

U. S. S. S. S.

29 JUL 1960

**THE INDIAN ASSOCIATION
FOR THE
CULTIVATION OF SCIENCE**

Annual Report for 1959-60

THE INDIAN ASSOCIATION
FOR THE
CULTIVATION OF SCIENCE

ANNUAL REPORT FOR 1959-60

JADAVPUR, CALCUTTA-32

COUNCIL MEMBERS FOR 1959-60.

- President* Prof. S. N. Bose, F.R.S., F.N.I.
- Vice-Presidents* .. Sri R. P. Mookerjee, M.A., B.L.
Dr. K. S. Krishnan, D.Sc., F.R.S.
- Director (Acting)* .. Prof. S. C. Sirkar, D.Sc., F.N.I.
(upto December 10, 1959).
- Director* Dr. K. Banerjee, D.Sc., F.N.I.
(from December 11, 1959).
- Members* Dr. T. Sen, Dr. Eng. (Munich), A.M.M.E., M.I.E.
(India).
Dr. Narendra Nath Saha, M.Sc., Ph.D. (Leeds).
Prof. Nikhil Ranjan Sen, D.Sc., Ph.D.
Sri Dwijesh Chandra Chakrawarti, M.Sc.
Sri J. M. Majumder, M.A.
Dr. P. K. Bose, D.Sc., F.N.I.
Dr. B. C. Guha, D.Sc., F.N.I.
Dr. Kanai Lal Saha, M.B.
Dr. S. C. Ganguly, M.Sc., D.Phil.
Prof. A. Mookherji, D.Sc.
Prof. D. K. Banerjee, D.Sc. (Cal.), F.A.Sc.
Dr. Bejoy Sankar Basak, M.Sc., D.Phil.
- Trustee-Member* .. Sri R. P. Mookerjee, M.A., B.L.
- Nominees of the National Institute of Sciences of India.* Dr. D. M. Bose, M.A., Ph.D., F.N.I., Director,
Bose Institute, Calcutta.
Dr. N. R. Tawde, F.N.I., Professor of Physics,
Karnatak University, Dharwar.
- Nominees of the Government of India.* The Secretary, Ministry of Scientific Research &
Cultural Affairs (or his nominee).
Educational Adviser to the Government of India
(or his nominee).
Director-General of Scientific & Industrial Research
(Government of India).
Sri A. V. Venkateswaran, Financial Adviser,
Ministry of Scientific Research &
Cultural Affairs.
- Nominee of the Government of West Bengal.* Dr. D. M. Sen, M.A., Ph.D., Secretary to the Govern-
ment of West Bengal, Education Department.
- Professor-Members* .. Prof. S. R. Palit, D.Sc., F.N.I.
Prof. B. N. Srivastava, D.Sc., F.N.I.

THE INDIAN ASSOCIATION for the CULTIVATION OF SCIENCE

ANNUAL REPORT FOR 1959-60

1. GENERAL

During the year under review, death was reported of Dr. Amal Kumar Roy Choudhury, a Life Member of the Association and distinguished physician, Sri Kumud Behari Sen, an Ordinary Member and a well known chemist and Prof. R. C. Ray, a distinguished scientist who was associated with the Association as an expert nominee of the Council on a number of Selection Committees. The Council condoled their deaths and conveyed their sympathies to the members of the bereaved families. The Association also lost, by death, Dr. G. P. Majumdar, a Life Member of the Association, a distinguished botanist and previously a member of the Council of the Association. Death was also reported of Matilal Dey, a Senior Mechanic in the Workshop.

Dr. K. Banerjee, Professor and Head of the Department of Physics, Allahabad University was appointed Director and assumed charge of the Association on December 11, 1959. Prof. S. C. Sirkar, the present Mahendralal Sirkar Professor, whose appointment as Acting Director was reported last year, continued to exercise the functions of the Director till the new Director took over from him. The Council expressed its thanks to Prof. Sirkar for the services rendered by him as Acting Director.

The year under review was the fourth year of the Second Five Year Plan period. For the entire period, the Association had asked of the Government of India for a non-recurring grant of Rs. 25 lakhs, (Rs. 11.24 lakhs for building and Rs. 13.76 for purchase of equipments, standard reference books etc.) and a recurring grant of Rs. 40 lakhs. The corresponding figures of non-recurring and recurring grants requested from the State Government of West Bengal were Rs. 12.50 lakhs (Rs. 5.62 lakhs for building and Rs. 6.88 lakhs for equipments, standard reference books etc.) and Rs. 6.79 lakhs respectively. During the four years of the Second Five Year Plan period, the Association received from the Government of India non-recurring grants totalling Rs. 4,21,246/- for building and Rs. 5,53,654/- for scientific equipments and books and recurring grants totalling Rs. 26,88,267/- towards maintenance expenditures. The corresponding grants received from the Government of West Bengal were Rs. 2,10,500/-, Rs. 2,77,000/-, and Rs. 3,49,300/-. It will be noticed that the actual receipts fell far short of the expenditures, resulting in

the partial fulfilment of the development plan as originally envisaged. This has been taken into account in preparing the Third Five Year Plan of the Association discussed in what follows.

Third Five Year Plan

During the year under review, following a request from the Government of India, the Association prepared and submitted to the Government of India its proposals for development and expenditure during the Third Five Year Plan period beginning 1961-62. The proposals were framed at a number of meetings of the Staff Committee, were approved by the Finance Committee and the Council at their meetings held on May 12 and May 13, 1959 respectively, and finally endorsed by the Association at its Annual General Meeting held on July 28, 1959. The optimum size of the Third Five Year Plan was decided upon mainly on the basis of the recommendation of the Reviewing Committee that a policy of consolidation should be pursued so that the existing resources of the Association could be put to the best use. With that end in view, a common pattern of staff was adopted for all research departments, with the provision of a Reader and a slightly higher proportion of scholars for each department, a new section for the preparation of rare chemicals under the Department of Organic Chemistry was proposed to be introduced and the Workshop staff was sought to be strengthened in order to enable its work to be divided in two sections, one for making new apparatus and instruments and the other for repair work. The laboratory grant was proposed to be increased to Rs. 16,000 for each department of Physics except Theoretical Physics and to Rs. 18,000/- for each department of Chemistry.

As regards the non-recurring grants for equipments, those provided for in the Second Five Year Plan period, but not purchased for want of funds and a few new equipments thought necessary for the consolidation and improvement of the quality of the work undertaken, were included in the Third Five Year Plan. A provision for a non-recurring grant of Rs. 20,000/- a year was recommended for purchase of books in the Library.

The Building programme comprised mainly of the construction of quarters with funds to be obtained by way of loans from the Government.

In preparing the estimates on account of recurring establishment charges, the salaries and remuneration of the research and technical staff were worked out on the basis of the scales of pay and scholarships as recommended by the Reviewing Committee, and those of the administrative and the grade IV staff on the basis of the basic salary in the Calcutta University, as recommended by the Finance Committee.

Towards the end of the year, the Finance Committee and the Council approved of the Director's supplementary proposals, both recurring and non-recurring, in respect of the Department of Central Scientific Services, for inclusion in the Third Five Year Plan. While approving of these proposals the Council suggested that the demands for building grants be revised to Rs. 25 lakhs with a view to arranging for complete residential accommodation for the

staff and the scholars and a further provision for a grant of Rs. 5 lakhs towards rehabilitation of equipments be included.

Summary of grants proposed for both meeting recurring and non-recurring expenditures with their yearly break-down are given below :

A. Recurring grants for meeting expenditures on account of salaries and allowances of Staff including Laboratory, Library, Workshop etc. grants.

Year	Originally proposed and approved at the Annual General Meeting.	Director's Supplementary proposals.	Total
1961-62	14,31,366	45,925	14,77,291
1962-63	14,87,377	47,542	15,34,919
1963-64	15,37,499	49,492	15,86,991
1964-65	15,88,361	51,442	16,39,803
1965-66	16,49,272	53,460	17,02,732
	76,93,875	2,47,861	79,41,736

B. Non-recurring grants for meeting expenditures on the purchase of equipments, books etc.

Year	Originally proposed and approved at the Annual General Meeting.	Director's Supplementary proposals.	Total
1961-62	3,38,900	4,00,000	7,38,900
1962-63	2,37,200	1,00,000	3,37,200
1963-64	2,46,500	—	2,46,500
1964-65	2,04,500	—	2,04,500
1965-66	1,37,000	—	1,37,000
	11,64,100	5,00,000	16,64,100

C. Building grant for residential accommodation of the staff and scholars

Rs. 25,00,000*

D. Grant for rehabilitation of equipments

Rs. 5,00,000

*Note—The original proposal was for a loan of Rs. 9,02,399 for construction of staff quarters with the following break-down.

1961-62	—	Rs. 2,00,000
1962-63	—	„ 2,00,000
1963-64	—	„ 2,00,000
1964-65	—	„ 2,00,000
1965-66	—	„ 1,02,399
		„ 9,02,399

Council Election, Enrolment and Resignation of Members

At the Annual General Meeting held on July 28, 1959, Prof. S. N. Bose was elected to the office of the President and Sri R. P. Mookerjee and Dr. K. S. Krishnan were elected to the office of the two Vice-Presidents on the recommendation of the Council in each case. Prof. D. K. Banerjee and Dr. Bejoy Sankar Basak were elected as Ordinary Members of the Council at the annual election held as usual during the months of April, May and June. The National Institute of Sciences of India nominated Dr. D. M. Bose, Director, Bose Institute, Calcutta and Dr. N. R. Tawde, Professor of Physics, Karnatak University, Dharwar, on the Council of the Association. Sri A. V. Venkateswaran, Financial Adviser attached to the Ministry of Scientific Research and Cultural Affairs was nominated by the Government of India on the Council and the Finance Committee. Prof. S. R. Palit and Prof. B. N. Srivastava were appointed Professor-Members, former from the Chemistry and the latter from the Physics Departments.

Dr. T. Sen was appointed a Trustee on the recommendation of the Council. In the absence of any nomination, no Ordinary Fellow was elected during the year under review.

One gentleman was elected a Life Member of the Association. 102 gentlemen were elected and 71 admitted as Ordinary Members during the year. The membership of 10 Ordinary Members ceased for non-payment of subscription for over two years.

General Meetings and Meetings of the Council and the Committees

One Annual General Meeting, two General Meetings, eight meetings of the Council, five of the Finance Committee, eighteen of the Staff Committee, and three meetings of the Construction Committee were held during the year under review. The meetings of the various Selection Committees and Appointing Boards totalled twenty-two. Furthermore, there were one meeting of the Trustees and two meetings of each of the Sub-Committees to look into the question of adjustment of advances and other matters, the Meghnad Saha Memorial Committee, and the Board of Editors of the Indian Journal of Physics.

Staff and Scholars

During the year under review eight research departments continued their activities as in the previous year. Despite the best of efforts, it was not found possible to make appointment to the post of Professor of Inorganic Chemistry. The Council finally decided to advertise the post as Professor of Chemistry and further that the selected candidate would be required to take charge of the Department of Inorganic Chemistry. In the Department of Macromolecules (formerly Department for Researches in Applied High Polymers), Sri P. Bagchi resigned his post of Readership to accept the post of Joint-Director of the Research Department of Messrs. The East India Pharmaceutical Works Ltd. Dr. A. K. Sircar, Research Officer, in the same Department, resigned his

post to join the Indian Rubber Manufacturers' Research Association as a Senior Scientific Officer. Dr. B. V. Ramanamurty, Research Officer in the Department of General Physics & X-rays and Dr. Adhir Ranjan Deb, Research Officer in the Department of Optics resigned their respective posts, the former to accept the post of a Lecturer in Physics at the Indian Institute of Technology, Madras, and the latter that of the Applied Physicist at the Indian Agricultural Research Institute, New Delhi.

The award to Prof. P. C. Dutta of a Royal Society Bursary grant was reported last year. Prof. Dutta spent about eight months in Europe, studying at the Imperial College, London, at Oxford and visiting research centres on the continent. Prof. S. R. Palit participated in, and presided over one of the sessions of, the International High Polymer Conference held at Wiesbaden, West Germany, in October 1959. Dr. N. N. Saha, Research Officer, Department of Organic Chemistry was awarded a Post Doctoral Fellowship at the University of Chicago and resigned his post at the Association. Dr. Usha Ranjan Ghatak, a Post Doctorate Fellow, Sri Jaswant Rai Mahajan and Dr. Suvash Chandra Ray, Senior Research Scholars in the Department of Organic Chemistry, went to the U.S.A. on post Doctorate Fellowships for prosecuting higher studies and research there. Dr. Manoj Mohan Ray, a Senior Research Scholar in the Department of Inorganic Chemistry was similarly awarded a Post Doctorate Fellowship for work in the U.S.A. Sri A. K. Roy Chaudhuri, on a deputation from the Association, attended the Summer School Lectures and Seminar in Theoretical Physics held in Mussoorie under the guidance of Prof. S. N. Bose, F.R.S., National Professor and President of the Association. The Seminar was organized by the Ministry of Scientific Research and Cultural Affairs, Government of India.

Research Schemes

C.S.I.R. The Council of Scientific and Industrial Research sanctioned the following schemes for the year under review :

Under Professor S. R. Palit as investigator-in-charge

- (1) Studies on Thermodynamic properties of high polymer solutions and binary liquid mixtures ;
- (2) Liquid Crystalline detergent Systems ;
- (3) Fundamental Studies on the Solvent extraction of coal.

The schemes were continued from the previous year.

Under Professor S. C. Sirkar as investigator-in-charge

- (1) Investigation of Crystal Structure of frozen organic liquids at low temperature, continued from the previous year.

Under Professor B. N. Srivastava as investigator-in-charge

- (1) Studies on Mutual diffusion of gases by radioactive tracer technique, a new scheme introduced during the year.

Under Prof. P. C. Dutta as investigator-in-charge

- (1) Synthetic studies in diterpenoid resin acids, continued from the previous year ;
- (2) Synthetic studies in triterpenoids, continued from the previous year ;
- (3) Preparation of industrially important Sesquiterpenes, a new scheme introduced during the year.

Under Sri P. Bagchi as investigator-in-charge, later on transferred to Dr. P. Mukherjee on the former's resignation

- (1) Absolute values of rate constants in Polymerization, continued from the previous year.

Under Dr. A. K. Sirkar as investigator-in-charge

- (1) Mechanism of vulcanization of rubber, continued from the previous year.

In addition to the sanction of the above schemes, the C.S.I.R. awarded four Senior Research Fellowships on Rs. 400/- p.m. each and two Junior Research Fellowships on Rs. 250/- p.m. each.

Development Scheme for research training facilities under the Scientific Man Power Committee : This scheme of training research scholars, introduced by the Government of India, was in the ninth year of its operation during 1959-60. Eighteen Senior Scholarships were made available, which were allotted to the Department as follows : General Physics & X-rays—4; Magnetism—2; Optics—2; Physical Chemistry—2; Organic Chemistry—3; Inorganic Chemistry—2; Theoretical Physics—2; Macromolecules—1.

Prof. B. N. Srivastava had under him an Atomic Energy Commission Scheme on "Design of Thermal Diffusion column for efficient isotopic separation", continued from the previous year and terminated during the year under review.

The Scheme for the conversion of quinine to quinidine and isolation of quinidine from cinchona febrifuge, sanctioned by the Director of Cinchona, Government of West Bengal, was continued during the first part of the year under the supervision of Prof. P. C. Dutta and then terminated.

The scheme for solving the problem of capping cement for electric lamps initiated by Messrs. Bengal Electric Lamp Works Ltd., was in operation during the year in the Department of Macromolecules, and an assistant was engaged to work on this problem.

The scheme on "Styrenation of Shellac" instituted by the Indian Lac Cess Committee under Prof. S. R. Palit was continued from the previous year.

National Professor's Research Scheme : During the year under review, the Ministry of Scientific Research and Cultural Affairs sanctioned a grant to enable National Professor S. N. Bose to carry on his research and placed the grant at the disposal of the Association. The Council accepted the scheme and agreed to afford the necessary facilities.

Doctorate Degrees awarded to Research Workers

The following research workers of the Association were admitted to the D.Sc. and D. Phil (Science) degrees of the University of Calcutta, Agra and Jadavpur during the year under review :

Name.	Department.	Degree.	Subject.
Sri A. K. Roy Choudhury	Theoretical Physics	D.Sc. (Cal.)	Problems in Relativistic Cosmology and General Theory of Relativity with two papers in the Quantum theory of the Solid State.
Sri M. N. Das	Physical Chemistry	D.Sc. (Cal.)	Studies in Non-aqueous Acid base titrimetry.
Sri K. P. Srivastava	General Physics & X-rays	D.Phil (Cal.)	Transport properties of gases.
Sri S. K. Datta	Magnetism	D.Phil (Cal.)	Paramagnetic behaviour of the single crystals of some similarly constituted salts of the iron group.
Sri S. K. Datta Roy	„	D.Phil (Cal.)	Paramagnetic behaviour of the single crystals of some trivalent alums and trioxa- laurs of the iron group between 300°K and 100°K and a subsidiary thesis on a new electrodynamic method for the measurement of magnetic fields.
Sri G. S. R. Krishna Murthi	Optics	D.Phil (Cal.)	X-ray analysis of crystal structure of organic com- pound at different tempera- ture.
Sri Smriti Bhusan Roy	„	D.Phil (Cal.)	Ultra-violet absorption on spectra of frozen solution of some aromatic compounds.
Sri S. N. Biswas	Theoretical Physics	D.Phil (Cal.)	Theories of Fundamental particles and their applica- tions.
Sri S. R. Chatterjee	Physical Chemistry	D.Phil (Cal.)	Studies on Vinyl polymer- zation.
Sri B. Biswas	„	D.Phil (Cal.)	Equilibrium properties of solutions.
Sri Suryya Kumar Das	„	D.Phil (Cal.)	Chain Transfer in addition polymerization and cross- transfer in copolymeriza- tion.
Sri G. R. Somayajulu	„	D.Phil (Jadavpur)	Correlation of Physical Properties ; Force Constant, Atomic size, Boiling point etc.
Sri Jaswant Rai Mahajan	Organic Chemistry	D.Phil (Cal.)	Synthetic Studies in Sesqui- terpenoids.

Name.	Department.	Degree.	Subject.
Sri Soumendra Lal Mukherjee	Organic Chemistry	D.Phil (Cal.)	Synthetic investigation of Resin Acids.
Sri N. L. Zutshi	"	Ph.D. (Agra)	Chemical Studies in Indian essential Oil.
Sri Dilip Kumar Dutta	"	D.Phil (Cal.)	Studies in cyclization Reactions; Synthetic studies on resin acids.
Sri Rabindra Lal Dutta	Inorganic Chemistry	D.Phil (Cal.)	Studies on Chelate complexes with polydentate liquids.
Sri Nihar Ranjan Sen Gupta	"	D.Phil (Cal.)	Studies on metal biguanide complexes.
Sri Sailendra Nath Poddar	"	D.Phil (Cal.)	Studies in coordination compounds.
Sri Asit Kumar Ray	"	D.Phil (Cal.)	Studies on coordination complexes and their analytical application.

Ripon and Coochbehar Professorship, Dr. Bimala Churn Law Gold Medal, Mahendralal Sircar Memorial Lecture and Symposium

During the year under review, Prof. Niels Bohr, N.L. was awarded the Dr. Bimala Churn Law Gold Medal of the Association for 1955 at a meeting held for this purpose on January 18, 1960. Prof. Bohr delivered an address on this occasion.

Prof. M. Guinier, Professor of Solid Physics, University of Paris and Professor of X-ray techniques at Conservatoire National des Arts et Métiers, Paris was appointed Ripon Professor of the Association for 1958 and delivered a course of two lectures on (1) "Recent developments of x-ray and micrography apparatus in France", (2) "Analysis of the structure of imperfect crystal with reference to alloys" on September 28 and 29, 1959.

Prof. L. F. Bates, F.R.S., Professor of Physics, University of Nottingham, U.K. was appointed Ripon Professor of Physics for 1959 and delivered a course of two lectures on (1) "Visualization of magnetic processes", and (2) "Thermal changes accompanying magnetization" on January 27, 1960.

Prof. P. Ray, F.N.I., delivered the Memorial Lecture on "The need for a new outlook in science" at the 56th Death Anniversary of late Dr. Mahendralal Sircar, Founder of the Association, on February 23, 1960.

A symposium on "High Polymers" was held at the Association in January 1960 under the auspices of the Chemical Research Committee of the C.S.I.R. for which purpose grants were sanctioned to the Association. Prof. S. R. Palit acted as the Convenor.

General Matters

The Council of the Association requested the Government of India in the Ministry of Scientific Research & Cultural Affairs to arrange for the audit of the accounts of the Association by the Accountant General, West Bengal. At the request of the Ministry, the Comptroller and Auditor General of India decided to undertake the audit of the accounts of the Association and suggested the inclusion of a number of provisions in the Regulations and Bye-laws of the Association. The Council, at its meeting held on October 4, 1959, approved of the suggestions and Regulation 33(a) was amended accordingly at the General Meeting of the Association held on December 1, 1959.

During the year under review the Council approved of the Rules for utilization of monies at credit of the Depreciation Fund as drafted by the Accountant General, West Bengal.

The question of renewing the request to the Government of India for a loan for the construction of the proposed hostel was reported last year. On receipt of a favourable reply from the Government of India asking the Association to submit latest plans and estimates and stipulating a number of conditions governing the loan, the Council of the Association resolved that a sum of Rs. 1,00,000/- be asked for as a loan from the Government of India for the economic construction of a hostel good for the accommodation of 25 students. The request for the loan was submitted to the Government of India and steps were taken to prepare the plans and estimates.

Library

156 books were added to the Library's stock during the year under review, bringing the total number of volumes accessioned upto March 31, 1960, to 13,708. The number of journals received on subscription, in exchange of *Indian Journal of Physics* and on complimentary basis, were 107, 144 and 42 respectively. A list of the books and periodicals added to the library during this year will be found in the Appendix.

Workshop

Maintenance, repairing of instruments, overhauling, assembling, erection and allied works for carrying out day to day work for the research for all the departments constituted the main activity of the workshop during the year under review. The number of such types of incoming jobs are very large and it is not possible to give details of them.

During the year, the workshop gave greater attention to the preparation of the instruments and accessories requiring more skill and precision workmanship. A list of few expensive instruments made during the year 1959-60 is given below:—

- (a) A complete unit of diffusion chamber with capillary sliding valves, air tight compartments etc.

- (b) High temperature electrical measuring apparatus.
- (c) Complete microwave unit including wave guides (plain and taper), resonating head, flanges etc.
- (d) Vacuum tight jacket Weisenberg camera.
- (e) Hertzfield type osmometers (5 nos).
- (f) Plastometer with dial gauge fittings.
- (g) Complete thermal diffusion apparatus with insulating chambers.
- (h) High temperature torsion balance.
- (i) Bomb calorimeter (to withstand 2000 lbs. sq. inch pressure).
- (j) Two unit rotating vacuum evaporator.
- (k) Liquid air cryostat.
- (l) Swivel turntable electromagnet with calibration degrees over the dials and vernier attachment.
- (m) Large number of heating tubes of various sizes and temperatures, chassis instruments covers etc.

Other activities of the Workshop included repairs, maintenance of laboratory furniture, fume cupboards etc. and the preparation of carpentry fittings for routine research work, in the Carpentry Section. In glass blowing, over 2,000 table blowing jobs were handled. Likewise, approximately 400 electrical jobs, both A.C. and D.C. were carried out during the year under review.

Indian Journal of Physics

During the period from April 1, 1959 to March 31, 1960 eleven issues of the journal were published. The last issue which ought to have come out in March 1960, was published by the middle of April, 1960 due to unavoidable circumstances. The year of the journal continued to be the calendar year, the Volume No. being 33 (April to December, 1959) and 34 (from January, 1960).

During the period mentioned above 76 papers and 19 "letters to the Editor" were received for publication against 72 papers and 13 "letters to the Editor" received in the preceding year. Also 11 papers received in 1958-59 were carried over to 1959-60. Of these 87 papers and 19 "letters to the Editor", 62 papers and 15 "letters to the Editor" were published during 1959-60, 9 papers were rejected and the rest were carried over to 1960-61.

The number of subscribers during April 1959 to December 1959 was 275 through the Indian Physical Society (at a concessional rate), 96 in India 378 in foreign countries. The corresponding figures for 1958 were 275, 107, 346 respectively. Also 135 copies of the journal were sent to the members of the Association, 102 copies were exchanged with other scientific journals and 70 copies were distributed as complimentary copies.

The Board of Editors for Vol. 33 (1959) was constituted as : Prof. R. K. Asundi, Prof. K. Banerjee, Prof. D. M. Bose, Prof. S. N. Bose, Prof. K. R. Dixit, Prof. P. S. Gill, Prof. S. K. Mitra, Prof. P. Ray, Prof. K. R. Rao, Prof. S. C. Sirkar and Prof. B. N. Srivastava ; Prof. S. C. Sirkar continued as the Honorary-Secretary to the Board of Editors.

Visitors

The several distinguished scientists and persons who visited the Association during the year under review include Prof. Niels Bohr and Mrs. Bohr of Denmark ; Prof. Horia Hulubei of the Academy of Bukharest Institute of Atomic Physics, Rumania ; Prof. Christo Christov, Dean of the Faculty of Science, University of Sofia, Bulgaria ; Prof. Eric Thilo, of the German Democratic Republic, Prof. L. F. Bates and Mrs. Bates of the University of Nottingham ; Dr. R. B. Dingle of the Department of Theoretical Physics, Scotland, U.K. ; Prof. F. Trondolonburg from the Federal Republic of Germany ; Dr. H. E. Duckworth of Canada ; and Prof. M. Guinier, Professor of Solid Physics, University of Paris, France.

Grants-in-aid

We gratefully acknowledge the receipts of the following grants-in-aid, recurring, non-recurring and on account of the various research schemes :—

	1959-60
(A) <i>Grants-in-aid—Government of India</i>	
	Rs.
1. Recurring	7,45,767
2. Scholarship (Development)	38,550
3. Non-recurring—	
Equipment & Reference Books	1,90,000
4. Grant for expenditure in connection with Reviewing Committee	20,000
5. Prof. S. N. Bose, National Professor's Research Grant	
Recurring Rs. 20,000	
Non-recurring „ 6,000	26,000
	—————
(B) <i>Grant-in-aid—Government of West Bengal</i>	
1. Recurring—arrear for 1958-59	38,300
—do— for 1959-60	80,000
2. Non-Recurring—	
Equipment (1958-59)	50,000
(C) <i>Grant-in-aid—CSIR Schemes</i>	
1. Investigation of Crystal Structure of frozen Organic Liquids at low temperature	2,157
2. Synthetic Studies in diterpenoid resin acids	5,561
3. Liquid Crystalline detergent systems (Arrear for 1958-59)	200

4. Absolute Values of rate Constant in Polymerization ..	2,817
5. Synthetic Studies in Triterpenoids	4,000
6. Mechanism of Vulcanization of rubber	4,170
7. Award of Fellowship to Sri S. L. Mukherjee ..	1,591
8. Thermal Diffusion & Inter Diffusion of Gases (Arrear)	35
9. Award of Fellowship to Sri P. Ghosh	1,094
10. Preparation of Industrially Important Sesquiterpenes	4,850
11. Studies on Mutual Diffusion of Gases by Radio Active Tracer Technique	5,320
12. Meeting of the Chemical Research Committee and Symposium on High Polymers held under the auspices of the Chemical Research Committee on 28th, 29th, 30th December, 1959 and 1st January, 1960	4,250
(D) Grant—Bengal Electric Lamp Works for capping Cement	1,776
(E) Grant—Department of Atomic Energy—Design of thermal diffusion column for efficient isotopic separation (Arrear for 1958-59)	1,825
(F) Grant—Indian Lac Cess Committee	1,368
(G) Grant—Orissa Government Scholarship	396

Acknowledgements

The Council wish to express their appreciation and thanks to the retiring Ordinary Members of the Council, nominees of the National Institute of Sciences of India and of the Government of India and the Professor-members for their services to the cause of the Association.

The Council also record their thanks to the Board of Trustees, the Members of the various Selection Committees, Appointing Boards and other committees of the Association, to the Board of Editors, Editorial Collaborators and Referees for their voluntary services.

II. RESEARCH WORK CARRIED OUT IN THE DEPARTMENTS DURING THE FINANCIAL YEAR 1959-60

A. DEPARTMENT OF GENERAL PHYSICS AND X-RAYS

The research activities in the department have been carried along the following lines during the year 1959-60:—

I. *General Physics* :

- (1) Inter-diffusion coefficient of gases.
- (2) Thermal diffusion column.
- (3) Thermal conductivity of polyatomic gases and gas mixtures.
- (4) Heat transfer in dissociating gases and chemically reacting gas mixtures.
- (5) Determination of intermolecular potentials.
- (6) Low temperature physics.

II. *X-rays* :

- (7) Structure of organic crystals.
- (8) Low temperature study of crystal structures.
- (9) X-ray study of alloys.

Inter-diffusion coefficient of gases

B. N. Srivastava and K. P. Srivastava have measured the inter-diffusion coefficients of a large number of monatomic gas pairs at different temperatures. These data have been utilized by them to obtain unlike molecular interactions on the Lennard-Jones (12:6) model. R. Paul and I. B. Srivastava have started experiments for measuring the inter-diffusion coefficients of diatomic and monatomic gases and have extended the temperature range of their measurements.

R. Paul has obtained theoretically the corrections to be applied for the concentration dependence of the inter-diffusion coefficient in a Ney and Armistead type of apparatus.

The construction of an all-metal apparatus to measure the inter-diffusion coefficients of gases by using the radio-active tracer technique has been completed by R. Paul.

Thermal diffusion column

The work on the thermal diffusion column which was interrupted by the termination of the scheme by the Atomic Energy Department has been again started by A. K. Batabyal, and experiments are in progress to study the hydrodynamics of gas flow in a co-axial type thermal diffusion column with a view to

determining the operating parameters for achieving optimum efficiency in separation. This will also serve as a check on the accuracy of our design and fabrication of the column. All these experiments are being undertaken at present with mixtures of ordinary gases and the work with isotopes will start as soon as a mass spectrometer is acquired.

Thermal conductivity of polyatomic gases and gas mixtures

Thermal conductivity of a large number of binary mixtures of diatomic-monatomic and diatomic-diatomc gases have been measured by B. N. Srivastava and A. K. Barua. The data show that at least at the temperature of their experiments the condition of local chemical equilibrium is not satisfied on account of the relaxation of rotational energy. Consequently the experimental values of conductivity are less than those given by the theory of Hirschfelder which is based on the assumption of local chemical equilibrium. Except for this drawback, Hirschfelder's theory is quite successful in predicting the concentration dependence of the thermal conductivity of polyatomic gas mixtures. B. N. Srivastava and A. K. Barua have also developed a method for obtaining the value of Z , the number of collisions required to make a rotational-translational energy transfer in a diatomic gas from the experimental data on thermal conductivity. The values thus obtained are in fair agreement with the values obtained by other methods.

Heat transfer in dissociating gases and chemically reacting gas mixtures

B. N. Srivastava and A. K. Barua have set up a new type of all-glass apparatus for the measurement of the thermal conductivity of dissociating gases and chemically reacting gas mixtures. The apparatus is also capable of giving the equilibrium constant of the system simultaneously. The system $N_2O_4 \rightleftharpoons 2 NO_2$ in the temperature range 30–90°C and pressure range of 10-50 cm. of Hg. has been studied. It has been observed that as predicted by the recent theories the thermal conductivity of a reacting system is actually an order of magnitude higher than the corresponding non-reacting mixture.

Determination of inter-molecular potentials

A. K. Barua has obtained the potential energy function for He-He interaction on the exp-6-8 model by utilizing the second-virial and the Joule-Thomson coefficient data over an extensive range of temperature. The necessary quantum corrections have been considered. The experimental data are in better agreement with the theory on the exp-6-8 model than on either the exp-6 or the L-J (12:6) model.

R. Paul and A. K. Barua have combined accurate data on inter-diffusion coefficient and viscosity of gas mixtures to obtain unlike molecular interactions on the exp-6 and the L-J (12:6) models respectively.

Low temperature physics

As reported earlier, the helium liquefier has been completely installed, along with its various circuits, including the circuit for the evaporation of liquid helium. Several trial runs for obtaining liquid helium were made and it was observed that the capacity of our existing charcoal purifier in the hydrogen circuit is not sufficient for continuous liquefaction of hydrogen (from locally manufactured high pressure hydrogen) for several hours, a prerequisite for the liquefaction of helium. In order, therefore, to handle the locally manufactured hydrogen of larger impurity content the capacity of the charcoal purifiers has been increased to four times and the charcoal pot thus required has been prepared out of available materials and has been found to be quite satisfactory.

A new type of J. T. Valve is being designed and constructed for the hydrogen stage. The present design is simple and easy in construction and is more compact than the old Schallamach screw driver type of valve.

A detailed study of the existing theories and the experimental results obtained so far on electrical and thermal conductivities of metals and alloys has been carried out. An attempt is being made to explain the observed discrepancies between the experimental data and the existing theories. An apparatus for the study of thermal and electrical conductivities of metals and alloys from room temperatures down to liquid helium temperatures has been designed and is being constructed in our workshop.

Structure of organic crystals

The detailed analysis of (4:1:3) chloro-dinitro-benzene has been taken up by E. M. Gopalkrishna. The electron density in the unit cell has been calculated in (100) projection and thus the y and z coordinates of all the atoms in the unit cell have been determined. A note on this work with the title "Application of sign relations in the case of (4:1:3) chloro-dinitro-benzene" has already been published. The electron density in the unit cell in the (010) projection has also been calculated for the determination of the x-coordinates of all the atoms. The final refinement of all the three coordinates of each atom by the Fourier difference synthesis and three-dimensional Fourier synthesis along some sections is under progress.

The determination of the molecular structure of naphthazarin was taken up by P. Srivastava. The structure has been determined at room temperature and the reliability index came out to be 0.23. The refinement of the structure by means of low temperature technique and Fourier refinement methods is nearing completion.

X-ray investigation of alloys has been carried out by A. Quader. Equilibrium diagram of Ag-Cd alloy system has been studied by taking x-ray powder diffraction photographs of quenched specimens upto the composition of 68

weight percent of cadmium. A pure face-centred cubic, β phase between 50.75 to 53.6 wt. % Cd was obtained below 228°C. The approximate phase boundaries were established. The results of these investigations have been communicated for publication.

The thermal expansion of α -phase silver-cadmium alloys was measured from high temperature x-ray powder diffraction photographs. The results are in the process of interpretation.

A few aluminium rich Cu-Al alloys were prepared in order to study the precipitation hardening effects by both x-ray and internal friction methods. A torsion pendulum has been designed and constructed for measuring internal friction in metals and alloys at high temperatures. Internal friction in 2 wt% Cu-Al alloy, 70-30 brass and α -phase Ag-Cd alloys have been measured. The results will be published soon.

Miscellaneous

Prof. K. Singh, Professor of Chemistry, Institute of Armament Studies, Kirkee came to the Department for taking Laue pictures in connection with his studies on elastic constants. Dr. R. P. Rastogi, Reader, Panjab University, delivered a course of lectures on 'Thermodynamics of Irreversible processes'. Sri K. P. Srivastava was awarded the degree of D.Phil (Science) of the Calcutta University for his work on 'Transport Properties of Gases'. Shri A. K. Barua has submitted his thesis for the D.Phil degree of the Calcutta University.

List of Papers published during the year 1959-60

1. Mutual diffusion of binary mixtures of He, A and Xe at different temperatures—by K. P. Srivastava, *Physica*, **25**, 571, 1959.
2. Thermal conductivity of binary mixtures of diatomic and monatomic gases—by B. N. Srivastava and A. K. Barua, *J. Chem. Phys.*, **32**, 427, 1960.
3. Force parameters for some non-polar molecules on the exp-6-8 model—by A. K. Barua, *J. Chem. Phys.*, **31**, 957, 1959.
4. Thermal conductivity and Eucken-type correction for binary mixtures of N_2 with some rare gases—by A. K. Barua, *Physica*, **25**, 1275, 1959.
5. The temperature dependence of the coefficient of inter-diffusion of some pairs of rare gases—by K. P. Srivastava and A. K. Barua, *Ind. J. Phys.*, **33**, 229, 1959.
6. Unlike molecular interaction from viscosity and inter-diffusion—by A. K. Barua, *Ind. J. Phys.*, **33**, 221, 1959.
7. Intermolecular potential of He—by A. K. Barua, *Ind. J. Phys.*, **34**, 76, 1960.
8. Force constants for unlike molecular interactions on exp-six model from inter-diffusion—by R. Paul, *Ind. J. Phys.*, **34**, 141, 1960.
9. A simple liquid air transfer valve for controlled evaporation—by J. K. N. Sharma, *Current Science*, **28**, 194, 1959.
10. An x-ray study of Chinizarin—by B. V. R. Murty, *Z. Krist.*, **111**, 3, 1959.

11. An x-ray study of (4:1:3) chloro-dinitro-benzene (α -modification. I)—by E. M. Gopala Krishna, *Z. Krist.*, **111**, 2, 1959.
12. Application of sign relations in the case of (4:1:3) chloro-dinitro-benzene—by E. M. Gopala Krishna, *Ind. J. Phys.*, **34**, 152, 1960.

Papers in the Press

1. Relaxation effects in the thermal conductivity of diatomic gases and gas mixtures—by B. N. Srivastava, and A. K. Barua, Proceedings of the Symposium on 'Rate-processes in physico-chemical reactions' organised by the Ind. Chem. Soc. (Bombay, 1960).
2. Thermal conductivity and Eucken-type correction for the binary mixtures H_2 -He, H_2 -Ne, H_2 -Kr, H_2 -Xe—by A. K. Barua, *Ind. J. Phys.*
3. Structure of Naphthazarin—by P. Srivastava, *Ind. J. Phys.*
4. The calculation of the rotational-translational relaxations in H_2 from thermal conductivity—by B. N. Srivastava and A. K. Barua, *Proc. Phys. Soc.* (Lond.)
5. An x-ray study of Ag-Cd alloys—by Md. A. Quader, *J. Inst. of Metals*.
6. Effect of concentration dependence of the diffusion coefficient in Ney and Armistead apparatus—by R. Paul, *Phys. Fluids*.

B. DEPARTMENT OF MAGNETISM

During the year under review research work was carried out on (1) Paramagnetic susceptibilities, (2) Paramagnetic resonance, (3) Phase transitions and thermal changes of structures by x-ray methods, (4) Problems of semi-conduction, (5) Development of cryogenic techniques, (6) Ferromagnetism, and (7) Miscellaneous.

(1) In connection with the susceptibility measurements of the single crystals of a number of dihalides of Cu^{2+} , fluosilicates of Cu^{2+} , Ni^{2+} and Co^{2+} double oxalates of Cr^{3+} and V^{3+} , formates, acetates and propionates of Cu^{2+} , Ni^{2+} and Co^{2+} it has been felt that the high order of accuracy achieved in the anisotropy measurements should also be attained in these measurements. The quartz fibre microbalance devised by Bose in this laboratory though very convenient for single crystal work, suffered from a rather low deflectional sensitiveness. R. Bagchi and Miss N. Bose are investigating the possibilities of removing this difficulty by introducing an electronic method of detecting the small deflections. In this method the beam of the balance carries a thin metal foil serving as one plate of a capacitor. The change in capacitance due to deflection of the balance arm causes a change in the plate current of an oscillatory circuit which is amplified suitably and observed in the usual way. Preliminary trials have shown that the sensitivity of the arrangement is very high. Attempts are being made to reduce extraneous disturbing factors. P. Ghosh, who has been entrusted with the measurement of the absolute susceptibilities of the powders of copper and nickel dihalides and of a number of Tutton salts of

copper and nickel by the Curie method made a modification in the bifilar suspension system whereby the "zero-shifting" which has so long been the most troublesome source of error in this method has been totally eliminated.

A. S. Chakravarty and R. Chatterji have completely worked out the theories for magnetic susceptibilities of V^{+3} , Ti^{+3} , Co^{2+} and Fe^{2+} which give now a complete co-ordinated picture of the susceptibility, paramagnetic resonance and optical absorption behaviours of the salts of these ions. It is now clearly shown that in all the paramagnetic salts the thermal expansion of the lattice causes a major change in the anisotropic crystalline fields. Moreover, the effect of the long range electric fields in similarly constituted salts of the same ion is quite appreciable as predicted earlier by Bose *et al.* In most of the salts the crystalline field arises from a semicovalent model as predicted by Owen and Bose *et al.*, rather than an electrostatic model taken earlier. They have now started to develop a theory for Ni^{2+} ions. In order to test the various implications of the theories already worked out highly accurate magnetic data are evidently necessary. The different methods of attaining large sensitiveness in magnetic measurements as stated above will therefore be extremely useful for the present purpose.

(2) All the electronic instruments as also a large electromagnet for the paramagnetic resonance work have been obtained from abroad. A rotating base for the magnet has been constructed here in which the position of the magnet can be accurately determined from a large circular horizontal vernier scale attached with it (also designed and made here). The low temperature 3cm wave guide of German silver, filled with distrene, as also the cavity resonator have been constructed and have been fitted up. Special arrangements have been made so that (i) the cavity can be tuned from the top and outside the cryostat when the resonator is inside it and (ii) the crystal can be introduced into the cavity from the top and rotated through any desired angle without disturbing the other settings in any way. All these units have been fitted up with the main wave guide line and have been found to be in resonance and capable of delivering fairly good power without any loss of the sharpness of resonance. U. S. Ghosh, R. Chatterji and R. Bagchi will soon start to study with this set the paramagnetic resonance of the single crystals of the Tutton salts of the iron group of elements after a few other preliminary test work and standardisation of conditions have been done.

(3) In order to determine more decisively the transition points of $\gamma\text{-Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$ due to dehydration, the importance of which has been indicated in the last year's report, an arrangement has been made by S. Roy wherein the weight losses at definite temperatures are measured when the sample is also at these temperatures (the temperatures being recorded by a previously calibrated iron-constantan thermo-couple). The present procedure totally eliminates the chance of any rehydration, the possibility of which was always there in the usual process of studying dehydration losses.

Miss G. Bhowmick is engaged in determining the structural changes of single crystals of copper ammonium sulphate due to thermal dehydration. In

pointing out the importance of such a study it may be mentioned here that this crystal as well as all other similar ones lose completely the magnetic anisotropy due to thermal dehydration near 70°C.

In order to study the expected anomalous thermal expansion in some paramagnetic crystals such as $\text{Cu}(\text{NH}_4\text{SO}_4) \cdot 6\text{H}_2\text{O}$, $\text{Ni}(\text{NH}_4\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$, etc., about which reference was made in the report of the previous year, S. Roy and Miss G. Bhowmick have designed and nearly completed a 19cm low temperature camera.

(4) It was reported last year that the usual chemical purificatory treatments cause a misalignment between different crystal blocks in graphite causing a derangement in the structure. From a study of the intensity distribution along the length of the extended spots in a x-ray rotation picture of graphite, S. Roy and R. Bhattacharya could devise a method for determining the amount of derangement produced by these treatments and they are now utilizing it to find the misalignments which have actually taken place.

In order to ascertain the effect of these treatments on the electrical conductivities of graphite, R. Bhattacharya undertook a detailed measurement of the principal conductivities of graphite before and after treatment. It has been shown that due to such treatments the C-axis conductivity is enhanced and the conductivity in a perpendicular direction is decreased quite in conformity with the x-ray findings. It is therefore obvious that combining these measurements with the amounts of derangements obtained by the x-ray methods as stated above, the true conductivity of graphite can be found since, it has been observed that naturally occurring crystals of graphite always possess a certain amount of derangement in the structure even before any treatment and hence can not give the true conductivity. R. Bhattacharya has been utilizing this method to find the true conductivities of graphite.

The existing theories to explain the electronic properties of graphite, which are of course not adequate, are all based on the available results of electrical conductivities, magneto-resistance effect, Hall effect, thermo-electric effect, magnetic properties, etc., which were all obtained with crystals purified in the usual way. In order therefore to propose a proper theory for graphite a programme of work has been undertaken in which the true values of these properties will be obtained in the manner indicated above.

Observing that there is always a discrepancy in the values of C-axis electrical conductivity of graphite measured here at different times as well as elsewhere, R. Bhattacharya remeasured these values with a new arrangement in which the uncertainty regarding the surface imperfections and the necessary electrical contacts with the crystal surfaces have been totally eliminated since now the contacts to both the surfaces are made with mercury. The values so obtained are quite consistent and reproducible.

(5) The modifications of the hydrogen cryostat which was reported last year to have been undertaken has not progressed much, owing to too heavy

pressure of work in the workshop. The liquid air cryostat is complete and trials are in progress.

In all our own works in different lines, measurements at low temperatures are essential. Therefore large number of calibrated thermocouples are necessary. Unfortunately solid CO_2 for calibration is not now-a-days available in Calcutta. So we are constructing a simple and efficient solid carbon-dioxide machine, which will be soon given a trial.

(6) The construction of an automatic a.c. ferromagnetic B-H meter was undertaken last year. This is nearly completed and D. L. Roy is setting it up to take measurements over wide ranges of field and temperature.

(7) *Miscellaneous* : In connection with the work on defect centres S. K. Dutta has assembled some of the preliminary units required for obtaining good alkali halide crystals, namely, the furnaces and the arrangements for obtaining single crystals from the melts.

S. K. Dutta has been awarded a senior research fellowship of the National Institute of Sciences of India for carrying out the above programme of work.

Magnetic measurements on a number of samples from Agra College and Atomic Energy Commission and x-ray measurements on samples from Science College, Calcutta were done in this department.

A. S. Chakravarty has submitted thesis for the D.Phil (Sc.) of the University of Calcutta.

Doctorate Degrees

S. K. Datta and S. K. Datta-Roy have been admitted to the D.Phil. (Sc.) degree of the Calcutta University.

List of Papers published during the year 1959-60

1. Paramagnetic behaviour of some iron group of elements—by A. Bose, *Bulletin of the National Institute of Sciences of India*, No. 14, 36, 1959.
2. Paramagnetic resonance and crystal structure—by A. Bose, Proceedings of the symposium on microwaves held in connection with Sir J. C. Bose Centenary Celebrations, 1959.
3. A gas flow cryostat in the range of temperatures 400°K to 20°K —by A. Bose, Proceedings of the International Measurements Conference, Budapest, 1959.
4. Analysis of the soft x-ray spectra of graphite and the suggestion of a suitable electronic picture of it—by A. K. Dutta, *Proc. Phys. Soc. Lond.*, **74**, 604, 1959.
5. Characteristics of the free electrons and the Brillouin zone of graphite from its soft x-ray spectra—by A. K. Dutta, *Bulletin of the National Institute of Sciences of India*, No. 14, 71, 1959.
6. Magnetic properties of V^{3+} ions—by A. S. Chakravarty, *Bulletin of the National Institute of Sciences of India*, No. 14, 48, 1959.

7. On the magnetic susceptibility and anisotropy of trivalent vanadium alum under the crystalline field, etc.—by A. S. Chakravarty, *Proc. Phys. Soc. Lond.*, **74**, 711, 1959.
8. Effect of chemical treatment on the structure and properties of graphite—by S. Roy, *Ind. Jr. Phys.*, **33**, 282, 1959.
9. Effect of chemical treatment on the electrical conductivity of graphite—by R. Bhattacharya, *Ind. Jr. Phys.*, **33**, 407, 1959.
10. Studies on the magnetic susceptibility of some V³⁺ alums and Ti³⁺ Caesium alum in the range 300°K to 100°K—by S. K. Dutta Roy, A. S. Chakravarty and A. Bose, *Ind. Jr. Phys.*, **33**, 483, 1959.
11. A preliminary note on the magnetic anisotropy and susceptibility of Fe (NH₄SO₄)₂·6H₂O—by A. S. Chakravarty and R. Chatterji, *Ind. Jour. Phys.*, **34**, 10, 1960.
12. The nature of the crystalline fields in Ti³⁺ alum—by A. Bose, A. S. Chakravarty and R. Chatterji, *Proc. Roy. Soc. A.*, **255**, 145, 1960.
13. Magnetic behaviours of titanium caesium sulphate alum—by A. Bose, A. S. Chakravarty and R. Chatterjee, *Ind. Jour. Phys.*, **33**, 325, 1959.
14. A short note on the crystalline electric fields in hydrated CO²⁺ salts—by A. S. Chakravarty and R. Chatterjee, *Ind. Jour. Phys.*, **33**, 531, 1959.

Papers in the Press

1. Paramagnetic behaviour of hydrated CO²⁺ salts—by A. Bose, A. S. Chakravarty and R. Chatterjee, *Proc. Roy. Soc.*
2. Nature of crystalline electric fields in hydrated Fe²⁺ salts—by A. Bose, A. S. Chakravarty and R. Chatterjee, *Proc. Roy. Soc.*

C. DEPARTMENT OF OPTICS

The investigations carried out in this Department during the year 1959-60 can be classified under the following lines of research :

- (1) Raman spectra,
- (2) Infrared absorption spectra,
- (3) Ultraviolet absorption spectra,
- (4) Structure of resonance lines of certain elements filtered through vapours of these substances,
- (5) Absorption of microwaves in some organic liquids, and
- (6) X-ray analysis of structure of organic compounds at -180°C.

Raman spectra

The Raman spectra of ortho- and parachloroanisole in the solid state at -180°C have been studied and compared with those for the substances in the liquid state by Krishna Kumar Deb. He has observed that the ortho compound in the solid state at -180°C does not produce any new low-frequency Raman line and the other Raman lines do not undergo any appreciable change when the liquid is solidified. In the case of the para compound, however, a strong new line appears in the low frequency region and some of the other lines disappear when the liquid is solidified. He has concluded that in the latter case the liquid consists of a mixture of monomeric and dimeric molecules while the solidi-

fied mass consists only of groups of molecules and that in the case of the ortho compound the chelation of the OCH_3 group with the chlorine atom prevents the formation of such dimers.

Infrared absorption spectra

In continuation of his investigations on the influence of environment on the rotational isomerism of some disubstituted ethanes Monomohan Mazumder has studied the infrared absorption spectra of solutions of ethylene chlorhydrin in different solvents and of the pure substance in the vapour state and has concluded from the changes observed in the spectra with change of environment that in the pure liquid the molecules form two types of dimers.

S. B. Banerjee and K. C. Medhi have studied the infrared absorption spectra of mesitylene in the vapour and liquid states and in solution in different solvents and have observed some influence of environment on the spectra. They have concluded from the results that the π -electrons of the benzene ring are attracted by the CH or CH_3 group of the neighbouring molecule and therefore the stretching vibration undergoes changes with change of environment.

The infrared absorption spectra of ten specimens of diamond, which were classified previously under three different types, have been studied by S. C. Sirkar and it has been shown that excepting the band at 1360 cm^{-1} , all the other bands are due to impurities present in the crystal in minute quantities and that these bands are not due to characteristic vibrations of the diamond lattice. The band 1360 cm^{-1} has been assigned to the vibration of those portions of the lattice which are under strain due to presence of impurities.

Ultraviolet absorption spectra

In continuation of the investigations on the ultraviolet absorption spectra of organic compounds in the liquid state and in the solid state at low temperatures, S. B. Banerjee studied the spectra of α -fluoronaphthalene. Of the two systems of bands observed in the near ultraviolet region one has been found to shift towards red by 1100 cm^{-1} and the other by 440 cm^{-1} with the liquefaction of the vapour, but with solidification of the liquid no further changes are observed. He has concluded that probably the molecules are dimeric in the liquid state.

Similar investigations have been carried out in the case of the three isomeric fluorotoluenes by S. K. Sen. He has revised the analysis of the bands due to the ortho compound with the help of the spectrum of the substance in the solid state at -180°C . The spectrum to *m*-fluorotoluene in the liquid state shows two systems of bands, one due to the single molecules and the other due to dimers, and the latter system persists when the liquid is solidified. The spectrum due to para fluorotoluene in the solid state at -180°C shows a splitting of the bands which has been attributed to the perturbation of the transition energy by the field of the permanent dipoles of the neighbouring molecules,

Structure of resonance lines of certain elements filtered through vapours of the substances

It was formerly shown by G. S. Kastha that when the resonance lines of Hg and Na are filtered through vapours of the corresponding substances each of these lines is split up into a doublet the separation between the components of which depends on the temperature and pressure of the vapour in the absorption cell. He has now put forward a quantitative theory of the phenomenon and has shown that when two atoms at a distance from each other are excited by absorbing the resonance radiation they may come sufficiently close to each other before returning to the ground state. Radiation from this pair of neighbouring excited atoms may then take place in two steps, one of the atoms coming to the ground state first and then the other. In that case, resonance takes place between the two atoms and Kastha has shown that the perturbation of the energy of the radiation by this resonance explains the observed splitting of the re-emitted resonance line into two components.

Absorption of microwaves in some organic liquids

In continuation of his previous investigation T. J. Bhattacharyya has studied the absorption of 3.18-cm microwaves in ethylene chlorhydrin in the pure state and in solution in different solvents. He has concluded from the results that the pure liquid consists of two types of dimeric molecules which break up into monomers in solution in certain solvents.

X-ray analysis of structure of organic compounds at -180°C

The space groups of the crystals formed by certain frozen organic liquids were determined in this Department formerly by G. S. R. Krishna Murti and S. G. Biswas independently. In the year under review Krishna Murti analyzed the Debye-Scherrer patterns due to cyclohexanone and methanol in the crystalline state at -180°C and determined the space groups to which these crystals belong. S. G. Biswas analyzed the Debye-Scherrer pattern due to 1, 3, 5-trichlorobenzene and also an electron diffraction pattern due to a small crystallite of this substance. This crystallite was found to have a fibrous structure. The electron diffraction pattern confirmed the analysis of the Debye-Scherrer pattern and the space group was determined from the latter pattern. He next studied the Debye-Scherrer patterns due to ortho-, meta- and paraxylene in the solid state at -180°C and analysed all these patterns. The space group has been found for the first time in each of these three cases.

Doctorate degree awarded to research workers

The following workers of the Optics Department were admitted to the D.Phil. (Science) degree of the Calcutta University during 1959-60 for the theses mentioned against their names :

1. Sri G. S. R. Krishna Murti for his thesis entitled "X-ray analysis of crystal structure of organic compounds at different temperatures".

2. Sri Smriti Bhusan Roy for his thesis entitled "Ultraviolet absorption spectra of frozen solutions of some aromatic compounds".

List of Papers published during the year 1959-60

1. Singlet-triplet transition in para chlorotoluene—by J. K. Roy, *Ind. J. Phys.*, **33**, 209, 1959.
2. On the polarised electronic spectra of single crystal of para dibromobenzene at -180°C —by T. N. Misra, *Ind. J. Phys.*, **33**, 276, 1959.
3. Infrared absorption spectra of ethylene chlorhydrin in the vapour state and in solution in different solvents—by Monomohan Mazumder, *Ind. J. Phys.*, **33**, 346, 1959.
4. Space group of 1, 3, 5-trichlorobenzene—by S. G. Biswas, *Ind. J. Phys.*, **33**, 371, 1959.
5. Space group of cyclohexane at -180°C —by G. S. R. Krishna Murti, *Ind. J. Phys.*, **33**, 401, 1959.
6. On the crystal structure of methanol at -180°C —by G. S. R. Krishna Murti, *Ind. J. Phys.*, **33**, 459, 1959.
7. On the absorption of 3.18 cm microwaves in ethylene chlorhydrin and its solutions—by T. J. Bhattacharyya, *Ind. J. Phys.*, **33**, 498, 1959.
8. Influence of interatomic resonance on the frequency of re-emitted resonance radiation—by G. S. Kastha, *Ind. J. Phys.*, **33**, 534, 1959.
9. On the infrared spectra of mesitylene in the vapour and liquid states and in solution—by S. B. Banerjee and K. C. Medhi, *Ind. J. Phys.*, **34**, 1, 1960.
10. Infrared absorption spectra of diamonds of different types—by S. C. Sirkar, *Ind. J. Phys.*, **34**, 13, 1960.
11. On the electronic spectra of α -fluoronaphthalene in the liquid and solid states—by S. B. Banerjee, *Ind. J. Phys.*, **34**, 61, 1960.

Papers in the Press

1. Raman spectra of ortho- and parachloroanisole in the solid state at -180°C —by Krishna Kumar Dev, *Ind. J. Phys.*, **34**.
2. Ultraviolet absorption spectra of ortho-, meta- and parafluorotoluene in the liquid and solid states—by S. K. Sen, *Ind. J. Phys.*, **34**.

D. DEPARTMENT OF THEORETICAL PHYSICS

The investigations carried out in the Department of Theoretical Physics during the year 1959-60 are mainly in the following lines :

- (1) Neutron strength function $\bar{\Gamma}_n/D$ with complex diffuse boundary potential.
- (2) Neutron energy levels in a diffuse potential and their splitting due to spin-orbit interaction.
- (3) Effect of nuclear magnetic moment on the bremsstrahlung of electrons.

- (4) Production of bremsstrahlung by longitudinally polarised electron-proton collisions.
- (5) Penetration factor in alpha-decay.
- (6) General theory of relativity.
- (7) Relativistic cosmology.

Neutron strength function $\bar{\Gamma}_n^0/D$ with complex diffuse boundary potential

The neutron strength function $\bar{\Gamma}_n^0/D$ which is defined as the ratio of nuclear level width to level spacing for neutrons is related to the scattering of neutrons by nucleus. $\bar{\Gamma}_n^0/D$ as calculated with a square well optical model potential explains the irregular trend of the average neutron scattering cross section as functions of nuclear mass and shows sharp increases near mass number $A=55$ and $A=155$. However, the theory with this model predicts more pronounced maxima and minima of $\bar{\Gamma}_n^0/D$ with the variation of mass number than what is experimentally observed. Later Feshbach and others have studied the same problem with Woods-Saxon type of potential and they find that the diffuse potential of this type gives much less pronounced maxima and minima of $\bar{\Gamma}_n^0/D$ than that given by square well, thereby bringing the theory to a better agreement with experimental finding than the previous one. Taking a complex spherical well with a diffuse boundary which may be said to be intermediate between a square well and a Woods-Saxon type, it is found that this potential gives nearly the same results as does the Woods-Saxon type and at the same time allows easier solution than the latter. For the bound state problem, the imaginary part of the potential is zero and it is found that s-state energy eigen values agree with similar calculations of Green and Lee.

Neutron energy levels in a diffuse potential and their splitting due to spin-orbit interaction

The energy eigen values of neutrons within the nucleus for a spherically symmetrical potential $V(r) = -V_0 [1 + e^{(r-R)/a}]^{-1}$ have been investigated by following a new method due to Lanczos for solving the differential equation. The s and p state energy levels have been calculated for atomic mass 200 with the values of parameters adopted by Feshbach, Porter and Weisskopf in their calculation of the neutron strength function with a similar potential. The results of our calculation agree closely with those of Malenka, whose potential is nearly, though not exactly, the same as ours.

The splitting of the neutron energy levels due to spin-orbit interaction has also been investigated by the perturbation method with the unperturbed wave functions obtained by the technique mentioned above.

Effect of nuclear magnetic moment on the bremsstrahlung of electrons

In the collision of high energy electrons with the nucleus, the electron suffers deflection in the coulomb field of the nucleus and in consequence brems-

strahlung is produced. The nucleus has a magnetic moment which can also influence the motion of the electron. Berg and Lindner (1958) have already calculated the high energy bremsstrahlung in electron-proton collisions taking into account the recoil of the proton and the effect of its anomalous magnetic moment. However, their method can not easily be extended to nuclei other than proton because the representation of the magnetic moment operator offers difficulties for nuclei whose magnetic moments come from both orbital and spin motion of several nucleons. We have treated the problem of electron-nucleus bremsstrahlung, by representing the nucleus as a static model having charge and magnetic moment, the electromagnetic potentials of such a model has been given by Newton. The effect of the magnetic moment is appreciable when the energy of the electron is of the order of the rest energy of the proton *i.e.*, of the order of one Bev. and the atomic number of the target is small. For an electron with one Bev. energy, the neglect of the recoil effect in our calculation seems to be justified when the mass of the target nucleus is much heavier than that of the proton.

Production of bremsstrahlung by longitudinally polarised electron-proton collisions

It is of importance to calculate the differential cross section of radiative collisions between a longitudinally polarised electron and a nucleon polarised in the same or opposite direction. The simple scattering of two polarised fermions has already been investigated. The effect of the polarisation in the case of bremsstrahlung production becomes important when the kinetic energy of the recoil proton is comparable to its rest energy. In our case there will be two matrix elements one of which corresponds to the radiation emitted by the electron (M_I) and the other by the proton (M_{II}). The contribution to the differential cross section from M_I is very much greater than that from M_{II} when the photon emerges nearly parallel to either the incident or the final electron. We have considered only M_I and so our formula for the differential cross section is valid when the angle of emergence of the proton with the direction of the electron is very small or kinetic energy acquired by the proton is small compared to its rest energy.

Penetration factor in alpha-decay

The penetration probability of α -particles through a potential barrier has been calculated using Woods-Saxon potential for the nuclear field. The calculation of the wave function in the region outside the nuclear surface where only the Coulomb potential is present has been given by Abramowitz (1949). In solving the Schrödinger equation in the neighbourhood of the nuclear boundary we have employed, instead of the WKB approximation, the method of solution given by Lancelotti (1938), according to which the differential equation has been equated to an error term which is proportional to Tshebysheff's polynomial of a given order. Consequently the equation admits of a finite power series solution. The penetration factor has been calculated from the value of the wavefunction at the point near the nuclear boundary where the potential

energy is equal to the kinetic energy of the emitted α -particle. The value of the half-life of $^{214}_{84}\text{Po}$ calculated from this penetration factor comes out to be twice the experimental value. Further extension to cases of excited state transitions is under consideration.

General theory of relativity

Rainich had shown that the contents of the Maxwell electromagnetic equations and the Einstein gravitational equations can be presented in the form of a unified theory provided the electromagnetic field is non-null. When the electromagnetic field is static, the solutions of the above theory have been found for the case of the diagonalized metric tensor being functions of one co-ordinate alone.

Relativistic cosmology

If one assumes that the cosmic matter is rotating relative to the compass of inertia and the expansion is isotropic, then there exists in the past history a minimum in the volume of any element of cosmic fluid. It has been found that the maximum density closely corresponds to the density required in the α - β - γ theory of the origin of nuclei. This work was reported at the Summer School of Theoretical Physics held at Mussoorie, May-June, 1959 and is awaiting publication in its proceedings.

Doctorate degree awarded to research workers

Sri Amal Kumar Raychoudhuri was admitted to the D.Sc. degree and Sri Samarendra Nath Biswas to the D.Phil. (Science) degree of the Calcutta University on the basis of their work done in the Department of Theoretical Physics.

List of Papers published during the year 1959-60

1. Neutron strength function Γ_n^0/D with complex diffuse boundary potential—by Arundhati Ghosh, *Ind. Jour. Phys.*, **33**, 395, 1959.
2. Effect of nuclear magnetic moment on the bremsstrahlung of electrons—by Sasabindu Sarkar, *Nuovo Cimento*, **15**, 686, 1960.
3. Neutron energy levels in a diffuse potential—by Arundhati Ghosh and N. C. Sil, *Nuclear Physics*, **16**, 1960.
4. Penetration factor in alpha-decay—by S. K. Dutta, T. K. Mitra & N. C. Sil, *Ind. Jour. Phys.*, **34**, 205, 1960.

Papers in the Press

1. Splitting of neutron energy levels due to spin-orbit coupling—by Arundhati Ghosh, *Ind. Jour. Phys.*
2. Static electromagnetic fields in general relativity—by A. Raychoudhuri, *Annals of Physics (U.S.A.)*.
3. Production of bremsstrahlung by longitudinally polarised electron-proton collisions—by Sasabindu Sarkar, *Nuovo Cimento*.

E. DEPARTMENT OF PHYSICAL CHEMISTRY

Investigations carried out in the Department during the year 1959-60 may be classified under the following headings:—

High Polymers

- 1.1. Kinetics and chain transfer.
- 1.2. Studies in aqueous polymerization.
- 1.3. Studies on polyampholytes.
- 1.4. Metallic soaps as initiators in polymerization.
- 1.5. Redox polymers.

General Physical Chemistry

- 2.1. Thermodynamic properties of binary systems.
- 2.2. Acidity function in non-aqueous systems.
- 2.3. Nature of potassium permanganate and oxalic acid reaction in an atmosphere of nitrogen.
- 2.4. Kinetics of conversion from colourless to coloured form of magenta in benzene on addition of alcohol.

Ad hoc Research Problems

- 3.1. Solvent extraction of coal.
- 3.2. Styrenation of shellac.

High Polymers

1.1. *Kinetics and chain transfer.* The polymerization of the higher esters of methacrylic acid has been studied by S. R. Chatterjee and S. N. Khanna in order to determine the effect of lengthening of the ester group on the reactivity of the monomer molecules and their respective derived radicals. The various rate constants and their temperature dependence over a range of temperature have been determined.

1.2. *Studies in aqueous polymerization.* The kinetics of the aqueous heterogeneous polymerization of two vinyl monomers, acrylonitrile and vinyl acetate initiated by several redox systems has been investigated by M. Biswas. The relationship of the stability of the separating polymer phase with the rate and other factors of the heterogeneous process has been established. Role of various solvents and non-solvents for the polymeric entities on the kinetics of the process has been elucidated.

1.3. *Studies on polyampholytes.* A polyampholyte of the polyamino acid type has been synthesized from polyacrylonitrile by B. Mukerjee, M. L. Bhaskar Rao and A. N. Dey and its physico-chemical properties have been studied. An interesting slow coagulation of the colloidal polyampholyte at

cent percent neutralization of the -NH_2 groups with HCl has also been observed. Further studies are in progress.

1.4. *Metallic soaps as initiators of polymerization.* The possible exploitation of metallic soaps to produce stereo-specific polymers has been tried by V. L. Murthy in view of the general specificity of action of metals as well as the mobility of the metal part in a metallic soap. Using a border-line solvent like n-heptane the polymerization of styrene using ferric laurate as catalyst revealed a definite formation of crystallites as evidenced by x-ray diffraction analysis. As regards efficiency, a mixture of iron and chromium laurates was found to be most efficient in action whereas iron laurate was found to be individually the best in the polymerization of methyl methacrylate.

1.5. *Redox polymers.* Several soluble and insoluble redox polymers have been synthesized by Bhaskar Rao and B. Mukerjee. The polymers undergo reversible redox reaction. The insoluble resins react in a manner analogous to the reaction in a homogeneous phase. The physico-chemical studies of these resins are being pursued.

1.6. *Detection of end groups in polymers.* B. Mukerjee, R. S. Konar, P. Ghosh and Miss L. V. Asolkar have worked on the detection of end groups in polymers by a new technique developed in this laboratory called 'Dye partition technique'. Different end groups have been introduced in polymers and their existence confirmed by the above technique. Quantitative aspect of the problem is under investigation.

General Physical Chemistry

2.1. *Thermodynamic properties of binary systems.* S. N. Bhattacharjee and A. V. Anantaraman are continuing their study on the effect of small orientational forces on excess enthalpy and excess volume of mixing. The liquid-vapour equilibrium still has been constructed and put to operation for the study of two other important excess thermodynamic properties, excess Gibbs free energy and excess entropy. Systems whose excess enthalpy and excess volume have been measured, are being studied for their excess Gibbs free energy and excess entropy.

2.2. *Acidity function in non-aqueous systems.* Ch. Kalidas has completed the work on the determination of the Hammett's acidity function in non-aqueous systems with special reference to glycolic media.

2.3. *Nature of potassium permanganate and oxalic acid reaction in an atmosphere of nitrogen.* The nature of "active" oxalic acid as produced by the above reaction is being investigated by R. S. Konar. Two interesting observations have been made. Firstly, "active" oxalic acid can initiate polymerization and this it does even nearly two weeks after its preparation provided the active oxalic acid is preserved at a temperature below about 24°C . Secondly, the polymer formed by initiation with active oxalic acid gives strong positive

test for carboxyl end groups thus providing the first experimental evidence that stable COOH free radicals are formed in "active" oxalic acid. It is suggested that such free radicals are stabilized by complexing with oxalic acid.

2.4. *Kinetics of conversion from colourless to coloured form of magenta in benzene on addition of alcohol.* The kinetics of the above reactions is being studied by A. Ghosh. In benzene magenta forms a faint yellow (almost colourless) solution. On addition of alcohol the colour of the dye solution changes to pink. The change is not instantaneous and seems to follow second order equation. The rate constant increases rapidly with increase in percentage of alcohol in the reaction medium. Further work is in progress.

Ad hoc Research Problems

3.1. *Solvent extraction of Coal.* In continuation of the previous work, S. R. Chatterjee has found that better solvents of coal have structures containing nitrogen and oxygen atoms possessing an available unshared pair of electrons. Extraction of coal by polar solvents after controlled oxidation is under progress.

3.2. *Styrenation of Shellac.* Styrenation of modified shellac (modified by the addition of maleic anhydride) has been tried by B. Mukherjee under different condition. The physico-chemical study of the products is under investigation.

List of Papers published during the year 1959-60

1. Kinetics of the Polymerization of Methyl Isopropenyl Ketone, Part II. Chain Transfer Studies—by A. K. Chaudhuri, *Die Makromol. Chemie.*, **31**, 214, 1959.
2. Metallic Soaps as Initiators of Vinyl Polymerization of Methyl Methacrylate using Ferric Laurate as Catalyst—by V. Lingamurty and S. R. Palit, *J. Sci. Ind. Research*, **18B**, 140, 1959.
3. Denaturation of a Synthetic Polyampholyte—by M. L. Bhaskara Rao and S. R. Palit, *Proc. Chem. Soc.*, 222, 1959.
4. A Polyampholyte with "Built-in-Dye"—by M. L. Bhaskara Rao and Santi R. Palit, *Proc. Chem. Soc.*, 223, 1959.
5. Some Observations on the Effects of Physical Nature of the Separating Phase on the Rate of Heterogeneous Polymerization—by S. R. Palit and T. Guha, *J. Poly. Sci.*, **34**, 243, 1959.
6. Effect of Synthetic Soil Conditioners on the Cation Exchange Capacity of Soils and Clays—by Triloki Nath and B. R. Nagar, *Current Sci.*, **28**, 193, 1959.
7. Hexachlorobenzene from Carbon Tetrachloride—by S. C. Srivastava, *J. Sci. Ind. Research*, **18B**, 438, 1959.
8. Some Notes on Colour Formation in the Polymerization of Methyl Isopropenyl Ketone—by A. K. Chaudhuri, *Die Makromol. Chemie.*, **33**, 249, 1959.
9. A Rapid Precision Method for end group Determination of High Polymer—by S. R. Palit, *Die Makromol. Chemie.*, **36**, 89, 1959.
10. Dipole moments of Long Chain Dicarboxylic Acids—by R. J. R. Mohan Rao and S. R. Palit, *Ind. Jour. Phys.*, **34**, 55, 1960.
11. Electronic Correlation of Molar Refraction—by S. R. Palit and G. R. Somayajulu, *J. Chem. Soc.*, 459, 1960.
12. Examination of Cinders from a High Ash Coal and its possible utilization—by T. Guha, K. Mitra and S. R. Palit, *J. Sci. Ind. Research*, **18A**, 564, 1959.

F. DEPARTMENT OF ORGANIC CHEMISTRY

Research activities of the department are being mainly continued along the lines indicated in the previous report and consist mainly of synthetic studies in the alicyclic field. Degradative studies are also being done to some extent. These have been detailed out below.

(i) Stereospecific synthetic studies on diterpenoid resin acids related to podocarpic and abietic acids and diterpenoids having *gem*-dimethyl groupings.

(ii) Synthetic studies on sesquiterpenoids : (a) mono-carbocyclic lactones and bicyclic guaianolides ; (b) industrially important alcohol, guaiol ; (c) attempts at the synthesis of macrocyclic compounds ; (d) caryophyllene.

(iii) Studies on the conversion of cinchonine to chinchonidine and quinine to quinidine.

(iv) Studies on the synthesis of bridged ring systems similar to naturally occurring products, namely, cedrene and clovene.

(v) Studies on the synthesis of iso-quinoline derivatives and indole alkaloids.

(vi) Synthetic studies on carcinogenic polycyclic aromatic hydrocarbons.

U. R. Ghatak achieved a signal success in the synthesis of dl-podocarpic acid and with the synthesis of des-isopropyl-dehydroabietic acid by D. K. Datta, all of the stereoisomers are now available by synthesis.

The gross structure of sesquiterpenoid lactones, guaianolides, has been arrived at in an elegant way by J. R. Mahajan. Notable progress in the synthesis of mono-carbocyclic lactone, xanthatin, has also been made.

Successful synthesis of an important bicyclic potential intermediate in two stereo-isomeric forms for the synthesis of di- and tri-terpenoids has been completed by S. L. Mukherjee. He has also been able to develop a new method for the introduction of *gem*-dimethyl grouping.

S. A. Narang, working on the synthesis of industrially important sesquiterpenoids has built up the gross structure of guaiol in which the position of the double bond has to be established.

Synthesis of dehydroabietic acid in different stereo-isomeric forms has been completed by M. Sharma.

Stereospecific synthesis of methoxy ether of Nimbiol, a bitter principle isolated from *Melia Azadirachta*, Linn., has been completed by P. K. Ramchandran.

Detailed studies to synthesise bicyclic intermediates in different stereoisomeric forms has been undertaken by N. K. Basu.

N. G. Kundu has been successful in synthesizing a tricyclic bridged ring structure and is engaged in the elucidation of its stereochemistry.

A new method for the synthesis of substituted dihydroisoquinoline has been carried out by G. C. Banerjee and N. N. Saha.

A. K. Mandal is engaged in the study of azulenes and azulenogenic lactone and A. K. Das Gupta on heterocyclic systems related to indole alkaloids.

The following Research workers have been admitted to the degree of Ph.D. or D.Phil.

1. Dr. Jaswant Rai Mahajan, D.Phil. (Calcutta)—Subject: Synthetic studies in Sesquiterpenoids.
2. Dr. Soumyendra Lal Mukherjee, D.Phil. (Calcutta)—Subject: Synthetic Investigations of Resin Acids.
3. Dr. N. L. Zutshi, Ph.D. (Agra)—Subject: The Chemical studies in Indian Essential Oil.
4. Dr. Dilip Kumar Datta, D.Phil. (Calcutta)—Subject: Studies in cyclisation Reactions ; Synthetic studies in Resin Acids.

The following research workers of the department have proceeded abroad during this year on fellowships :

1. Dr. N. N. Saha, R.O. of the Department left for Chicago with a fellowship for researches in Cancer.
2. Dr. J. R. Mahajan, who was also awarded National Research fellowship by the Government of India, proceeded to the John Hopkins University, U.S.A. to work on Sesquiterpenoids under Prof. Nikon.
3. Dr. U. R. Ghatak, *the best worker of the Department during the last six years*, has gone to the University of Maine on Post-doctoral Fellowship.
4. Dr. S. C. Ray proceeded to the University of Washington on a Post-doctoral Fellowship.

List of Papers published during the year 1959-60

1. Synthetic studies on Resin acids. Part III—by Saha, Ganguli and Dutta, *J. Amer. Chem. Soc.*, **81**, 3670, 1959.
2. Synthetic studies on Resin acids, Part IV—by Ghatak, Datta and Ray, *ibid.*, **82**, 1728, 1960.
3. Synthetic studies of Terpenoids. Part III—by Mahajan and Dutta, *J. Chem. Soc.*, 62, 1960.

4. Synthetic studies of Terpenoids, Part IV—by Mukherjee and Dutta, *J. Chem. Soc.*, 67, 1960.
5. Synthesis of condensed cyclic systems. I. A new synthesis of 7-methyl-0:3:3-bicyclo-octane-3-one and 8-methyl-0:3:4-bicyclononan-4-one—by Ghatak and Sen, *J. Org. Chem.*, 24, 1866, 1959.
6. A new Synthesis of 1:1-Dimethyl- Δ -5:10-octalin-6-one—by S. Mukherjee, *J. Sci. and Ind. Research*, Sec. B, 1993, 1960.

Papers in the Press

1. Synthetic studies of Terpenoids, Part V—by Narang and Dutta, *J. Chem. Soc.*, 1960.
2. Synthesis of 3-methyl-5, 6, 7, 8-tetrahydro-1-naphthol—by Dutta and Bagehi, *J. Org. Chem.*, 1960.

G. DEPARTMENT OF INORGANIC CHEMISTRY

As reported in the previous year, research work in this department was mainly continued on the study of Co-ordination Complexes and their applications in the field of analytical chemistry.

Physico-chemical investigations on the metal complexes of various ligands were continued and in some cases the formation constants were determined by spectrophotometric and ion-exchange methods.

In continuation of the work on organic reagents containing the oximino group, D. Banerjea and K. K. Tripathi have developed a method for the spectrophotometric determination of nickel with nicotinamidoxime. The nature of the nickel complex which is formed has been investigated polarographically.

A simple graphical method has been developed by D. Banerjea and K. K. Tripathi for evaluating the successive association constants of species in solution from data on distribution experiments. The method has been successfully applied in studying the association of uranium(VI) ion with some of the common anions in acid medium from the results of distribution experiments with a cation-exchange resin.

The same authors have completed investigations on the polarographic behaviour of rhenium(VII) in oxalate and cyanide media. Further work on the polarographic behaviour of rhenium(VII) in various other supporting electrolytes is in progress. Investigations have been carried out by D. Banerjea and B. Chakravarty on the polarographic behaviour of a number of isomeric (*cis* and *trans*) complexes of platinum(II) and palladium(II) in suitable supporting electrolytes.

D. Banerjea and B. Chakravarty have developed methods for the amperometric determination of copper with mandelamidoxime and salicylamidoxime.

Satisfactory results have been obtained for the estimation of copper in traces in presence of a variety of other ions.

The same authors are now engaged in studying the kinetics of acid hydrolysis (aquation) of chromium(III)-tris-biguanide ion. It is interesting to note that this cationic species is much more labile than the less stable but analogous chromium(III)-tris-ethylenediamine cation. A novel mechanism involving protonation of the complex-bound ligand followed by bond rupture has been proposed to account for all the observed facts.

In continuation of his work on metal complexes of guanylalkylureas, R. L. Dutta has completed his studies on copper, nickel, palladium and cobalt complexes. The instability constants of the copper and nickel complexes have been determined by spectrophotometric method. His work on metal complexes of hydroxamic acid has been continued and a number of coloured complexes of iron, vanadium and molybdenum have been isolated. Complex compounds of n-hexylbiguanide and hexamethylene biguanide with metals have been prepared and studied by the same author.

Nihar Ranjan Sen Gupta has made a comprehensive study on hydroxy-alkyl-and alkoxy-alkyl biguanide metal complexes of copper, nickel, palladium, cobalt and chromium. He has also determined the instability constants of copper and nickel complexes.

3-Oximinomethyl salicylic acid has been employed as an analytical reagent by Asit Kumar Ray for the estimation of copper, nickel, iron and uranium.

Complex compounds of quadrivalent and pentavalent rhenium with pyridine and its analogues have been prepared by D. Sen and B. Sur.

S. Lahiri has prepared and studied the complex compounds of copper, nickel, cobalt and chromium with cyclo-hexyl biguanide and 2-ethyl-hexyl biguanide.

A. K. Chakraburty continued the physico-chemical studies on the co-ordination complexes of hydroxamic acids which included the determination of the thermodynamic stability constants of the hydroxamic acid complexes of iron and uranium.

During the year under review, following scholars in the department of Inorganic Chemistry have been awarded the D.Phil. degree in Science by the University of Calcutta. The title of their theses is given against the name of each of them.

1. Rabindra Lal Dutta : Studies on Chelate Complexes with Polydentate Ligands.
2. Nihar Ranjan Sen Gupta : Studies on metal biguanide complexes.
3. Sailendra Nath Poddar : Studies in Co-ordination Compounds.
4. Asit Kumar Ray : Studies on Co-ordination Complexes and their analytical applications.

List of Papers published during the year 1959-60

1. Amperometric determination of copper with mandelamidoxime—by D. Banerjea & B. Chakravarty, *Z. anal. Chem.*, **171**, 4, 1959.
2. Amperometric determination of copper with salicylamidoxime—by D. Banerjea & B. Chakravarty, *J. Ind. Chem. Soc.*, **37**, 43, 1960.
3. Studies on the metal complexes of hydroxamic acids, Part III. Coloured complexes of iron, vanadium and molybdenum with isonicotino-hydroxamic acid and their analytical uses—by R. L. Dutta, *J. Indian Chem. Soc.*, **36**, 285, 1959.
4. —Do— Part IV. Coloured complexes of vanadium and iron with quinaldino hydroxamic acid and their analytical uses—by R. L. Dutt, *J. Indian Chem. Soc.*, **36**, 339, 1959.
5. —Do— Part V. Co-determination of iron and manganese with anthranilo hydroxamic acid—by R. L. Dutt, *J. Indian Chem. Soc.*, **37**, 167, 1960.
6. Guanylalkylureas and their metallic complexes, Part I. Synthesis of guanylalkylureas —by R. L. Dutta and Priyadarajan Ray, *J. Indian Chem. Soc.*, **36**, 499, 1959.
7. —Do— Part II. Copper complexes—by R. L. Dutta and Priyadarajan Ray, *J. Indian Chem. Soc.*, **36**, 567, 1959.
8. —Do— Part III. Nickel complexes—by R. L. Dutta and Priyadarajan Ray, *J. Indian Chem. Soc.*, **36**, 576, 1959.
9. Complex compounds of n-hexylbiguanide with metallic elements—by R. L. Dutta, *Z. anorg Chem.*, **302**, 237, 1959.
10. Complex compounds of hexamethylene di biguanide with metallic elements—by R. L. Dutta, *J. Indian Chem. Soc.*, **37**, 32, 1960.
11. Dicyano cobalt (III) biguanide complexes—by Nihar Ranjan Sen Gupta and Priyadarajan Ray, *J. Indian Chem. Soc.*, **36**, 201, 1959.
12. Hydroxy- and alkoxy-alkyl biguanide metal complexes. Part I. Copper complexes—by Nihar Ranjan Sen Gupta and Priyadarajan Ray, *J. Indian Chem. Soc.*, **36**, 373, 1959.
13. —Do— Part II. Nickel and palladium complexes—by Nihar Ranjan Sen Gupta and Priyadarajan Ray, *J. Indian Chem. Soc.*, **36**, 489, 1959.
14. —Do— Part III. Cobalt and chromium complexes—by Nihar Ranjan Sen Gupta and Priyadarajan Ray, *J. Indian Chem. Soc.*, **36**, 581, 1959.
15. 3-Oximinomethyl salicylic acid as an analytical reagent Part I. Estimation of copper and nickel—by Asit Kumar Ray & Priyadarajan Ray, *J. Indian Chem. Soc.*, **37**, 133, 1960.
16. —Do— Part II. Spectrophotometric determination of uranium—by Asit Kumar Ray and Priyadarajan Ray, *J. Indian Chem. Soc.*, **37**, 141, 1960.

Papers in the Press

1. Association of uranium (VI) with anions in aqueous perchloric acid medium—by D. Banerjea & K. K. Tripathi, *J. Inorg. and Nucl. Chem.*
2. Guanylalkylureas and their metallic complexes. Part IV. Instability constants of copper and nickel complexes—by R. L. Dutta, *J. Indian Chem. Soc.*
3. —Do— Part V. Palladium Complexes—by R. L. Dutta, Bimanesh Sur and Nihar Ranjan Sen Gupta.

4. —Do— Part VI. Cobalt complexes—B. L. Dutta, Bimanesh Sur and Nihar Ranjan Sen Gupta, *J. Indian Chem. Soc.*
5. Complex compounds of cyclohexyl- and 2-ethylhexyl-biguanides with metallic elements—by S. Lahiri, *Z. anorg. Chem.*
6. Hydroxy- and alkoxy-alkyl biguanide metal complexes. Part IV. Instability constants of copper and nickel complexes—by Nihar Ranjan Sen Gupta and Priyadarajan Ray, *J. Indian Chem. Soc.*
7. Nicotinamidoxime as an analytical reagent. Part III. Polarographic studies on the nature of the nickel complex and spectrophotometric determination of the metal—by K. K. Tripathi and D. Banerjea, *Z. anal. Chem.*
8. Spectrophotometric determination of iron and copper with methyl-2-pyridylketoxime and their simultaneous determination in mixtures—by D. Banerjea and K. K. Tripathi, *Anal. Chem.*
9. 3-Oximinomethylsalicylic acid as an analytical reagent. Part III. Spectrophotometric determination of iron (III)—by Asit Kumar Ray, *J. Indian Chem. Soc.*
10. Polarographic behaviour of some Pt(II) and Pd(II) complexes—by B. Chakravarty and D. Banerjea, *J. Inorg. Nucl. Chem.*

H. DEPARTMENT OF MACROMOLECULES

The Department is mainly conducting research on elucidation of structure of natural polymers and on problems concerning rubber.

Polysaccharides

Schemes of research on the isolation and elucidation of the structures of polysaccharides are worked out. Significant progress has been made in this line. The detailed structure of hemicellulose present in the kernel of *Cocos nucifera* was established, whereas a general structure was assigned to the hemicellulose present in the kernel of *Borassus flavilifera* Linn. The structural investigation of hemicellulose from *pisum sativum* has been started. Preliminary studies on the nature of uronic acid part of the pectins from *Atrocarpus integrifolia*, *Psidium guajava* Linn, *Mangifera indica*, and of the gum from *Odina wodier* Roxb. have been conducted. Some of the physico-chemical studies on the two fractions of starch isolated from *Trapa bispinosa* Roxbg, are in progress.

Rubber Section

The schemes initiated to throw more light on the problem of vulcanisation of rubber have progressed satisfactorily. Estimation of some important thiazole type of accelerators, sulphur, tetramethyl thiuram disulphide have been carried out amperometrically. Study of the mechanism of the acceleration during vulcanisation of rubber and work on the mastication of rubber have also been taken up. Studies of some aspects on the hard rubber reaction by D.T.A. were carried out.

Solution properties of polymers

Viscometric and Light scattering methods were standardised. Many of the results obtained by using these methods gave substantial knowledge about the molecular architecture of the natural polymers.

The department is in great need of some chemicals and instruments, like polarimeter etc., which are of vital importance for the work in this field. We have applied for the import licences. It is desirable that the grants should be made available for their purchase at an early date so that the work may not be hampered.

List of Papers published during the year 1959-60

1. Estimation of Tetramethylene Thiuram disulphide—by P. K. Chatterjee, D. Banerjee and A. K. Sircar, *J. Sci. Ind. Res.*, **19B**, 3, 118, 1960.

Papers in the Press

1. Estimation of sulphur in presence of accelerators—by P. K. Chatterjee, D. Banerjee and A. K. Sircar, *J. Sci. Ind. Rec.*
2. Quantitative determination of thiazole type of rubber accelerators by amperometric titrations—by P. K. Chatterjee, D. Banerjee and A. K. Sircar, *Trans. Inst. Rub. Indus.*

K. BANERJEE,

Director.

LIST OF BOOKS

[Added during 1959-60]

Author/Organization.	Title and Volume.
1. Schrodinger, E. ..	Expanding Universe.
2.	Informator Nauki Polskiej 1958.
3. Calcutta University ..	Proceedings of the Physics Seminar, Sept. 9, 10 & 11, 1957.
4. Gmelins Handbuch der Anorganischen Chemie.	"Fluor" Ergänzungsband (supp) Sys. No. 5, Auf. 8, 1959.
5. Bugher, J. C. & others Editors.	Progress in Nuclear Energy : Medical Sciences. Series 7 vol. 2, 1959.
6. Japan. Society for Testing Materials.	Proceedings of the First Japan Congress on testing materials.
7.	Handbook of learned societies in Japan, 1959.
8. Kelley, M. T., Editor ..	Progress in Nuclear Energy: Analytical Chemistry, vol. 1, series 9, 1959.
9. Pitt, H. R.	Lectures on measure theory and probability.
10. Alfvén, H.	Lectures on magneto-hydrodynamics and cosmic rays.
11. Bruhat, F.	Lectures on Lie Groups and representations of locally compact groups.
12. Schwart, L.	Lectures on mixed problems in partial differential equations and representations of semi-groups.
13. Wentzel, G.	Lectures on special topics in field theory.
14. Wentzel, G.	Lectures on special topics in quantum mechanics.
15. Serber, R.	Lectures on high energy nuclear reactions.
16. Serber, R.	Lectures on parity, charge conjugation and time reversal.
17. Skeist, I.	Epoxy resins.
18. Battista, O. A.	Fundamentals of High Polymers.
19. Huggins, M. L.	Physical chemistry of High Polymers.
20. Whistler, R. L. & Smart, C. L.	Polysaccharide chemistry.
21. Ives, H. C.	Mathematical Tables, 2nd edn. 1945.
22. Bollenback, G. N.	Methyl glucoside.
23. Cook, J. W.	Progress in organic chemistry. vol. 4, 1958.
24. Ghosh, J. C. & others ..	Some catalytic gas reactions of Industrial importance.
25. Copson, E. T.	Introduction to the theory of functions of a complex variable.
26. Titchmarsh, E. C.	Theory of functions, 2nd edn. 1952.
27. Hudson, R. G. & Lipka, J.	A Table of integrals.
28. Brown, G. I.	Introduction to electronic theories of organic chemistry.
29. Allen, M. J.	Organic electrode processes.
30. Baker, J. W.	Electronic theories of organic chemistry.
31. Lacey, W. N. & Sage, B. H.	Thermodynamics of one component systems.
32. Bateman, H.	Higher transcendental functions, vols. 1 & 2.
33. Hirschfelder, J. O. & others.	Molecular theory of gases and liquids.
34. Abraham, M.	Classical theory of electricity and magnetism.
35. Gilreath, E. S.	Fundamental concepts of Inorganic chemistry.
36. Holman, R. T. & others ..	Progress in the chemistry of fats and other lipids, vol. 5.
37. Truter, E. V.	Wool wax.
38. Dirac, P. A. M.	Principles of quantum mechanics.
39. Gmelins Handbuch der Anorganischen Chemie.	Magnetische Werkstoffe, Sys. No. 59, Auf. 8.
40. Condon, E. U. & Odishaw, H., Editors.	Handbook of physics.
41. Simonsen, J. & Ross, W. C. J.	Terpenes, vol. 5.
42. Barlow, H. M.	Micro-wave and wave guides.
43. Bohr, N.	Atomic physics and human knowledge.
44. U. S. Dept. of Commerce. National Bureau of Standards.	Research highlights of the National Bureau of Standards. Annual Report 1958.

Author/Organization.	Title and Volume.
45. U. S. Dept. of Commerce. National Bureau of Standards.	Standard x-ray diffraction powder patterns vol. 8, NBS Circular 539, 1959.
46. —Do—	Standard materials: Circular 552, 1959.
47. —Do—	Energy spectrum resulting from electron slowing down. : Circular 597, 1959.
48. —Do—	Techniques for accurate measurement of Antenna Gain. : Circular 598, 1958.
49. —Do—	Calibration of liquid-in-glass thermometers: Circular 600, 1959.
50. —Do—	Testing of glass volumetric apparatus: Circular 602, 1959.
51. —Do—	Checking prepackaged commodities: Handbook 67, 1959.
52. Bugher, J. C. & others. Editors.	Progress in Nuclear energy: Biological Sciences. vol. 2 Series 6, 1959.
53. Maxwell, I. R. & others. Editors.	Progress in Nuclear energy: Economics of nuclear power. vol. 2, series 7, 1959.
54. French, A. P.	Principles of modern physics.
55. Fischer, H. & Mansur, L. C., Editors.	Conference on extremely high temperatures.
56. Kittel, C.	Elementary statistical physics.
57. Pigman, W., Editor	Carbohydrates.
58. Ranganathan, S. R.	Library Administration.
59. Seitz, F. & Turnbull, D., Editors.	Solid state physics, vols. 6 & 7.
60. Bamford, C. H. & others	Kinetics of vinyl polymerization by radical mechanisms.
61. Feigl, F.	Spot tests in organic analysis.
62. Riddle, E. H.	Monomeric acrylic esters.
63. Stickland, A. C., Editor	Reports on progress in physics, vol. 22, 1959.
64. Chattopadhyay, S. R.	Studies on vinyl polymerisation. (Thesis).
65. Biswas, B.	Equilibrium properties of solutions. (Thesis).
66.	Simposio Internazionale di Chimica Macromolecolare. (Milano-Torino 26 Sept.—2 Oct. 1954).
67. R. Plank. Editor	Handbuch der Kältetechnik, Bd. 7, 1959. Sorptions kaltemaschinen.
68. Chaudhury, A. K.	Studies on vinyl polymerization. (Thesis).
69. Sen, B. M.	Light and matter.
70. Sheehan, J. C., Ed-in-Chief.	Organic syntheses, vol. 28, 1958.
71. Webster, A. G.	Partial differential equations of mathematical physics.
72. Townes, C. H. & Schawlow, A. L.	Microwave spectroscopy.
73. Schiff, L. I.	Quantum mechanics.
74. Adam, C. C.	Space flight.
75. Roberts, J. D.	Nuclear magnetic resonance.
76. Present, R. D.	Kinetic theory of gases.
77. Munitz, M. K., Editor	Theories of the universe.
78. Ingersoll, L. R. & others	Heat conduction.
79. Lips, E. M. H.	Engineering metallurgy.
80. Nowacki, W.	Fouriersynthese kristallen.
81. Guggenheim, E. A. & Prue, J. E.	Physico-chemical calculations.
82.	Indian ephemeris and nautical Almanac for the year 1960.
83. Cowling, T. G.	Magnetohydrodynamics.
84. Spitzer, L. (Jr.)	Physics of fully ionized gases.
85. U. S. Dept. of Commerce. National Bureau of Standards.	On the theory of fading of a fluctuating signal imposed on a constant signal. NBS Circular 599.
86. —Do—	Record survey: Recording surfaces and making methods. NBS Circular 601.
87. —Do—	Stark broadening functions for the hydrogen lines. NBS Circular 603.
88. —Do—	Maximum permissible body burdens and maximum permissible concentrations of radio-nuclides in air and in water for occupational exposure. NBS Circular 69.

Author/Organization.	Title and Volume.
89. U. S. Dept. of Commerce. National Bureau of Standards.	Energy dissipation by fast electrons. NBS Monograph 1.
90. Longmire, C. & others. Editors.	Progress in nuclear energy: Plasma physics and thermonuclear research. vol. 1, series 2, 1959.
91. Guggenheim, E. A. ..	Boltzmann's distribution law.
92. Dana, E. S. & Ford, W. E.	A Textbook of mineralogy. 1959.
93. Marley, W. G. & Morgan, K. Z., Editors.	Progress in nuclear energy: Health physics. vol. 1, series 12, 1959.
94.....	Annual Report of the Smithsonian Institution, 1958.
95. Haar, D. Ter	Introduction to the physics of many-body systems. No. 5.
96. Schwinger, J., Editor ..	Quantum electrodynamics.
97. Fisher, J. C. & others. Editors.	Dislocations and mechanical properties of crystals.
98. Basolo, F. & Pearson, R. G.	Mechanisms of inorganic reactions.
99. Buerger, M. J.	Vector space.
100. Perrin, J. de.	Oeuvres scientifiques, 1950.
101. Langevin, P. de.	Oeuvres scientifiques, 1950.
102. Eckert, E. R. G. & Drake, R. M.	Heat and mass transfer.
103. Birchenall, C. E.	Physical metallurgy.
104. Reid, R. C. & Sherwood, T. K.	Properties of gases and liquids.
105. Price, W. J.	Nuclear radiation detection.
106. Pople, J. A. & others ..	Higher-resolution nuclear magnetic resonance.
107. American Inst. of Physics.	Proceedings of the Fourth symposium on magnetism and magnetic materials.
108. Bennett, A. A. & others ..	Numerical integration of differential equations.
109. Edsall, J. T. & Wyman, J.	Biophysical chemistry, vol. 1.
110. Jirgenson, B.	Organic colloids.
111. Seitz, F. & Turnbull, D., Editors.	Solid state physics, vol. 9, 1959.
112. Acton, F. S.	Analysis of straight-line data.
113. Dixon, M. & Webb, S. C. ..	Enzymes.
114. Warschauer, D. M.	Semiconductors and transistors.
115. Mellan, I.	Source book of industrial solvents, vol. 2.
116. Lowther, H.	Introduction to physical chemistry.
117. Megson, N. J. L.	Phenolic resin chemistry.
118.	Design of physics research laboratories.
119.	Many body problem.
120. Flügge, S., Editor	Handbuch der Physik vol. 3, pt. 2, 1959: Principles of the thermodynamics and statistics.
121. —Do—	vol. 12, 1958: Thermodynamics of gases.
122. —Do—	vol. 14, 1956: Low temperature physics, 1.
123. —Do—	vol. 34, 1958: Corpuscles and radiation in matter. II.
124. —Do—	vol. 36, 1956: Atoms II.
125. —Do—	vol. 37/I, 1959: Atoms. III—Molecules I.
126. —Do—	vol. 38/I, 1958: Experimental properties of atomic nuclei.
127. —Do—	vol. 41/I, 1959: Nuclear reactions. II: Theory.
128. —Do—	vol. 44, 1959: Nuclear instrumentation. I.
129. —Do—	vol. 51, 1958: Astrophysics. II: Stellar structure.
130. —Do—	vol. 53, 1959: Astrophysics. IV: Stellar systems.
131. Plank, R., Editor	Handbuch der Kältetechnik, vol. 3, 1959: Verfahren der Kälteerzeugung und Grundlagen der Wärmeübertragung.
132. Fresenius, W. & Jander, G., Editors.	Handbuch der Analytischen Chemie: Band. 7: Teil 2, II. Qualitative Nachweisverfahren: Bd. 7 Elemente der seibenten gruppe.
133. —Do—	Bd. VIII b. Teil. 2.: II. Qualitative Nachweisverfahren, Bd. 8b. Elemente der achten neben-gruppe.
134.	Directory of Scientific Institutions in Indonesia.

Author/Organization.	Title and Volume.
135. U. S. Dept. of Commerce. National Bureau of Standards.	X-ray attenuation coefficients from 10 Kev to 100 Mev. Supplement to Circular 583, 1959.
136. —Do—	Hydraulic research in the United States. Misc. Publ. 227, 1959.
137. U. S. Dept. of Commerce. National Bureau of Standards.	CRPL exponential reference atmosphere. NBS Monograph 4, 1959.
138. —Do—	Preservation of documents by lamination. NBS Monograph 5, 1959.
139. Orr, C.	Between earth and space.
140. Sachs, R. G.	Nuclear theory.
141. Mathyoo, A. T. Compiled.	Rubber manufacturing industry.
142.	Applied Physics Alumni Annual 1959-60.
143.	Studies in theoretical physics: Proceedings of the Summer School of Theoretical Physics. Held at Mussorie, 22nd May to 18th June, 1959. Part 2.
144. Seitz, F. & Turnbull, D., Editors.	Solid state physics, vol. 8.
145. Melville, H.	Big Molecules.
146. Scott, J. R.	Ebonite.
147. Mehler, A. H.	Introduction to enzymology.
148. Salmon, J. E. & Hale, D. K.	Ion exchange: A laboratory manual.
149. Mason, P. & Wookey, N. ..	Rheology of Elastomers.
150. Pearson, W. B.	A Handbook of Lattice spacings and structures of metals and alloys.
151. Pauli, W.	Theory of relativity.
152.	World of learning, 1960.
153. U. S. Dept. of Commerce. National Bureau of Standards.	Federal basis for weights and measures. Circular 593, 1958.
154. —Do—	Safe handling of bodies containing radioactive isotopes. Handbook 65, 1958.
155. —Do—	Specification for dry cells and batteries. Handbook 71, 1959.
156. —Do—	Research highlights of the National Bureau of Standards. Annual Report 1959.

JOURNALS SUBSCRIBED DURING 1959-60

1. Acta Crystallographica.
2. Advances in Physics.
3. American Journal of Physics.
4. Analyst.
5. Analytical Abstracts.
6. Analytica Chimica Acta.
7. Analytical Chemistry.
8. Angewandte Chemie.
9. Annalen der Chemie.
10. Annales de Physique.
11. Annals of Mathematics.
12. Annals of Physics.
13. Applied Scientific Research, A & B.
14. ASHRAE Journal.
15. Astrophysical Journal.
16. British Journal of Applied Physics.
17. Bulletin of the American Physical Society.
18. Bulletin of the Chemical Society of Japan.
19. Canadian Journal of Chemistry.
20. Canadian Journal of Physics.
21. Canadian Journal of Mathematics.
22. Chemical Abstracts.
23. Chemical Reviews.
24. Chemische Berichte.
25. Chemistry & Industry.
26. Chimie Analytique.
27. Collection of Czechoslovak Chemical Communications.
28. Comptes Rendus de Séances de L'Académie de Sciences.
29. Current Chemical Papers. (Chemical Society, London).
30. Discovery.
31. Discussions of the Faraday Society.
32. Electronics.
33. Experientia.
34. Geophysics.
35. Helvetica Chimica Acta.
36. Institute of Rubber Industry : Transactions and Proceedings.
37. Isis.
38. Journal für Praktische Chemie.
39. Journal of American Chemical Society.
40. Journal of Applied Chemistry.
41. Journal of Applied Physics.
42. Journal of Biological Chemistry.
43. Journal of Chemical Education.
44. Journal of Chemical Physics.
45. Journal of Chemical Society (London).
46. Journal of Colloid Science.
47. Journal of the Electrochemical Society (New York).
48. Journal of Inorganic & Nuclear Chemistry.
49. Journal of the Institute of Metals with Bulletin & Metallurgical Abstracts (London).
50. Journal of the Institute of Petroleum.
51. Journal of Molecular Spectroscopy.
52. Journal of Nuclear Energy.
53. Journal of Organic Chemistry.
54. Journal of Physical Chemistry.
55. Journal of Polymer Science.
56. Journal of the Rubber Research Institute of Malaya.
57. Journal of Science of Food & Agriculture.
58. Kolloid Zeitschrift.
59. Kunststoffe.
60. Machine Shop Magazine.
61. Makromolekulare Chemie.
62. Mathematical Review.
63. Mikrochimica Acta.
64. Nature.
65. Naturwissenschaften.
66. Nuclear Physics.
67. Nucleonics.
68. Nuovo Cimento.
69. Philosophical Magazine.
70. Philosophical Transactions of the Royal Society of London. Series A: Physical Sciences.
71. Physical Review.
72. Physics & Chemistry of Solids.
73. Physics of Fluids.
74. Physikalische Berichte.
75. Proceedings of the Chemical Society (London).
76. Proceedings of the National Academy of Sciences of U.S.A.
77. Proceedings of Physical Society (London).
78. Proceedings of the Royal Institution of Great Britain.
79. Proceedings of the Royal Society, London. Series A: Physical Sciences.
80. Quarterly Reviews.
81. Research.
82. Resins-Rubbers-Plastics.
83. Reviews of Modern Physics.
84. Rubber Age.
85. Rubber Chemistry and Technology.
86. Rubber World.
87. Science Abstracts. Sec. A: Physics.

- | | |
|--|--|
| 88. Science Progress. | 100. Zeitschrift für Anorganische und Allgemeine Chemie. |
| 89. Scientific American. | 101. Zeitschrift für Astrophysik. |
| 90. Seifen-Ole-Fette-Wachse. | 102. Zeitschrift für Elektrochemie & Berichte der Bunsengesellschaft für Physikalische Chemie. |
| 91. Spectrochimica Acta. | 103. Zeitschrift für Kristallographie. |
| 92. Soviet Physics (JETP). | 104. Zeitschrift für Naturforschung, A & B. |
| 93. Tetrahedron. | 105. Zeitschrift für Physik. |
| 94. Textile Research Journal. | 106. Zeitschrift für Physikalische Chemie. |
| 95. Transactions of the American Mathematical Society. | 107. Zeitschrift für Physikalische Chemie (Frankfurter Ausgabe). |
| 96. Transactions of the Faraday Society. | |
| 97. Vacuum. | |
| 98. Zeitschrift für Analytische Chemie. | |
| 99. Zeitschrift für Angewandte Physik. | |

JOURNALS RECEIVED IN EXCHANGE DURING 1959-60

- | | |
|---|--|
| 1. Acta Academiae Aboensis: Mathematica et Physica. | 25. Bulletin of the Central Leather Research Institute (Madras). |
| 2. Acta Physica Academiae Scientiarum Hungaricae. | 26. Bulletin of the Geological Survey of India. Series A: Economic Geology. |
| 3. Acta Physica Polonica. | 27. Buletinul Institutui Politehnic DIN IASI. |
| 4. Agra University Journal of Research. | 28. Bulletin. Research Council of Israel. Sec. A: Chemistry. |
| 5. American Ceramic Society Bulletin. | 29. Bulletin. Research Council of Israel. Sec. F: Mathematics & Physics. |
| 6. Annalen der Physik. | 30. Bulletin Signalétique. Part I: Mathématique-Astronomie-Physique-Chimie etc. |
| 7. Annales de la Faculté des Sciences de Marseille. | 31. Bulletin Signalétique. Part II: Sciences Biologiques etc. |
| 8. Annales de la Société Scientifique de Bruxelles. | 32. Bulletin Signaletique.: Philosophie et Sciences Humaines. |
| 9. Applied Mechanics Reviews. | 33. Chemist. |
| 10. Archives des Sciences. | 34. Communications from the Kamerlingh Onnes Laboratory of the University of Leiden. |
| 11. Arkiv for Fysik. | 35. Comptes Rendus de L'Académie Bulgare des Sciences. |
| 12. Arkiv for Matematik. | 36. Comptes Rendus des Travaux du Laboratoire Carlsberg. |
| 13. Australian Journal of Agricultural Research. | 37. Current Science. |
| 14. Australian Journal of Chemistry. | 38. Czechoslovak Journal of Physics. |
| 15. Australian Journal of Experimental Biology and Medical Science. | 39. Doklady Akademii Nauk SSSR. |
| 16. Australian Journal of Physics. | 40. Electro Technology. |
| 17. Avtomaticheskaja Svarka. | 41. Endeavour. |
| 18. Avtomatika i Telemekhanika. | 42. Energia Nucleare. |
| 19. Bell Laboratories Record. | 43. Glasnik Matematicko-Fizicki I Astro-nomski (Czechoslovak). |
| 20. Biological Bulletin. | 44. Helvetica Physica Acta. |
| 21. Boletin del Centro de Documentacion Cientifica y Technica de Mexico. | 45. Indian Journal of Agricultural Science. |
| 22. Bulletin de l'Académie Polonaise des Sciences: Séries des Sciences Chimiques, Géologiques et Géographiques. | 46. Indian Journal of Theoretical Physics. |
| 23. Bulletin de l'Académie Polonaise des Sciences: Séries des Sciences Mathématiques, Astronomiques et Physiques. | |
| 24. Bulletin of the Calcutta Mathematical Society. | |

47. Indian Science Congress Association: Proceedings.
48. Indian Minerals.
49. Illinois Biological Monographs.
50. Insdoc List.
51. Insdoc Report.
52. Iowa State College Journal of Science.
53. Journal de Chimie Physique et de Physico-Chimie Biologique.
54. Journal de Physique et le Radium.
55. Journal of American Ceramic Society.
56. Journal of British Institute of Radio Engineers.
57. Journal of the Franklin Institute.
58. Journal of Geophysical Research.
59. Journal of the Indian Chemical Society.
60. Journal of the Indian Institute of Science: Section A.
61. Journal of the Indian Institute of Science: Section B.
62. Journal of the Indian Leather Technologists' Association.
63. Journal of the Institution of Telecommunication Engineers (New Delhi).
64. Journal of Mathematics & Physics.
65. Journal of the Optical Society of America.
66. Journal of Physical Society of Japan.
67. Journal of Research of the National Bureau of Standards. Sec. A: Physics & Chemistry.
68. Journal of Research of the National Bureau of Standards. Section B: Mathematics & Mathematical Physics.
69. Journal of Royal Aeronautical Society.
70. Journal of Scientific & Industrial Research. Section A: General.
71. Journal of Scientific & Industrial Research. Section B & C: Physical & Biological Sciences.
72. Journal of Scientific Instruments.
73. Kolloidnii Zhurnal.
74. Kongelige Danske Videnskabernes Selskab: Matematisk-fysiske Meddelelser.
75. Kongelige Danske Videnskabernes Selskab: Matematisk-fysiske Skrifter.
76. Kongelige Danske Videnskabernes Selskab: Biologiske Meddelelser.
77. Kongelige Danske Videnskabernes Selskab: Biologiske Skrifter.
78. Koninklijke Nederlandse Akademie van Wetenschappen: Proceedings. Series A: Mathematical Sciences.
79. —Do— Series B: Physical Sciences.
80. —Do— Series C: Biological & Medical Sciences.
81. Kungl. Fysiografiska Sällskapet I Lund Forhandlingar.
82. Kungl. Tekniska Högskolans Handlingar.
83. Laboratories N. V. Philips' Gloeilampenfabrieken.
84. L'Ingenieur: Revue Trimestrielle Canadienne.
85. Memoirs of the Faculty of Science. Kyusyu University. Series B: Physics.
86. Memoirs and Proceedings of the Manchester Literary and Philosophical Society.
87. NML Technical Journal.
88. Natur und Volk.
89. New Zealand Journal of Science.
90. New Zealand Journal of Geology & Geophysics.
91. Nuclear Science Abstracts.
92. Optics and Spectroscopy.
93. Osaka Mathematical Journal.
94. Philips Research Reports.
95. Philips Technical Review.
96. Physica.
97. Prikladna Mekhanika.
98. Problemy Vostokovedeniia.
99. Proceedings of the Cambridge Philosophical Society.
100. Proceedings of the Egyptian Academy of Science.
101. Proceedings of the Indian Academy of Sciences. Sec. A.
102. Proceedings of the Indian Academy of Sciences. Sec. B.
103. Proceedings of the Institute of Radio Engineers (Australia).
104. Proceedings of the Japan Academy.
105. Proceedings of National Institute of Sciences of India. Section A: Physical Sciences.
106. —Do— Section B: Biological Sciences.
107. Proceedings of the Royal Society of Edinburgh. Sec. A.
108. —Do— Sec. B.

- | | |
|--|--|
| 109. Progress of Theoretical Physics. | 127. Societas Scientiarum Fennica: Commentationes Biologicae. |
| 110. Quarterly Journal of Royal Meteorological Society. | 128. —Do— Commentationes Physico-Mathematicae. |
| 111. Referativnii Zhurnal: Fizika. | 129. South African Journal of Science. |
| 112. Research Bulletin of the Punjab University: Zoology. | 130. Studii Si Cercetari de Fizica. |
| 113. —Do— New Series: Science. | 131. Studii Si Cercetari Stiintifice: Fizica Si Stiinte Tehnica. |
| 114. Review of the Polish Academy of Sciences. | 132. Tellus. |
| 115. Review of Scientific Instruments. | 133. Tohoku Mathematical Journal. |
| 116. Revue de Physique. | 134. Transactions of the National Research Institute for Metals (Japan). |
| 117. Revue D'Optique. | 135. Vestnik Arevnei istorii. |
| 118. Rumania To-day. | 136. Vierteljahrsschrift der Naturforschenden Gesellschaft in Zurich. |
| 119. Sankhya: Indian Journal of Statistics. | 137. Verhandlungen der Naturforschenden Gesellschaft in Basel. |
| 120. Science & Culture. | 138. Visnik Akademii Nauk (Ukrainskoi RSR). |
| 121. Science Report of the Research Institute of Tohoku University. Series A: Physics, Chemistry & Metallurgy. | 139. Yokohama Mathematical Journal. |
| 122. Scientia Sinica. | 140. Zhurnal Tekhnicheskoi fiziki. |
| 123. Scientific Papers of the Institute of Physical & Chemical Research. (Tokyo). | 141. Zhurnal Fizicheskoi Khimii. |
| 124. Scientific Proceedings of the Royal Dublin Society. Series A. | 142. Zhurnal Analiticheskoi Khimii. |
| 125. Senckenbergiana Biologia. | 143. Zhurnal Eksperimentalnoi i Teoreticheskoi fiziki. |
| 126. Senckenbergiana Lethaca. | 144. Zhurnal Prikladnoi Khimii. |

OTHER PUBLICATIONS RECEIVED AS COMPLIMENTARY ISSUES DURING 1959-60

- | | |
|--|--|
| 1. Afinidad. | 22. Journal of Science of the Hiroshima University. Series A. |
| 2. Astrophysics Norvegica. | 23. Journal of Technology. |
| 3. Atom. | 24. Metric Measures. |
| 4. Bayerische Akademie der Wissenschaften: Mathematisch-Naturwissenschaftliche Klasse. | 25. Metropolitan-Vickers Gazette. |
| 5. Bulletin Institute for the Study of the USSR. | 26. Natural Science Report of the Ochanomizu University. |
| 6. C.S.I.R. News. | 27. Notas de Fisica. |
| 7. Commonwealth Today. | 28. Philips Industrial & Electronic Bulletin. |
| 8. Education Abstracts (Unesco). | 29. Philips Serving Science & Industry. |
| 9. Far East Trade. | 30. Photographie und Forschung. |
| 10. French Economic & Technical Bulletin. | 31. Scientific Papers of the College of General Education. Tokyo University. |
| 11. General Radio Experimenter. | 32. Scientific Reports of Indian Agricultural Research Institute. |
| 12. Half Yearly Journal of Mysore University. Section A. | 33. Siemens Review. |
| 13. Hewlett-Packard Journal. | 34. Smithsonian Contributions to Astrophysics. |
| 14. Hilger Journal. | 35. Soviet Land. |
| 15. Indian Journal of Meteorology & Geophysics. | 36. Unesco Bulletin for Libraries. |
| 16. Indian Journal of Physics. | 37. Unesco Chronicle. |
| 17. Indian Manufacture and Production. | 38. University of Illinois Engineering Experiment Station Bulletin. |
| 18. Ionospheric Data. | 39. Vijnam Karmee. |
| 19. Ionospheric Prediction. | 40. Voltas Information. |
| 20. Journal of the Institute of Polytechnics. Osaka University. Series A: Mathematics. | 41. WMO Bulletin. |
| 21. Journal of the Mechanical Laboratory of Japan. | 42. World Veteran. |

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

BUDGET ESTIMATES—1960-61

(Excluding grants for C.S.I.R. Scheme, Development of Research Training Facilities etc.)

RECEIPTS

Heads of Receipts	Actuals for 1958-59 (Pre- audited)	Original Budget Estimates 1959-60	Revised Budget 1959-60	Budget Estimates 1960-61	Remarks
I. Government of India					
(1) Grant-in-aid	6,80,000	8,05,123	} 7,67,328*	8,78,300	*The Governments were request- ed to provide for addl. grants totalling Rs. 49,318/- to meet addl. demands as provided for under expenditures estimates.
(2) Contribution to D.A. .. (5% of the Govt. of India grant)	}	40,256		43,915	
II. Government of West Bengal					
(1) Grant-in-aid	1,00,000**	1,53,721	1,27,888*	1,53,700	**Rs. 25,000/- received during 1959-60.
Do (arrear for 1958-59) ..	—	—	25,000	—	
(2) Travel grant received from Govern- ment of West Bengal on account of Prof. Palit's visit to U.K. ..	2,000	—	—	—	
III. Other Receipts					
(1) Interest from General Fund ..	247	500	500	500	
(2) Ordinary Membership Subscription ..	1,556	1,200	1,600	1,500	
(3) Life Membership Fee	—	500	500	500(1)	(1) Contra
(4) Indian Journal of Physics	13,873	15,000	13,000	14,000	
(5) Miscellaneous	368	500	500	500	
(6) Sale of Monographs etc.	419	500	900	500	
(7) Sale of Bijnaner Itihas	6,043	3,000	3,000	3,000(1)	(1) Contra
(8) Seat rent	980	500	700	800	
IV. Contribution from M.L.S. & V.L.M. Prof. Fund					
	8,420	8,420	8,420	8,420	
V. Amount carried over from previous year for meeting outstanding liabilities					
	24,606	—	—	—	
Total Rs. ..	8,38,512	10,29,220	9,49,336	11,05,635	

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

BUDGET ESTIMATES—1960-61

(Excluding C.S.I.R. Schemes, Scientific Man Power Committee Scheme etc.)

EXPENDITURE

Heads of Expenditure	Actuals for 1958-59 (Preaudit)	Original Budget for 1959-60	Revised Budget 1959-60	Budget Estimates 1960-61	Remarks	
I. Establishment : Salary						
Director & his staff—Existing ..	15,669	25,245	8,452(1)	25,257	(1) Including addl. demand of Rs. 318/- as per Finance committee resolution, for converting the post of 'Stenographer' to that of 'Personal Assistant'.	
Deptt. of Central Scientific Services under 5-Yr. Plan ..	4,229	5,550	4,532	5,844		
General Physics & X-rays—Existing ..	20,561	23,275	19,302	23,363		
New posts under 5-Yr. Plan ..	10,835	22,875	10,080	18,640		
Magnetism—Existing ..	14,738	17,685	17,035	17,590		
New posts under 5-Yr. Plan ..	14,587	17,975	16,361	19,330		
Optics—Existing ..	31,467	32,765	29,620	32,615		
New posts under 5-Yr. Plan ..	8,755	11,690	9,692	10,490		
Theoretical Physics—Existing ..	21,050	24,587	23,985	25,807		
New posts under 5-Yr. Plan ..	13,361	20,075	12,117	17,150		
Physical Chemistry—Existing ..	29,631	31,573	28,261	30,982		
New posts under 5-Yr. Plan ..						
(a) General Physical Chemistry ..	4,354	10,196	6,380	12,099		
(b) Biological Polymers Section ..	—	2,760	—	—		
Organic Chemistry—Existing ..	28,314	33,112	25,889	35,142		
New posts under 5-Yr. Plan ..	7,777	14,988	6,546	11,760		
Inorganic Chemistry—Existing ..	18,883	29,534	15,556	30,294		
New posts under 5-Yr. Plan (Analytical Laboratory) ..	6,018	12,616	5,362	11,828		
Macro-Molecules—New posts under 5-Yr. Plan ..	40,463	51,237	38,006	49,552		
(Formed by amalgamating the sections of Training in High Polymers, Technological application of High Polymers Rubber, Plastic & Resin)						
Carried Over ..	2,90,692	3,87,738	2,77,176	3,77,743		

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

BUDGET ESTIMATES—1960-61

(Excluding C.S.I.R. Schemes Scientific Man Power Committee Scheme etc.)

EXPENDITURE—Contd.

Heads of Expenditure	Actuals for 1958-59 (Pre- audited)	Original Budget for 1959-60	Revised Budget 1959-60	Budget Estimates 1960-61	Remarks
Brought Forward ..	2,90,692	3,87,738	2,77,176	3,77,743	
Library—Existing ..	5,361	5,592	4,771	5,451	
New posts under 5-Yr. Plan ..	683	995	612	1,680	
Workshop—Existing ..	14,751	17,276	13,452	17,521	
New posts under 5-Yr. Plan ..	8,933	10,707	9,303	9,951	
Indian Journal of Physics—Existing ..	4,275	4,736	3,925	4,148	
Administration—Existing ..	32,037	32,597	33,942	33,733	
New posts under 5-Yr. Plan ..	6,858	9,441	9,012	9,201	
New posts under 5-Yr. Plan— Publication Section ..	2,010	2,026	1,940	2,134	
2. Dearness Pay—Existing ..	24,848	26,170	23,583	26,612	
New posts under 5-Yr. Plan ..	15,126	22,449	17,225	21,590	
Dearness Allowance—Existing ..	30,844	33,370	29,258	32,912	
New posts under 5-Yr. Plan ..	15,168	22,449	17,225	21,590	
Ad interim increase of Rs. 5/- in the D.A.— Existing ..	7,704	8,160	4,701	5,040	
New posts under 5-Yr. Plan ..	3,611	—	2,879	3,450	
3. Provident Fund—Existing ..	—	21,489	24,325	22,192	
New posts under 5-Yr. Plan ..	27,941	11,687	1,835	11,419	
Previous years' liabilities ..	—	—	2,989	—	
4. House Rent Allowance—Existing ..	9,141	10,541	9,284	11,860	
New posts under 5-Yr. Plan ..	5,637	9,068	6,720	8,620	
5. Allowance to Foreign Expert ..	—	9,500	—	9,500	
6(a). Additional provision for giving effect to the revised scales of pay for the Research and technical staff as recommended by the Reviewing Committee ..	—	—	—	44,314	
6(b). Additional provision for giving effect to the revised scales of pay for the administra- tive staff, worked out on the basis of the Calcutta University Pay Scales in the context of the resolution of the Finance Committee and the Council ..	—	—	—	11,020	
Carried Over ..	5,05,620	6,45,991	4,94,157	6,91,681	

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

BUDGET ESTIMATES—1960-61

EXPENDITURE—Contd.

Heads of Expenditure	Actuals for 1958-59 (Pre- audited)	Original Budget for 1959-60	Revised Budget 1959-60	Budget Estimates 1960-61	Remarks
Brought Forward ..	5,05,620	6,45,991	4,94,157	6,91,681	
II. Laboratory Grants					
Central Scientific Services	2,671	7,000	27,000 (2)	12,000	(2) Includes addl. demand of Rs. 20,000/- for purchase of X-ray equipments as per Finance Committee's resolution.
Previous years' liabilities	—	—	2,776	—	
General Physics & X-rays	11,132	12,000	12,000	12,000	
Previous years' liabilities	2,388	—	820	—	
Magnetism	6,732	12,000	20,000 (3)	12,000	(3) Includes addl. demand of Rs. 8,000/- for purchase of Cathode Ray Oscillograph etc.
Previous years' liabilities	918	—	5,267	—	
Optics	11,012	12,000	12,000	12,000	
Previous years' liabilities	4,218	—	988	—	
Theoretical Physics	631	3,000	3,000	3,000	
Previous years' liabilities	112	—	164	—	
Physical Chemistry	14,616	18,000	34,000 (4)	18,000	(4) Includes addl. demand of Rs. 16,000/- for purchase of vapour phase partition Chromatographic apparatus etc.
Previous years' liabilities	272	—	3,324	—	
Organic Chemistry	15,266	15,000	15,000	15,000	
Previous years' liabilities	2,186	—	1,600	—	
Inorganic Chemistry	11,871	18,000	18,000	18,000	
Previous years' liabilities	1,473	—	6,457	—	
Macro-Molecules	9,919	12,000	12,000	12,000	
Previous years' liabilities	—	—	2,015	—	
III. Library					
Previous years' liabilities	4,798	21,000	26,000 (5)	25,000	(5) Includes addl. demand of Rs. 5,000/- for purchase of books.
Previous years' liabilities	1,082	—	15,982	—	
IV. Workshop					
Previous years' liabilities	13,149	15,000	15,000	15,000	
Previous years' liabilities	—	—	1,652	—	
V. Indian Journal of Physics					
Previous years' liabilities	17,942	20,000	20,000	21,000	
Previous years' liabilities	209	—	—	—	
Carried Over	6,38,217	8,10,991	7,49,202	8,66,681	

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

BUDGET ESTIMATES—1960-61

EXPENDITURE—Contd.

Heads of Expenditure	Actuals for 1958-59 (Pre-3 audited)	Original Budget for 1959-60	Revised Budget 1959-60	Budget Estimates 1960-61	Remarks
Brought Forward ..	6,38,217	8,10,991	7,49,202	8,66,681	
VI(a) Publication Expenses (General) ..	3,500	} 10,000	5,000	10,000	
Previous years' liabilities ..	1,450		743	—	
(b) Bijnaner Itihas ..	220	3,000*	3,000*	3,000*	* Contra
6,043					
VII. To Life Membership and Institutional Membership fee ..	—	500*	500*	500*	* Contra
VIII(a) Laboratory Services General Expenses & Miscellaneous, including previous years' liabilities ..	75,685	79,362	91,960	86,712	
(b) Contribution to Depreciation Fund					
(1) Building Maintenance A/c (Depreciation Fund) ..	61,505	62,341	62,341	63,000	
(2) Depreciation Fund for Scientific Instruments & Equipments ..	33,707	41,216	41,216	42,000	
IX. Part payment of loan ..	6,631	6,695(1)	20,645	20,645(2)	(1) To be increased to Rs. 20,645/-. (2) As per Govt. of India letter No. 12(5)/53-SR. II dated 24.8.59 on the out- standing balance of Rs. 3,09,659.35.
Interest @ 1% on the outstanding loan ..	3,369	3,305	3,303	3,097	
X. Provision for enabling members of Re- search Departments to attend meet- ings, conferences and spend sometime at Research Institutes in foreign coun- tries ..	7,246	5,000	4,800	5,000	
XI. Provision for research grant to Emeritus and Honorary Professors ..	—	—	—	10,000(3)	(3) Rs. 5,000/- will be for Emeritus Professor and Rs. 5,000/- for research work to be carried out by honorary workers (Coun- cil res. dated 4.10.59).
XII. Excess of payments in 1958-59 over receipts in 1958-59 ..	—	—	29,892	—	
Grand Total Rs. ..	8,37,573	10,22,410	10,12,602	11,10,635	

152

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

BUDGET ESTIMATES—1960-61

LABORATORY EXPENSES & GENERAL SERVICES

Heads of Expenditure	Actuals for 1958-59 (Pre- audited)	Original Budget for 1959-60	Revised Budget 1959-60	Budget Estimates 1960-61	Remarks
1. Building Maintenance A/c. (Depreciation Fund)	—	—	—	—	Shown under Budget Head VIII(b) as per Council resolution on 31.1.59.
2. Electric Fittings	2,816	5,000	5,000	5,000	
Previous years' liabilities	290	—	408	—	
3. Furniture	4,407	6,000	7,000	6,000	
Previous years' liabilities	2,104	—	1,080	—	
4. Gas	3,435	5,000	4,000	5,000	
5. Electricity	15,266	12,000	15,000	16,000	
6. Telephone	2,561	2,000	3,000	2,500	
7. Printing—letter head, forms, ledgers, etc.	1,399	2,000	2,500	2,000	
Previous years' liabilities	423	—	146	—	
8. Stationery & Contingency	8,522	8,000	8,000	8,500	
Previous years' liabilities	—	—	757	—	
9. Postage	4,035	4,500	4,500	4,500	
10. Advertisement	5,719	5,000	5,000	5,700	
11. Municipal Tax	539	2,000	2,000	2,000	
12. Audit Fee	400	1,000	3,000	1,000	
Previous years' liabilities	—	—	—	—	
13. Insurance Premium	1,046	1,200	1,200	1,200	
14. Meeting Expenses	1,554	750	750	1,500	
15. Indian Science Congress Association	12	12	12	12	
16(a) For attending Council & Selection Committee Meetings, if any	5,588	5,000	5,000	5,500	
(b) For attending Indian Science Congress and meetings other than meetings of the Association's Council or any of its own Committees	3,073	2,000	3,000	3,000	
Carried Over	63,189	61,462	71,353	69,412	

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

BUDGET ESTIMATES—1960-61

LABORATORY SERVICES & GENERAL EXPENSES—Contd.

Heads of Expenditure	Actuals for 1958-59 (Pre- audited)	Original Budget for 1959-60	Revised Budget 1959-60	Budget Estimates 1960-61	Remarks
Brought Forward ..	63,189	61,462	71,353	69,412	
17. Bank Charges	71	500	500	500	
18. Contribution to Indian Science News Association	1,000	1,000	1,000	—	
19. Motor Van Upkeep	3,960	4,000	4,000	4,000	
Previous years' liabilities	353	—	714	—	
20. Miscellaneous	4,564	5,000	5,500	5,000	
Previous years' liabilities	368	—	139	—	
21. Provision for leave salaries, allowances, higher salaries etc.	1,442	1,000	2,000	1,000	
22. Contribution to Depreciation fund for Scientific instruments and equipments	—	—	—	—	
23. Provision for medical benefit to employees	—	5,000	5,000	5,000	Shown under Budget Head VIII(b) as per Council resolution on 31.1.59.
24. Contribution to Association's Canteen	600	600	850	1,000	
25. Contribution to Science Association Club	139	200	304	200	
26. Meghnad Saha Memorial Gold Medal	—	600	600	600	
Total Rs. ..	75,685	79,362	91,960	86,712	Total carried over to page

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

JADAVPUR, CALCUTTA-32.

BUDGET PROVISION—NON-RECURRING FOR 1960-61

A. The Departmentwise break-up for provisions of the non-recurring grant for the purchase of scientific equipments, standard reference books etc. for 1960-61.

Departments.	Govt. of India.			Govt. of West Bengal.		
	50% of the grant for 1959-60 not available.	Demand as per 5-Yr. Plan 1960-61.	Total Demand.	50% of the grant for 1959-60 not available.	Demand as per 5-Yr. Plan 1960-61.	Total Demand.
Central Scientific Services	—	—	—	28,000	7,000	35,000
General Physics & X-rays	32,400	57,334	89,734	16,000	31,166	47,166
Magnetism	18,000	26,000	44,000	8,000	13,000	21,000
Optics	48,500	14,334	62,834	—	—	—
Theoretical Physics	—	—	—	—	—	—
Physical Chemistry	22,000	52,000	74,000	19,500	26,000	45,500
Organic Chemistry	7,400	—	7,400	3,000	—	3,000
Inorganic Chemistry	15,500	27,200	42,700	12,000	13,600	25,600
Macro-Molecules	20,000	5,000	25,000	11,500	—	11,500
Workshop	5,000	4,000	9,000	6,000	2,000	8,000
	6,000	10,000	16,000	3,000	5,000	8,000
Administration	6,500	—	6,500	4,000	—	4,000
	1,81,300	1,95,868	3,77,168	1,11,000	97,766	2,08,766

B. Provision for Building, Gas Plant, Laboratory Benches, General Furniture etc. 1960-61.

Items.	Demand for 1960-61.	Govt. of India share.	Govt. of West Bengal share.
Sanitary, electrical and gas connection, road, drainage etc. which will remain unfinished during 1959-60	1,00,200	66,800	33,400
Laboratory Benches, General Furniture etc.	51,000	34,000	17,000
Gas Plant	39,000	26,000	13,000
Compound wall, Durwan's quarter Gate & Gate Pillars etc.	21,000	14,000	7,000
	2,11,200	1,40,800	70,400

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

DEPT. OF CENTRAL SCIENTIFIC SERVICES UNDER THE DIRECTOR

Additional requirements in respect of staff and equipments to be included in the Budget Estimates for 1960-61

A. Staff (Recurring)

Posts.	No.	Scale of Pay.	Basic.		D. P.		D. A.		H.R.A.	Adoc D.A.	P.F.
Reader	1	600-40-800	600×12	7,200	42.50×12	510	42.50×12	510	—	—	643
Research Officer ..	1	300-20-500	300×12	3,600	35 ×12	420	35 ×12	420	266	60	335
Senior Research Scholar	2	200-25-300	200×12×2	4,800	—	—	—	—	—	—	—
Clerk (Senior Grade) I	1	80-5-120. EB-8- 200-10/2-220	80×12	960	25 ×12	300	25 ×12	300	126	60	105
Bearer	1	20-1-35	20×12	240	20 ×12	240	20 ×12	240	48	60	40
			6	16,800	1,470		1,470		440	180	1,123

(56)

B. Equipment (Non-Recurring)

Demountable X-ray Equipment with necessary cameras—Rs. 50,000/-

A. Recurring .. Rs. 21,483/-

B. Non-Recurring .. Rs. 50,000/-

Rs. 71,483/-

Salary .. Rs. 16,800

D. P. .. " 1,470

D. A. .. " 1,470

HRA .. " 440

Adhoc. D.A. .. " 180

P. F. .. " 1,123

21,483

INDIAN ASSOCIATION
JADAVPUR

Statement of Receipts & Payments

Receipts	Payments
To Opening Balance	
To Grants	
To Sale of Publications	
To Other Receipts	
Total	

THE INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

Balance Sheet and Statement of Accounts
1958-1959

JADAVPUR, CALCUTTA-32

**INDIAN ASSOCIATION
JADAVPUR,**

Statement of Receipts & Payments Account

RECEIPTS.	Amount. Rs. np.	Total. Rs. np.	G. Total Rs. np.
<i>To Opening Balances—</i>			
Imprest Cash	1,300.00		
In hand including cheques	925.72		
At State Bank of India on Current Account, Jadavpur	39,023.78		
At State Bank of India on Current Account, Head Office	1,22,029.68		
At State Bank of India, Depreciation Fund Account	60,080.00		
At State Bank of India on Current Account for Life and Institutional Membership Fund	30,630.94		
At State Bank of India on Current Account for Building Maintenance Fund	1,69,059.87		4,23,049.99
<i>Government of India—</i>			
Grant in Aid (Recurring)	6,80,000.00		
Grant in Aid (Development Scheme)	27,372.79		
Grant in Aid (Non-Recurring)	3,69,900.00		
Dr. A. Bose's Individual Research Works	6,000.00		10,83,272.79
<i>Government of West Bengal—</i>			
Grant in Aid (Recurring)	1,25,000.00		
Grant in Aid (Non-Recurring)	70,500.00		
Travel Grant to Dr. S. R. Palit	2,000.00		1,97,500.00
<i>Miscellaneous—</i>			
Interest on Investment (General Fund)	495.00		
Ordinary Membership Subscription	1,556.24		
Indian Journal of Physics	13,118.66		
Miscellaneous	368.10		
Seat Rent	980.00		
Sale of Special Monographs & Books	419.28		
Sale of Bijnaner Itihas	6,042.77		
Bijnaner Itihas Fund	5,000.00		
Contribution from M.L.S. Prof. Fund	4,480.00		
Contribution from V.L.M. Fund	3,940.00		36,400.05
<i>Council of Scientific & Industrial Research Grants—</i>			
Mechanism of Vulcanization of Rubber	3,450.00		
Synthetic Studies in Triterpenoids	1,150.00		
Construction of Osmometer etc.	4.66	4,604.66	
		Carried Over ..	17,40,222.83

FOR THE CULTIVATION OF SCIENCE

CALCUTTA-32.

for the year ended 31st March, 1959.

PAYMENTS.	Amount.		Total.		G. Total	
	Rs.	np.	Rs.	np.	Rs.	np.
<i>By Establishment—</i>						
Department of Genl. Physics & X-Rays ..	20,500.14					
—Do— —Do— New Posts—5 year Plan ..	9,257.59					
Department of Magnetism ..	14,748.04					
—Do— New Posts—5 Year Plan ..	14,798.05					
Department of Optics ..	31,467.30					
—Do— New Posts—5 Year Plan ..	7,865.09					
Department of Theoretical Physics ..	21,050.27					
—Do— New Posts—5 Year Plan ..	13,360.96					
Department of Physical Chemistry ..	29,502.78					
—Do— New Posts—5 Year Plan ..	3,299.90					
Department of Organic Chemistry ..	28,209.23					
—Do— General—5 Year Plan ..	7,777.09					
—Do— Applied High Polymer— 5 Year Plan ..	40,863.44					
Department of Inorganic Chemistry— —Do— Analytical Laboratory— 5 Year Plan ..	17,783.30					
Library ..	5,360.62					
—Do— 5 Year Plan ..	682.46					
Workshop ..	14,751.36					
—Do— 5 Year Plan ..	8,934.31					
Administration ..	32,285.53					
—Do— New Posts—5 Year Plan ..	6,858.12					
—Do— Publication Section ..	2,009.93					
Director's Office ..	15,668.95					
Central Scientific Services ..	4,227.93					
Indian Journal of Physics ..	4,275.50					
Contribution to Provident Fund ..	24,075.49					
D.P. Existing ..	24,844.45					
D.P. New 5 Year Plan ..	15,126.56					
D.A. Existing ..	30,844.46					
D.A. New 5 Year Plan ..	15,228.58					
H.R.A. Existing ..	9,140.72					
H.R.A. New 5 Year Plan ..	5,713.10					
Ad interim D.A. (Existing) ..	7,703.85					
—Do— 5 Year Plan ..	3,621.33					4,97,854.06
<i>Laboratory Grants—</i>						
<i>General Physics & X-Rays (Recurring)</i>						
Laboratory Charges ..	8,631.41					
Scientific Instruments ..	3,541.08					
<i>Genl. Physics & X-Rays (Revoted)</i>						
Laboratory Charges ..	1,631.60					
Scientific Instruments ..	756.37					14,560.46
Carried Over ..						5,12,414.52

INDIAN ASSOCIATION

JADAVPUR,

Statement of Receipts & Payments Account

RECEIPTS.	Amount. Rs. np.	Total. Rs. np.	G. Total Rs. np.
Brought Forward ..		4,604.66	17,40,222.83
To Thermodynamic of Properties on High Polymer etc.	8,159.35		
Thermal Diffusion and Inter-Diffusion of Gases	270.00		
Liquid Crystalline Detergent System	9,177.81		
Investigation of Frozen Organic Liquids	4,414.64		
Synthetic Studies in Deterpenoid Resin Acids	4,943.70		
Fundamental Studies on the Solvent Extraction of Coal	5,733.80		
Absolute Values of Rate Constants etc. Grant of Fellowship to Dr. S. C. Srivastava	8,367.48 3,800.00	44,866.78	49,471.44
C.S.I.R. Employees Provident Fund			14.00
Advance & Suspense			64,835.30
Life and Institutional Membership Fund			250.00
Provident Fund Subscription			135.02
Security Deposit from Staff			60.00
<i>Income Tax—</i> Deducted from Salary	8,902.74		
Less Paid	8,858.84		43.90
Library Deposit			50.00
Non-Recurring Govt. of India Grant (Applied High Polymer) Instruments			2,259.68
<i>Building Maintenance Fund—</i> Deposit in Fund	47,800.00		
Less Bank Debit	1.52		47,798.48
Depreciation Fund for Scientific Instrument etc.			60,079.94
Grant:—I.C.A.R. Synthetic Poly- electrolytes etc.			6,546.88
Grant:—D.A.E. Thermal Diffusion etc.			3,606.00
<i>Grant—Assam Govt. Scholarship—</i> Grant Received	1,800.00		
Less Refund	650.00		1,150.00
Grant:—Bengal Electric Lamp			150.00
Grant:—Director of Cinchona (W. Bengal Government)			6,695.00
Workshop Machines			851.80
Organic Chemistry (Instruments)			488.63
Carried Over ..			19,84,708.90

FOR THE CULTIVATION OF SCIENCE

CALCUTTA-32.

for the year ended 31st March, 1959.

PAYMENTS.		Amount.	Total.	G. Total
		Rs. np.	Rs. np.	Rs. np.
Brought Forward ..				5,12,414.52
<i>Laboratory Grants—Contd.</i>				
<i>Optics (Recurring)</i>				
Laboratory Charges	.. ..	5,429.19		
Scientific Instruments	.. ..	5,510.61		
<i>Optics (Revoted)</i>				
Laboratory Charges	.. ..	315.48		
Scientific Instruments	.. ..	3,903.06	15,158.34	
<i>Magnetism (Recurring)</i>				
Laboratory Charges	.. ..	2,755.51		
Scientific Instruments	.. ..	2,082.45		
<i>Magnetism (Revoted)</i>				
Laboratory Charges	.. ..	834.22		
Scientific Instruments	.. ..	84.00	5,756.18	
<i>Theoretical Physics (Recurring)</i>				
Laboratory Charges	.. ..	134.53		
Scientific Instruments	.. ..	496.15		
<i>Theoretical Physics (Revoted)</i>				
Laboratory Charges	.. ..	38.45		
Scientific Instruments	.. ..	73.50	742.63	
<i>Physical Chemistry (Recurring)</i>				
Laboratory Charges	.. ..	14,763.68		
Scientific Instruments	.. ..	4,754.72		
<i>Physical Chemistry (Revoted)</i>				
Laboratory Charges	.. ..	237.75		
Scientific Instruments	.. ..	34.55	19,790.70	
<i>Organic Chemistry (Recurring)</i>				
Laboratory Charges	.. ..	12,588.04		
Microanalytical Instruments	.. ..	118.13		
Microanalytical Laboratory Charges	.. ..	2,230.12		
<i>Organic Chemistry (Revoted)</i>				
Laboratory Charges	.. ..	1,042.09		
Microanalytical Laboratory Charges	.. ..	556.95		
Scientific Instruments	.. ..	586.95	17,122.28	
<i>Inorganic Chemistry (Recurring)</i>				
Laboratory Charges	.. ..	10,223.06		
Scientific Instruments	.. ..	3,504.80		
<i>Inorganic Chemistry (Revoted)</i>				
Laboratory Charges	.. ..	974.08		
Scientific Instruments	.. ..	1,561.94	16,263.88	
Carried Over ..			74,834.01	5,12,414.52

INDIAN ASSOCIATION

JADAVPUR,

Statement of Receipts & Payments Account

RECEIPTS.	Amount.		Total.		G. Total	
	Rs.	np.	Rs.	np.	Rs.	np.
Brought Forward ..					19,84,708.90	

Carried Over .. 19,84,708.90

FOR THE CULTIVATION OF SCIENCE

CALCUTTA-32.

for the year ended 31st March, 1959.

PAYMENTS.	Amount. Rs. np.	Total. Rs. np.	G. Total Rs. np.
Brought Forward ..		74,834.01	5,12,414.52
<i>Laboratory Grants—Contd.</i>			
<i>Central Scientific Services (Recurring)</i>			
Charges	1,128.95		
Instruments	1,542.19	2,671.14	
<i>Applied High Polymer</i>			
Laboratory Charges	6,988.08		
Scientific Instruments	1,382.74	8,370.82	85,875.97
<i>Laboratory Grants Govt. of India (Non-Recurring)</i>			
Genl. Physics & X-Rays (Equipments) ..	52,393.28		
—Do— (Charges)	44.96		
Magnetism (Instruments)	32,212.92		
Optics (Instruments)	4,206.05		
Physical Chemistry (Equipments)	24,528.86		
Organic Chemistry (Equipments)	2,950.50		
—Do— (Charges)	801.45		
Organic Chemistry (Applied High Polymer)			
(Instruments)	39,890.02		
(Charges)	751.09		
Inorganic Chemistry (Equipments)	11,028.77		
—Do— (Charges)	4,873.38		
General Administration	3,144.75		
Workshop Machines	5,000.00		
Tubewell and Pump House	906.32		
Furniture & Fittings	12,500.00		
Air-Conditioning Equipments	448.68		
Central Scientific Services (Equipments)	30,433.20		
Library Books and Journals	454.59		
Laboratory—Benches & Genl. Furniture ..	15,907.04		2,42,475.86
<i>Laboratory Grants—Govt. of West Bengal—(Non-Recurring) :—</i>			
Genl. Physics & X-Rays (Equipments) ..	24,035.76		
—Do— (Charges)	1,486.47		
Organic Chemistry (Equipments)	195.92		
—Do— (Charges)	1,438.18		
Inorganic Chemistry (Charges)	882.00		
Magnetism (Equipment)	5,437.50		
—Do— (Charges)	1,242.89		
<i>Central Scientific Services :</i>			
Equipment	26,419.84		
<i>Organic Chemistry—High Polymer :</i>			
Equipment	6,116.32		
Charges	193.09		
General Administration (Equipment) ..	2,418.69	69,866.66	
	Carried Over ..		8,40,766.35

**FOR THE CULTIVATION OF SCIENCE
CALCUTTA-32.**

for the year ended 31st March, 1959.

PAYMENTS.		Amount.	Total.	G. Total.
		Rs. np.	Rs. np.	Rs. np.
	Brought Forward		69,866.66	8,40,766.35
<i>Library :</i>				
	(Books & Journals)	2,097.52	2,097.52	71,964.18
	Dr. A. Bose's Grant from Govt. of India			1,706.25
<i>Library Grants (Recurring) :</i>				
	Books & Journals	3,821.65		
	Up-Keep	994.30		
<i>Library Grants (Revoted) :</i>				
	Books & Journals	778.37		
	Up-Keep	304.00		5,898.32
<i>Workshop Grants (Recurring) :</i>				
	Workshop Charges	9,389.87		
	Instrument	3,801.36		13,191.23
<i>Indian Journal of Physics :</i>				
	Publication Expenses	17,941.71		
	—Do— (Revoted)	209.00		18,150.71
<i>Miscellaneous :</i>				
	Electric Fittings & Equipments	330.50		
	Electric Fittings Consumable	2,485.47		
	—Do— (Revoted) Consumable	289.87		
	Gas Charges	3,434.65		
	Electric Charges	15,265.96		
	Telephone	2,561.06		
	Printing	1,399.09		
	—Do— (Revoted)	423.00		
	Stationery & Contingency	8,522.69		
	Postage	4,035.67		
	Advertisement	4,075.12		
	Municipal Tax	538.88		
	T.A. for attending meeting etc.	5,588.14		
	T.A. for attending for Science Congress	3,073.38		
	Provision for enabling members of Research staff to spend sometime in Foreign Countries	1,746.00		
	Bank Charges	286.18		
	Insurance	1,046.25		
	Contribution to Science Asson. Club	139.00		
	—Do— Indian Science News Association	1,000.00		
	Meeting Expenses	1,612.00		
<i>Miscellaneous :</i>				
	Capital	185.74		
	—Do— (Expenses)	4,558.64		
	—Do— (Revoted)	368.16	62,965.45	
	Carried Over			9,51,677.04

FOR THE CULTIVATION OF SCIENCE

CALCUTTA-32.

for the year ended 31st March, 1959.

PAYMENTS.		Amount.	Total.	G. Total.
		Rs. np.	Rs. np.	Rs. np.
	Brought Forward ..		62,965.45	9,51,677.04
	Provision for Higher Salaries & Leave allowance ..	1,441.86		
	Provision for Research Staff to attend meeting ..	1,500.00		
	—Do— (Revoted) ..	5,000.00		
	Audit Fee ..	400.00		
	Publication General ..	1,450.36		
	—Do— (Revoted) ..	219.50		
	Indian Science Congress Subscription ..	12.00		
	Contribution for Association Canteen ..	600.00		
	Interest paid on Govt. of India Loan ..	3,369.35		
	Motor Van Up-Keep ..	3,960.19		
	—Do— (Revoted) ..	352.88		
	Publication—Bijnaner Itihas ..	132.81		
	Bijnaner Itihas Fund ..	2,184.82		
	Expenses in connection with Reviewing Committee ..	19,649.70	40,273.47	1,03,238.92
	Furniture & Fittings ..	10,189.31		
	—Do— (Revoted) ..	2,104.00		12,293.31
	<i>Construction—</i>			
	Workshop ..	10,497.53		
	Main Research Building 1st. Floor ..	38,852.61		
	Sanitary & Electric Fittings ..	35,950.00		
	Residential Quarters ..	988.00		86,288.14
	Laboratory Fittings ..	155.88		
	—Do— (Consumable) ..	112.83		268.71
	Advance & Suspenses ..			31,732.21
	<i>C.S.I.R. :—</i>			
	Crystal Structure of Frozen etc.:			
	Contingency ..	1,135.15		
	Staff ..	3,418.70	4,553.85	
	Thermodynamic Properties etc.:			
	Contingencies ..	547.53		
	Staff ..	6,410.78	6,958.31	
	Thermal Diffusion etc.:			
	Contingency ..	99.63		
	Staff ..	270.00	369.63	
	Liquid Crystalline etc.:			
	Contingency ..	2,110.86		
	Staff ..	6,497.19	8,608.05	
	Carried Over ..		20,489.84	11,85,498.33

FOR THE CULTIVATION OF SCIENCE

CALCUTTA-32.

for the year ended 31st March, 1959.

PAYMENTS.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..		20,489.84	11,85,498.33
Synthetic Studies in Deterpenoid etc.:			
Contingency	917.95		
Staff	3,941.20	4,859.15	
Absolute Value of Rate Constant:			
Equipment	701.40		
Contingency	882.81		
Staff	5,840.00	7,424.21	
Fundamental Studies on the Solvent Extraction of Coal:			
Contingency	1,651.72		
Staff	4,800.00	6,451.72	
Synthetic Studies in Triterpenoids:			
Contingency	400.00		
Staff	750.00	1,150.00	
Mechanism of Vulcanization of Rubber			
Equipment	551.25		
Contingency	350.70		
Staff	725.81	1,627.76	
Fellowship to Dr. S. C. Srivastava:			
Contingency	108.72		
Staff	2,800.00	2,908.72	44,911.40
Development of Research Training Facilities:			
Genl. Physics & X-Rays	9,605.53		
Optics	2,400.00		
Physical Chemistry	1,819.35		
Organic Chemistry	5,890.32		
Inorganic Chemistry	3,600.00		
Theoretical Physics	2,400.00		
Magnetism	1,140.00		26,855.20
I.C.A.R.—Synthetic Polyelectrolytes etc.:			
Equipment	971.00		
Contingency	224.06		
Staff	3,350.80	4,545.86	
I.L.C.C.—Styrenation of Shellac:			
Contingency		344.89	
D.A.E.—Design of Thermal etc.:			
Overhead	420.00		
Contingency	964.98		
Staff	3,994.16	5,379.14	
Carried Over ..		10,269.89	12,57,264.93

INDIAN ASSOCIATION

JADAVPUR,

Income & Expenditure Account for

EXPENDITURE.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
To <i>Establishment</i> —General			
Department of Genl. Physics & X-Rays	20,500.14		
" " Magnetism	14,748.04		
" " Optics	31,467.30		
" " Theoretical Physics	21,050.27		
" " Physical Chemistry	29,502.78		
" " Organic Chemistry	28,209.23		
" " Inorganic Chemistry	17,783.30		
Library	5,360.62		
Workshop	14,751.36		
Indian Journal of Physics	4,275.50		
Administration	32,285.53		
Director and his staff	15,668.95	2,35,603.02	
„ <i>Allowances</i> —Existing Staff			
Dearness Allowance	30,844.46		
Dearness Pay	24,844.45		
House Rent Allowance	9,140.72		
Ad-interim D.A.	7,703.85	72,533.48	
„ <i>Establishment</i> —New Posts (5 Yr. Plan)			
Department of Genl. Physics & X-Rays	9,257.59		
" " Magnetism	14,798.05		
" " Optics	7,865.09		
" " Theoretical Physics	13,360.96		
" " Physical Chemistry (General)	3,299.90		
" " Organic Chemistry	7,777.09		
" " Applied High Polymer	40,863.44		
" " Inorganic Chemistry Analytical Laboratory	6,017.63		
Carried Over ..	1,03,239.75	3,08,136.50	

FOR THE CULTIVATION OF SCIENCE CALCUTTA-32.

the year ended 31st March, 1959.

INCOME.		Amount.	Total.	G. Total.
		Rs. np.	Rs. np.	Rs. np.
By Government of India—				
	Grant-in-Aid (Recurring) ..	6,80,000.00		
	Grant-in-Aid for Development ..	27,372.79		
,, Government of West Bengal—				
	Grant-in-Aid (Recurring) ..	75,000.00		7,82,372.79
,, Miscellaneous—				
	Ordinary Membership Subscription ..	1,556.24		
	Journal Subscription ..	13,118.66		
	Miscellaneous ..	368.10		
	Sale of Special Monograph & Book ..	419.28		
	Interest ..	495.00		
	Seat Rent ..	980.00		
	Contribution from M.L.S. Prof. Fund ..	4,480.00		
	Contribution from V.L.M. Fund ..	3,940.00		25,357.28
	Excess of Expenditure over Income ..			30,121.66
				8,37,851.73
Carried Over ..				8,37,851.73

INDIAN ASSOCIATION
JADAVPUR,

Income & Expenditure Account for

EXPENDITURE.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..	1,03,239.75	3,08,136.50	
Central Scientific Services	4,227.93		
Library	682.46		
Workshop	8,934.31		
Administration	6,858.12		
Publication Section	2,009.93	1,25,952.50	
To Allowances—5 Yr. Plan :			
Dearness Pay	15,126.56		
Dearness Allowance	15,228.58		
House Rent Allowance	5,713.10		
Ad-interim D.A.	3,621.33	39,689.57	
To Provident Fund Contribution ..		24,075.49	4,97,854.06
To Laboratory Grant :			
General Physics & X-Rays.			
Recurring Charges	8,631.41		
Recurring (Revoted) Charges ..	1,631.60		
Govt. of India Non-Recurring Charges	44.96		
Govt. of West Bengal Non-Recurring			
Charges	1,486.47	11,794.44	
Optics :			
Recurring Charges	5,429.19		
Recurring (Revoted) Charges ..	315.48	5,744.67	
Theoretical Physics :			
Recurring Charges	134.53		
Recurring (Revoted) Charges ..	38.45	172.98	
Physical Chemistry :			
Recurring Charges	14,763.68		
Recurring (Revoted) Charges ..	237.75	15,001.43	
Organic Chemistry :			
Non-Recurring Govt. of India Charges	801.45		
Non-Recurring Govt. of West Bengal			
Charges	1,438.18		
Recurring (Revoted) Charges ..	1,042.09		
Recurring Charges	12,588.04	15,869.76	
Micro-analytical Laboratory :			
Recurring Charges	2,230.12		
Revoted Charges	556.95	2,787.07	
Carried Over ..		51,370.35	4,97,854.06

FOR THE CULTIVATION OF SCIENCE

CALCUTTA-32.

the year ended 31st March, 1959.

INCOME.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..			8,37,851.73

Carried Over .. 8,37,851.73

INDIAN ASSOCIATION

JADAVPUR,

Income & Expenditure Account for

EXPENDITURE.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..		51,370.35	4,97,854.06
Applied High Polymer :			
Recurring Charges			
Govt. of India Grant	6,988.08		
Non-Recurring (Charges)	751.09		
Govt. of West Bengal (Non-Recurring Charges)	193.09	7,932.26	
Inorganic Chemistry :			
Recurring Charges	10,223.06		
Recurring (Revoted) Charges	974.08		
Govt. of India Grant (Non-Recurring Charges)	4,873.38		
Govt. of West Bengal Grant (Non-Recurring Charges)	882.00	16,952.52	
Magnetism :			
Recurring Charges	2,755.51		
Recurring (Revoted) Charges	834.22		
Non-Recurring Govt. of West Bengal Charges	1,242.89	4,832.62	
Central Scientific Services :			
Recurring Charges		1,128.95	
Library Grant :			
Recurring—Upkeep	994.30		
Recurring (Revoted) Charges	304.00	1,298.30	
Workshop Grant :			
Recurring Charges	9,389.87	9,389.87	92,904.87
Miscellaneous :			
Electrical Fittings (Consumable)	2,485.47		
—Do— (Revoted)	289.87		
Electric Charges	15,265.96		
Gas Charges	3,434.65		
Telephone Charges	2,561.06		
Postage	4,035.67		
Bank Charges	286.18		
Stationery & Contingency	8,522.69		
Printing	1,399.09		
Printing (Revoted)	423.00		
Advertisement	4,075.12		
Motor Van Upkeep	3,960.19		
—Do— (Revoted)	352.88		
Municipal Taxes	538.88		
Audit Fee	400.00		
Carried Over ..	48,030.71		5,90,758.93

**FOR THE CULTIVATION OF SCIENCE
CALCUTTA-32.**

the year ended 31st March, 1959.

INCOME.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..			8,37,851.73

Carried Over .. 8,37,851.73

INDIAN ASSOCIATION

JADAVPUR,

Income & Expenditure Account for

EXPENDITURE.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..	48,030.71		5,90,758.93
Indian Journal of Physics :			
Publication Expenses	17,941.71		
—Do— (Revoted)	209.00		
Meeting Expenses	1,612.00		
Insurance	1,046.25		
Contribution to Science Association Club	139.00		
Indian Science Congress Subscription ..	12.00		
Travelling Allowance for attending Meeting etc.	5,588.14		
T.A. for attending Science Congress ..	3,073.38		
Provision for Research Staff to attend Meeting etc.	1,746.00		
—Do—	1,500.00		
—Do— (Revoted)	5,000.00		
Provision for Higher salaries and leave allowance	1,441.86		
Contribution to Indian Science News Association	1,000.00		
Contribution to Association Canteen ..	600.00		
Miscellaneous Expenses	4,558.64		
—Do— (Revoted)	368.16		
Laboratory Fittings (Consumable) ..	112.83	93,979.68	
Development of Research Training Facilities :			
General Physics & X-Rays	9,605.53		
Optics	2,400.00		
Theoretical Physics	2,400.00		
Physical Chemistry	1,819.35		
Organic Chemistry	5,890.32		
Inorganic Chemistry	3,600.00		
Magnetism	1,140.00	26,855.20	
Interest on Govt. of India Loan	3,369.35		
Publication (General)	1,450.36		
—Do— (Revoted)	219.50	5,039.21	
Depreciation :			
As per Schedule 'A'	80,917.82		
As per Schedule 'B'	40,300.89	1,21,218.71	2,47,092.80
			<u>8,37,851.73</u>

**FOR THE CULTIVATION OF SCIENCE
CALCUTTA-32.**

the year ended 31st March, 1959.

INCOME.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..			8,37,851.73

8,37,851.73

INDIAN ASSOCIATION

JADAVPUR,

Balance Sheet

LIABILITIES.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
<i>General Fund—</i>			
Brought Forward		40,40,103.69	
<i>Add :—</i>			
(i) Sundry adjustment	6,356.38		
(ii) Grant-in-aid Non-recurring— Government of India	3,69,900.00		
(iii) Grant-in-aid Non-Recurring— Government of West Bengal	70,500.00		
(iv) Grant-in-aid—Recurring— Government of West Bengal for 1957-58 received this year	50,000.00	4,96,756.38	
		<u>45,36,860.07</u>	
<i>Less :—</i>			
(i) Transferred to Building Maintenance Fund	47,300.00		
(ii) Transferred to Depreciation Fund for Scientific Instruments	60,080.00		
(iii) Transferred to Bijnaner Itihas Fund	5,000.00		
(iv) Excess of Expenditure over Income	30,121.66	1,42,501.66	43,94,358.41
<i>Life & Institutional Membership Fund—</i>			
Brought Forward	30,380.94		
<i>Add :—</i>			
Receipts during the year	250.00		30,630.94
<i>Building Maintenance Fund—</i>			
Brought Forward		1,21,759.87	
<i>Add :—</i>			
(i) Transferred from General Fund	47,300.00		
(ii) Interest	500.00		
(iii) Transferred from Depreciation Fund	61,505.00	1,09,305.00	
		<u>2,31,064.87</u>	
<i>Less—Bank Charge</i>		1.52	2,31,063.35
<i>Depreciation Fund—</i>			
Brought Forward		1,98,767.61	
<i>Add :—</i>			
Amount provided this year— as per Schedule 'A'	80,917.82		
as per Schedule 'B'	40,300.89	1,21,218.71	
		<u>3,19,986.32</u>	<u>46,56,052.70</u>
Carried Over			

FOR THE CULTIVATION OF SCIENCE

CALCUTTA-32.

as at 31st March, 1959.

ASSETS.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
<i>Fixed Assets :</i>			
(Other than Laboratory Fittings & Scientific Instruments)			
<i>At Cost—</i>			
As per Schedule 'A'			35,24,032.43
Laboratory Fittings & Scientific Instruments			
<i>At Cost—</i>			
As per Schedule 'B'			11,47,459.30
<i>Investments—</i>			
On account of Special Funds lodged with with the State Bank of India :			
As per last Account :—			
Mahendralal Sircar Professorship Fund—			
3% Conversion Loan 1946, at face value ..		1,49,500.00	
Viharilal Mitra Fund—			
3% Conversion Loan 1946, at face value ..		1,32,000.00	
Ripon Professorship Fund—			
3% Loan 1896-97, at face value ..	4,000.00		
3% Conversion Loan 1946, at face value ..	21,000.00	25,000.00	
Hare Professorship Fund—			
3% Conversion Loan 1946, at face value ..		1,500.00	
Cooch Behar Professorship Fund—			
3% Conversion Loan 1946, at face value ..		33,000.00	
Victoria Professorship Fund—			
3% Conversion Loan 1946, at face value ..		1,500.00	
Joykessen Mukherjee Gold Medal Fund—			
3% Conversion Loan 1946, at face value ..		13,400.00	
Dr. Bimala Churan Law Gold Medal Fund—			
3% 1st Development Loan 1970-75, at face value	2,000.00		
3% Conversion Loan 1946, at face value ..	5,000.00	7,000.00	
Dr. Sircar Research Medal Fund—			
3% Conversion Loan 1946, at face value ..		5,000.00	
Woodburn Medal Fund—			
3% Conversion Loan 1946, at face value ..		1,500.00	
Nikunja Garabini Prize Fund—			
3% Conversion Loan 1946, at face value ..		1,000.00	
Jatindra Chandra Prize Fund—			
3% Conversion Loan 1946, at face value ..		1,000.00	
General Fund—			
3% Conversion Loan 1946, at face value ..		9,500.00	
Building Fund—			
3% Conversion Loan 1946, at face value ..		3,97,400.00	
		16,500.00	
			50,68,891.73
Carried Over ..			

INDIAN ASSOCIATION

JADAVPUR,

Balance Sheet

LIABILITIES.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..		3,19,986.32	46,56,052.70
<i>Less :—</i>			
Transferred to Building Maintenance and Depreciation Fund for Scientific Instruments		95,211.42	2,24,774.90
Bijnaner Itihas Fund—			
Brought Forward		2,225.92	
<i>Add :—</i>			
(i) Sale Proceed of Books	6,042.77		
(ii) Association's grant transferred from General Fund	5,000.00	11,042.77	
<i>Less :—</i>			
Expenses this year—		13,268.69	
(i) For Publication	132.81		
(ii) From Fund	2,184.82	2,317.63	10,951.06
Depreciation Fund for Scientific Instruments—			
(i) Transferred from General Fund ..	60,080.00		
(ii) Transferred from Depreciation Fund ..	33,706.42		
Less Bank Charge	93,786.42		
	0.06		93,786.36
<i>Special Fund—</i>			
Mahendra Lal Sircar Professorship Fund ..		1,49,500.00	
Viharilal Mitra Fund		1,32,000.00	
Ripon Professorship Fund		25,000.00	
Hare Professorship Fund		1,500.00	
Cooch Behar Professorship Fund		33,000.00	
Victoria Professorship Fund		1,500.00	
Joykessen Mukherjee Gold Medal Fund ..		13,400.00	
Dr. Bimala Churan Law Gold Medal Fund		7,000.00	
Dr. Sircar Research Medal Fund		5,000.00	
Woodburn Medal Fund		1,500.00	
Nikunja Garabini Prize Fund		1,000.00	
Jatindra Chandra Prize Fund		1,000.00	
Building Fund		9,500.00	3,80,900.00
<i>Library Deposits—</i>			
Brought Forward		190.00	
<i>Add—This Year</i>		50.00	240.00
Security Deposit from Staff—			
Brought Forward		10.00	
<i>Add—This Year</i>		60.00	70.00
Amounts due to—			
C.S.I.R. Employees Provident Fund—			
Brought Forward		107.00	
<i>Add—This Year</i>		14.00	121.00
Carried Over ..			53,66,896.02

FOR THE CULTIVATION OF SCIENCE

CALCUTTA-32.

as at 31st March, 1959.

ASSETS.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..			50,68,891.73
<i>Security Deposits—</i>			
As per last Account :			
Calcutta Electric Supply Corporation Ltd. ..		15,97.80	
Oriental Gas Co. Ltd.			
Balance as per last account	40.00		
Add this year	30.00	70.00	
Thomas Cook		150.00	1,597.80
<i>Advance & Suspense—</i>			
As per list			54,213.18
<i>National Research Fellowship—</i>			
Amount due from Government of India :			99.56
<i>Amount due from I.C.A.R.—</i>			
Expenses incurred for Synthetic Polyelectrolytes—			
Balance as per last account		5,179.30	
Add expenditure this year		4,545.86	
Less—grant received this year		9,725.16	
		6,546.88	3,178.28
<i>Amount due from C.S.I.R.—</i>			
(a) Scheme for Construction of Light Scattering Apparatus—			
As per last Account		454.01	
(b) Scheme—Thermal Diffusion & Inter Diffusion etc.—			
Expenses incurred during the year	369.63		
Amount brought forward	64.98		
Grant received	270.00	334.98	34.65
(c) Scheme—Synthetic Studies in Deterpenoid resin acids :			
Brought Forward	425.30		
Add—Expenses during the year	4,859.15		
		5,284.45	
Less—Grant received	4,943.70	340.75	829.41
<i>Indian Lac Cess Committee—Scheme for Styrenation of Shellac—</i>			
Expenses during the year	344.89		
Less—Amount brought forward	293.90		50.99
<i>D. A. E.—Design of Thermal etc.—</i>			
Expenses during the year		5,379.14	
<i>Less—</i>			
(i) Balance brought forward	114.27		
(ii) Grant received	3,606.00	3,720.27	1,658.87
		Carried Over ..	51,30,739.82

INDIAN ASSOCIATION

JADAVPUR,

Balance Sheet

LIABILITIES.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..			53,66,896.02
M. L. S. Professorship Fund			1,000.00
Staff Provident Fund—			
Brought Forward		237.87	
Add—This Year		135.02	372.89
Amount due for Scholarship—			
Brought Forward		649.61	
Less Paid		51.61	598.00
Amount due for Salary			88.84
Loans from Government of India Secured against Land & Buildings per Contra :		3,36,935.00	
Brought Forward		6,630.65	3,30,304.35
Less—Refunded			
<i>Advance & Suspense—</i>			
As per list			4,154.07
<i>Amount due to C.S.I.R.—</i>			
(a) Scheme Mechanism of Vulcanization of Rubber—Grants received	3,450.00		
Less—Expenses during the year	1,627.76	1,822.24	
(b) Grant of Fellowship to Dr. S. C. Srivastava—Grant received	3,800.00		
Less—Expenses during the year	2,908.72	891.28	
(c) Scheme for Construction of Osmometer suitable for High Polymer Research :			
Balance as per last account	77.16		
Add—on account of cancellation of a D.D.	4.66	81.82	
(d) Scheme for Thermodynamic Properties etc.—Grants received	8,159.35		
Less—Amount brought forward 15.87 Expenses this year .. 6,958.31	6,974.18	1,185.17	
(e) Scheme for Fundamental Studies on Solvent Extraction of Coal :			
Brought Forward	2,500.52		
Add—Grant received	5,733.80		
	8,234.32		
Less—Expenses this year	6,451.72	1,782.60	
Carried Over ..		5,763.11	57,03,414.17

FOR THE CULTIVATION OF SCIENCE

CALCUTTA-32.

as at 31st March, 1959.

ASSETS.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..			51,30,739.82
Amounts due from Government of India— for Expenses in connection with Reviewing Committee			19,649.70
Puja Advance Recoverable from staff— Brought Forward	63.75		
Add—This year	51.55		115.30
<i>Closing Balances—</i>			
Imprest Cash	1,400.00		
In Hand including Cheques	1,02,534.89		
At State Bank of India on Current— Jadavpur University	1,72,449.36		
Less—Head Office— Main Account	56,798.46	1,15,650.90	
At Bank for Depreciation Fund	93,786.36		
At Building Maintenance Fund	2,31,063.35		
At Live & Institutional Membership Fund	30,630.94		
Difference in books			5,75,066.44
This years' credit balance	Rs. 100.80		
Less last year's balance (Dr.)	Rs. 12.00		88.80

Carried Over .. 57,25,660.06

INDIAN ASSOCIATION

JADAVPUR,

Balance Sheet

LIABILITIES.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..		5,763.11	57,03,414.16
(f) Scheme—Mutual Solubilization of Oil & Water :			
Brought forward		988.03	
(g) Scheme—Crystal Structure of Frozen Organic Liquid at Low Temperature :			
Brought Forward	714.42		
Add—Grant received	4,414.64		
	5,129.06		
Less—Expenses this year	4,553.85	575.21	
(h) Scheme—Absolute Value of Rate Constants in Polymerisation :			
Brought Forward	4,042.38		
Add—Grant received	8,367.48		
	12,409.86		
Less—Expenses this year	7,424.21	4,985.65	
(i) Scheme—Liquid Crystalline Detergent :			
Brought Forward	131.88		
Grant received	9,177.81		
	9,309.69		
Less—Expenses this year	8,608.05	701.64	13,013.64
Assam Government Scholarship—			
Balance Brought forward	410.71		
Add—Grant received	1,800.00		
	2,210.71		
Less— (i) Expenses this year	1,350.00		
(ii) Refund	650.00	2,000.00	210.71
Liabilities for Income-tax for salary :			
Brought forward	2.91		
Add—This year	43.90		46.81
		Carried Over ..	57,16,685.33

**FOR THE CULTIVATION OF SCIENCE
CALCUTTA-32.**

as at 31st March, 1959.

ASSETS.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..			57,25,660.06

Carried Over .. 57,25,660.06

INDIAN ASSOCIATION

JADAVPUR,

Balance Sheet

LIABILITIES.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..			57,16,685.33
Dr. A. Bose's grant from Govt. of India			
Grant received	6,000.00		
Less—expenditure during the year ..	1,706.25		4,293.75
Bengal Electric Lamp—Capping Cement ..			150.00
Director of Cinchona—Cinchona Scheme—			
Grant received	6,695.00		
Less—Expenditure during the year ..	2,164.02		4,530.98
			<u>57,25,660.06</u>

**FOR THE CULTIVATION OF SCIENCE
CALCUTTA-32.**

as at 31st March, 1959.

ASSETS.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..			57,25,660.06

57,25,660.06

Sd/- Accounts Officer.

Sd/- Registrar.

Sd/- Director.

AUDIT CERTIFICATE.

I have examined the foregoing Accounts and Balance Sheet of the Indian Association for the Cultivation of Science, Jadavpur for the year 1958-59. I have obtained all the information and explanation that I have required, and subject to the observation in the separate Audit Note, I certify, as a result of my audit, that in my opinion these Accounts and Balance Sheet have been drawn up so as to exhibit a true and fair view of the state of affairs of the concern according to the best of my information and explanation given to me and as shown by the books of the concern.

Calcutta, the 19th April, 1960.

Sd/- S. P. GUGNANI,
Deputy Accountant General (OA)
West Bengal.

**INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE,
JADAVPUR, CALCUTTA-32.**

SCHEDULE "A"

Fixed Assets as at 31st March, 1959.

(Other than Laboratory Fittings and Scientific Instruments).

PARTICULARS.	Cost as on 1.4.58.	Additions in 1958-59.	Less Adjustment 1958-59.	Total cost as on 31.3.59.	Depreciation up to 31.3.58.	Depreciation for 1958-59.	Total Depreciation upto 31.3.59.	Balance as on 31.3.59.
1. Land Acquisition at Cost	6,61,947.44	—	—	6,61,947.44	—	—	—	6,61,947.44
2. Buildings	14,77,326.19	38,852.61	—	15,16,178.80	49,179.48	28,562.92	77,742.40	14,38,436.40
3. Workshop Buildings	1,93,612.36	10,497.53	—	2,04,109.89	5,392.80	3,764.39	9,157.19	194,952.70
4. Residential Quarters	35,587.34	988.00	—	36,575.34	981.07	691.87	1,672.94	34,902.40
5. Electric Installation	1,54,762.79	36,280.50	—	1,91,043.29	14,161.81	7,030.67	21,192.48	1,69,850.81
6. Land Development & Road construction	99,491.83	—	—	99,491.83	1,610.17	978.81	2,588.98	96,902.85
7. Laboratory Fittings & furniture	1,23,967.67	16,062.92	—	1,40,030.59	23,242.46	10,072.52	33,314.98	1,06,715.61
8. Plant & Machinery ..	66,386.78	—	—	66,386.78	12,504.00	5,388.27	17,892.27	48,494.51
9. Workshop Machines & equipments	1,56,611.75	8,801.36	851.80	1,64,561.31	12,396.76	7,168.01	19,564.77	1,44,996.54
10. Library (Books)	2,18,416.85	7,152.13	—	2,25,568.98	7,175.22	4,224.83	11,400.05	2,14,168.93
11. Furniture and Fittings	87,695.54	24,793.31	—	1,12,488.85	11,802.60	7,589.29	19,391.89	93,096.96
12. Lifts	29,853.62	—	—	29,853.62	2,826.12	1,351.37	4,177.49	25,676.13
13. Tubewells	9,252.69	906.32	—	10,159.01	433.00	881.96	1,314.96	8,844.05
14. Air-conditioning equipment	24,288.09	448.68	—	24,736.77	1,711.48	1,128.83	2,840.31	21,896.46
15. Equipment (Adm) formerly shown as Public Speaking arrangement	15,620.23	5,749.18	—	21,369.41	249.97	768.52	1,018.49	20,350.92
16. Motor Van	9,707.00	—	—	9,707.00	3,495.00	1,242.40	4,737.40	4,969.60
17. Tools & Implements	891.00	—	—	891.00	86.88	40.20	127.08	763.92
18. Cycles (Vehicles) ..	378.12	—	—	378.12	48.44	32.96	81.40	296.72
19. Installation of International Telephone	8,500.00	54.40	—	8,554.40	—	—	—	8,554.40
Total Rs.	33,74,297.29.	1,50,586.94	851.80	35,24,032.43	1,47,297.26	80,917.82	2,28,215.08	32,95,817.35

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE
JADAVPUR, CALCUTTA-32.

SCHEDULE "B"

Scientific Instruments & Laboratory Fittings as at 31st March, 1959.

PARTICULARS.	Cost as on 1.4.58.	Additions in 1958-59.	Less Adjustment 1958-59.	Total cost as on 31.3.58.	Depreciation up to 31.3.58.	Depreciation for 1958-59.	Total Depreciation upto 31.3.59.	Balance as on 31.3.59.
1. General Physics & X-rays ..	2,77,643.69	80,726.49	—	3,58,370.18	21,118.29	12,826.27	33,944.56	3,24,425.62
2. Magnetism ..	53,113.86	39,816.87	—	92,930.73	1,303.14	2,950.53	3,893.67	89,037.06
3. Optics ..	1,06,929.34	13,619.72	—	1,20,549.06	6,838.93	5,004.56	11,843.49	1,08,705.57
4. Physical Chemistry	1,19,678.48	29,318.13	—	1,48,996.61	6,477.56	5,660.05	12,137.61	1,36,859.00
5. Organic Chemistry (General) ..	74,347.52	3,146.42	488.63	77,005.31	6,241.43	3,380.86	9,622.29	67,383.02
6. Organic Chemistry (High Polymer) ..	16,840.61	47,389.08	2,259.68	61,970.01	230.21	717.55	947.76	61,022.25
7. Theoretical Physics	38,997.78	569.65	—	39,567.43	3,155.38	1,790.11	4,945.49	34,621.94
8. Botany ..	150.00	—	—	150.00	—	—	—	150.00
9. Inorganic Chemistry	80,860.92	16,095.51	—	96,956.43	5,911.75	3,747.47	9,659.22	87,297.21
10. Central Scientific Services ..	91,315.13	58,395.23	—	1,49,710.36	193.66	4,556.08	4,749.74	1,44,960.62
11. Mycro-analytical Laboratory ..	548.10	705.08	—	1,253.18	—	27.41	27.41	1,225.77
Total Rs. ..	8,60,425.43	2,89,782.18	2,748.31	11,47,459.30	51,470.35	40,300.89	91,771.24	10,55,688.06

"These Schedules are annexures to the Balance Sheet as at 31st March, 1959."

INDIAN ASSOCIATION

JADAVPUR,

Special

Statement of Receipts & Payments

RECEIPTS.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Opening Balances as on 1st April, 1958 with the State Bank of India as Current Account for :—			
Research Endowment Fund	15,257.17		
Woodburn Medal Fund	559.42		
Victoria Professorship Fund	599.50		
Library Reserve Fund	1,859.31		
Building Fund	4,557.42		
Dr. Bimala Charan Law Gold Medal Fund	763.57		
Hare Professorship Fund	624.63		
Nikunja Garabini Prize Fund	410.01		
Veharilal Mitra Fund	16,016.66		
Dr. Sirkar Research Medal Fund	2,221.64		
Jaikrishna Mukherjee Gold Medal Fund	676.05		
Mahendralal Sirkar Professorship Fund	10,709.00		
Jatindra Charan Prize Fund	397.17		
Ripon Professorship Fund	7,526.73		
Cooch Behar Professorship Fund	7,859.26		70,037.54
<i>Woodburn Medal Fund—</i>			
Interest			30.00
<i>Victoria Professorship Fund—</i>			
Interest			52.50
<i>Building Fund—</i>			
Interest			277.50
<i>Bimala Charan Law Gold Medal Fund—</i>			
Interest	210.00		
Refund of Income-Tax	79.88		289.88
<i>Hare Professorship Fund—</i>			
Interest			22.50
<i>Nikunja Garabini Prize Fund—</i>			
Interest			15.00
<i>Veharilal Mitra Fund—</i>			
Interest			3,736.50
<i>Dr. Sirkar Research Fund—</i>			
Interest			112.50
<i>Jaykishen Mukherjee Gold Medal Fund—</i>			
Interest		394.50	
Special Publication			394.50
Carried Over			74,968.42

FOR THE CULTIVATION OF SCIENCE
CALCUTTA-32.

Funds.

for the year ended 31st March, 1959.

PAYMENTS.	Amount.		Total.	G. Total.
	Rs.	np.	Rs. np.	Rs. np.
<i>Research Endowment Fund—</i>				
Bank Charges		—
Interest to General Fund		
<i>Woodburn Medal Fund—</i>				
Bank Charges		0.39
<i>Victoria Professorship Fund—</i>				
Bank Charges		0.52
<i>Library Reserve Fund—</i>				
Bank Charges		—
<i>Building Fund—</i>				
Bank Charges		0.70
<i>Dr. Bimala Charan Law Gold Medal Fund—</i>				
Bank Charges		1.00
Income Tax		
Transferred to General Fund		—
<i>Hare Professorship Fund—</i>				
Bank Charges		0.25
<i>Nikunja Garabini Prize Fund—</i>				
Bank Charges		0.25
<i>Veharilal Mitra Fund—</i>				
Bank Charges	10.07	
Transfer to General Fund	3,940.00	3,950.07
<i>Dr. Sirkar Research Medal Fund—</i>				
Bank Charges		0.37
<i>Jaikishen Mukherjee Gold Medal Fund—</i>				
Bank Charges	1.31	
Cost of Medal	385.54	386.85
Transfer to General Fund		
<i>Mahendralal Sirkar Professorship Fund—</i>				
Bank Charges	8.25	
Transfer to General Fund	4,480.00	4,488.25

Carried Over ..

8,828.65

**FOR THE CULTIVATION OF SCIENCE
CALCUTTA-32.**

Funds.

for the year ended 31st March, 1959.

PAYMENTS.	Amount. Rs. np.	Total. Rs. np.	G. Total. Rs. np.
Brought Forward ..			8,828.65
<i>Jatindra Chandra Prize Fund—</i>			
Bank Charges			0.39
<i>Ripon Professorship Fund—</i>			
Bank Charges	2.02		
Transfer to General Fund	750.00		752.02
<i>Cooch Behar Professorship Fund—</i>			
Honorarium	902.00		
Bank Charges	2.64		
Transfer to General Fund			904.64
Closing Balances :—on current with State Bank of India Account :			
Research Endowment Fund	15,257.17		
Woodburn Medal Fund	589.03		
Victoria Professorship Fund	651.48		
Library Reserve Fund	1,859.31		
Building Fund	4,834.22		
Dr. Bimala Charan Law Gold Medal Fund	1,052.45		
Hare Professorship Fund	646.88		
Nikunja Garabini Prize Fund	424.76		
Veharilal Mitra Fund	15,803.09		
Dr. Sirker Rescarch Fund	2,333.77		
Jaikishen Mukherjee Gold Medal Fund	683.70		
Mahendralal Sirker Professorship Fund	9,258.25		
Jatindra Chandra Prize Fund	419.28		
Ripon Professorship Fund	7,434.71		
Cooch Behar Professorship Fund	7,832.12		
			69,080.22
			79,565.92

