DEGREES

The program in Arts and Sciences is under the direction of the Faculty of Philosophy which awards the degrees of Bachelor of Arts, Master of Arts and Doctor of Philosophy. For this purpose the faculty is organized into departments and into the following four groups each of which supervises several departmental programs and interdepartmental or group programs:

- Humanities
- Social Sciences
- Biological Sciences
- Physical Sciences

BACHELOR OF ARTS

PLAN OF STUDIES

A student selects the subjects he will study in accordance with his intellectual interests in so far as that is made possible by his degree of preparation. This principle is applied to those entering from high school as well as to more advanced students, but the less advanced students have to spend more time on the basic disciplines related to their major interest. In following his curiosity and completing the training essential in pursuing it, a student discovers the subject or combination of subjects that he desires to investigate further and it becomes his “major.” The planning of studies for the A.B. is there divided into two parts:

1) Before the choice of a major
2) After the choice of a major.

The major may be more or less specialized. More specialized interests are met by majoring under a Department or Interdepartmental committee. Less specialized interests are met by majoring in one of the Group Programs.

The number of majors offered is large. The purpose of this multiplicity is to enable students to fit their studies to their individual needs.

ADVISERS

At all stages of his program, the student is aided by a member of the faculty who is assigned to advise him. Students transferring from other colleges or universities may select their major at entrance, subject to the approval of the Department or Group concerned, and are then assigned an adviser in the field of their major. Students entering from high school...
The Biological Sciences Group Major is designed to lead to the A.B. degree after four years of residence, and the requirements listed above are minimum ones. A request for acceptance as a group major is initiated by the student at the end of the first, or during the second, year, with satisfactory grades being the only requirement for acceptance. There should remain ample time for the student to take elective subjects, either to broaden himself or to concentrate in areas of particular interest by taking additional advanced courses or by doing research under guidance. The number and type of elective courses will be determined by consultation with the student’s adviser.

Some students may wish to complete their requirements for the A.B. degree in less than four years of residence. In addition to completing the requirements listed above, such students must have a high academic average, pass an oral examination to demonstrate their competence in their major field, and complete a research program under the guidance of a staff member. An application for graduation in less than four years must be filed through the adviser at least one term prior to the time of the awarding of the degree. The attention of those who may be interested is called to the combined A.B.-M.A. Program, described below, which is in general to be preferred.

The program as outlined above does not necessarily meet the entrance requirements of medical or dental schools. The student who plans to enter these professions should therefore familiarize himself with the particular requirements of the various professional schools. The adviser is prepared to assist the student in the selection of suitable courses.

In arranging a schedule of courses for the first and second years of study, General Program I or II as listed on p. 47 would serve as a satisfactory introduction for Biological Sciences Group majors. Biology 1-2 and Introductory Psychology may be taken in either the first or second year, while Physics 1-2 would normally be a second or third year course. The particular arrangement of courses, however, is determined by the student in consultation with his adviser.

**COMBINED A.B.-M.A. PROGRAM**

This program is designed for qualified students who want to pursue a course of concentrated study in a particular area of interest, and who can do so in the normal time of four resident years. The requirements for the M.A. degree, in addition to those already stated for the A.B. degree, include 1) a thesis based upon original research, and 2) a greater pro-

**ARTS AND SCIENCES**

**PHYSICAL SCIENCES GROUP**

SCOPE OF THE GROUP

The Group is composed mainly of members of the departments of Chemistry, Geology, Mathematics, and Physics. Members of the Isaiah Bowman Department of Geography, the Chesapeake Bay Institute, and the Department of Biophysics are affiliated with the Physical Sciences Group as well as with other groups. Some members of the faculty of the School of Engineering also belong to this Group. The purpose of this diversity of membership is to provide maximum flexibility in setting courses of study and research programs for the students.

DEPARTMENTAL MAJORS

Students who have selected the department in which they wish to major will find the requirements and suggested programs of study listed under the appropriate departments in this catalogue. The following two year program is suggested for entering students who plan to major in one of the physical sciences, but who have not yet decided upon a special field. (Note: Students who think that they might wish to major in geology should take Geology 1-2 in either the first or second year; students who might wish to major in chemistry should take Chemistry 7-8 or 23-24 and 25-26 as the second year elective.)

First year:
- Mathematics 1-5 or 5-6
- Chemistry 1-2
- French or German

*Other programs of study are discussed on pp. 46-48.*
UNDERGRADUATE PROGRAMS

One year course in social science or the humanities
Elective (optional; for most first year students four courses constitute a full schedule)

Second year:
Physics 1-2
Mathematics 6-7 or 7-8 (Mathematics 7-8 required for Geology majors)
English writing 1-2 (if absolved by previous study or examination an elective may be substituted; see Note above)
Elective (see Note above)

After the student has decided upon the course of study that he wishes to follow, he should make application through his adviser for acceptance as either a departmental or interdepartmental major. This should be done not later than the middle of the second year.

INTERDEPARTMENTAL MAJORS

Although most candidates for the A. B. degree will wish to be majors in specific departments, there may be some who prefer to acquire a broad training in the physical sciences, thus avoiding specialization; other students may want to delay specialization or to specialize in a borderline field, and for these students appropriate interdepartmental major programs can be arranged.

DEGREE IN LESS THAN FOUR YEARS

A student with an exceptional academic record may, on the recommendation of his department or committee, be considered for the award of the A. B. degree in less than four years. He will need to demonstrate marked ability for independent work as shown by a paper based on laboratory or library research or by passing an examination in some specialized subject in which he has not had a formal course of instruction.

GENERAL PROGRAMS FOR THE FIRST TWO YEARS

In order for a student's selection of Major to be approved by the Group or Department concerned, he must meet the requirements of that group. Requirements of the Departments are stated in the Departmental announcements. Those of the Groups are best stated in terms of programs for the first two years. The following general programs show how a student may use his first two years to prepare for any one of several Departmental and Group Majors. Somewhat more specific and specialized programs are indicated in the Group announcements (pp. 37-46).

PROGRAM I

First Year
Math. 1, 5 or 5, 6 *
Chemistry 1-2
French or German
Political Economy 1 and 2 or Political Science 1 and 2 or Political Economy 1 and Political Science 1
Optional Elective

Second Year
Biology 1-2
Foreign Language
English Literature, Introductory
Two or three electives *
Optional elective

Students completing satisfactorily the above program are eligible for acceptance as a major in the Biological Sciences Group Program, Biology, Geography, Geology, German, History, Philosophy, Psychology, Political Economy or Romance Languages, provided electives and alternatives are used to include at least one full year of the prospective major subject. If the student chooses electives so that he also has a total of five courses within the Humanities and Social Sciences, he will be eligible for acceptance as a major in Art, English, and Political Science, for the General Major in Social Sciences, and for the Liberal Arts Major in the Humanities Group.

PROGRAM II

First Year
Mathematics 1, 5 or 5, 6 *
Chemistry 1-2
French or German
Political Economy 1 and 5 or Political Science 1 and 2 or Political Economy 1 and Political Science 1
Optional Elective

Second Year
Physics 1-2
Political Economy 1, 2 or 5 or Political Science 1 or 2
History 1-2
Elective
Writing (unless absolved)

Those completing satisfactorily Program II are eligible for acceptance in the Biological Sciences Group Program, in the General Major in Social Sciences or as a major in Chemistry (except Physical Chemistry), English, Geography, Geology, German, History, Mathematics, Philosophy, Physics, Political Economy, Political Science, Psychology, or Romance Languages, provided electives and alternatives are used so as to include at least one full year of the prospective major subject.

*Students wishing to major in the Sciences should take Mathematics 6 among electives in the second year if unable to take it the first year.
MATHMATICS (11)

Professor Wintner
Professor Lewis (On leave of absence.)
Professor Chow
Professor Hartman
Associate Professor Morrill
Associate Professor Haviland
Associate Professor Mostow

Associate Professor Maunier (On leave of absence.)
Assistant Professor Ehrenpreis (On leave of absence.)
Assistant Professor Dyer
Dr. Washinazer, Lecturer
Dr. Schwartzman

All members of the Department of Mathematics belong to the Physical Sciences Group. Students who major in mathematics are presented to this group for degrees (see p. 45).

REQUIREMENTS FOR THE BACHELOR OF ARTS DEGREE

The formal requirements for acceptance by the Department of Mathematics as a major are a knowledge of the following:

English Writing
French or German (reading knowledge)
Analytic Geometry and Differential Calculus

Evidence for the fulfillment of any of these requirements is either the satisfactory completion of appropriate courses or certification by the department involved.

After a student is accepted as a major in the department, his program of study is prepared in consultation with an adviser in the department. In order to obtain an A.B. degree, a major in the Department of Mathematics must satisfy the following minimal requirements:

MATHMATICS. The candidate should have a knowledge of algebra and of the theory of functions of real and of complex variables, equivalent to that provided by Mathematics 303-304, 310, 325-326, and of one further topic of at least the same level of advancement.

PHYSICS. The candidate should have a knowledge of at least one topic beyond General Physics, such as Atomic Physics or Thermodynamics and Kinetic Theory.

GENERAL. The candidate should have a knowledge in at least three of the following fields: English literature, philosophy, language (classical or modern in addition to that mentioned above), science (biological or physical, other than physics), social science, history,
Students who expect to study mathematics beyond the A.B. degree are advised to obtain a reading knowledge of both French and German.

Information about advanced degrees, Master of Arts and Doctor of Philosophy, will be found in the circular on Graduate Programs, a copy of which will be mailed upon request.

COURSES

Honors sections, as well as regular sections, will be offered in Mathematics 6, 7 and 8 for the benefit of qualified students desiring a deeper discussion of the topics involved.

Algebra and Trigonometry 1. Four hours weekly, first term.

Pre-requisite: high school algebra; trigonometry.

Intermediate Mathematics 3-4. Four hours weekly through the year.

Pre-requisite: Mathematics 1, 2, 6 or its equivalent.

Analytic Geometry 5-6. Four hours weekly, one term.

Pre-requisite: Trigonometry.

Calculus 6-7. Four hours weekly, one term.

Pre-requisite: Analytic Geometry.

Calculus 7-8. Four hours weekly, one term.

Pre-requisite: Calculus 6 or its equivalent.

Calculus 8-9. Four hours weekly, one term.

Pre-requisite: Calculus 7 or its equivalent.

Elementary Differential Equations and Infinite Series 9. Three hours weekly, one term.

Pre-requisite: Calculus 8 or its equivalent.

Introduction to Advanced Algebra 303-304. Three hours weekly through the year.

Pre-requisite: Consent of the instructor.

Vector Analysis and Related Topics 308. Three hours weekly, one term.

Pre-requisite: Elementary differential equations.
Functions of a Complex Variable 510. Three hours weekly, second term.
Cauchy-Riemann differential equations, Cauchy's integral theorem and integral formula, power series, analytic continuation, poles, essential singularities, residues and contour integrals, entire functions.
Prerequisite: Infinite series.

Projective Geometry 519. Professor Chow. Three hours weekly, first term.
Principle of duality, theorems of Desargue and Pappus, collineations and correlations, conics, systems of conics, introduction of coordinates.

Introduction to Basic Analysis 325-326. Three hours weekly through the year.
The real number system, limits and continuity, derivatives, Riemann integrals, implicit functions, infinite series and products, uniform convergence, multiple limits, the elementary functions, definite integrals containing a parameter.

Fourier Analysis for Physicists 327. Professor Wintner. Three hours weekly, first term.

Statistics for Physicists 328. Professor Wintner. Three hours weekly, second term.

Courses numbered 601-699 will be found in the circular on Graduate Programs.

OCEANOGRAPHY (24)
Chesapeake Bay Institute

Associate Professor Pritchard, Director
Associate Professor Montgomery
Associate Professor Carrith

The academic program of the Department of Oceanography is at the graduate level. Work in the Department is planned to prepare students for the M.A. and Ph.D. degrees. The program of the Department and requirements for degrees are given in detail in The Johns Hopkins University Circular—Graduate Programs in Arts and Sciences, Business and Industrial Management and Engineering.

The science of oceanography is a complex one. The oceans cover over seventy per cent of the earth's surface to an average depth of over two miles. Within the oceans processes are operating and events taking place that by themselves can be thought of as belonging within one of the basic science fields. The water is in continual motion, being acted upon by gravitational and wind forces. These aspects of the science are studied by workers whose training, both undergraduate and graduate, is in the physical sciences. Life processes, reproduction, growth and death go on in...