experiments, such as calibrations, titration exercises, etc.

13. "Should the Kjeldahl determination be included in the introductory course?" --The Group was divided on this question. An interesting factor

here was the type of samples employed by those using the determination. The samples issued varied from dried food, to cereals, fertilizer, and even leather.

14. "How can students be induced to keep better laboratory notebook records?" --Everyone agreed that it was difficult to impress upon the student the necessity of keeping neat, complete and proper notebook records of his laboratory work. No significant suggestions were made toward the alleviation of this difficulty.

15. "To what extent should classical methods be replaced by the more modern instrumental techniques?" --practically all agreed that, for an introductory course at least, the classical methods provide the fundamental techniques and also provide basic chemical theory. For this reason these methods are a significant part of the course in quantitative analysis. A thorough grounding in these fundamentals must precede the introduction of "push-button" instruments, where the shiny black case, the knobs and dials, so often hide the chemistry involved.

16. "Relative merits of distilled and de-mineralized water for laboratory use." --Either was considered satisfactory, with the de-mineralizer apparently the more preferred because of its simplicity.

17. "To what extent should the student be required to calibrate his equipment?" --In all cases, calibration of the volumetric glassware (buret, pipet, flask) was considered essential. A calibration of the analytical weights was considered too time-consuming to be required in the introductory course, but thought of to be of value in an advanced course.

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One member of the Group described the program which has been recently introduced at his school wherein qualitative and quantitative analysis are being taught simultaneously in a single year course. This is accomplished by using the same separations for the quantitative procedures as are used in qualitative analysis. In many cases the student is allowed a choice of quantitative method once the separation is made. Since the program is relatively new, a definite opinion as to its merit would be premature. However, the indications are that it will be satisfactory.

Another Group member described his method of requiring frequent library reports --a report on a 3 X 5 filing card, abstracting an article from recent literature. He reported that such a procedure had been used

successfully to encourage students to acquaint themselves with the current literature.

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This summarizes most of the topics discussed by the Group. Many other things were mentioned briefly and a great number of interesting and helpful comments were offered by everyone participating in the discussion, but because of their great number it would be impossible to include all of them in this brief summary.

Submitted by,

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