

## SIXTH-FORM PHYSICS AND CHEMISTRY

IT is generally agreed that the present standard of the higher school certificate examinations, which serve as a means of selection for State and county major scholarships in addition to their function as tests of a two-year sixth-form course, strains the average candidate. It is also said that they cause even the gifted boy to be cramped by a too early specialization, which reacts unfavourably on his university career and later life, a charge which is made against the open scholarship examinations at Oxford and Cambridge themselves. Some of these effects are noticeable in physics and chemistry; parts of the normal course are too exacting for the boy of moderate ability, while the boy who proceeds to the university is likely to be disappointed and unsettled by the recapitulation during his first year of work already done at school.

The report of the Institute of Physics on the Education and Training of Physicists remarked in 1943 on the economy of time and effort that could be achieved by rationalization of the whole scheme of scholarship and higher school certificate examinations. A first step towards general agreement along these lines has been made by the Cambridge Joint Advisory Committees, which have issued syllabuses\* indicating the course of school work on which the Cambridge Higher School Certificate Examination, the Oxford and Cambridge Joint Board Higher Certificate Examination, and the College Scholarship examinations will be based. The Science Masters' Association and the Association of Women Science Teachers were represented on the Committees, which comprised school and university teachers, and representatives were appointed as observers by the Joint Matriculation Board of the Northern Universities and the University of London Matriculation and School Examinations Council.

The syllabuses have been adjusted to the capacity of the average candidate, and designed to avoid overlapping with first-year university work. Scholarship and distinction candidates would offer an optional theoretical paper on each of the syllabuses in addition to the practical examination and two theoretical papers compulsory for all candidates, the practice which has for some years been followed by, for example, the Northern Universities Joint Matriculation Board. It is hoped that this would serve to select scholars without subjecting them to the pressure of unduly advanced work.

The Physics Committee has faced the chief problem of the sixth-form physics class—the 'weak mathematicians' and those whose interests are not primarily mathematical. It is undoubtedly possible for such boys to make good progress in physics up to a certain standard, without being able to do themselves justice in examinations with the present kind of question. They can follow a quite rigorous argument with intelligent resignation, and understand and apply the physical principles concerned, but cannot do mathematical problems of the conventional type. Most teachers will therefore approve of the list of topics, mainly mathematical, and some of acknowledged difficulty to all students (such as the force between the plates of a condenser), on which questions will not be asked.

\* Cambridge Joint Advisory Committees. Syllabuses for Examinations taken by Sixth Form Pupils in Physics and Chemistry. Pp. 16. (London: Camb. Univ. Press, 1944.) 6d.

The usual ground has been extended by including simple radio theory, and appliances such as the cinematograph, gramophone, sound film projector, loud speaker, and cathode ray oscillograph. It should thus no longer be theoretically possible (as it was some years ago) for a boy to leave school, after two years of specializing in science, completely uninstructed in the principles of most of the electrical appliances to be met in the outside world.

Experiments of the 'pure practical' type, involving problems on topics not necessarily covered by the theory syllabus, may be set in the practical examination. The boy of outstanding promise should more readily reveal it in this kind of exercise than in the usual routine type of experiment, and a practical course containing a good proportion of these problems has a surprisingly stimulating effect on a class.

In drawing up the chemistry syllabus, the Committee concerned has borne in mind that the study of this subject should be based on experimental work, and that a clear understanding of chemical and physical principles, founded on first-hand knowledge, is of paramount importance.

In general and inorganic chemistry, importance is attached to the gradation in properties of the elements and their compounds, such as hydrides, oxides and halides; this study to be closely linked with the Periodic Table. The Committee stresses that every effort should be made to provide the student with a mental picture of the molecular processes involved in the fusion of solids, evaporation of liquids, diffusion, gaseous reactions and chemical equilibria, and that the mathematical treatment of these topics should not be expected.

Most teachers will welcome the decision to delete from the syllabus, limiting densities, the phase rule, ionic mobilities, transport numbers and quantitative problems on solubility products, since experience has shown that these are rather beyond the grasp of the average sixth-form pupil.

In organic chemistry the usual sixth-form syllabus has been pruned considerably. Emphasis is placed on a knowledge of the arrangement of the atoms (excluding stereoisomerism) in the molecules of compounds, and of the typical reactions of characteristic groups, rather than on the preparation of a large number of compounds. The economic aspects of the subject have not been overlooked, and teachers will be glad to see that the cracking of oils, polymerization of olefines, and syntheses from acetylene and carbon monoxide have been included in the syllabus.

In the practical work the Committee recommends that a knowledge of the standard qualitative analysis tables should not be required, but that analysis should be closely linked with the teaching of inorganic chemistry, and that the fundamental principles involved should be clearly understood. The identification of mixtures of salts is limited to three radicals, of which no two metals will be in the same group, and the phosphate elimination will not be required. The volumetric work is confined to acid, alkali, permanganate, thiosulphate and silver nitrate (in neutral solution) titrations, and if problems are set involving other reagents, sufficient working details will be given.

The syllabuses do not seem too long for the time allowance of seven or eight forty-minute periods, which is proposed for each of the subjects, physics and chemistry; these allowances are more generous than those on which the present arduous courses are covered in some schools.

The Committees invite criticism and comment, which will be considered before further editions are issued. No doubt individual teachers will have constructive suggestions to make, and probably the very detailed list of topics for study and omission will be revised from time to time; but the syllabuses as a whole will be widely welcomed, representing as they do a standard which the majority of sixth-form boys should be able to reach.

Teachers and examiners, who have for many years accepted with patience the hitherto untested hypothesis that many of the defects of their students are due to their own excessive zeal, will have another reason for welcoming the new syllabuses. One factor responsible for literary incapacity, narrowness of outlook, and other personal shortcomings, has now been much reduced in magnitude; should these failings still persist appreciably, attention may in future be turned to other factors in the curriculum. Mere absence of intensive specialization is not enough; a sound general course for the sixth-form science student calls for the best that the humaner studies can provide, and they now have their chance.

The shifting of emphasis from the needs of the gifted few to the needs of the majority still leaves a problem to be faced. The good scholarship boy at present enters the sixth form at the age of fifteen, takes a higher school certificate examination for the first time at sixteen or seventeen, and then (in peace-time) has a year and a term at least in which to compete for awards, proceeding to the university at eighteen or nineteen. With the proposed scheme, it seems likely that boys of scholarship calibre may gain awards at seventeen, which is generally considered too young for entering a university. It would appear undesirable for these boys to spend a further year at school simply marking time with the rest of the class, and anticipation of university work is one of the disadvantages of the present system. It would be valuable indeed if the Committees, in later issues of the syllabuses, could round off an already excellent job by suggesting general syllabuses covering a year's post-higher school certificate work for those who are preparing either to enter a university or start directly on their careers after a final year at school.

## AGRICULTURAL EDUCATION ASSOCIATION JUBILEE MEETING

**T**HE Agricultural Education Association celebrated its fiftieth birthday at a luncheon at the Holborn Restaurant, which took place during the annual conference held during December 12 and 13 in London. The principal guest was the Minister of Agriculture, who had with him Sir George Courthorpe, president of the Royal Agricultural Society, Mr. Nevill, representing the National Farmers' Union, the United States agricultural attaché, and the chairman of the Horticultural Education Association.

In his address, Mr. Hudson said that the Agricultural Education Association has important functions to perform; not the least is the opportunity it affords workers of meeting and getting to know each other. He referred to the legislation which has recently been passed providing for the establishment of a unified National Agricultural Advisory Service,

and defended the decision to separate responsibility for farm institutes from the main scheme. "We want and intend to make this Service one which by its conditions, its opportunities of advancement and its scope will attract to it the most highly qualified men in all its branches", the Minister continued.

Mr. Hudson stressed the importance which he attaches to the twin jobs of education and advice for the future of agriculture. The future of the industry will depend upon the ability of the farmer to produce food at prices which will bear a reasonable comparison with the prices at which we can buy food from overseas; to do this, the industry must make use of all the latest scientific discoveries, all the most up-to-date methods that exist in the world and are suitable for British conditions. The farmer is not a person who is able to travel about freely and see and learn things for himself; it must be through the eyes and ears of technical advisers that he will be able to keep abreast of modern developments. Mr. Hudson said he is anxious about the great scarcity which exists to-day of good technical men. Men must be found for the Advisory Service; men to teach the older students at the universities and colleges; men to teach the younger students at the farm institutes; men to instruct the large numbers of ex-Servicemen; men to staff the research stations, and so on. Men with an expert agricultural training will also be wanted by commercial firms, by the Colonial Agricultural Service and in other fields. Therefore it might be difficult for a time to push on as rapidly as he would like.

Dr. Charles Crowther had previously given an account of the early days of the Association. It was founded in 1894 at the instance of Mr. Brooke-Hunt, then the one education inspector of the Board of Agriculture. At first the membership was small, consisting of a handful of heads of agricultural educational institutions and departments. Soon, membership was thrown open to members of staffs, and in 1912 the Association numbered 130. After the War of 1914-18, a great expansion took place, and the present membership is between four and five hundred. After referring to the contributions which the Association has made to experimental work, Dr. Crowther said that it has never failed to formulate its views and present them to every commission or Government committee that has reviewed the field of agricultural education during the past fifty years, and the recommendations and subsequent administrative action have shown clearly the potency of the Association's intervention. Dr. Crowther concluded with the comment that the more highly specialized agricultural education becomes the greater will be the need for the Agricultural Education Association.

A feature of the programme at this jubilee meeting were the surveys of progress during the past half-century in grassland, livestock and dairying. Very aptly, Sir George Stapledon contributed the review of grassland work. He claimed that permanent grass dominated the outlook at first. Even the pioneer investigations of Somerville, Gilchrist and Elliot were mainly directed towards permanent turf. To Gilchrist, Sir George gave the credit for bringing together the important factors of phosphates, wild white clover, sensible seeds mixtures and the greater needs of the farmer. He paid tribute to the valuable work on the nutritive value of grass carried out by Prof. T. W. Fagan and Dr. H. E. Woodman, saying that if we do not have a clear understanding of the factors influencing the nutritive value of grass we