DOCUMENT RESUME

ED 059 905 SE 013 422

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| TITLE | Science Education Newsletter No. 17. |
| INSTITUTION | British Council, London (England). |
| PUB DATE | Dec 71 |
| NOTE | 38p. |
| EDRS PRICE | MF-$0.65 HC-$3.29 |
| DESCRIPTORS | *Curriculum; *Instruction; International Education; *Mathematics Education; Measurement; Newsletters; *Science Education; Tests |
| IDENTIFIERS | Great Britain |

ABSTRACT

Short notes on the progress of five science and four mathematics curriculum projects in Britain; reports of conferences on mathematics and science education, educational technology, and the Mathematics Association; reports on the activities of a number of educational and professional associations; comments on examination procedures, a teachers' center for biology, computer education schools, and an international youth science meeting; and a list of recent publications in science and mathematics education comprise the major portion of the newsletter. There are also reports of activities in science and mathematics education in Australia, Iran, Malta, and Zambia; a list of prize winners in an international award program for science and mathematics teachers; and reports of international meetings under the auspices of UNESCO and other international agencies. One of these meetings established the Science Education Program for Africa; the other two were concerned with integrated science. (AL)

THE BRITISH COUNCIL

# SCIENCE EDUCATION NEWSLETTER

No. 17 DECEMBER 1971

Issued by:
Science Department,
The British Council,
59 New Oxford Street,
London, WC1A 1BP

CONTENTS

Activities in Britain



Overseas Activities



International Activities

1. Nuffield Advanced Physical Science (See SEN 9:4, 9:12, 12:1 and 15:2)

The first book will not now appear from the publishers until July 1972 although as reported in SEN 15:2 interim teachers' guides and students' work-book are available for schools introducing physical science. The books will be published between July and December of 1972. The course is divided into 3 sections: 1 - a basic course 75%
2 - options 15%
3 - a project 10%

In the examination there are 3 theory papers and a special paper. There is no practical paper.

Further information can be obtained from the Director of the project, Dr J E Spice at Winchester College, Winchester.

2. Nuffield Advanced Level Physics (See SEN 2:3e, 3:7, 7:2, 9:3, 12:1, 14:5, 15:1)

The publications with their proposed date of publication of this project are as follows:

Standard 8 Film loops

X-Ray Diffraction

| | | | |
|---|---|---|---|
| XX 1663 | 1 Production of the X-Ray Beam | £6.30 | Already available |
| XX1664 | II Diffraction of Monochromatic X-Rays by a single crystal | £6.30 | |
| XX1665 | III Diffraction of Monochromatic X-Rays by a Powder Specimen | £6.30 | |
| XX1666 | IV Determination of the Wavelength using a Diffraction Grating | £6.30 | |
| For the Student | | | |
| XX1668 | Forward or Backwards 1 | £5.50 | |
| XX1669 | Forward or Backwards 2 | £5.50 | |
| XX1670 | Forward or Backwards 3 | £5.50 | |
| XX1667 | Solving a Standing Wave Equation for the Hydrogen Atom | £4.25 | |
| XX1673 | Change and Change (16 mm film) | £22.50 | |
| XX1671 | Wind induced Oscillations | £6.30 | |

Film Strips

| | | | |
|---|---|---|---|
| XX1674 | Unit 1: Materials and Structure | £1.40 approx. | Sept 71 |
| XX1675 | Unit 4: Waves and Oscillations | £1.40 approx. | Sept 71 |
| XX1676 | Unit 9: Change and Chance | £1.40 approx. | Sept 71 |

Students' Laboratory Book

| | | | |
|---|---|---|---|
| 0827072 | Students' Book I | ** | Dec 1971 |
| * 0827080 | Students' Book II | ** | Dec 1971 |
| 0827099 | Students' Book III | ** | Jan 1972 |
| 0827102 | Students' Book IV | ** | Feb 1972 |
| 0827110 | Students' Book V | ** | Feb 1972 |
| 0827137 | Students' Book VI | ** | May 1972 |
| 0827161 | Students' Book VII | ** | ** |
| 0827196 | Students' Book VIII | ** | ** |
| 0827218 | Students' Book IX | ** | ** |

For the Teachers and Students

| | | | |
|---|---|---|---|
| 0827145 | Unit: 10 | ** | June 1972 |

For the Teacher

| | | | |
|---|---|---|---|
| 082717X | Teachers' Handbook: Supplementary Maths | ** | ** |
| 0827064 | Teachers' Handbook | ** | Dec 1971 |
| 0827013 | Teachers' Guide I | ** | Dec 1971 |
| 0827021 | Teachers' Guide II | ** | Dec 1971 |
| 082703X | Teachers' Guide III | ** | Jan 1972 |
| 0827048 | Teachers' Guide IV | ** | Feb 1972 |
| 0827056 | Teachers' Guide V | ** | Feb 1972 |
| 0827129 | Teachers' Guide VI | ** | May 1972 |
| 0827157 | Teachers' Guide VII | ** | ** |
| 0827188 | Teachers' Guide VIII | ** | ** |
| 082720X | Teachers' Guide IX | ** | ** |

Programmed Text

| | | | |
|---|---|---|---|
| | Avogadro's Constant | ** | ** |

** Indicates a forthcoming title (price/date unscheduled)

3. The Nuffield Combined Science Continuation Project

The Nuffield Foundation has set up a one-year investigation under the direction of C D Bingham and M J Elwell, organisers of the Nuffield Combined Science project, into the use of Combined Science in middle schools. The aim will be to produce a guide for consideration by all those who are concerned with science in middle schools. The investigators will be seeking advice and visiting schools during the autumn term and asking such questions as 'Is a syllabus needed?', 'Are laboratories needed?', 'Can all science be taught by group activities?', 'Should combined science be introduced at the age of 8 or 9?' 'If so, why?' 'The role of combined science in the integrated day', 'Is a supplementary guide necessary to enable the published text for the combined science project to be used more effectively in middle schools?' Enquiries can be sent to the Nuffield Combined Science Continuation Project, Chelsea College, Bridges Place, London SW6.

4. Schools Council Project on the Educational Use of Living Organisms (EULO) (See SEN 15:5)

4.1 The aims and details of this project were given in SEN 15. An article on the progress of the project appears in the Journal of Biological Education, Volume 5, No.5, October 1971. The Journal is published for the Institute of Biology by Academic Press, London and New York. In the article, written by Dr P J Kelly and J D Wray, an analysis of the schools survey which was carried out with regard to the use of living organisms in schools is given and also a summary of the needs of the schools. The project, which was initiated by the Institute of Biology and the Royal Society of Biological Education, hopes to publish in 1972 the first four in the series of twelve booklets which it will be producing. The first four booklets will be entitled:

i. Animal Houses

ii. Small mammals

iii. Genetics

iv. Microorganisms

The booklets will be published by English University Press. Each booklet will cover such topics as The Supply, Maintenance and Use of the Living Organisms concerned.

4.2 An international conference on the educational use of living material from 17-20 April 1972 is being organised by the Institute of Biology and the Schools Council Educational Use of Living Organisms project in association with UNESCO, the British Council and the Centre for Science Education at Chelsea College.

The conference will cover such topics as 1. Supply and Conservation; 2. Use of resources; 3. Techniques of maintenance and use; 4. Legal and Ethical aspects of the use of living material; 4. Use of living material in modern biology courses; 5. International co-operation. There will also be manufacturers, suppliers and publishers exhibitions.

Further information on the project and also on the conference can be obtained from Mr J D Wray, Schools Council Educational Use of Living Organisms Project, Centre for Science Education, Chelsea College, Bridges Place, London SW6.

5. Schools Council Project Technology (See SEN 13:9, 14:11 and 15:7)

School Technology Bulletin No.19, the journal of Schools Council Project Technology, was issued in September 1971. The Bulletin includes:

1. "Teaching material notes". In this article Mr G Viles, Deputy Project Co-ordinator, gives up to date information on the state of publication of material from the project. It includes a description of the extensive course material being developed under the heading of 'Basic Electronics'.

2. Two reports on the course of Engineering Science, one by Mr John Gamlin who outlines the progress of the A level in Engineering Science introduced by the Joint Matriculation Board four years ago and the other by Mr Deryk T Kelly, leader of Loughborough's Engineering Science Development Unit, giving an account of the work which has taken place during the first year of the Unit. In addition to leading the ESDU, Mr Kelly is Examiner and chief course-work moderator for JMB Engineering Science (Advanced).

3. "Technology on Wheels" - an article written by Mr Geoffrey Sneed, Director of the Shell School Technology programme based at the Institute for Educational Technology, University of Surrey. Mr Sneed introduces the article by giving a brief outline of the aims and objectives of the project and then continues to give detailed information on the new mobile exhibition unit which has recently been developed. The unit became operational in March of this year and was developed from a 22' caravan.

Copies of School Technology can be obtained from Schools Council Project Technology, College of Education, Loughborough LE11 OBR, normal annual subscription £1.50, special annual subscription for teachers and students sending cash with order £1.00.

6. "APLET 72" (Association for Programmed Learning and Educational Technology)

The Association for Programmed Learning and Educational Technology will hold its International Conference for 1972 at the University of Bath from 27-30 March. Closing date for registration is 21 January 1972 and application forms can be obtained from the Conference Secretary, University School of

Education, Upper Borough Walls, Bath BA1 5AL. The pattern of the Conference will be different from other years and the accent will be on an active participation by delegates. Delegates whose papers are accepted will not be asked to read them but will be expected to take part in a discussion group within a specified module. There will be four main modules:

Module 1 - Design of Courses and Curricula

Module 2 - Selection of methods

Module 3 - Evaluation

Module 4 - Dissemination and training

Supplementary modules 5 and 6 on medical education.

Within each module salient issues from the discussion group will be brought to the final sessions by rapporteurs and also incorporated in the Conference proceedings.

7. Schools Council/Reading University VIth Form Mathematics Curriculum Project (See SEN 15:8)

The fourth newsletter produced by this project appeared in October and this is the second newsletter that has been produced during the main phase of the project which began in January 1971. The newsletter gives up-to-date information on the state of the project and includes details of the trials procedure. Plans are being made to publish the first set of package materials mentioned in SEN 15:8 and to launch an experimental two-year course in applied mathematics beginning in September 1972. Copies of the newsletter and more information on the project are available from the Schools Council/Reading University VIth Form Mathematics Project, School of Education, Reading University, London Road, Reading.

8. Schools Council Secondary Mathematics Project (See SEN 5:6, 12:9, 14:14)

As has been stated in previous SENs, the aim of this project is to produce a series of teachers' guides which will lead teachers into reassessing their work in mathematics with pupils between 13 and 16 years of age of average and below average ability. It will provide source materials and ideas from which the teachers can make up their own courses. Some further trials material has now been prepared. They are:

i. Space travel and mathematics.

ii. Some simple functions.

iii. Algebra of a sort.

iv. From Counting to Calculating - a study of arithmetic for secondary pupils.

The final edition of the books will be published by Chatto & Windus. The trial editions are not generally available but details can be obtained from the Project Director, Mr P Floyd, Institute of Education, University of Exeter, Gandy Street, Exeter EX4 SQL.

9. Mathematics for the Majority - Continuation Project

This Project will run from 1971 to 1974. The experience in the trial and associated schools using the teachers' guides prepared by the 'Mathematics for the Majority' Project revealed the need for pupil material if schools were to be able to develop courses to harvest the full potential of the ideas and suggestions contained in the guides. This further Project was therefore set up to:

1. Develop pupil assignments and study guides related to the 'Mathematics for the Majority' teachers' guides, other published texts, and new packs of source materials including film loops, audio tapes and pictorial material developed simultaneously by the Project team.

2. Maintain contact with the network of associated schools already built up by the 'Mathematics for the Majority' Project by testing different parts of the new materials in different groups of the schools and by inviting local groups of teachers to contribute to the development of the new materials, especially the individual assignment.

3. Produce one further teachers' guide to the new pupil material.

Local Authorities wishing to participate are forming teachers into writing groups; each writing group will work for one term producing a complete pupil material package on some environmental aspect of mathematics. This material in draft form will be sent to the Project for production in more polished form and then distributed to other areas for testing. The tested packages, press comments and amendments will be returned to the Project and prepared for publication. The Project aims to involve the maximum possible number of teachers in this writing programme to produce materials that will be effective when used by inexperienced and non-specialist teachers. The writing group will be supported by Project co-ordinators who will normally be local curriculum development leaders seconded to the Project on a part-time basis. This is to ensure that participating schools are regularly visited and supported by a Project representative. Writing and testing should happen simultaneously in the first place. Writing groups will then test packages from other areas for three terms following their own writing activities.

The Project has produced a journal called 'News Maths' which appeared in the summer of 1971, price 20p. The paper has three different aims:

1. To keep teachers in touch with Project headquarters and also keep participating areas up-to-date on developments in other participating areas.

2. To give a clear picture of the Project as a whole to teachers and Authorities who have never heard of it, or who have decided not to participate at this stage.

3. To provide starting points and examples for teachers who want to base at least some of their mathematics teaching on news events and other materials taken from newspapers or from radio and TV programmes.

The first edition is devoted mainly to explaining the intentions and organisation of the Project.

The Director of the Project is Mr P Kaner at the Institute of Education, University of Exeter, Gandy Street, Exeter EX4 SQL. Further information may be obtained from him or from the Schools Council Information Centre.

O. Midland Mathematics Experiment (See SEN 2:6c, 5:7 & 5:8, 14:17)

As stated previously, this mathematics project at both the ordinary and advanced level secondary school stages, began in 1961 and has been supported by funds from the Nuffield Foundation and Schools Council. Members of the project have been concerned with the writing of CSE, GCE, O-level and A-level syllabuses, the testing of these in schools and the publication of

revised texts for more general use. Volume 11b (CSE) of the course has been published by George Harrap & Co, price £1.30. This is the fourth year CSF course. The Director of the project is Mr C Hope, Worcester College of Education, Henwick Grove, Worcester and the Secretary Mr R H Collins, Harold Malley Grammar School, Solihull, Warwickshire. Further information can be obtained from Mr Collins.

11. The Institute of Mathematics and its Applications

The Institute of Mathematics and its Applications was founded in mid-1964 and has rapidly established its place among professional scientists and technologists as the recognised processional and representative body for mathematicians. The sole object for which the Institute was founded is the advancement of mathematics and its applications. It parallels in its function the activities of the other professional Institutes of Chemistry, Physics and Biology. There are six grades of individual membership of the Institute apart from Honorary Fellowship: these are Fellowship, Associate Fellowship, Graduate Membership, Licentiateship, Companion Membership and Student Membership. The aim of the Institute is to use these grades to secure recognition or representation of all who are engaged in mathematical work, independently of how each may in the first place have become a mathematician.

Since its inception the Institute has had a rapidly growing programme of meetings throughout the country covering various mathematical topics including, in the education field, the teaching of mathematics in universities and polytechnics, sixth form mathematics syllabuses and recently the teaching of mathematics to non-specialists (see SEN 17:10).

The Institute publishes through Academic Press a research journal called 'The Journal of the Institute of Mathematics and its Applications'. This is issued three times annually at the retail price of £8.50 a volume or £17 annually but members of the Institute may obtain it at the special rate of £1.50 a volume or £3 annually. In addition the Institute publishes a bulletin containing articles of wide mathematical or professional interest, book reviews, notices of meetings etc. Occasionally special issues are printed eg that on computer science in April 1970. From time to time the Institute commissions publication of books through a recognised publishing house, often based on conferences organised by the Institute.

The biggest single field of the Institute's work is in mathematical education. The whole range of education from schools to postgraduate work and covering the mathematical needs of scientists, technologists, economists and others, as well as those of future mathematical specialists, is considered by the Council of the Institute to be a field in which it ought to undertake whatever activities may from time to time be needed. The Institute administers the courses and examinations for Higher National Certificate Diplomas in Mathematics, Statistics and Computing. More recently it has administered similar awards in computer studies on behalf of a joint committee representing the Department of Education & Science, the Institute of Statisticians, the Royal Statistical Society, the British Computer Society, the Institute and teacher organisations. In 1968 the first examination was held for the Institute's own Graduateship; this examination is of Honours Degree Standard. With the Royal Society the Institute jointly sponsors the Joint Committee on Mathematical Education for which the Institute provides the secretariat.

Full details of the various grades of membership, membership degrees and publications etc can be obtained from 'The Institute of Mathematics and its Applications', Maitland House, Warrior Square, Southend-on-Sea, Essex.

12. The teaching of mathematics to non-specialists

This was the title of a conference held at the University of Loughborough from 27-29 September 1971 and organised by the Institute of Mathematics and its Applications. (See SEN 17:11) Many more prople are taught mathematics and require mathematics in one form or another than will actually become mathematicians. This conference was particularly concerned with the teaching

of what may be described as "service" mathematics, that is mathematics for those people who will use mathematics as a major tool in their work, engineers and so on. With the growth of the teaching of modern mathematics and other changes in the teaching of mathematics at school level, it is not surprising that there are changes in the teaching of mathematics at the tertiary level either in technical colleges or elsewhere also under way and this conference was particularly concerned with the teaching of mathematics beyond the school certificate level.

The conference was opened by a stimulating address from Professor H Halberstam (University of Nottingham) on the subject "Should mathematics be taught to non-mathematicians for other than vocational reasons?" This address set the scene for some very interesting topics and discussions which followed and which covered the teaching of mathematics to biologists (a major modern development), economists, engineers and computer scientists. In addition the conference explored some of the new approaches to the teaching situation in that it looked at the possibilities of team teaching after an address by Professor L R B Elton (University of Surrey) and subsequently went on to look at teaching problems at various interfaces with a talk from Professor Sir James Lighthill (Cambridge University). A further element on teaching methods was displayed by Professor A C Bajpai (Loughborough University) who talked about, and demonstrated, the roles which integrated packages could play in the teaching of mathematics to non-specialists. A major feature in organising the teaching of mathematics under these circumstances concerns the inter-departmental liaison and co-operation necessary and this field was explored by Mr J E Sellars (Lanchester Polytechnic) who proposed an interesting flow model of how such consultations and co-operation could be achieved. The proceedings of the conference will subsequently be published by the Institute of Mathematics and its Applications.

## 13. Mathematical Association

The Mathematical Association, which celebrated its centenary this year, has published an entirely new journal entitled "Mathematics in School". A possible criticism of many publications of the Mathematical Association is that they are too high powered for the average non-specialist teacher. "Mathematics in School" sets out with the deliberate intention of providing teachers, especially those who teach the 7-16 age range, with practical classroom advice. Its publication will be six times a year in alternate months from November 1971. Regular features will include a puzzle feature by Canon Eperson, a popular account of the work of famous men by Michael Holt, reviews of books and equipment, the latest developments in educational technology by a team of experts at Dundee College of Education, a letter by letter dictionary of mathematics starting with Algebra, a forum for discussing the latest fashions and assessment, such as multiple choice questions and course work, work cards to be used in the classroom, readable news on computer developments. Each issue will also include main articles covering a wide range of topics. For example, there are four main articles in the first issue: 1. Teaching fractions to mixed ability groups; 2. Implications of metrication; 3. Difficulties with negative numbers; 4. The beginnings of the Mathematical Association, including some facsimile reproductions of old textbooks. The annual subscription is £3.00 and the journal can be ordered from the Journal Services Manager, Longman Group Ltd, Journals Division, 33 Montgomery Street, Edinburgh EH7 5JX.

## 14. International Conference on Curriculum Development in Secondary Science

This Conference is being arranged by British Council Courses Department and is Course 229. It will be held in London from 3-16 September 1972 at the Centre for Science Education, Chelsea College of Science & Technology. The Course Director will be Professor E H Coulson, OBE, organiser of the

Nuffield A-level Chemistry Project. Applicants applying for the Conference are required to have a knowledge of English sufficient to enable them to comprehend lectures in English and also to enter freely into discussion. A knowledge of a science subject at a degree standard is also required or a qualification which enables a person to teach science to university entrance level.

Fee for the Course: £126

Applications for the Course to be sent to be received by 15 May 1972. Applications should be sent via The British Council Representative in the applicant's country or, for persons in Britain, to The British Council, Courses Department, 3 Hanover Street, London W1R 9HH.

15. The National Foundation for Educational Research (NFER)

The National Foundation for Educational Research is an independent research foundation carrying out empirical research on education and educational psychology. It was founded in 1946 with funds provided by teachers' associations such as the National Union of Teachers and by local education authorities, universities and the Ministry of Education. Today its much increased membership reflects the scope of its service to education and the partnership which exists between the Foundation and all those who are professionally concerned with the serving of education in the United Kingdom.

The reputation of the Foundation and its influence on the selection of areas of research for investigation have increased very greatly since the 1960s, mainly because of the growing recognition by teachers and political education administrators of the need for some basis of verifiable fact for decisions affecting children's education.

Its membership and the Board of Management represent administrative and teachers' opinions at all levels. Members are drawn from local education authorities and the associations of teachers, inspectors and education officers, English and Welsh universities and the Armed Services; many colleges of education are affiliated members.

The Foundation has a staff of 160 research officers, administrators, publishing and ancillary staff. Its basic finances are drawn from members' subscriptions and from a grant-in-aid from the Department of Education & Science. Local education authorities contribute over 90% of the subscription income, the balance coming from teachers' associations, universities and establishments for further education. The grant-in-aid from the Department of Education & Science is currently £10,000 a year. About two-thirds of the Foundation's current research programme is sponsored by the Department of Education & Science, the Schools Council and the Social Science Research Council for Independent Trusts.

Over the last few years a number of very interesting research reports have appeared under the sponsorship of the NFER. In the field of science and mathematics education the following are of note:

a. Achievement in mathematics. A national study of secondary schools, edited by D A Pidgeon, 1967, price £2.00. This report is part of the large-scale international project (IEA) concerned with the outcome of mathematics teaching.

b. "Mathematics and the conditions of learning" - a study of arithmetic in the primary school by J E Biggs, 1967, price £3.50. In this empirical study Dr Biggs' main object has been to compare the effectiveness of different methods of teaching arithmetic.

c. "The teacher and research" - by B Kane and C Schroeder, 1970, price £1.90. A study of great value in bringing researchers in education and teachers to a better understanding of each others work, problems and aims.

On more general subjects:

d. "In-service training" by B Kane, 1969, £1.15. A study of teachers' views and preferences relating to teacher participation in in-service training and its organisation.

And, in the field of primary work:

e. "Piagetian tests for the primary school" by K R Fogelman, 1970, price 85p. This concise publication gives a summary of the aims, methods and results of some recent Piagetian studies of concept development. The tests used are carefully described to enable teachers to reproduce them in the classroom.

Under the Exploring Education series a recent publication is:

f. "Curriculum evaluation" - S Wiseman and D Pidgeon, 1970, price 55p In this short and readable book the authors advocate and explain a more objective approach to curriculum development.

g. "Teaching technique in primary maths" - by J D Williams, 1971, 75p. This compact book with coloured illustrations reviews the basic tools and resources of modern mathematics teaching theories that lie behind them. It describes the research that has been done on Dienes, Cuisenaire, Montessori and other methods which shows exactly to what extent they are effective.

The NFER also publishes the journal 'Educational Research' which is intended to bring up-to-date research information to local authorities, administrators, practising teachers and others concerned with the results of educational research. It presents authoritative articles reviewing research findings on a wide range of problems written in plain language. The journal is issued three times annually, in November, February and June to correspond with the academic year and includes book reviews and publishers' advertisements. Annual subscription is £1.65 post free. Subscription orders for the journal should be addressed to the distributors, 'Education Research' Department, King, Thorne & Stace Ltd, Kingthorne House, School Road, Hove, Sussex BN3 5JE. Although not all the articles in the journal are relevant to the field of science and mathematics, frequently important articles appear in this context. For example, volume 13, no.3, June 1971, contains a most interesting article on "The implementation of Nuffield O-level chemistry courses in secondary schools" by E W Jenkins, Centre for Studies in Science Education, Department of Education, University of Leeds. The NFER has its headquarters at The Mere, Upton Park, Slough, Bucks SL1 2DQ from which further information can be obtained.

16. Item Bank Project

In July 1966 the Schools Council asked the National Foundation for Educational Research to carry out a pilot study into the feasibility of establishing banks, or libraries, of examination questions or items suitable for measuring the achievements of 16-year olds taking CSE examinations. The objectives of item banking are:

1. To provide examiners with more objective information about the characteristics of the examinations they are using and thereby improve the chances of securing comparability of standards between and within CSE Regional Boards.

2. To build up libraries of first-class examination questions or items which can be put at the disposal of examination boards and teachers wishing to set school-based examinations.

3. To familiarise more teachers with the ideas of modern examining, particularly the notion that an examination should be devised on the basis of a blue-print, a document which codifies in detail the student attributes or behaviours which the examiner wishes to evaluate and also the subject matter which is thought conducive to the achievement of these objectives.

4. To develop the classifications of achievement which are universally applicable so that teachers become more aware of what it is they are testing and why, and also so that CSE grades can be made to have more substance and meaning.

5. To detect and train item writing talent so that item banks may be stocked with items of the best quality.

Initially mathematics teachers in one CSE region were asked to write specific specifications or blue-prints for a CSE examination. These blue-prints were amalgamated into a composite version; sufficient items were collected for this and the items were tested on a sample of CSE candidates. Items surviving the testing and the final pruning were sent to the original teachers with the request that they should choose a purpose-built test of 40 items to serve as a short alternative CSE examination and administer this to their CSE candidates. From the results of these tests a relationship between scores and CSE grades was derived. Thus, anyone drawing a test from the bank could be told the sequence of mean scores on the test which the candidate he allocates to certain grades should obtain in order that the grades he awards should be nationally comparable.

The Directors of the project were Mr R Wood and Dr L S Skurnik, National Foundation for Educational Research, The Mere, Upton Park, Slough, Bucks.

Publications

1. 'Item Banking' by R Wood and L S Skurnik, published by NFER, 1969, price £2.25.

2. 'Question Banks: their use in school examinations', Schools Council Examination Bulletin 22, published by Evans/Methuen Educational, 1971, price 22p.

17. Computer Education in Schools (See SEN 6, 9:16, 9:17, 10:10i, 11:10, 10.12, 12:22(r) and 15:9b)

17.1 Examination syllabuses have been developed at CSE level in Kent. Most of the syllabuses are for examination by mode III (see SEN 16:5(b)). Schools in the area have support from the Medway & Maidstone College of Technology which provides access for schools to its computer. The College has on its staff a schools liaison officer to provide support for schools (teachers and pupils) using the service. Students in the schools are able to write their own programmes which are run on the college computer - thus giving practical experience to a wide proportion of students.

17.2 At A-level 'Computer Science' is examined as a separate subject by AEB and by the Oxford Local Examinations Board. AEB and London University offer an alternative syllabus in Mathematics in which a candidate takes one pure maths paper and one paper on computations. The London syllabus has grown from the special syllabus examined for the Royal Liberty School, which was examined for the last time in July 1971.

17.3 Suggestions for a possible computer appreciation course, not necessarily aimed at examinations, are given in the publication 'Computer Education for all' (Schools Committee, The British Computer Society) 1970 and in the Bellis report 'Computers & The Schools: Curriculum paper No 6' Scottish Education Dept (HMSO).

17.4 The 'Computer Booklist for Schools' is a select list of about 140 books on computing - available from Schools Education Officer, National Computing Centre Ltd, Quay House, Quay Street, Manchester M3 3HU. There is no charge for the list but an applicant should enclose a self addressed 9 x 4 envelope and international reply coupon.

17.5 The Computer Education Group publishes the journal 'Computer Education' which contains reports and discussions on current developments in the field and should be of interest to anyone thinking of introducing a course in computer appreciation or in any way connected with computer education. The annual subscription is 50p which includes a copy of each issue of the journal (published 3 times a year). Issue no 7 (April 1971) contains as a supplement a report based on the international conference organised by the International Federation for Information Processing on computer education held in Amsterdam in 1970, including a survey of developments in various parts of the world and the recommendations of the conference. Issue no 8 contains a detailed account of plans for computer education in Berkshire which indicates clearly some of the practical and technical difficulties to be overcome in introducing such a course and would be of direct interest to anyone in the planning stage of evolving such courses.

Address: Computer Education Group, North Staffordshire Polytechnic, Beaconside, Stafford.

17.6 The National Computing Centre: Schools Education (NCC) - Students Cobol Course (SEN 15:9(b)) reported the NCC teaching package 'Computers and their impact on Business and Society'. NCC have now produced a further package 'Students Cobol', which has been tested in several schools and colleges. COBOL (Common Business Oriented Language) is a high level language and the course provides a basic introduction. The course can be used independently or as part of a wider syllabus course such as A-level computer science. The course contains teachers' material and a class list for 5 students. Also a lecturer's guide - 'A teacher's course for students' cobol' has been produced. This is aimed at those involved in training teachers to use the package. Further details from NCC address as in 17.4 above.

## 18. 13th London International Youth Science Fortnight

The Council for International Contact organised the 13th London International Youth Science Fortnight which took place from 29 July to 11 August 1971. It is one of the largest meetings of young people taking place in Britain and 25 countries were represented in the 500 participants of the course. The opening ceremony took place at the Institute of Electrical Engineers and the President of the Institution of Electrical Engineers, the Rt Hon Lord Nelson of Stafford, presided over the ceremony. The principal address was given by Sir Vivien Fuchs, who is President-elect of the British Association for the Advancement of Science. Sir Vivien entitled his talk "The Antarctic Today" and illustrated it with slides and a film. The theme of the Fortnight was "The World's Water" and included in the programme were lectures entitled "What is Water?", "Water - Source of Life", "Prevention and Control of Marine Pollution". The programme also included visits to such places as the Science Museum, Kew Gardens and industrial and research establishments.

The motivation behind the work of the Council for International Contact is the promotion of international understanding and it is hoped that this will be the result when young people meet together in a conference such as this. The 14th International Youth Science Fortnight will take place in London from 26 July to 7 August 1972. Further information on the Science Fortnight can be obtained from the Director, Mr George McGowan, 308 Earls Court Road, Kensington, London SW5 9BD.

19. Advisory Centre for Education, Cambridge

The Advisory Centre for Education at Cambridge is a non-profit making body set up 10 years ago to promote new ideas in the field of education. Its main organ is the magazine 'Where' published for parents. A sister organisation set up by the Advisory Centre soon after its own foundation is the National Extension College through which some of the original ideas behind the Open University were tried out. The Advisory Centre was responsible for the manufacture and distribution of science packs, ie experiment packs for children, see SEN 6:16. They are called 'Things of Science'. There are 2 series, one for older children and one for younger children, and provide material to be used in the child's own home by the child himself, on subjects ranging from soil-less gardening to the laws of chance. The Centre has now produced another series of discovery packs on environment for children aged 9-14. These have been designed with the idea of making

a. The child's home surroundings more interesting and full of discoveries, and also giving information on

b. The use of the local museum.

Outlines of the 6 discovery packs

i. The Landscape. The introductory booklet traces the history of man's investigations into the face of Britain. In the pack there is a fossil panorama, with an accompanying fossil search wheel, and a rock guide. There is experimental work with 'minimum' streams and a section about hunting for evidence of the Ice Age. There is a soil identification card. There is a section about beaches and the pebbles on them. The pack finishes with ideas about presenting the discoveries - different maps for different purposes.

ii. Field archaeology. Using Maxey as the thread, Dr Peter Wade-Martins introduces work with air photographs, maps etc - the techniques of preliminary archaeological investigation. The pack then deals with the way a dig is carried out. As well as giving hints on what a child can spot around his own home, the pack gives some ideas about pottery styles etc.

iii. The countryside. The pack intrcduces ecology, without the almost statutory description of field box E. Included in the pack are a set of identification cards for indicator species, for use in a water pollution survey; similar ideas on the use of lichens for estimating air pollution; a couple of comparison cards for two types of grass area, and a woodland/habitat search card. Monks Wood Experimental Station have suggested and helped on many of the ideas of this pack.

iv. Roman Britain. Somewhat in the way of pack No 2, this title introduces techniques and compares styles, tracing the reconstruction of a small villa-farm and of a more imposing residence. Day-to-day life in Roman Britain.

v. Housing and houses. Ideas and discoveries about the vernacular buildings of Britain.

vi. Towns. Modern towns and their problems - changing traffic, housing and shopping patterns and what they presage for the future.

## 20. Croydon Biology Teachers' Centre

The Croydon Biology Teachers' Centre was established in September 1967 with the aim of testing and evaluating the content and materials of the Nuffield O-level biology project with a view to producing in-service courses for teachers from Croydon and five other South London boroughs. From the beginning the work of the Biology Centre has been to discover what type of courses teachers want and what else can be done to help in the difficult task of running fully experimental courses in biology departments. As well as running in-service teachers' courses, the Centre has developed various other services for teachers. These include specimen services, technician courses, day courses in field biology, ecological bookets, apparatus loans, exam question bank and library facilities. The Centre has a staff consisting of two part-time teachers acting as organising and assistant tutors and two fulltime technicians. The Warden of the Centre is Mr D Ford, Croydon Biology Centre, Chipstead, Surrey Road, Coulsdon, Surrey CR3 3YD.

## 21. GCE Examinations in Science

A summary on the current and proposed developments in GCE examinations in science was given in the September edition of the Association for Science bulletin 'Education in Science'. The ASE have kindly given us permission to reprint this information in the newsletter. The ASE themselves were grateful to the Examining Boards for supplying the information, and for permission to publish the summary, compiled by the Examinations Secretary Mr P S Rees.

### Associated Examining Board

#### Biology

O-level: two new alternative syllabuses have been published (1971); the examination for alternative A includes short answer and structured questions.

A-level: a new syllabus is under consideration, to include specification of the abilities to be tested, and an entirely new form of examination will be offered.

#### Chemistry

O-level: a new form of examination was introduced in 1971, including an objective test paper.

#### Environmental Studies

O-(alternative)- level: a new syllabus has been published. The relevant examination includes a 30% component of teacher assessment.

#### Engineering Science

A-level: an entirely new syllabus has been introduced (1971). The examination includes a component of teacher assessment of course work.

#### Geology

O-level: a revised syllabus will be introduced in 1974 with an amended form of examination.

A-level: a revised syllabus is in preparation for publication in 1976.

#### Human Biology

O-level: a new syllabus and a new form of examination was introduced in 1970.

A-level: a syllabus in in course of preparation for examination in 1974, or as soon as possible thereafter.

Physical Science

O-level: the syllabus introduced in 1971 includes a mode 3 component; there will be a relevant teachers' assessment component in the examination.

A-level: the syllabus is being prepared for examination in 1975 or as soon as possible thereafter.

Physics

O-level: a new form of examination was introduced in 1971, including an objective test paper.

Physics-with-Chemistry

O-level: an amended form of examination was introduced in 1971, with some sections comprising compulsory short answer questions.

Joint Matriculation Board

Biology

O-level: a revised alternative syllabus was introduced in 1969 and will replace the present syllabus in 1971. The examination paper is divided into two sections, Section A consisting of compulsory questions requiring short answers, while Section B has questions requiring longer answers. An experiment in mixed mode examining is being conducted through the Research Unit using a mixture of Mode 1 (the compulsory short-answer section of the normal syllabus) and course work assessment procedures.

A-level: a revised syllabus was introduced in 1965 and amplified in 1970. The separate subjects Botany and Zoology were withdrawn after the examination of 1968. Consideration is being given to a revision of the syllabus to produce a 'core' of compulsory material and a number of optional topics; methods of assessment of practical skills are also under consideration.

Chemistry

O-level: a revised syllabus was introduced in 1968. The paper consists of two sections, one consisting of compulsory objective questions or questions requiring short answers.

A-level: a revised syllabus has been introduced for the examination of 1971 and will replace the present syllabus in 1973. Abilities are specified and the weighting given to each ability is stated. There will be two written papers, each divided into three sections:

Section 1 - compulsory objective test questions
Section 2 - compulsory short answer questions
Section 3 - a choice of questions requiring answers in essay form

The practical examination will be revised and an experimental scheme for internal assessment of practical skills is being tried in 1972, to be moderated against the written examination.
Consideration is being given to the provision of an alternative syllabus based on the relevance of Chemistry to technology and society, based on a compulsory 'core' of material and a series of optional topics.

Engineering Science

A-level: this new syllabus was introduced in 1969. The papers are divided into sections designed to test specific abilities or areas of the syllabus and the candidate's practical ability is assessed by the teacher and moderated by the examiners.

General Science

O-level: a revised syllabus was introduced in 1971. Paper 1 consists of

compulsory objective questions and paper II of questions requiring answers in essay form.

Geology

A-level: a revised syllabus was introduced in 1970 and consideration is now being given to the examination.

Physical Science

O-level: a syllabus in this new subject is proposed for 1973.

A-level: proposals are nearing completion for the introduction of a new syllabus which will include a statement of the objectives of the examination and of the weighting to be given to the abilities. The examination will use a variety of techniques and consideration is being given to the method of assessing practical technique.

Physics

O-level: the revised syllabus introduced in 1968 replaced the old syllabus in 1970. Section A of the paper consists of compulsory objective questions.

A-level: a revised syllabus and examination will be introduced in 1973. A new form of practical examination is being tested in a pilot scheme. Internal assessment of practical skills is under discussion.

Physics-with-Chemistry

O-level: a revised syllabus has been introduced for 1971.

Publication: 'Examining in Advanced Level Science Subjects of the GCE' is available free of charge from the Secretary, Joint Matriculation Board, Manchester 15.

Northern Ireland GCE Examinations Board

Biology

O-level: two examination papers are now set - Paper I has a large number of compulsory short objective questions and a compulsory short essay, selected from a number of biological topics; Paper II consists of a choice of more discursive questions.

A-level: two 3-hour papers and a practical test are set.

Chemistry

O-level: from 1972, Paper I will consist entirely of objective questions; Paper II has four compulsory structured questions plus a choice of 3 from 5 free response questions. Periodic Tables are supplied to the candidates, and from 1973, data sheets where necessary. The 1973 syllabus shows some slight modifications, involving a slight reduction in the content of the syllabus.

A-level: three written papers are now set. Paper I consists of compulsory objective type questions. Paper II has eight compulsory structured questions. Paper III consists of free-response questions in which some choice is permitted. Periodic Tables and data sheets are supplied to the candidates. Minor modifications are apparent in both the 1972 and 1973 syllabuses, which both include a section on 'Chemistry in the World'.

Engineering Science

A-level: the syllabus, recently introduced, is mathematical in form and the examination consists of two 3-hour papers, although practical notebooks must be made available for inspection by the examiners.

General Science

O-level: the syllabus was extensively revised for 1972.

Physics

O-level: Paper I consists of short-answer questions while Paper II provides a choice of two questions from five in each of two sections. Minor modifications were made to the syllabus for 1972, and again for 1973.

A-level: two 3-hour papers and a practical test are set. Both the 1972 and the 1973 syllabuses show minor modifications.

Oxford and Cambridge Schools Examination Board

Biology

O-level: a new syllabus was first examined in 1969, with a reduced prescription of specific organisms and more flexibility in examining. A multiple-choice question with 20 items has been included in the papers since 1968.

A-level: a new syllabus was first examined in 1969, aiming to give greater freedom in teaching, by the elimination of specific organisms (apart from flowering plant and mammal) and giving more emphasis to quantitative work.

Botany/Zoology

A-level: a combined syllabus has been introduced for the 1971 examination together with a new scheme of papers. The scheme is designed so that the basic work can be done in conjunction with the teaching of Biology. The emphasis on specific organisms has been greatly reduced.

Chemistry

O-level: the practical paper was discontinued in 1969. The Board is at present considering replies from schools to a questionnaire on the revision of the syllabus.

A-level: a 50-item objective test (multiple choice and multiple completion) was first set as paper I in 1970. Paper II is made up of the same type of questions as set in previous years.

Combined Science

O-level: a new subject undergoing trials. The three sciences are taught separately and the examination consists of one paper covering all three subjects (probably in short answer form) and one paper in each of the three sciences. Candidates can be awarded either a double subject pass or a single subject pass.

General Science

O-level: a new syllabus was introduced in 1970 but the pattern of the examination is unchanged.

Physics-with-Chemistry

O-level: the practical papers have been discontinued. The Chemistry syllabus is to be revised together with that for the whole subject Chemistry.

Physics:

O-level: the practical paper was discontinued in 1968 and a new syllabus operated from 1970.

A-level: a 50-item objective test (multiple choice and multiple completion) was first set as paper I in 1969. Paper II consists of essay-type questions as in previous years.

Oxford Local Examinations

Biology

O-level: full-scale revision of the syllabus will be considered during the autumn of 1971.

A-level: the first draft of a completely revised syllabus has just been published, in which the emphasis has been placed on function, rather than on the study of a few specified types as previously. Specimen papers will be available later in 1971.

Chemistry

O-level: full-scale revision of the syllabus will be considered during the autumn of 1971.

A-level: the 1974 Regulations will contain a new syllabus which has recently been sent to schools for comment, together with specimen papers. In both papers I and II, section A consists of short-answer questions, and section B of longer questions.

Physics

A-level: paper I will be replaced by a multiple-choice paper in 1973.

22. Internavex 71

The International Audio-Visual Aids Conference and Exhibition was held at the start of September 1971 in the National Hall, Olympia, London. Organized jointly by the National Committee for Audio-Visual Aids in Education (NCAVAE) and the Educational Foundation for Visual Aids (EFVA), exhibits on show were from over 90 firms manufacturing audio-visual aids. Also included were examples of work done in primary and secondary schools. Aids on display ranged from simple felt tip pens to the most impressive of modern teaching machines.

Publications

1. 'Visual Education' (SEN 12:22n). Monthly - annual subscription £2.40 - from NCAVAE, 33 Queen Anne Street, London W1M OAL contains information about and evaluation of visual aids in education. The July issue is an enlarged publication and is sold separately as The 'Visual Education Yearbook'(40p).

2. 'Visual Education National Information Service for Schools' (VENISS) (SEN 12:21) is an information service operated by NCAVAE and EFVA for the benefit of educationists. Membership, open to individuals or institutions, is by annual subscription of £4 (overseas), for which one receives the EFVA magazine 'Visual Education' published by NCAVAE and the 'Visual Education Yearbook'. Further details from VENISS, 33 Queen Anne Street, London W1M OAL.

3. 'Resources' - a new magazine for teachers - first issue October 1970, published by Educational Resources Ltd. Price 25p. Annual subscription British Isles £3.00, overseas £3.75.

The National Audio-visual Aids Centre 254-256 Belsize Road, London NW6 has a demonstration centre, where visitors can preview aids that they may later wish to use.

The Centre also organizes short courses in the use of teaching aids - full details of the course programme are available from the centre.

23. Publications

23.1 Schools Council Working Paper 33, Choosing a Curriculum for the Young School Leaver published by Evans Methuen Educational, price 26p.

This publication is a report on a conference held at Scarborough from 16-20 June 1969 which was held to attempt to explore some of the problems associated with Nuffield and Schools Council sponsored projects aimed at the young school leaver. The Conference was particularly aware of the fact that the school leaving age would be raised in 1972/73. At the end of the foreword by Guy Rogers, Chairman of the Conference, he writes "This report therefore is presented in the hope that it may provoke the further constructive thinking that will be necessary if we are to ensure that development work not only ties in with genuine needs but can then itself be tied in with the whole curriculum that makes sense in today's world. Chapter headings in the working paper include

i. Educational Objectives and Learning Experiences

ii. Variety in Schools Council and Nuffield Projects

iii. Problems of School Organisation

iv. The roles of Teachers and their In-service Education.

The first Appendices gives statements on participating projects which include North-West Regional Curriculum Development Project, Mathematics for the Majority Project, Nuffield Secondary Science Project, Nuffield Resources for Learning Project and Project Technology.

23.2 Schools Council Working Paper 34 - the 1968 CSE Monitoring Experiment by Desmond L Nuttall, National Foundation for Educational Research in England and Wales, published by Evans Methuen Educational, price 42p.

The report is the fourth of a series describing the procedures and results of studies investigating the grade standards of the Certificate of Secondary Education examinations. It is the last of the current series and therefore takes stock of the current situations with regard to grade standards in the light of the studies of previous years.

23.3 Schools Council Working Paper 38 - Support for School Science and Technology, published by Evans Methuen Educational, price 40p.

This is a report from the School Science and Technology Committee Working Party on school science and technology centres in the UK with suggestions for a national framework for local activities. The report is divided into 4 sections.

Section 1 - The School Science and Technology Centres

Section 2 - Form, Function and Financing of Local Activities

Section 3 - A Possible National Framework

Section 4 - Summary

There are six appendices to the paper and these include a review of physics, chemistry and biology centres; the position in Scotland; local technology centres; the North-London Science Centre; special centres, eg Centre for Science Education, Chelsea; local activities of other bodies in support of science and technology.

23.4 Schools Council Project

The Schools Council has published in looseleaf form a profile and index

of their curriculum research and development projects. These are projects that were being sponsored wholly or in part by the Schools Council at 1 April 1971. Profiles are also given on all projects which finished before April 1971 and which have published reports or material that is now available to the public. Five projects financed wholly by the Nuffield Foundation but which link closely with the work of the Schools Council projects have also been included in the information. The profiles are intended as a brief introduction to the work of the Council's research and development projects. Because there is always a danger when publishing such information that it will quickly become out of date, the publishers have tried to strike a balance between giving a lot of information of a somewhat ephemeral nature on the one hand and giving sufficient detail of aims, objectives, procedures and materials on the other. The project profiles have been grouped under 11 broad subject headings, English, Humanities, Languages, Creative Studies, Mathematics, Science, Inter-related studies, Home, School, and Community, School Organisation, Staff and Resources and Examinations. Within these groups projects are arranged from those dealing with primary children through middle school to secondary. Projects dealing with the whole age range come at the end of the section. Sets of the sheets are available from the Schools Council at a cost of 50p (70p including package and postage) and 75p overseas. Information on the sheets is not copyright and there is no objection to sheets being photocopied locally by teachers' centres or schools. The address of the Schools Council is Schools Council, 160 Great Portland Street, London W1N 6LL.

23.5 Science Teaching from 5-16

This is the title of a report on 3 conferences held at the University of Keele and published by the University of Keele Institute of Education as an occasional publication. The report contains the commentary on the conferences by Messrs D A Rawney, I F Roberts, both of the University of Keele, and K Wild, Science Adviser, Staffordshire Education Authority. Much of the material available in the literature on current science education developments concentrates on the curriculum development side proper in the narrow sense of design and production of new materials. Far less attention has been paid to questions of the problems of implementation in schools and certainly to the opinions of teachers who actually have to carry out this implementation. A notable feature of this report is that it provides a forum for teacher opinion of this kind. The report is divided into a number of sections covering the courses available, issues which arise in teaching these courses, patterns of implementation in various schools, and further issues to be considered bearing upon the problems of implementation.

The section on the courses available covers the standard Nuffield Foundation courses in junior science, O-level biology, chemistry and physics, combined science and secondary science. In addition it covers a brief outline of the Schools Council 5-13 Project and the Schools Council Integrated Science Project. These are in essence brief descriptions of these projects on which greater detail can be found elsewhere.

Under the subject of the issues which arise from considering the implementation of these courses an interesting cross-section of viewpoints emerges on such subjects as the acceptability of general science, the early Nuffield philosophy, how much teacher guidance is required, should work sheets and notes be used and the important problems of interfaces between the various projects.

The section dealing with patterns of implementation in science education will provide interesting food for thought for those concerned with the introduction and implementation of new science courses in their schools, particularly where more than one type of science course has to be offered.

The fifth section on other problems of implementation covers topics such as equipment, laboratories, the actual arrangement of schools, ie what effect will the introduction of middle schools have on the patterns of teaching, the problems of implementation on new examination methods, particularly in the case of the new mode 3 CSE type examination in relation to modern science teaching methods and last, but by no means least, the problems of initial and in-service training of teachers to introduce them to modern methods and maintain their contact with them. At the end of the publication there is a valuable short list of references which would form a very useful reading list for someone wishing to study this field in more detail. The final item in the book contains an appendix covering the publications of all the Nuffield materials. This report will be of considerable interest to all those concerned with the practical teaching problems of introducing modern science courses, is available from the University of Keele Institute of Education, price 15p.

23.6 Science For the '70's, Vol 2, A J Mee, D Ritchie and A Boyd. Published by Heinemann Educational Books, price 90p.

Volume 2 of this very modern text for the teaching of Integrated Science to junior forms of secondary schools is now available. (See SEN 16:10)

23.7 CSE Biology, Book 1 - General Plant & Animal Biology
Book 2 - Human Biology & Hygiene both by
E J Ewington and D F Moore, published by Routledge & Kegan Paul, price £1.60 each.

The books in the CSE Science Series adopt the latest approach to science teaching for secondary schools and the new middle schools. The students are encouraged to discover as much as possible for themselves rather than simply to verify what they are told to be true. Most of the experiments are simple and require the minimum of equipment. At the end of most chapters there is a "Test Yourself" section to reinforce knowledge and understanding of important points. SI units have been used throughout the series. These two new volumes are designed to follow on the first volume, Common Core Science, which provided a two-year course in basic science. They are intended to take pupils up to the standards required by the CSE biology examination. The parallel volumes are Chemistry, General Science in two parts and Physics in two parts. The Chemistry volume is already available; General Science and Physics will appear later.

23.8 Biology by Enquiry - Book 3, by Clarke, Booth and others, published by Heinemann Educational Books, price £1.30.

The third and last book in the Biology by Enquiry series written by a group of Scottish teachers and lecturers was published by Heinemann Educational Books Ltd in August 1971. The third book takes the students up to the H grade of the Scottish Biology syllabus. The book is divided into four parts in which a number of themes are developed. Part 1 entitled "Aspects of Control", Part 2 "The Genetic Basis of Control", Part 3 "Structure and Function", Part 4 "The Changing World". At the beginning of each part is a short introduction which discusses very briefly the topics to be considered and the ways in which they are inter-related. One aim of the course is to show that biology as a subject inevitably blends with others leading into areas of sociology, philosophy and ethics, amongst others.

23.9 New Trends in Biology Teaching, Volume 3, published by UNESCO

This volume of New Trends in Biology Teaching is the third in the series. They are published every two years under the auspices of UNESCO by the Commission on Education of the International Union of Biological Sciences and are intended to help biology teachers solve the difficult problems which arise as a result of the increasing amount of knowledge that must be imparted to

pupils. This third volume, like the previous two, is a selection of original texts and extracts from pedagogical reviews. The contents are divided into four main sections:

1. General
2. Individual disciplines
3. Educational methods and techniques
4. Local developments

In the last section is a paper 'A-level Biology in West Africa: a new syllabus' written by V W Ewer and a second one 'Biological education in relation to manpower requirement in the Western State of Nigeria', V Ninan. The volume is written in both English and French.

23.10 Biology - a Functional Approach by M B V Roberts MA PhD, published by Thomas Nelson & Sons Ltd, price £3.75.

This book is intended as a pre-university text for prospective biologists, medical students and agriculturalists. In the book an attempt has been made to strike the right balance between the modern investigatory approach and also dealing with the traditional topics. The author has tried to reassess traditional topics such as anatomy and organ physiology in the light of recent advances and to combine both into a modern functional framework. Modern work in biology, particularly cell structure and function, is making it possible to draw together seemingly disconnected threads into a series of unifying principles and it is these that the author tries to emphasise. The book does not include laboratory schedules or examination questions but the author has taken pains to give evidence for stated facts wherever possible, particularly where it will be difficult or impossible for the student to verify them for himself. The book is divided into 6 parts. Part 1 - Organisation in cells and organisms. Part 2 - The maintenance of life. Part 3 - Adjustment and control. Part 4 - Response and co-ordination. Part 5 - Reproduction Development and Heredity. Part 6 - Ecology and Evolution.

23.11 Problems in Plant Physiology by Margaret K Sands, Teachers' Edition £1.75, students' edition 60p, published by John Murray.

Biology in schools is rapidly moving from descriptive qualitative work to an experimental analytical approach. Hypotheses about observed phenomenon are formulated, experimental test and design data presented and interpreted and conclusions drawn. This book consists of problems in which information is given and questions requiring analysis of the data asked. The problems can be used a. as a teaching aid, b. as a training in some scientific skills and c. as a source of questions for school examination papers and as a practice for public examinations. Sixty problems are presented in the book, all covering experimental work in plant physiology at VIth form level. The teachers' edition contains all the problems in full and also provides suggestions for answers, question by question.

23.12 Environmental Studies: The construction of an A-level syllabus. S McB Carson, National Foundation for Educational Research (NFER), price £1.00 (see also SEN 17:15).

Most work in environmental studies in schools up to now has been at primary or junior secondary level. This book is unique in that it describes a project in this field at advanced level and is the result of the Hertfordshire A-level Environmental Studies Working Party deliberations. It is a response to the increasing social concern for the quality of environment and its conservation; to the need to ensure that all pupils, including the most

able, in their final years of schooling shall be brought to share that concern; and therefore, the teachers think, to the need for an A-level qualification in environmental studies suitable for entry into higher education and for certain career opportunities. The work was carried out between 1966 and 1970 and this publication describes the results of this work under the headings of:

a. Environment and examinations

b. Problems of the countryside

c. World conservation problems

d. The urban and social environment

e. Various study group reports.

It contains a detailed syllabus and teaching notes together with articles on field study, methods of examination, specimen question papers and timetables. A valuable feature of the book is the resources list contained at the end of the book which will be extremely useful to teachers working in this field.

23.13 Field Worker, the Environmental Studies magazine. Published by Alan Machin Associates Ltd, 6 Stone Buildings, Lincoln's Inn, London WC2, subscription United Kingdom £1.20 per annum.

It is natural that the current interest in environmental studies should spark off developments in the periodical field and this magazine is now in the sixth edition of its first volume. The interests of the periodical are not confined to the shores of the United Kingdom and volume 1 has contained articles on such subjects as 'Air passage to India', 'The Economic development of the West Indies' and 'Letter from Tanzania'. It has also included articles on the teaching of conservation, on environmental studies and on such subjects as pollution and other matters of considerable importance and interest at the present time. Although many of the articles are in fact dealing with problems of conservation etc in the United Kingdom the extention of the principles involved to overseas countries is often very clear and projections easily made. This, together with the valuable articles on overseas countries, suggests that this magazine deserves considerable attention from overseas workers in this field.

23.14 New Geography 1970-1971 by John Laffin, published by Abelard-Schuman price £2.00.

The purpose of this book is to enable students to keep abreast of developments in human, physical, economic and scientific geography. It is the third edition of the book and is completely new, not merely revised. The classification of the book is alphabetical on the basis of countries, commodities and related geographical matters such as geology, ecology, population, oceanology.

23.15 Titrimetric Analysis for A and S levels (SI edition), J G Stark, published by John Murray, price 35p.

This new edition of a well known practical text incorporating the use of SI Units will be welcomed by teachers facing problems of converting from previous systems. The SI Unit of concentration is the "Mole per cubic metre". However in titrimetric analyais a decimal fraction of this unit "Mole per litre -(cubic decimetre)" is more convenient. The symbol M is used for Moles, litres -1 throughout the book. A brief discussion of the obsolete term "normality" is also included. In addition to the discussion of the principles and experimental methods applicable to titrimetric analysis the book contains sections on acid base titrations, radox titrations, precipitation titrations and 2 sections covering complexometric titrations and conductometric and potentiometric titrations, the latter being a particularly interesting section those teachers perhaps less familiar with these more modern techniques.

This book will be a valuable aid in the conversion of advanced level practical chemistry work to modern systems of units and to modern experimental techniques.

23.16 Advances in Chemical Education. Chemistry in Britain Vol 7 No 8 1971 published by the Royal Institute of Chemistry.

The structure and approach to Undergraduate Chemistry Courses in Britain has been receiving a great deal of attention in recent years. A notable contribution to this field was the report by the Committee under Professor Eaborn on the enquiry into the Relationship between University Courses in Chemistry and the Needs of Industry (1970) published by the Royal Institute of Chemistry at £2.00. The current edition of "Chemistry in Britain" contains a number of articles concerning developments at this level on the teaching of mathematics at university level for chemists by J N Murrell, Professor of Chemistry, University of Sussex, on programmed learning chemistry by Dr R M Beard of the Department of Higher Education, Institute of Education, University of London and on first year chemistry teaching in Scottish Universities by Dr D E Hore and Mr E J Yeaman of the University of Dundee. The latter article has particular interest since the Scottish educational system (see SEN 16:10) has now produced a complete absorption of new chemistry syllabuses throughout the secondary school and pupils are now going on to university with different knowledge and outlook on chemistry than hitherto. Educational researchers continue suggesting new methods of approach and presentation. The authors of this article present a picture of first year chemistry teaching in Scottish Universities showing the areas where these influences have already produced changes and where other changes are likely to occur. "Chemistry in Britain" is available from the Chemical Society Publication Sales Office, Blackhorse Road, Letchworth, Herts, price £7.00 per annum or 70p a single copy.

23.17 Royal Institute of Chemistry Monographs for Teachers No 17 - An Introduction to Biochemistry, E G Brown, price 70p; No 18 - Principles of Crystal Chemistry by E Cartmell, price 60p; No 19 - The Molecular Basis of Entropy and Chemical Equilibrium by P A H Wyatt, price £1.00.

These three further publications in the Royal Institute of Chemistry series of monographs for teachers were published in June 1971. The first, on Biochemistry, attempts to give a broad picture of the present position in the field of biochemistry and as well as concerning itself with biologically important molecules such as fats, carbohydrates, proteins and nucleo-proteins, it deals with such topics as chemical evolution and the origin of life, enzyme catalysis, bio-energetics, metabolism, biochemical control and integration and even has a section on the future of biochemistry. A useful chapter on approaches and techniques is also included. This would prove a very valuable addition to the material available for modern teachers with interests in this field.

The Principles of Crystal Chemistry deals in some detail with the basic crystal structures with which the inorganic and organic chemists normally deal at school level and is very clearly illustrated. The subject of crystal lattice energy receives particular attention, as does that of crystal defects. This topic is now emphasised in most modern inorganic chemistry courses and this text will form a useful supplementary reader both for the teacher and the good VIth form student.

The subject of entropy has often been regarded with some considerable degree of trepidation by chemistry teachers and it is appropriate that this series of teachers' monographs should now deal with a subject which is rapidly finding a place in most school curricula. The recent films by Professor George Porter on the laws of disorder made by the ICI Film Library have contributed considerably to teachers' understanding of the qualitative aspects of

entropy and chemical equilibria. This text sets out to deal more thoroughly with the more quantitative aspects of entropy starting from heat and work and the first law of thermodynamics through the concept of quantum states and building up to a discussion of the properties of real systems and the factors determining equilibrium and changes in entropy. For the teacher who wishes to go beyond the qualitative arguments this book will prove a valuable addition to the range of material previously available on this topic. The complete range of titles available in this series is listed below.

1. Principles of Electrolysis. C.W Davies. (Second edition) 30p.
2. Principles of Oxidation and Reduction. A G Sharpe. (Second edition) 30p.
3. Principles of Extraction of Metals. D J G Ives. 40p.
4. Principles of Metallic Corrosion. J P Chilton. (Second edition) 40p.
7. Principles of Catalysis. G C Bond. (Second edition) 40p.
8. Principles of Atomic Orbitals. N N Greenwood. (Revised edition) 40p.
9. Principles of Reaction Kinetics. P G Ashmore. (Second edition) 40p.
10. Industrial Chemistry - Inorganic. D M Samuel. (Second edition) £1.20.
11. Industrial Chemistry - Organic. D M Samuel. 30p.
12. Elements of Chemical Thermodynamics. E A Guggenheim. (Second edition) 40p.
13. Principles of Osmotic Phenomena. J F Thain. 40p.
14. Principles of the Colloidal State. G D Parfitt. 30p.
15. Physicochemical Quantities and Units. M L McGlashan. (Second edition) 70p. (Library edition £1.40)
16. Chemical Processing in Industry. M D Wynne. 40p.
17. An Introduction to Biochemistry. E G Brown. 70p. (Library edition £1.40)
18. Principles of Crystal Chemistry. E Cartmell. 60p. (Library edition £1.20)
19. The Molecular Basis of Entropy and Chemical Equilibrium. P A H Wyatt. 50p. (Library edition £1.00)

Sales of all Royal Institute of Chemistry publications, other than sales to Institute members of 'Education in Chemistry' and 'RIC Reviews', are handled by The Chemical Society. Orders for publications, together with the appropriate remittance, should be sent to: The Chemical Society Publications Sales Office, Blackhorse Road, Letchworth, Hertfordshire SG6 1HN.

23.18 Radio Chemistry, Modern Physical Science Report No 6. The Association for Science Education, price 40p.

The Association for Science Education has been interested in the teaching of modern physics and allied subjects for some time and this is the latest report to appear in the series of Modern Physical Science Reports. Radio Chemistry and Radioactivity are borderline subjects which overlap both physics and chemistry. Owing to its importance in the modern world it is desirable that the basic principles should be included in any set science course. The report describes a range of experiments suitable for use at both Ordinary and Advanced level. Six experiments are specially recommended for O-level, since only uranium, thorium and potassium salts are used, for which no special training is needed nor in the United Kingdom is permission required from the Department of Education & Science. A list of appropriate apparatus and notes on suitable apparatus are included. Teachers intending to embark on work in this field are advised to study particularly the safety precautions required and the likely health hazards and to consult the regulations operating in their countries in respect of the use of radioisotopes and radioactive materials at

school level, or where appropriate in industry and higher academic levels if no specific precautions exist for school work. This will be found to be a very useful range of experiments and complete details are provided with added notes on the individual possible health hazards incurred in each individual experiment.

23.19 Introductory Electronics by J W Hill, published by Blackie, price 90p.

A very well presented course of experimental work designed to cover some of the CSE options but potentially of much wider use. It is written for both teacher and pupil and should be invaluable to teachers wishing to build up courses in this subject. Experiments are lited under various headings eg

i. Electrical circuits and Ohm's law

ii. The collapse of magnetic fields

iii. Alternating to current

iv. Oscillatory circuits.

23.20 Basic Astronomy by H Haysham, published by Thomas Reid, price £3.25.

Astronomy is a subject which has received greater attention in schools recently as a component of new physics and environmental studies courses and a number of examination boards now have Ordinary level syllabuses for the subject. It is unusual to find a book of this kind written for schools by an author who is a master-mariner and Fellow of the Royal Astronomical Society. Mr Haysham is, in fact, lecturer in navigational astronomy at the South Shields Marine Technical College. The book is a lucid and clearly written account of the principal aspects of the study of astronomy and contains a list of simple projects and research which the reader/pupil can undertake whether they be in the northern or southern hemisphere. The book has much to commend it to teachers and pupils in a field where previously good texts on this subject have been rather scarce.

23.21 Nuffield Audio-Visual Package for A-level

The Principles and Applications of Atomic Spectra is the title of the fifth and last audio-visual package in a series produced jointly by Rank Audio-Visual Limited and Mullard Limited in the interests of science education. The package comprises a 60mm colour film, an 8mm film cassette (super or standard 8) and an illustrated teachers' booklet. The Scientific and Educational Adviser for the materials is Dr J E Spice of Winchester College and the Nuffield A-level Scientific Teaching Project. Ordering information for the 60mm film is as follows:

60mm, 23 minutes, colour film, reference No 21.9001, hire rate £2.75, purchase price £94.60

All the information for the 8mm loop and the teachers' booklet are still not available. For further information and orders, the sole distributors are the Rank Film Library, Rank Audio-Visual Limited, PO Box 70, Great West Road, Brentford, Middlesex.

23.22 Teaching Technique in Primary Mathematics by J D Williams, published by the National Foundation for Educational Research in England and Wales in their series 'Exploring Education'.

This is a valuable little book which seeks to set in perspective much of the development work which has taken place in modern mathematics from the point of view of its impact of teaching techniques at the primary level. It deals first of all with the tools of teaching which it subdivides into three rate chapters concerned a. with structured materials, b. with calculating

devices old and new and c. with programmed instruction, films and television. It goes on to deal with the subject of arithmetic and such questions as what should be taught when? do speed and accuracy matter? does practice make perfect? etc. A short chapter on Piaget and Dienes covers the child development aspects of this work and provides a brief introduction which many readers will no doubt with to follow up through the excellent bibliography which is included with the list of references at the end of the book. The penultimate chapter lists seven items as the "Seven Pillars of Modern Teaching Method", understanding, variety of experience, concrete experience, feedback, self-pacing, discovery and intrinsic motivation. The final chapter, entitled "Analysing and Sequence in Courses", attempts to provide a simple framework whereby the teacher can decide what and for what to teach. This will be a particularly valuable book in the context of teacher training as well as for the practising teacher meeting this subject for the first time.

23.23 The Development of Educational Technology in Colleges of Education. Occasional Paper No 3, National Council for Educational Technology, J D Brown MA.

Early descriptions of educational technology as being audio-visual in essence sprang from the fact that many of the electronic devices that are involved rely largely on the visual image or the spoken word rather than the understanding of written symbols. In this pamphlet it is assumed that what is essential to the term 'educational technology' is not just the consideration of devices but the adoption of certain procedures, ie

i. the clarification of the ends to be achieved;

ii. the arrangement of the material to be communicated, and

iii. the choice of the means of presentation, whose variety and scope has been immensely widened by technology.

The pamphlet goes on to consider the characteristics of colleges of education that affect the application of educational technology, the position in respect of present resources and courses, the use of educational technology in the colleges as at present practised. It forms an interesting summary of the present position in this rapidly developing field.

23.24 Education and Training (Technical Education and Industrial Training) Volume 13, No 8, August 1971, price 30p.

As many people will be aware, the structure and content of teacher training in the United Kingdom are at present the subject of consideration by the Lord James Committee on Teacher Training. The August edition of Education and Training contains a series of articles which provide an interesting selection of the issues at present being discussed in the context of possible reconstructions of teacher training in Britain. Some of the problems discussed are by no means confined to the United Kingdom and this edition of Education and Training will be of considerably wider interest. The following articles are of particular interest:

Page 258 - The future for teacher training
" 260 - The Loughborough Sandwich
" 262 - A College of Education in the year 2001
" 264 - Inter-Professional Degrees
" 266 - Don't spare the horses
" 268 - Areas of Neglect
" 271 - Team teaching in further education
" 274 - Micro teaching by CCTV

Education and Training is published by MacMillan Journals Ltd, 4 Little Essex Street, London WC2R 3LS.

23.25 Quantitative data in Science and Technology

This is the subject of Occasional Publication No 7 of the Association of Special Libraries and Information Bureau (ASLIB) by B Mountstevens, A Osborne and M Slater. The question of information retrieval in the sciences has become one of considerable importance with the vast proliferation of scientific research and scientific applications in technology over the last decades. Important factors influencing the data problem include co-ordination of data compilation, data need studies, the need for critical evaluation, the trustworthiness of recorded data, compilation problems, the creation of data centres etc.

The creation of data information services is of comparatively recent date and in many cases depends on computer memories and computer programmes for efficient, rapid and accurate retrieval of information. This publication contains three sections: Part 1, The Data problem as seen in recent literature; Part 2, Data Search in Technical Libraries and Part 3, A Sampling of Data Centres. Other publications in this series are:

An Evaluation of British Scientific Journals, J Martyn and A Gilchrist, Occasional Publication No 1.

Use made of Technical Libraries, M Slater and P Fisher, Occasional Publication No 2.

The use of bibliographic records in Libraries, P A Thomas and H East, Occasional Publication No 3.

A procedural model for the use of bibliographic records in Libraries, P A Thomas, Occasional Publication No 4.

Notes on the operation of specialised information centres, J Martyn, Occasional Publication No 5.

The distribution of scientific and technical libraries and users in Great Britain, A Presanis, Occasional Publication No 6.

These publications are produced by the Association of Special Libraries and Information Bureau (ASLIB), 3 Belgrave Square, London SW1.

23.26 Publication 'Going Metric'

The first issue of the Metrication Board's new bulletin which will appear quarterly was published in July 1971. The aim of the bulletin is to provide everyone with a regular flow of information about what is going on in Government, in industry and in education. It includes what is happening in industry, in commerce, in trade as metrication programmes are followed through and also up-to-date information on the advance of metric in the Commonwealth, in the United States and throughout the world. It gives details of metrication conferences, exhibitions and other coming events and also sources of films and publications. The contents of the first bulletin are 'Progress in construction'; 'Freight charges'; new film 'Industry goes metric'; exhibitions, weighing machines, metric identification and world progress. The bulletin is obtained from the Information Office J, Metrication Board, 22 Kingsway, London WC2B 6LE.

23.27 A Teachers' Guide to Tests and Testing, second edition, by S Jackson, Longmans, price £1.00.

With the current interest in new methods of evaluation this little book is a valuable guide to the teacher on the nature of testing and the inter-

pretation of results and is recommended to all people in the educational field who are about to become involved in this field. In addition to a section dealing with the nature of tests and the interpretation of results, there is a large section giving details of various tests. The appendices on rank and product moment correlation, mean and standard deviations and a table for relating percentile schools to standard schools will be valuable to the uninitiated. There is also included a list of addresses of test publishers which again will be valuable for the people beginning to work in this field.

23.28 Association of Science Education Publications: Supplement No 2 (1971) to Science Books for a School Library, 5th edition, 1968.

The Association has recently published a supplement. The contents are sub-divided into biology, chemistry, physics, astronomy, geology, applied science and elementary science. The biology and chemistry are sub-divided: Biology 1 - Historical and General; 2 - Animal Life; 3 - Plant Life. Chemistry 1 - Historical and General; 2 - Practical; 3 - Theoretical and Descriptive.

23.29 Report of the 5th Commonwealth Education Conference 1971, published by HMSO, price 95p.

The 5th Commonwealth Education Conference was held at Canberra, Australia from 3-17 February 1971. The theme of the Conference adopted by the Commonwealth Education Liaison Committee was "Matching needs to resources". The Conference objectives were:

a. To review present schemes of Commonwealth co-operation in education and to recommend ways by which these may be developed and made more effective.

b. To focus attention on major education problems which may provide further opportunities for Commonwealth co-operation, and

c. To consider any other proposals for the advancement of these general aims and to make recommendations concerning them.

The report on the Conference has now been published and is available from Her Majesty's Stationery Office.

## OVERSEAS ACTIVITIES

### 24. AUSTRALIA

The October 1971 edition of the Australian Science Teachers' Journal has as its theme "Curriculum Development". The Journal, which is Volume 17, No.3, includes many valuable and interesting articles. These include an article by Mr W C Hall, joint Director of the Schools Council Integrated Science Project, in which he discusses various curriculum types and shows how the Schools Council Integrated Science Project selected their approach. Mr E Richardson, a senior lecturer in education at Macquarie University, writes on "Renewed Curriculum Emphasis upon Technology". The Journal also has articles on curriculum implementation, teacher education and curriculum resource materials from USA. The Journal is available from The Editor, Australian Science Teachers Journal, School of Education, Macquarie University, North Ryle, NSW 2113, Australia, price per single copy $A2.00.

### 25. IRAN Science Teaching Seminars

Following the successful seminars held under the auspices of the British Council in Iran on new methods and examinations in Nuffield methods of teaching science in 1970, the Iranian Ministry of Education arranged for similar seminars to be held in July and August 1971. The Ministry requested two teaching experts to go out from Britain to assist in these seminars. Mr D R Skinner went out as a mathematics expert and Mr R N Fry went to assist in the biology courses. The seminars were held at Meshed and Tabriz.

### 26. MALTA

The following report on Science Education in Malta has been received from Mr D A Carter who is working in Malta under the Aid to Commonwealth Teaching of Science scheme.

The introduction of secondary education for all in October 1970, effectively produced three types of government secondary school. These were the 'old' Grammar and Technical and the 'new' secondary schools. Entry to the 'old' schools continues to be by selection examination at 11+. The new administration is presently considering changing this although no firm proposals have been published to date (October 1971).

With secondary education for all, it was necessary to undertake an appraisal of the syllabuses presently in existence. The Science Syllabus being used was the one followed by the old Grammar and Technical schools. This was a somewhat traditional general science syllabus planned for the first two years after which pupils would select subjects which would be sat at GCE 'O' level in the fifth year. This has now been changed to a one year course in science with selection of GCE subjects at the end of the first year. This naturally means that some pupils will receive no further formal science teaching after the first year, since all subjects studied from year 2 onwards are to be sat at GCE 'O' level, and all groupings of subjects do not include Science.

Happily the new secondary schools must look away from the traditional 'O' level courses since most of the pupils are not suited to this particular academic approach. This has allowed a rethinking of the science syllabus. For their first year (1970-71) these new schools followed the traditional gen science course which had been produced for the old schools. No scheme of work was produced, with an implicit methodology, and, in fact, little by way of practical work was attempted. Each week a science TV programme was followed by all schools and it was basically this programme that set the pace in the Science Teaching. Demonstrations were viewed by the pupils and sometimes repeated in their own laboratories.

During discussion at the Department of Education it was made clear that a science course embodying modern methods would need to be produced which would cover, and take advantage of, the several years that the children would attend the school. (Up to age 14). This course would need to produce:-

a. a good scientific basis for those children who would leave school at 14 and who would need to be as fully prepared as possible for life in an increasingly scientific world.

b. a basis, in the junior years, for further study of science in the later years. either on a non examination or examination basis.

It was felt that Science for the Seventies based on Scottish Integrated Science syllabus as laid down in Curriculum paper 7: Science in General Education (HMSO), should be adopted, as this imaginative course covers both necessities.

This course was introduced into the schools in October 1971. All the apparatus quoted in the course is not available in the schools. It is to be hoped that as much improvisation as possible will be attempted and that school science departments will gradually acquire more apparatus. It would be out of keeping with the spirit of modern science teaching that no improvisation or building of apparatus should take place. In the 'old' schools Science for the Seventies is to be introduced but only the first part will be covered as no further time, after year one, will be given to it.

It should be appreciated that changes were necessary in the scheme before it could be implemented in the schools. The major area for immediate change has been in the life sciences where, it was felt, easily available local spp. should replace types quoted for UK children. Since the essence of the course is for the class to measure, examine and experiment on the materials, the plants and animals should be easily available. Malta has a varied and interesting flora and fauna and there was little problem in suggesting changes. It is immaterial what is used as long as the main aims and principles are taught in the section. An example of one change was the substituting of woodlouse for earthworm. Earthworms are easily available in certain parts of Malta but not in all parts. Woodlice are easily obtainable and they lend themselves to investigations in both laboratory and field. Worksheets using this animal have been prepared and sent to the teachers. It is hoped that this will indicate that whatever they wish to use will be acceptable, if the aims listed at the beginning of the unit are covered.

At the end of the three year period there will need to be a continuing course in science for those pupils staying on at the unselective schools. This problem will best be dealt with as it is seen how the new syllabus has been taken up. It might become feasible to expand Science for the 70's to cover the remaining years at school (compulsory secondary education presently continues to 14, but there is a possibility of this being raised to 16). Alternatively, new courses might be introduced to consolidate and expand what has gone before. The new administration is talking of major changes in secondary school organisation and firm decisions on length of courses cannot, at present, be taken.

TV broadcasts continue but these now will have a somewhat different rôle. The direct teaching which was central to the programmes last year, has been firmly transferred to the teacher/pupil/laboratory learning

situation. The rôle of ETV is very much more one of enrichment. It has been agreed that apparatus, as yet not in the schools, will be shown and industrial applications of principles encountered and learnt in the laboratory, will also be shown. This system of ETV should complement and enrich the teaching/learning situation.

The concern of the Colleges of Education is naturally to produce teachers who can confidently tackle the science and the modern methodology implicit in the course. There is great disparity in the basic science attainment between the men and women on entry, to their respective College of Education. In the mens' college, most of the students opting for Science have at least one 'A' level science pass. This is usually physics. Some have two passes at 'A' level and almost invariably the second one will be chemistry. Almost none have any biological foundation. It has been felt expedient this year to allow people with one or more 'A' levels to undertake a number of Nuffield type investigations in topics related to their 'A' level passes. These will be carefully assessed to see that understanding and practical competence has been achieved in their previous course. Where a student does not possessa training in a particular area then teaching in that area will be given. The aim here will be to make certain that all topics in Science for the 70's will have been met, and that wherever possible, within the short time available, the student will be encouraged to expand his knowledge and understanding to allow him greater confidence in handling "new" topics in the laboratory situation. In an attempt to fuse this into one complete whole, a series of method classes will also be given.

At the women's college of Education it is rare for any of the science students to have an 'A' level and very few have followed even an 'O' level science course. All students in the first term follow a common course and part of that course is science. This does allow initiation and does result in the formation of a science class. Here it is easier to tackle the course on an integrated basis from the start. As in the men's college, the endeavour is to produce some measure of confidence in tackling the first years in secondary school, using the new syllabus. With no previous basis in science, it is not possible to achieve depth in the science content. The method is based firmly on student investigation with such books as Science for the 70's, Nuffield Combined Science, Nuffield Secondary Science and the 'O' and 'A' level Nuffield texts, forming a core from which further knowledge and understanding can grow. If students become used to practical laboratory investigations immediately, then it should form the "norm" for their future teaching of the subject.

Further information on any aspect of this report together with copies of the Wood louse work sheet can be obtained from Mr Carter c/o The British Council.

27. ZAMBIA

The Zambia Association for Science Education (ZASE) has sent us the following report.

The Association held its fourth Annual Conference at the Kabwe Teachers College from August 23rd to 27th. The main theme of the Conference was 'Whither Science Education in Zambia'. Schools in Zambia have recently changed from a two year Junior course to a three year course with 50% of pupils leaving secondary school at this point. The remainder go on to COSC studies in Forms IV and V. This change has necessitated a revision of the 3 year science course in the Junior school and the Conference was mainly concerned

with this. As a result of the general recommendations of the whole Conference, a Curriculum Development Panel has been set up to make more detailed recommendations to the Association and thence to the Ministry of Education and its Curriculum Development Centre.

The Association has, through its various panels, continued with its other day-to-day activities such as the publication of the teaching suggestions for use with the various science courses presently used in schools. It has recently issued a 'Zambian Biological Calendar' to be completed by members as a first step in a long-term project of gathering information about happenings in the biological world over the whole of the country. The Association has also recently published suggestions for work in ecology and will soon be supplementing this with a detailed bibliography listing books suitable for use by Biology teachers in this part of Africa.

The Bulletin of the Association in its new printed format has reached the second number of Volume 2 and is proving useful to teachers here. For the future, the Association is hoping to be able to mount in-service courses for laboratory assistants and to arrange a wide variety of visits for members to the many mining and industrial areas in Zambia. The Association also hopes to see implemented a scheme whereby schools will be able to construct from kits assembled in Zambia, much of the electrical apparatus needed for their science classes. This apparatus would be assembled in the schools and then sent to some central location for checking and calibration. Schools would then be able to obtain the apparatus at very attractive prices, either by cash payments or by credit for their work in assembling the kits.

Further information about the Association can be obtained from the Secretary, ZASE, PO Box RW-335, Ridgeway, Lusaka, Zambia.

## INTERNATIONAL ACTIVITIES

### 28. Guinness Awards for Science and Mathematics Teachers

In SEN 16:24 we unfortunately did not give a complete list of the prize-winners for the 1970/71 overseas section. We apologise for this omission. Joint sixth prize went to 1. Mr J D Haden, Uganda, "The role of science society in providing experience of elementary scientific research for the pupils of a Ugandan secondary school". 2. Mr Silvano Borruso, Kenya, on "Teaching aids: a three-dimensional representation of the periodic system of the chemical elements". 3. Mr Yaw A Bempong, Ghana, "The use of modern teaching aids in mathematics at an elementary level. 4. Mhd Haniffa bin Mohd Ghouse, Malaysia, "A detailed ecological survey of a local area". 5. Mr S Kanaganathan, Malaysia, "The teaching of science and mathematics by inexperienced, untrained graduates".

The office of the Guinness Awards for Science and Mathematics Teachers in the United Kingdom is Benjamin Franklin House, 36 Craven Street, London WC2.

### 29. Science Education Programme for Africa (SEPA) see SEN 14:32.

The Science Education Programme for Africa SEPA was formed in February 1970 at a meeting of Representatives of some African States and International Agencies including CEDO, UNESCO, UNICEF and the Educational Development Centre of United States of America. Consisting of a representative council, an executive committee and secretariat it seeks to promote excellence in the learning of science at all levels. The primary school level and the primary teacher training colleges receive top priority in its activities at present. The Ghana government has welcomed the establishment of the SEPA Secretariat in the country and the University College of Cape Coast has agreed to serve as SEPA's fiscal agent. In a recent report covering the period September 1970 - March 1971 background information on the development of the PROMREC programme is given. In addition it describes some of the science education programmes currently in operation in Malawi, Kenya, Ethiopia, Nigeria, Ghana, Liberia, Sierra Leone and The Gambia. The report is available from Mr H Dyasi, Executive Secretary, Science Education Programme for Africa, c/o Elementary Science Unit, PO Box M188, Accra, Ghana.

### 30. UNESCO Integrated Science Teaching in the Asian Region - Report of a Regional Workshop published by the UNESCO Regional Office for Education in Asia Bangkok 1971.

The Asian Regional Workshop on the progress of integrated science teaching was held in Manila, Philippines from August 3-17, 1970 and this publication represents the final report of that conference. The contents include the report of a discussion on the concept of integrated science teaching and a survey of the present situation in the Asian region.

It goes on to consider an approach to integrated science teaching in Asia and a means by which the development of international project for integrated science teaching could be carried out.

An important aspect of this work is teacher education for integrated science and the type of science teaching space and facilities and equipment which will be required. All these aspects are dealt with in subsequent sections. The report ends with a plan for future action in this field and a list of integrated science teaching projects elsewhere in the world.

With the current upsurge of interest in the integrated approach to science teaching throughout the world this will form an interesting source of ideas and information for other people involved in this work elsewhere in the world or those who may be contemplating some of the changes which are discussed in this publication.

The following quotations from the section on the concept of integrated science teaching set out very well the background to the current philosophy of this approach. "Two advances in other areas provided the key to the production of science courses that are in fact integrated. In the first place it became clear that the major advances in scientific research were taking place in inter-disciplinary areas molecular biology, geophysics, biochemistry and astrophysics to name a few. Such advances were often the result of the methods and the techniques developed in one scientific field being applied to the subject matter of another. This emphasised the totality of science, the fact that the boundaries that had formerly been taken for granted were becoming blurred and illusory. The second breakthrough came in science education itself when the first large scale curriculum projects developed new courses in physics, chemistry, biology, blatant nerve sciences. ...the major concepts were identified and the school children were introduced to the idea of building models to explain phenomena on the basis of existing knowledge. It could not be said that chemistry and biology were primarily concerned with encylopaedic masses of facts. ...the courses strongly advocate enquiry and discovery procedures. Any attempt to foster these courses as set out had in the first place to change the basic activities of the teachers telling to the supervising of enquiry activities. The lesson should be less teacher and book centred and become pupil and material centred. Integrated science teaching represents the next logical step in the evolution of science courses, the need is now felt to reflect the essential unity of science in courses that were truly unified and to present science as a whole to children who in real life experience their environment as a whole."

31. UNESCO

Conference on Integrated Sciences: University of Ibadan, 19 September to 4 October 1971.

The Workshop 'Planning for Integrated Science Education in Africa' was held at the Conference Centre, University of Ibadan, by invitation f the Government of Nigeria, from September 20th to October 4th, 1971. It was sponsored jointly by UNESCO and UNICEF, following Programme Resolution 2 - 21 adopted by the General Conference of UNESCO at its sixteenth session. The Workshop was attended by national participants from fourteen African countries, who were science education specialists concerned with developing programmes of integrated science education at the primary and lower secondary levels. It was also attended by invited consultants, UNESCO experts in science education associated with UNESCO/UNICEF projects in African countries, observers from bi-lateral aid organizations and UNESCO staff members from the UNESCO field Science Office for Africa, Nairobi, the Regional Educational Buildings Research Institute for Africa, Khartoum, and UNESCO Headquarters.

The Workshop was the second of two meetings for English-speaking African countries sponsored jointly by UNESCO and UNICEF. It followed the guidelines developed at the first meeting, which was held for policy - makers in Nairobi in July 1971, and embodied in the report "Education for Rural Development in Africa". The objectives of the Workshop were:

1. To exchange information on current projects and programmes aimed at the production and implementation of integrated science curricula in English-speaking African countries.

2. To review integrated science teaching programmes from outside Africa which might be used as resources in developing programmes for African Countries.

3. To make suggestions for the development of integrated science teaching programmes, including teaching approaches and methodology, learning materials (printed materials, equipment, teaching aids, etc) teacher training (pre-service, in-service and continuing education of teachers) and other relevant considerations.

4. To draw up a plan for collaborative action among participating countries.

The level of work discussed at the Workshop covered the teaching of science in an integrated approach during the first eight or nine years of schooling.

Activities during the workshop included talks and discussions in plenary sessions, visits to places of educational interest and displays of printed materials, audio-visual material and science teaching equipment. Four working groups were established on the subjects of curriculum planning, teaching materials and facilities, teacher education and evaluation. Working group A, which was concerned with curriculum planning followed the Nairobi Seminar recommendation that "the Workshop at Ibadan should spell out a clear concept of what integrated science includes within the framework of health, agriculture, nutrition etc. vis-a-vis the basic sciences of biology, chemistry and physics as general science where these are taught together". It also drew up a guide for curriculum planning for integrated science teaching in a hypothetical African Country, and constructed a specimen lesson. Group B was concerned with science teaching materials and facilities including printed materials, audio visual materials, and science equipment. It also drew up specifications for a prototype integrated science teaching laboratory. Group C was concerned with teachers education for integrated science teaching following the Nairobi Seminar recommendation that "the Workshop must isolate the implications of integrated science teaching relating to the training of teachers." It covered pre- and in-service training and further education of teachers, including the work of science teachers associations. It also produced specimen teaching materials for orienting teachers in service or in training towards an integrated approach to their teaching. Group D was concerned with evaluation and testing. The recommendations from these four working groups are embodied in the report and from chapters III, IV, V and VI of the report, respectively. The plan for collaborative action, which forms chapter VII of the report is drawn up from proposals and suggestions put forward by the working groups and in plenary sessions.

The Workshop was opened by Mrs F M Akintunde - Ighodalo, Permanent Secretary, Western State of Nigeria Ministry of Education. Addresses of welcome were also given by Professor G M Edington, Deputy Vice Chancellor of the University of Ibadan, and Dr N S Rajan, UNESCO Chief of Mission in Nigeria. A message of welcome was read out from Chief SO Awokoya, Director, Department of Science Teaching and Technological Education and Research, UNESCO. The Key-note address to the Workshop was given by Professor A Babs Fafunwa, Deputy Vice - Chancellor, University of Ife, Nigeria. The co-chairmen of the Workshop were Mr J M Akintola, Federal Ministry of Education, Nigeria and

Mr T A Balogun, Faculty of Education, University of Ibadan. The Organizing Committee for the Workshop established under the auspices of the Nigerian National Commission for UNESCO consisted of Mr J F Olagbemi, Mr J A Akintola, Mr A Osiyale, Rev P S Samuel, Mr R S G Agiobu Kemmer, Dr E A Yoloye, Mr F Oyewole, Mr C N Sharma, Mr N Lowe, and Mr L E Folivi, who also acted as Workshop Co-ordinator. Workshop Liaisonwas carried out by Mr S M Winsala, Conference Officer, University of Ibadan.

The report of this conference will be available in due course from the Division of Science Teaching, UNESCO, Place de Fontenoy, Paris 7$^{e}$, France.