BULLETIN

of the

American Association of Jesuit Scientists

Eastern Section
Founded 1922

PROCEEDINGS

of the

Twenty-Second Annual Meeting

MARYLAND-NEW YORK, September 2nd
Fordham University, New York, N. Y.

NEW ENGLAND, August 26th
Weston College, Weston, Mass.

Published at
CHEVERUS HIGH SCHOOL
Portland, Maine

Vol. XXI OCTOBER, 1943 No. 1.

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Bulletin of American Association of Jesuit Scientists

EASTERN STATES DIVISION

Vol. XXI **OCTOBER, 1943** **No. 1**

REV. ARTHUR J. HOHMAN, S.J.

R. I. P.

Early Education—St. Agnes Parochial School, Buffalo, N.Y.
High School—Canisius High School, Buffalo, N.Y.
College—Carroll College, Cleveland, O.
Ordained—Woodstock, Md., May 18, 1918.
Canisius College, Buffalo, N.Y.
Georgetown University, Washington, D.C.
Ateneo de Manila, Philippine Islands.
Boston College, Mass., 1923-1930.
St. Peters, Jersey City, N.J., 1930-1943.

REV. ARTHUR J. HOHMAN, S.J.

1886 — 1943

It is a pleasure to record the facts of a scholarly and efficient man. Father Hohman of the Society of Jesus, passed rather soon from this life to his eternal reward. Essentially Father Hohman was mild of character, quiet in manner, but above all a faithful worker and thorough teacher and guide. He spent forty years in the Society, with a splendid and exemplary record—doing all things well. He entered the Society on August 30, 1903, and was 57 years old when he was called home to his eternal reward. His early life followed the regular routine, namely novitiate, juniorate, and studies in philosophy and theology. After finishing his course in philosophy, he had the regular teaching period, where his individual characteristics could declare themselves and could display his fine qualities.

His first assignment in his regency, was to Boston College. The first or Tower Building, was used for all the departments of the college. Having prepared himself for teaching chemistry, he was given charge of the chemistry department, which at that time was located in the basement of the college building. He managed the department with zeal and efficiency. He had four assistants and several hundred students, and showed them all by good example how to impart knowledge and do accurate work in laboratory assignments.

The following year, the new Science-building was erected at Boston College and Father Hohman had the task of moving the department to the upper floors of the new building. It is easily understood, by those who had experience, that this is a difficult task, and far from pleasant. In order to fulfill all the needs in the department, he was assigned space on the first floor, part of the third floor, and all of the fourth floor. By his ingenuity, he arranged the architect's plans into an excellent arrangement.

He was a relentless worker all his life and he could be found at his various tasks not only during week-days, but also on Sundays and holidays, always maintaining a terrific zeal to do his assigned work in a perfect manner.

He was intensely interested in acquiring the proper equipment for the department in the lecture-rooms, laboratories, balance-rooms, library, stock-rooms; including individual equipment for the various courses, demonstrations, etc., etc.

He prepared his lectures well in the various subjects that he taught. His main object in teaching was clearness and accuracy, and in answering the questions of the students, he was clear and to the point. In the laboratory he was a strict disciplinarian, and periodically had inspection of lockers and equipment to assure order and cleanliness. In grading students he was firm but just, and would not permit leniency or laziness. He also showed his zeal as a good Professor, by organizing a chemistry academy. The main feature of this academy was to invite outstanding speakers to lecture to the students on some industrial or academic phase of chemistry and its applications. He also encouraged the students to affiliate themselves to the great American Chemical Society, the greatest science society in the world. This fact, would get the students interested in the work and the phases and fields of chemistry. It is clear, that all his endeavors were for the betterment of the students, and the improvement of the department. He maintained this zeal all during his life as Professor of Chemistry. He again showed his zeal at St. Peter's College, where he labored from 1933 to 1943, in Jersey City, here again he had the task of moving from the old building on Grand Street to the Chamber of Commerce Building. This location was only temporary, because after two years he again moved the Chemistry department to the new college on Hudson Boulevard. By inspection, one could see his extreme care and great anxiety for details. This characteristic was displayed in all the innumerable parts of the chemistry department.

Not only was he most faithful in his college work, but he was also most generous in his zeal for the spiritual welfare of his fellow-man. Every Saturday he faithfully heard confessions in the parish-church and each week he conducted a Sodality; each week also he helped out in one of the parish churches of the city. His generosity for spiritual work was outstanding. He never shirked work of any kind, whether educational or spiritual. While here at St. Peter's College, he found time to compile a Laboratory book in General Chemistry, which is still used at the College. He displayed this good example and his zeal for his work and his duties everywhere he labored.

A sincere summary of his life can be expressed in these words: He was quiet in manner and most efficient in his work for God and man. May he rest in peace.

REV. RICHARD B. SCHMITT, S.J.

PROGRAM OF THE A.A.J.S. — NEW ENGLAND DIVISION

AUGUST 26, 1943

Weston College Auditorium

FIRST SESSION

10:00 A.M. — 12:00 Noon

Welcome in behalf of the Reverend Rector of Weston College.

Introductory Address
FATHER AHERN

Address: "Time, Space, Continuum".
REV. JOSEPH P. KELLY, S.J.

Address: "Some Methods of Navigation in Emergencies".*
REV. FRANK HEYDEN, S.J.

Address: "The Lie Detector and its Principles." With demonstrations.
MR. CLARENCE N. BLAIS, S.J.

Address: "The Quadricentennial of Copernicus".
REV. M. J. AHERN, S.J.

Lunch

SECOND SESSION

2:30 — 5:00 P. M.

Address: "Some Methods of Micro-photography". A demonstration.
FR. AHERN assisted by MR. BLAIS

Discussion: "Our Science Teaching After the War".
A general discussion.

Scientific Motion Picture: "Petroleum and Its Uses".

* *Paper published in this Issue.*

PROGRAMME

Of the Twenty-second Annual Meeting

of the

AMERICAN ASSOCIATION OF JESUIT SCIENTISTS

EASTERN STATES DIVISION

(Maryland and New York Sections)

held at

FORDHAM UNIVERSITY, New York City

Wednesday, September 1, 1943

* * * * *

GENERAL MEETING

A short General Meeting, at which the customary business will be expedited, will be called at 10:00 A.M.

Immediately after the General Meeting and at such time in the afternoon as the Sections may determine, the Members will meet in Sectional Groups for the reading of papers according to the following programme.

SECTIONAL MEETINGS

BIOLOGY SECTION

(*Chairman*: Rev. Philip O'Neill, S.J.)

Circulation in the living transilluminated spleen: Fr. A. Coniff.
Some effects of colchicine on mitosis: Fr. Charles A. Berger.
Chromatic bodies in resting nuclei of spinacia stems:
Mr. Daniel McCoy.
Change of type in certain species of Bacteria: Mr. Ricard Anable.

CHEMISTRY SECTION

(*Acting Chairman*: Rev. Richard B. Schmitt, S.J.)

Occupational deferment of Chemistry Majors in the selective service system: Fr. Joseph T. Brown.
Application of statistics in industrial chemistry:
Fr. Francis W. Power.
Phenol Coefficient: Fr. Richard B. Schmitt, S.J.
The utilization of secondary-school chemistry in colleges:
Mr. Joseph A. Duke.
A device to aid drill work in symbols, valences and formulas: Mr. Howard McCaffrey.

MATHEMATICS AND PHYSICS (Combined)

(*Acting Chairman*, Mathematics: Rev. F. W. Sohon, S.J.)
(*Acting Chairman*, Physics: Rev. John S. O'Conor, S.J.)

The Angle Point: Fr. F. W. Sohon.

The Copernican Universe: (by title) Fr. Paul A. McNally.

Changes in the notion of Axiom in the development of non-Euclidean Geometry: Mr. Henry A. Boyle.

Hints on the care of preservation of laboratory furniture: Fr. Joseph Kelley.

Suggestions for simplified explanation of frequency modulation on the basis of electromechanical analogy: Fr. John S. O'Conor.

War-time acceleration in the teaching of elementary mathematics: Fr. Edward C. Phillips.

A closing general meeting will be held at 2 P. M.

Minutes of the Twenty-second Annual Meeting of the American Association of Jesuit Scientists. (Eastern States Division Maryland and New York Sections.)

On September 1, 1943, in the Lounge of Bishop's Hall, Fordham University, at 10 in the morning, began a one day session of the American Association of Jesuit Scientists, Maryland and New York Sections.

Fr. Robert I. Gannon, S.J., President of the University, in a cordial speech of welcome, congratulated the members on their successful efforts to keep the Association alive during these difficult war-years. He stressed the absolute need of continuity in all our institutions because of the still greater difficulties which face us, if a new beginning must be made after the war. He pointed out that Fordham University is making the same effort and is resolved not to allow any department of the University to be discontinued during the war.

The reading of the minutes of the preceding meeting having been dispensed with, they were approved as printed in the October 1942 issue of the Bulletin.

The report of the treasurer was presented by Fr. F. W. Power and approved by vote.

The President of the Association appointed Fr. R. B. Schmitt and Fr. F. W. Sohon to act as a Committee on Resolutions. The general meeting was then adjourned until 2 P. M. and the various Sections held separate meetings.

At 2 P. M., the general session was reopened with a report of the Committee on Resolutions. The following resolutions were approved by the Association:

Whereas, in these troublesome times, the arrangement of a place of meeting was no easy task, that was made possible by the invitation of Fordham University to assemble in her halls, be it resolved:

That the Association of Jesuit Scientists express its appreciation to Fordham University and to Rev. Fr. Rector, Fr. President and Fr. Minister for their hospitality to the members of the Association for their annual meeting and for the kind invitation to hold future meetings at this great metropolitan university, and be it further resolved:

That a copy of these resolutions be transmitted by the secretary to the above named fathers.

Whereas, the past year has witnessed the passing to a better life of Father Arthur J. Hohman, S.J., who was a charter member of this organization, who has given unstintedly of his time and ability to promote the activities of this Association, be it further resolved:

That this meeting express its sense of a loss in so active a member and that they individually remember him in their prayers and Masses to the Supreme Scientist, who alone knows the secrets of the universe.

Fr. John S. O'Conor called the attention of the members to an excellent "Symposium on Post-War Planning for Jesuit Education" sponsored and edited by Fr. Allan P. Farrell, S.J. which appeared in the June issue of The Jesuit Educational Quarterly; he also noted that only two scientists were listed among the 36 contributors to the symposium. In a formal resolution, the Association expressed the desire that someone write an article which will give the views of a Jesuit scientist on this subject. Fr. O'Conor was invited to write the article.

The secretary of the Association was then instructed in another resolution, to write to Fr. Farrell, who is also the Managing Editor of the Quarterly, and to inquire what methods are used to canvass the opinions of Jesuit scientists on the subject of Jesuit education.

The question was asked, whether, in the training of ours, sufficient stress is laid on the physical sciences. During the discussion, Fr. J. J. Hennessey described the new courses in mathematics which are now being offered at Woodstock and Fr. E. C. Phillips summarized the general policy which governs the teaching of the physical sciences in our seminaries. We follow the directives of the Holy See and meet the minimum requirements of the local accrediting associations; crowded schedules will not allow more.

By a rising vote of thanks, the members of the Association thanked Fr. Phillips, the president, for his time-consuming efforts, in the midst of many other occupations, to arrange for this successful meeting.

In consequence of the absence, due to war conditions, of the members of the New England Province, no elections were held either by the general assembly or by the various Sections, and there was no report on any business transacted by the Sections.

In view of the fact that the Chairmen of all the Sections except Biology, are in the New England Province the following members of the Maryland and New York Provinces were appointed in May to act as pro tempere Chairmen for the solicitation of papers, preparation of the Programmes and presiding at Sectional Meetings.

Rev. R. B. Schmitt (Chemistry).

Rev. F. W. Sohon (Mathematics).

Rev. J. S. O'Conor (Physics).

The association owes these generous members a debt of gratitude.

There being no further business, the general session was then adjourned at 2:30 P. M. and the Sectional Meetings were resumed.

The following members attended this meeting:

FATHERS:—

J. Assmuth
C. A. Berger
T. J. Brown
A. A. Coniff
J. J. Hennessey
A. A. Hufnagel
J. M. Kelley
E. L. McDevitt
P. H. McGrath
J. B. Muenzen
J. W. Murray
J. S. O'Conor
P. H. O'Neill
J. Peters
E. C. Phillips
F. W. Power
A. C. Roth
R. B. Schmitt
F. W. Sohon
L. M. Yeddanapalli
R. T. Zegers

SCHOLASTICS:—

R. J. Anable
R. G. Belmonte
H. A. Boyle
T. L. Cullen
J. A. Duke
H. A. McCaffrey
C. E. McCauley
D. F. McCoy

ABSTRACTS OF PAPERS DELIVERED AT THE NEW YORK-MARYLAND SECTION MEETING IN SEPTEMBER 2, 1943

PHENOL COEFFICIENT

(Abstract)

REV. RICHARD B. SCHMITT, S.J.

Phenol Coefficient is employed as a measure of the bactericidal compounds in comparison with phenol under standard conditions of examination. Many antiseptics when tested against organisms, have phenol coefficients of over a thousand. In other words, the problem is to find the concentration of phenol necessary to destroy the active bacteria without injury to the tissue.

The methods used today are uncertain and difficult to determine. For example, all materials must be completely sterile, which is done by the use of a good autoclave with high temperature, high pressure and a definite length of time.

The demands of the Bureau of Standards are necessary and difficult to obtain. Both local and systematic action of phenol are of practical importance. The methods we have at present could be improved.

PAPER: WAR-TIME ACCELERATION IN THE TEACHING OF ELEMENTARY MATHEMATICS

(Abstract)

REV. EDWARD C. PHILLIPS, S.J.

This paper described a condensed course in "factual Geometry" given to Army trainees to prepare them for admission to the general Freshman Mathematics Course of the Basic Engineering Curriculum. The students were all High School graduates, but had had no course whatever in Geometry. The syllabus was made so as to include all the definitions and propositions which would be directly used in the basic course; this "supply" course did not aim at giving a systematic development of the science of Geometry. Forty class-hours was the limit of time allowed by the Army authorities. The first class of about twenty students took a standard Plane Geometry Examination at the end of the course and most of them passed it with a rating of over 90%.

AN ELECTROMECHANICAL ANALOGY FOR THE SIMPLIFIED EXPLANATION OF FREQUENCY MODULATION

(Abstract)

REV. JOHN S. O'CONOR, S.J.

Amplitude modulation may be represented as the output of an alternator driven at constant angular speed,—on the direct field current of which is superposed a sinusoidal variation.

If an alternator is postulated in which the usual stator is not fixed but rotatable, and if this "stator" is rocked with an instantaneous angular velocity proportional to the instantaneous value of the modulating wave,—while the rotor is driven at constant speed, then the combined output is frequency modulated.

In addition to the above analogy, the graphical methods used for explaining the various types of modulation were briefly discussed and attention called to the treatment in the recently published "Applied Electronics" by E. E. Staff of M.I.T.

SAVING THE SURFACE OF LABORATORY FURNITURE

(Abstract)

REV. JOSEPH M. KELLEY, S.J.

Since the tops of laboratory tables soon show the effects of carelessness, accident and a sort of vandalism that seems inherent in a student in the presence of a neat and polished surface, some precautions for protecting and saving the appearance as well as the usefulness of laboratory tables seem worth noting. Here is suggested the use of a covering of some composition such as masonite which may be readily cut to the size of the table and when coated with acid proof paint makes a very neat appearance. No nails or tacks are needed to fasten the masonite in place if gummed paper or bookbinders' tape is used. Gummed paper is useful also instead of pins or tacks in fastening paper securely to the table top. Heavy cardboard, rubber matting, shields for table clamps, holders for messy pieces of equipment also help have the surface.

THE EXHALATION OF RADON FROM THE EARTH

(Abstract)

THOMAS L. CULLEN, S.J.

A resume was made of the work done by investigators in Dublin, Manila, and Innsbruck. The experimental value of the rate of exhalation was in close agreement with the value theoretically deduced from the amount of radon present in the atmosphere. The amount of radon in the soil at 3 cm. depth varies inversely with the exhalation, while the amount present in the atmosphere varies directly with the exhalation. Exhalation is impeded by cold weather and heavy rains, and is aided by strong winds.

ASTRONOMY

EMERGENCY NAVIGATION

REV. FRANCIS J. HEYDEN, S.J.

The present war is certainly "global" in its extent over the surface of the earth. The ordinary soldier, sailor, or aviator is confronted too often in the wide-spread battles for jungle and desert positions, for tiny islands or beach-heads, with the problem of finding his geographic position with reasonable accuracy in all sorts of emergencies. Eighteen men navigated from Corregiaor to Australia in an open boat with the aid of a small grammar school geography and a minimum of equipment. Soldiers are set adrift in their landing barges several miles from shore, and the responsibility of reaching the exact point for attack rests on the shoulders of the officer, an army man, in charge of the boat. The sailor may find himself alone on a life raft in the middle of the ocean. The aviator may be caught in the predicament of having his navigator wounded or killed. He may be a lone fighter pilot shot down between friendly and enemy shores. No branch of the armed service is exempt from such emergencies in the present war. Both Army and Navy recognize this fact, and they have shown much solicitude in recent months to provide simple methods for navigation in emergencies.

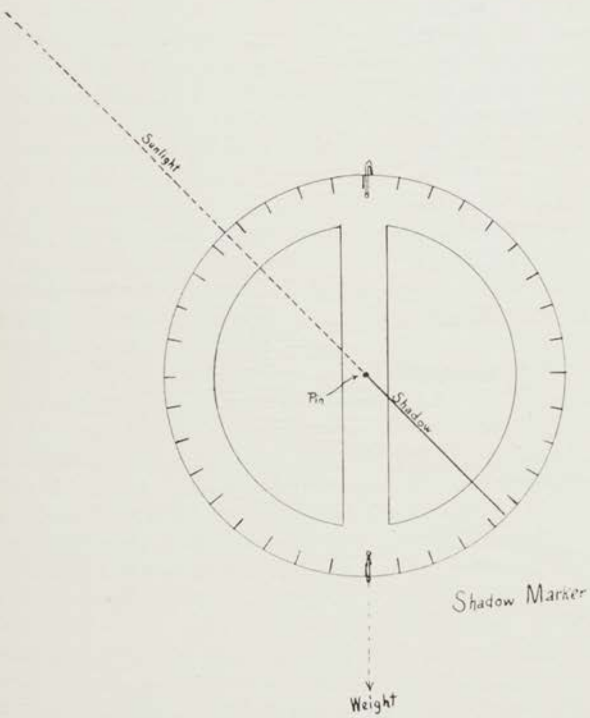
In preparing for an emergency we must consider all possible conditions. It is wrong to assume that there will always be instruments, charts, and an experienced navigator on hand. Under such conditions there is no emergency as far as navigation is concerned, The real emergency is the one in which the party involved has a minimum of knowledge and equipment for solving the navagational problem. We shall consider just what this minimum of knowledge and equipment should be.

The minimum knowledge for emergency navigation does not take long to acquire. If observations are restricted only to the meridian passage of the sun, or the altitude of Polaris in northern latitudes, the computations are reduced to simple addition and subtraction, and the methods of observation become least complicated. A clear understanding of how the principal celestial and terrestrial co-ordinates are fixed in the sky or on the earth without their complicated trigonometric relations is sufficient to enable one to compute a latitude and

*Note: This paper was delivered at the summer meeting of the A.A.J.S., New England Division, August 26, 1943 at Weston College, Weston, Mass.

longitude and to plot it on a chart. It is not difficult to learn how to work with a Mercator chart and to convert a true course to a magnetic course for a compass. One can pick up such knowledge alone from a simple textbook or became very proficient in it within a week or two in an elementary course on navigation.

The equipment required for observing the noon altitude of the sun and deriving a reasonably exact position from it consists of a good watch running on some standard zone time and a little graduated circle with a pin at the center which we call a "shadow marker". The shadow marker is such a simple instrument that almost any one can construct it. Yet experiments with it prove that it will give altitudes of the sun with an accuracy of about 0.°1 or roughly within six nautical miles. The principle of the instrument is this, that a weight hung at the bottom orientates the zero point in the direction of gravity, or along a vertical line running from the zenith to the nadir. The shadow cast by the pin in the center is sharp enough to permit readings within a fraction of a degree on the scale.



If the shadow marker is reversed so that a reading is taken on two sides, the average of the two readings eliminates errors which may arise from poor orientation of the scale.

There will be some difficulty in handling a shadow marker in an open boat. A heavy weight, a wrench or hammer, will keep it in the vertical line despite the swaying of the boat, but a slight wind will cause it to spin around. The effect of the wind can be greatly eliminated by reducing the solid area of the disk. The best model is constructed by first pasting the compass rose from a position plotting sheet on a thin board and then cutting around the scale inside and out so that only a narrow rim and a strip through the center for supporting the pin remain. The diagram shows the appearance of the shadow marker. The larger the circle, the greater will be the accuracy of the observations. The wind does not bother it very seriously, and, while making an observation, it can be shielded somewhat from the full effects of the wind.

To determine the noon altitude and the time of apparent noon as accurately as possible, the best procedure is to take a series of observations before and after the meridian passage of the sun. Generally the victims of an emergency have plenty of time for making these observations. By plotting the observed altitudes against the time of each observation a smooth curve whose maximum indicates the noon altitude and its time to within a minute can be drawn. If carefully done, the results should give the latitude within 0.°1 and the longitude within ten miles, provided the watch used for time was still quite accurate.

Besides the observations there must be some data for the sun's declination and time of meridian passage. These values can be tabulated for intervals of ten days in two compact tables. Intermediate values can be obtained with sufficient accuracy by interpolation. For altitudes greater than 30° refraction is negligible and no further corrections are necessary for the observed altitude because the shadow marker indicates the altitude of the sun's center and with respect to the direction of gravity instead of the visible horizon. No "dip" correction is required.

The equation of time is eliminated by giving the Greenwich Civil Time of the meridian passage of the sun. Since this varies only slightly within twenty-four hours, the tabulated G.C.T. of local apparent noon at Greenwich can be assumed to be the same all over the earth on any date. Thus these tabulated times are the local civil time of the apparent noon at any place. Declinations are obtained in the same way.

Let us assume that the observer's watch was set originally for the standard time zone, three hours west of Greenwich, and that he has some idea of the rate of the watch. Then no matter where he is, he will be able to observe the G.C.T. of the sun's passage at his meridian. He simply observes the watch time, corrects it for the rate of the watch, and adds three hours for the zone. He may have drifted half way around the earth, but he can still find the G.C.T. from his watch. From the tabulated data he has the local civil time for noon. The difference between the G.C.T. according to his watch and the tabulated L.C.T. gives him his longitude.

The shadow marker indicates the altitude of the sun. If he has made a series of observations, the peak of the smooth curve tells him the noon altitude. He can find the sun's declination for the date from his table. A simple rule for deriving the latitude from the altitude and declination runs as follows "Find the zenith distance by subtracting the observed altitude from 90°. Mark the result N or S opposite to the bearing of the sun. At noon the sun bears either directly north or south.) Take the algebraic sum of the zenith distance; and the declination; that is, add if both are N or S; subtract if one is N and the other S. Give the result, which is the latitude, the name (N or S) of the greater."

At present the shadow marker is practical only for observations of the sun. For stars some sort of sextant is necessary. We do recommend that a crew in a life-boat try to salvage a damaged sextant. With a sextant at hand it is possible to do regular navigating, at least to the extent of the knowledge of the observer. The very least he can do is find his northern latitude by an observation of Polaris. The small corrections necessary for this observation have been reduced to a compact table in which the amount to be added to or subtracted from the observed altitude corresponds to the meridian passage of certain well-known stars. For example, if Capella is on the observer's meridian when Polaris is observed, the correction for the observed altitude is —0° 37′; if Regulus is on the meridian, the correction is 0° 34′.

Having found his position, the castaway is not out of his difficulty. He has to decide where he is to go from there. If his watch is unreliable, he will soon lose track of his longitude, but he can always travel due east or west at the same latitude. In mid-ocean currents are important factors in deciding the best direction. The speed of the boat can be estimated by timing the passage of floating objects from bow to stern, but the current must be found from a chart. At present every life-boat or raft is equipped with a set of pilot charts showing currents and prevailing winds. These charts are printed on waterproof material and can be used for determining course and position. In case no charts are available, the progress of the boat can be determined in a day or two. If a current is strong, the more prudent procedure would be to turn and sail with it, even if the distance to the nearest land is greater.

Dr. Bart J. Bok at Harvard has prepared a small booklet which contains the basic instructions for navigation in emergencies and all of the tables for the time of noon, the sun's declination, magnetic variation, corrections to the altitude of Polaris, and a condensed traverse table. The booklet has been published on waterproof paper and is small enough to be tucked away in a uniform pocket or worn in a case tied around the neck. It has proved popular not only among the officers of the Amphibian Command for whom it was originally prepared, but with several officers of the Merchant Marine. The Coast Guard has asked for a more detailed edition which is now being prepared. The chief points considered in the booklet have been touched upon in this paper. Other methods of navigating in emergencies have been omitted from the booklet mainly because they seem less practical and are not as accurate as the shadow marker method.

Professor Smiley has published a very simple method in "Popular Astronomy" for May, 1943, which requires only a watch and a table of times of sunrise and sunset with latitudes corresponding to the lengths of day. The method gives an accuracy of only half a degree and presumes that the observer will be able to see the sun at both sunrise and sunset, which is not often possible at sea.

The Naval Observatory is developing a supecial sextant for use in emergency navigation. A manufacturer in New York is planning to make a sextant which will be reasonably accurate and retail for $1.50. There has been no recent news about either of these instruments. Every now and then some one comes in with an idea or an instrument which is as good as, if not better than, the shadow marker, but none have equalled it so far in simplicity. We feel that it is something which can even be built on a life-raft and have included a large printed compass rose with the waterproof booklet.

CHEMISTRY

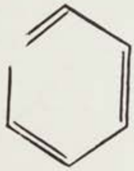
THE CONCEPT OF RESONANCE IN CHEMISTRY

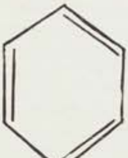
Rev. Bernard A. Fiekers, S.J.

For a definition of resonance let us present one that is largely based on that given by H. J. Lucas.[1] This definition is taken from the findings of other sciences, namely quantum and wave mechanics, and its terms are here discussed and explained. It can be accepted if necessary just as a working hypothesis may be accepted; its verification is to be sought in its many applications, especially in the field of organic chemistry. This definition follows.

"Whenever it is possible to write two or more reasonable structures for a compound in such manner that each of them differs only in bond types or in the location of distributed electric charges, but not in the position of any atom or group, then the truer structure for that compound is not given by any of the alternatives written; rather it is to be considered an average of all these alternatives, even though this average cannot be expressed in conventional structural formulas. In such a compound interatomic distances are generally observed to be shorter than normal distances; and the compound is stabler, requiring more energy to dissociate all of its atomic components than that which can be calculated from conventional bond energies. The compound is then SAID to resonate among all the structures proposed. The latter are said to contribute to the resonance of the compound. The weighted average of these contributions approaches the true representation of the compound itself according to the reasonableness or probability of each contributing structure."

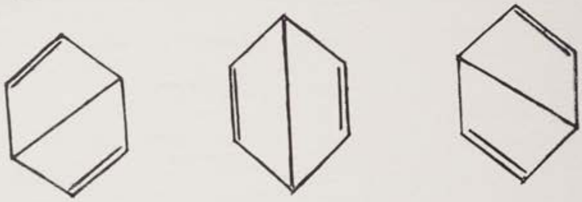
Reasonable structures are probable structures. Structure and energy are interrelated. Just as a triangle is more rigid a model than a parallelogram, to select a static example; likewise, certain dynamic





[1]H. J. Lucas, Chapter II., "This electronic basis of valence," pp. 6-b24 in E. F. Degering and others, "An outline of organic chemistry," 4th ed., Barnes and Noble, Inc., New York City, 1941, p. 11.

structures are more stable than others. The Kekulé structures for the benzene ring are generally accepted as stabler structures than the Baeyer, Ladenburg and other proposed models. In these examples the larger energy associated with "cross-bonding" indicates a greater ten-



dency for the structures to "fly apart"; less stability is therefore to be expected from such structures. These models have therefore less reasonableness and less probability.

This may seem to be arbitrary empiricism. The development of the concept presented here is substantially that of Pauling,[2] and "the student of chemistry", Pauling believes[3], "is able to develop a reliable and useful intuitive understanding of the concept of resonance in chemistry by a study of its applications to various problems . . ." The student of organic chemistry soon becomes familiar with conflicting properties of certain compounds that do not bespeak their conventionally written structures. By applying the resonance principle based on this knowledge, he can soon make an approach to the true structures of many of these compounds.

Structures are to differ only in the types of bonds or in the distribution of electric charge. Resonance can occur only between structures with the same number of unpaired electrons. Secondly resonance is not tautomerism. Keto enol isomerism is not a resonance phenomenon. For here in addition to the shift of the double bond there is also involved a shift of a hydrogen atom.

$$CH_3\ C{:}O\ CH_2\ C{:}O\ OC_2H_5 = CH_3\ COH : CH\ C{:}O\ OC_2H_5$$

There is to be sure a shift of electrons. This will be discussed later. Hydrogen chloride shows distribution of charge to some extent in its resonance forms and it is considered to resonate between the forms

$$\mathrm{H} : \underset{\cdot\cdot}{\overset{\cdot\cdot}{\mathrm{Cl}}} : \qquad \text{and} \qquad \overset{+}{\mathrm{H}} : \underset{\cdot\cdot}{\overset{\cdot\cdot}{\mathrm{Cl}}} :$$

A third possible structure:

$$\overset{-}{\mathrm{H}} : \underset{\cdot\cdot}{\overset{\cdot\cdot}{\mathrm{Cl}}}^{+} :$$

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[2] L. Pauling, "The nature of the chemical bond," 2nd ed., Cornell University Press, Ithaca, N. Y., 1940, 450 pp.
[3] ibid., p. 11

is considered highly improbable, due to the relatively greater electronegativity of chlorine with respect to hydrogen, and does not make a substantial contribution to the truer hydrogen chloride molecule.

The truer structure of the compound is not given by any of the alternatives written. The truer structure of benzene is not to be found in either of the Kekulé formulas nor in any of the other proposals. It we take successively two viewpoints, this principle may be clarified. Firstly, for any given moment, considering the electron as a particle with high velocity in a dynamic system, it is most likely to be found for the moment in a position and in a given configuration that lends maximum stability to the system. Since it is to be found in this situation most of its time, the larger atomic particles take up stable positions demanded by the electron density in this neighborhood within the structure. Now, if the electron should leave this neighborhood of overall stability from time to time, absent but for relatively short and infrequent periods, it would be impossible for larger and inert masses, such as atomic particles, to take up corresponding positions as rapidly as an electron. Now secondly, if we change our viewpoint and consider the phenomenon over a longer period of time, the larger particles will be effected to some extent by these electron excursions. The alteration will be dictated by the overall amount of time spent by electrons in absentia. Thus the truer picture of the system is to be had by considering the larger atomic particles in the system. At that point the electron picture can be neglected. None of the written alternatives in benzene, for example, adequately describe the molecule. Benzene does not vibrate between its resonance contributors in some ultra rapid tautomerism. Benzene, according to the resonance concept, is a hybrid molecule, a mongrel if you wish, the contributors are listed in its pedigree. Further, benzene is more adequately described as an average, a resultant of all contributors. Some of the contributors have low probability from energy considerations, and thus have but small contribution to make to this "weighted" average.

We may speak of an average or resultant structure. But we cannot say that the energy associated with this configuration is likewise an average. For the compound is stabler than stability calculated from conventional bond energies would indicate. In speaking therefore of an average structure we are somewhat inaccurate, and, for want of a better term, we choose one that approaches the true concept the closest. For energy and structure bespeak each other.

Such a compound is stabler than calculated stability requires. conventional bond energy values for making these calculations are culled from thermodynamic data for systems that do not resonate or resonate but slightly. In that realm there is fine agreement between data; whereas data originating in compounds, recently classified as resonating, have necessitated the development of this concept. The concept of resonance serves to harmonize the exceptions with the rule.

The question may be raised: Why are such compounds stabler? The answer is to be found in wave mechanics. Still a reasonably indicative answer may be given here. An inanimate electron when engaged in interaction with a larger atomic particle is associated with relatively high energy; when however it has to maintain dynamic equilibrium with many atomic particles and with other electrons as wel, when in a word it is an element in a more complicated system, then its energy in the large is nicely occupied. It is in the position of the theoretical horse equidistant between two bales of equally appetizing hay. With but a single bale to take care of, a picture of energy dissipation is guaranteed.

This concept of resonance differs essentially from the concept that the etymology of the term suggests. In many texts a vibrational concept is given or implied. The vibrational concept suggests some simply uniform vibrational mode. It would bespeak some average of all the complicated electron vibrations in a structure. Thus according to the vibrational concept, the second bond in any double is pictured as vibrating off one linkage and onto another with very definite frequency. Indeed the Planck equation:

$$e = h n$$

has been used to correlate this so-called frequency with the resonance energy. Such a concept is more primitive; but it goes a long way in giving an adequate explanation of phenomena for certain compounds, such as, for example, the two Kekulé structures for benzene; but it is only difficultly applicable to other compounds such as the guanidinium ion, the less probable contributors to benzene resonance and to compounds like hydrogen chloride that have distribution of charge. Modern thought on the matter calls for a less even distribution of vibrational frequencies than such a concept offers.

It would seem then that, according to the modern acceptance of the concept, resonance is not tautomerism, nor it is some highly simplified average vibrational phenomenon.

PHYSICS

THE CONSTRUCTION AND CALIBRATION OF A VACUUM-TUBE VOLTMETER.

By William G. Guindon, S.J.

The study of the output characteristics—voltage and power as functions of load resistance—of a power tube can be most easily carried out when a voltmeter of very high internal resistance is used to measure the drop across the load resistance. In studying these characteristics of a type '80 power tube at Weston College the writer had at his disposal only one voltmeter which covered the range needed, and this one had an internal resistance of 1500 ohms—10 ohms per volt on the 150-volt scale. This of course, meant that the measurement of the tube's output had to be limited to values of load resistance less than 1500 ohms, since the true load could never exceed the internal resistance of the meter, no matter how large the apparent load was made.

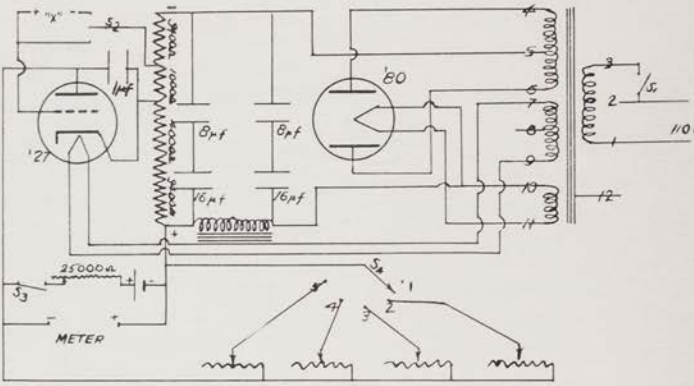
After this experience it was decided to construct a vacuum-tube voltmeter, which would act as though it had an internal resistance of infinity. The project would serve a double purpose of providing experience in designing an electronic circuit for a definite use and also of furnishing the laboratory at Weston with a voltmeter which would be of permanent value.

The general type of circuit chosen was that in which an unknown voltage inserted in the grid circuit of an amplifying tube causes a corresponding current in the plate circuit. The plate current can then be calibrated in terms of the input voltages.

The tube selected to act as the core of the instrument was a type '27, since this is a simple triode and one that was at hand. Provided with a proper plate potential and biased approximately to cut-off (for this a bias of roughly one quarter of the plate potential is necessary) the plate current in the tube will indicate any change in the grid voltage, except a further increase of bias. The unknown a. c. or d. c. voltage placed in series with the bias and the grid will cause a proportional change in plate current which is read on a milliammeter placed in the plate circuit. The plate circuit is shunted by a condenser filter to minimize the effect of the alternating component of the plate current when measuring a. c.

It was deemed advisable to provide a built-in power supply for the '27, since the necessity of exactly reproducing the power supply used in calibrating the instrument for every use of it would provide useless work and be a potential source of error. Hence, a type '80 power supply was designed to give the voltages needed for the plate and grid of the type '27. The circuit chosen was that of a full-wave rectifier with a pi-section filter and a resistance load acting as a drop-wire voltage divider. The taps from this drop-wire provide the voltages for the plate potential and grid bias of the type '27.

The diagram for the circuit is shown in the figure below.



A single transformer provides all the voltages needed for the entire hookup: 2.5 volts for the filament of the '27, 5.0 volts for the filament of the '80, and 600 volts with a mid-tap for the plates of the '80. Switch S_1 opens the primary. The numbers given on the taps on the diagram have been marked on the transformer.

The filter unit first attempted was made up of a choke coil with core and two 8 microfarad condensers. However, under the actual load conditions, the condensers, liquid electrolytic type, overheated because of the high potential across them. It was decided to distribute the 300 volts potential over two condensers in series in each arm of the filter. Hence a 16 microfarad (dry electrolytic type) condenser was inserted in each arm of the pi-section. There were no practicable condensers available which could take a peak voltage over 200 volts.

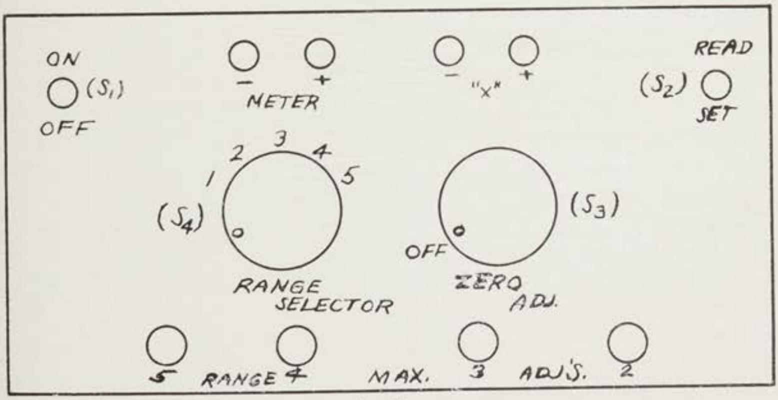
Another practical difficulty due to lack of material was encountered in arranging the load resistances which were to provide the voltage for the plate and grid circuits of the '27. A series hook-up, beginning at the positive end, in the following order: 3400 ohms, 4000 ohms, 1000 ohms, and 3400 ohms, gave a total drop of about 200 volts without overheating. They were all wire-wound resistors baked on porcelain cores. The juncture of the 4000 ohm resistor and the 1000 ohm registor served as the point of zero potential, to be connected to the cathode of the '27; taps from the juncture of the 1000 ohm and 3400 ohm resistors and from the positive end of the whole series give respectively—35 volts and 110 volts, to serve as grid and plate leads. All these resistors, as indeed all the parts of the meter, except the milliammeter itself, were taken from old radio sets.

Switch S_2 is used to connect the grid directly to its constant bias when the meter is not actually measuring. This is necessary to prevent damage to the milliammeter since the electron flow to the plate is left unretarded when the grid is left disconnected. S_2 is a single-pole, double—throw switch, which is so arranged that it connects the grid bias either directly to the grid or to the negative terminal of the unknown voltage. The positive unknown terminal is permanently connected to the grid itself.

The plate circuit filter of the '27 employs a one microfarad condenser. The meter is inserted in the plate circuit; no suitable meter was at hand for incorporation in the circuit, so one of the laboratory meters is connected externally. Across the meter terminals a switch, S_3, a 25000 ohm, variable resistor and a 1.5 volt battery are connected in series so that closing S_3 will cause a reversed current to flow through the meter. Adjusting the resistor sets the meter pointer to zero, despite the small constant current which arises in the plate circuit because the grid is not biased exactly to cut-off.

Since the greatest difficulty in the contructing the meter was experienced in securing the proper resistances in the load of the '80, the possibility of making the meter function for several ranges by arranging a set of different grid biases was not considered. The fact that the milliammeter to be used had a 5 milliampere range, while the tube would conduct in the hook-up up to 12 milliamperes pointed to arranging a set of shunts which could be selected by a Switch (S_4). Four such shunts were included, but only one was finally used.

After preliminary tests and calibration at Weston, the meter was taken to Boston College and there calibrated against standards. The



Panel Diagram

milliammeter used is a Weston Model 301 #777016, one of the laboratory meters of Weston College. The range for a. c. voltages is from one to twenty-four volts; for d. c. the meter has two scales: O-17 and O-37.

The following pages include operating directions and the results of the calibration.

OPERATING INSTRUCTIONS.

1. Connect the milliammeter (Model 301, #777016 to the posts marked "METER", observing polarity.

2. Switch S_2 to "SET" and connect unknown to posts marked "X", observing polarity.

3. Snap S_1 to "ON" and allow meter to warm up.

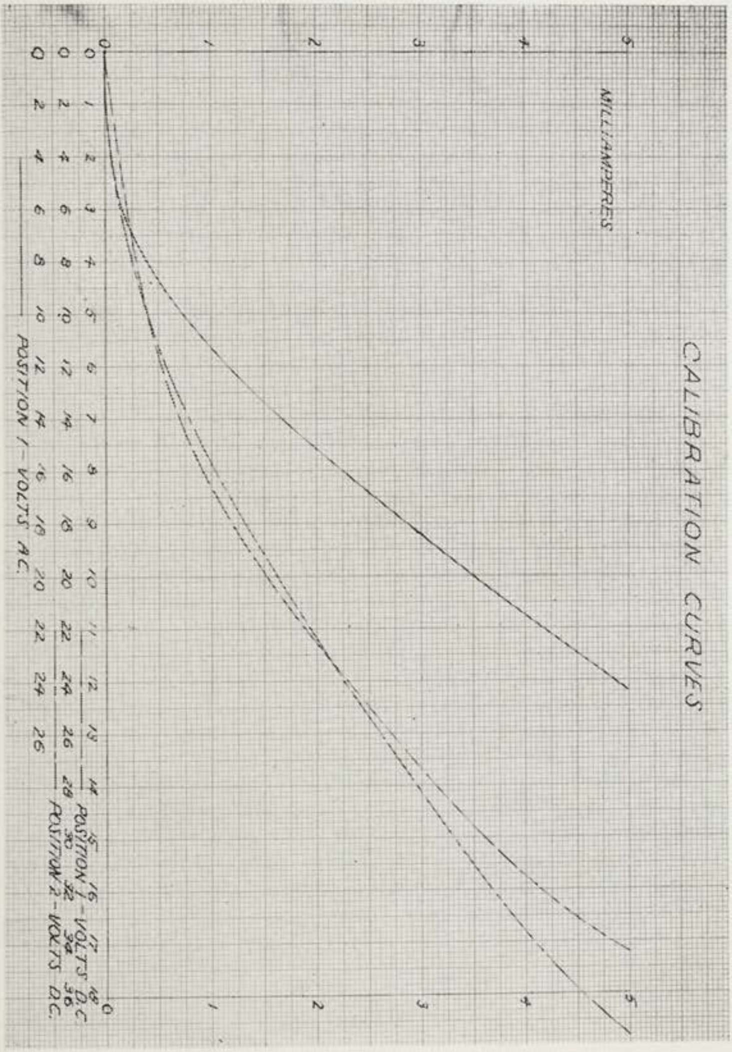
4. When milliammeter shows that plate current is steady (about 0.8 ma.) turn Zero Adjustor clockwise, thus closing S_3, and adjust until milliammeter reads zero. (This should all be done with S_4 Selector at "1")

5. Set Selector (S_4)to range desired.

6. Swith S_2 to "READ" and record value of current on milliammeter.

7. Consult calibration chart or table for the voltage across "X".

8. N. B. A. Be careful not to handle both meter and unknown terminals at once when power is on; 150 volts gives a good shock! B. The Range Maximum Adjustors should not be changed after calibration.


CALIBRATION CURVES
MILLIAMPERES
POSITION 1 - VOLTS D.C.
POSITION 2 - VOLTS D.C.
POSITION 1 - VOLTS A.C.

CALIBRATION DATA.

Position	Source	Meter Reading (Ma.)	Applied Voltage (Volts)
1	A. C.	5.0	24.4
		4.5	23.0
		4.0	21.6
		3.5	19.9
		3.0	18.4
		2.5	16.8
		2.0	15.1
		1.5	13.4
		1.0	11.25
		0.5	8.68
		0.25	6.90
		0.00	0.0
1	D. C.	5.0	17.2
		4.5	16.6
		4.0	15.7
		3.5	14.7
		3.0	13.7
		2.5	12.5
		2.0	11.3
		1.5	10.0
		1.0	8.25
		0.75	7.20
		0.50	5.75
		0.25	3.50
		0.00	0.0
2	D. C.	5.0	37.5
		4.5	36.2
		4.0	33.8
		3.5	30.8
		3.0	28.2
		2.5	25.2
		2.0	22.5
		1.5	19.6
		1.0	15.5
		0.75	13.5
		0.50	10.7
		0.25	8.00
		0.15	6.25
		0.10	4.60
		0.00	0.0

NEWS ITEMS

HOLY CROSS COLLEGE

Chemistry Department

The fleet came in on July 1, 1943 when the Navy V12 college training program was inaugurated at Holy Cross. At that time 250 civilians also reported to continue the thread of civilian life on the hill. Our Navy quota calls for about 621 Navy students. Our quota for premedical students stands at about 135 men. The rest are made up of N.R.O.T.C. students (quota about 188) and desk officer trainees. Among those who came, there were many transfers from other colleges. These came mostly from the smaller Catholic colleges around New York City and eastern New York State. Most upper class transfers will continue in their pre-service specialization as far as it is compatible with Navy studies. That brought us some chemists and many pre-medicals from other institutions. New Freshmen and men from the fleet will take the prescribed V 12 program. Under its prescriptions everybody will have at least one year of chemistry, except those who are to be transferred to the N.R.O.T.C. later on. Pre-medicals will get two and a half academic years of chemistry. Their first year comprises Navy C 1 and C 2, a general inorganic course with an introduction to qualitative analysis during the last eight weeks of the academic year. In second year they take quantitative analysis (C 3) during the first term, and this is followed by a year of organic chemistry (C 4 and C 5). Laboratory sessions according to this program are of three hours duration. Desk officer candidates will take general inorganic chemistry (C Ia and C2a) for the first three quarters of their second academic year and during the last quarter of that year they are in line for an intensely abbreviated Engineering Materials course (C 6). There is a place for physical chemistry (C 7) on the program for those colleges to which physics majors are assigned. This is purely a lecture course. The registration of this department stands at present at about 300 men, both civilian and Navy. We expect it to build up to about 400 or 450 men after the program has been permeated.

On the second of June Holy Cross graduated four men with the degree of Master of Science in chemistry. Of the four who started work for the same degree about the first of February this year, one resigned his fellowship to go into meteorology and the other three are expected to be awarded degrees about Thanksgiving time. The graduate assistant situation has become acute; on July 1st, Messrs. G. S. Gibson and J. L .Shea, S.J. came to this department in the capacity of part time laboratory instructors with part time teaching in other departments.

Prof. Olier L. Baril (staff) has been working for his doctorate at Clark University during the past few years and recently received the doctorate in chemistry from Clark. He experimented and presented a dissertation on the "Critical evaluation of Waters' theory in the Gattermann reaction".

At about the end of May, Alumni Day was held at the college. Some of the older alumni were astounded at the material progress made by the science departments. Among them was a former member of the department, Mr. Elmer Doyle, H.C. '18, who had not returned to the college since the day he left it in '23.

On May 18, 1943, Fr. Daniel Linehan of Weston College gave an illustrated lecture on seismology before the Worcester Society of Civil Engineers division of the Worcester Engineering Society at Worcester Polytechnical Institute. The meeting was well attended both by the professional engineers and students from local schools. Earlier in the day, the speaker and Fr. T. Smith gave a demonstration of seismic sounding at a proposed new air field west of the city.

Father Fiekers attended the Detroit meeting of the American Chemical Society at Detroit, Mich. in April. The scheduled luncheon of the Jesuit Colleges and Universities did not take place on account of rationing difficulties. The Catholic University group managed to hold a session which was interesting and well attended. Fr. Fiekers has been named among the councillors of the Worcester Chemists' Club.

Early in April, Colonial Beacon Oil Company's film on synthetic rubber, "Bouncing Molecules" was shown to the organic classes at the college. This is a very instructive sound and color (both 16 and 35 mm.) production. It has not had much publicity in educational circles. It may be borrowed gratis and is really worthwhile.

Father Francis W. Power, S.J., H.C. '15, professor of microchemistry at Fordham University addressed the Worcester Chemists' Club on the ninth of April and chose "Industrial applications of microchemistry" for his topic. Father Power's vita appears in the April issue of the Worcester Engineering Society Bulletin.

It is interesting to observe that the late Father George L. Coyle's Notes on Qualitative Analysis still live on. Professor Walter Hynes of Fordham University has revised them and included them in his new Qualitative Analysis.

Mr. Charles A. Polachi, graduate assistant, has been active in Worcester as War Gas Reconnaisance Officer. The Worcester group have developed a fine kit and technique for the detection of the commoner war gases.

Father Joseph A. Martus of Cranwell spent the summer in this department in the capacity of guest worker on the problem of aryl amine alkyl halide condensation rates which he opened up as a graduate assistant here in 1936. After the rates for various alkyl halides have been studied, we hope to have more to say on these reactions.

A dynamic model for illustrating the kinetic theory has been developed in this department. It is an adaptation of Fr. Theo Wulf's model (Z. physik. chem. Unterricht, 34, (1921) 5-13) and is designed for use on a horizontal projector. From it we can project kinetic illustrations of collisions, expansion against force, temperature effects. Brownian movement, the kinetic interpretation of the second law, distribution of velocities, solution pressure and probably the older concept of osmosis. Such a device should be a help in teaching condensed courses in war time.

At the meeting of the New England section of the Society for the Promotion of Engineering Education which took place at Mass. Inst. Tech. about the middle of September, Professor A. J. Scarlett of Dartmouth College spoke to the chemists from colleges with Navy programs on Chemistry in the Navy Program. On the topic of the Navy's Chemistry of Engineering Materials course (C 6), which has puzzled many departments as to content, procedure, equipment, etc., he had the following list of experiments to suggest: 1) Cement: Testing for purity, setting time, tensile strength of mortar, sieve analysis, aggregation and water ratios. 2) Water softening. 3) Measure of the tensile strength of plain carbon steels. 4) Hardness and hardenability tests. 5) Plot tensile strengths for steels other than carbon from published data. 6) Actual heat treatment of steel. 7) Phase diagram for brass. Prof. Scarlett has had the opportunity to teach this course to a group of about 28 men, one year in advance of Navy schedules. His personal interpretation of the "brief introduction to qualitative analysis" at the end of C 2a for deck officer trainees, was that it is to comprise much less than a standard 4 credit qualitative analysis course; in the C 2 course for pre-medical trainees, the matter should approximate that of a standard 4 credit qualitative course. These views were disputed in the meeting.

HOLY CROSS COLLEGE

Department of Technical Drawing

The introduction of the Navy V-12 college training program at Holy Cross in July, 1943, has had as one of its effects the inflation of the Department of Technical Drawing from a very minor appendage of the Department of Physics and Mathematics into one of the largest and most important (!) departments in the college. A course in Technical Drawing and a course in Descriptive Geometry is prescribed for all V-12 trainees, at least those in the lower classes of the college, and for all insofar as it can be worked into their programs. These courses were strongly recommended, although not made mandatory, for V-7 and V-5 candidates who still remained in the school, and, strangely enough, they were recommended even for candidates for the Supply Corps, who, apparently, would have no occasion to use the material covered in the courses. This is apparently in line with the Annapolis tradition, for at the Naval Academy these courses were prescribed for all midshipmen, and much emphasis was placed on them and much time was given to them. At one period, before acceleration became the fashion, Annapolis midshipmen took these courses over a period of two years. Of the 625 naval cadets enrolled at Holy Cross, then, approximately 225 were lined up for these two courses, and of these the greater number are Freshmen.

The situation had been anticipated. Up to the present year, only a small handful of students at Holy Cross had taken these courses, and they were handled entirely by Mr. Raymond E. McDonald, a member of the lay faculty, who taught the courses as part of his work in the Physics Department. To assist Mr. McDonald in handling the large groups, several members of the Jesuit faculty, were asked to prepare themselves to handle these courses. These were Fathers John Hutchinson, James E. Fitzgerald, William Donaldson, Joseph Shea. The assignment was made last February, and during the following months the Fathers prepared the courses privately with a weekly meeting directed by Mr. McDonald. This was a very difficult task since not one of the group had any background in the matter and they were beginning two difficult subjects from absolute zero.

In May, a very generous offer came from the Engineering School at Columbia University, addressed to Holy Cross among some other 30 liberal arts colleges who had been designated to receive the Navy program. Columbia offered to put the services of the Drafting Department of the Engineering School at the disposal of the liberal arts colleges, to help them prepare for situations such as was foreseen at Holy Cross. So to Morningside Heights went the Fathers and there from May 14 to May 30 they went through a very intensive course under the direction of the staff of the university's Drafting Department. Class sessions and laboratory periods and discussions of teaching techniques were held every day from 9 to 12 and from 1 to 5. A survey was made of the entire course; a display of text books and other equipment was arranged; and the whole thing turned out to be a very difficult but very profitable venture. The university officials and the members of the Drafting Department were most courteous and helpful. The facilities of the men's faculty club were put at the disposal of the Fathers during their stay, and practically everything that was needed for the course was provided by the university with their compliments. This period at Columbia, although it approximated the "six easy lessons" in the amount of time it took, was a tremendous help to the inexperienced Fathers.

At Holy Cross, three large classrooms in Carlin Hall were set aside for the drafting room laboratories. Since an incraese in numbers is expected in the semester beginning November 1st of this year, arrangements have been made for adding a fourth classroom. The Department was now faced with the problem of equipping them. The Navy sent in study tables, 50 by 32, about the size of an ordinary office desk. These became the drafting tables. All the rest of the equipment, drawing boards, triangles, etc., was purchased by the college from one of the best firms in the country, Keuffel and Esser. The Navy is supposed to re-imburse the college and the equipment becomes government property. The lack of a regular drafting table was to some extent offset by placing pieces of 2″ by 4″ under the drawing boards, giving them a slight slant forward. Sheets of oaktag cushion paper were fastened to the boards with Scotch tape, and cloth covers, made from old sheets and pillowcases were attached to the boards with thumb-tacks. The boards are left on the tables at all times and are thus somewhat protected when the rooms are used by other classes. Liberty transfer boxes, of heavy cardboard, were bought as containers for the equipment. These are about 15 by 9 by 7 inches and are marked with large Dennison numbers. At the end of the classes, these boxes are stored in the closets of the classrooms. The various articles of equipment have all been numbered with opaque indelible ink. All of this is rather a makeshift arangement, as is evident to anyone who has been in a regularly set up drafting room with its high tables and drawers or racks for storing equipment, etc. But it does work and it works satisfactorily and the trivial details mentioned above are given only to indicate that a suitable substitute could be worked out from nothing without too much expense.

Any number of other problems, entirely new to people with the typical Jesuit background, were solved "ambulando". The absolute necessity of a carefully planned, detailed syllabus was soon discovered. Arrangements had to be made to provide opportunity for slower boys to complete unfinished assignments outside of the regular class time. A marking system and some sort of standard for correcting drawings was devised. For a while, the new department was chiefly notable for its utter confusion. But after a few weeks, order began to emerge and by the end of six weeks things were functioning very smoothly, much as though such a department had been there for years.

One thing which proved a tremendous help was the division of the group into an advanced and a beginners' class. Many high schools give rather heavy courses in many of the phases of Technical Drawing, although very few touch Descriptive Geometry. It was found that approximately one-third of the total number had had consider-able work in drawing. These were aggregated into an advanced class. They followed the same schedule as the beginners as regards the various topics being treated and were held responsible for the same drawings as the beginners, and then they were given additional and more difficult work. This arrangement has proved very satisfactory all around. The class lectures can then be held down on an elementary level to suit the beginners and the advanced students are required to attend these only when some difficult point such as perspective drawing, is being discussed. Otherwise they go at once to their own room and after a brief introduction, they go directly to work.

The Navy curriculum calls for a course in Engineering Drawing or Mechanical Drawing, followed by a course in Descripitve Geometry. This order of things is puzzling. For years the Descriptive Geometry has preceded the Engineering Drawing. However, since this order was clearly indicated in the Navy curriculum, it has been followed. One thing which argued against a reverse arrangement, was the fear that the Navy would submit its own examination in Engineering Drawing at the end of the first semester. Now it appears that there is not to be an examination until the end of the second semester. Which would leave the way open for a reversing of the order, or for what would be far better, the working out of a single unified course which would merge the two into one. Since the line between them is not too sharp, there is much to be said for such a unified course.

CHEVERUS HIGH SCHOOL

Two new courses have been introduced into the science department of Cheverus High School this year. A general Science course has proved very popular with the Sophomores, and a physics course fills a real need and rounds out an adequate high school training in science. With priorities, ample equipment was secured for lecture demonstration and class experimentation. Both courses are taught by Fr. Hogan, S.J.

On the evening of September 23rd twelve members of the senior class met in the science class room to form a Science Club. Fr. Clavius, S.J., mathematician and famed in calendar reform was chosen as its patron. The number was deliberately restricted to facilitate the process of organization. Juniors and Sophomores will be eligible after the first quarter provided they attain an average of 80 and 85 respectively, in their science subjects. They will be voted into the club at the first meeting after the Christmas Holidays. Plans have been made for guest speakers, scientific movies and social evenings. Committees are now at work on plans for several projects and experimental work. The club is under the direction of Fr. Hutchinson, S.J.